

CRUISE REPORT



R/V Aranda

Cruise 01/2025

Combine 1
14. – 27.1.2025

This report is based on preliminary data and is subject to changes.

Objectives of the cruise

The objectives of the cruise were:

- 1) Sampling and analysis on hydrography and water chemistry
- 2) Sampling of oil, toxic and medical substances
- 3) Maintenance, installation and recovery of automated instruments (wave buoys and hydrophones)
- 4) Additional Sampling on zooplankton
- 5) Sampling and data collection on ice related to studies on greenhouse gases in the ice
- 6) Studies and data collection of ice characteristics with electromagnetic equipment, and radar and satellite data.

The cruise covered the Gulf of Finland, Northern Baltic Proper, the Gulf of Bothnia and in the Archipelago Sea.

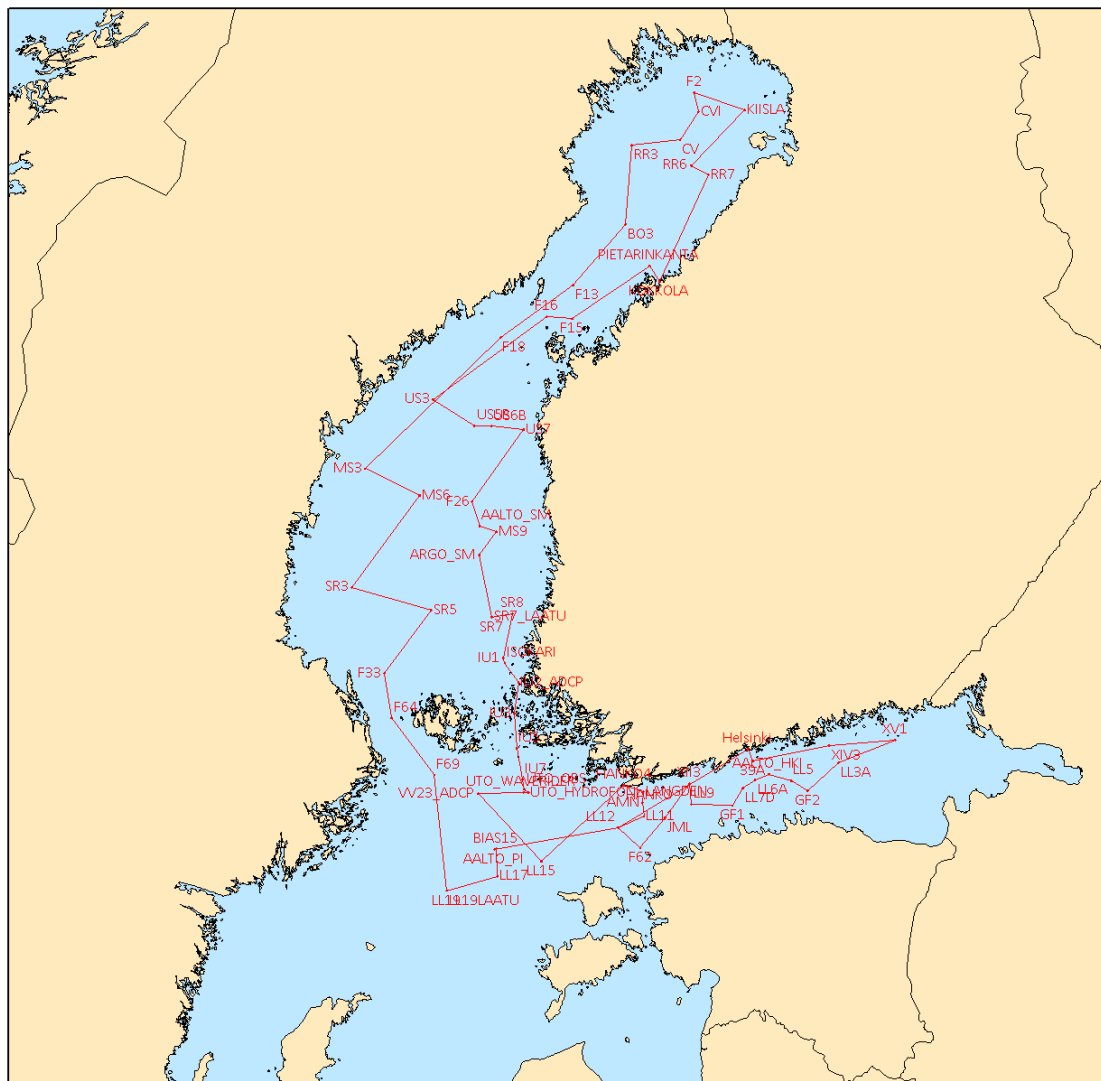
Table 1 The scientific crew

Name	On board	Organization
Lehtiniemi Maiju	14.01.2025 - 17.01.2025	Syke
Granlund Mira	14.01.-27.01.2025	Syke
Hyvärinen Susanna	14.01.-27.01.2025	Syke
Räike Antti	14.01.-27.01.2025	Syke
Lastumäki Ilkka	14.01.-27.01.2025	Syke
Knuuttila Seppo	14.01.2025 - 17.01.2025	Syke
Rantapusa Sami	14.01.-27.01.2025	IL
Roine Tuomo	14.01.2025 - 17.01.2025	II
Haavisto Noora	14.01.-27.01.2025	IL
Setälä Outi	14.01.2025 - 17.01.2025	Syke
Luhtanen Anne-Mari	14.01.2025 - 17.01.2025	Syke
Eklin Tero	14.01.2025 - 17.01.2025	Syke
Varmanen Pia	14.01.-27.01.2025	Syke
Kotilainen Pekka	17.01.-27.01.2025	Syke
Saavalainen Heli	14.01.2025 - 17.01.2025	HS
Mansikkamäki Saara	14.01.2025 - 17.01.2025	HS
Ohtonen Kimmo	14.01.2025 - 17.01.2025	Journalist, freelancer
Koskinen Jukka	14.01.2025 - 17.01.2025	Photographer, freelancer
Riikonen Jere	14.01.-27.01.2025	Syke
Lensu Mikko	17.01.-27.01.2025	IL
Seppänen Jaakko	17.01.-27.01.2025	IL
Hirvonen Mia	17.01.-27.01.2025	Merimieskirkko
Moberg Jarkko	21.01-27.01.2025	Syke

Cruise Route

Finnish Environment Institute
 Agnes Sjöbergin katu 2
 FI-00790 Helsinki
 Finland
<http://www.syke.fi/en>

Finnish Meteorological Institute
 Erik Palménin aukio 1
 P.O. Box 503
 FI-00101 Helsinki
 Finland
<http://en.ilmatiiteenlaitos.fi/>



Picture 1: Cruise route

Cruise Route of the 1st leg, Cruise Leader Maiju Lehtiniemi

Departure from Helsinki Tammasaari pier, January 14, 2025, at 1000 for the Gulf of Finland.

Arrival to Hanko, January 17, 2025, at 0930.

Cruise Route of the 2nd leg, Cruise Leader Pekka Kotilainen

Departure from Hanko January 17, 2025, at 0930 for the Archipelago Sea, Northern Baltic Proper and Gulf of Bothnia.

Arrival to Tammasaari, Helsinki 27.01.2024 klo 0700.

Observations

Gulf of Finland

The oxygen content of the Gulf of Finland was good from surface to bottom from the eastern Gulf of Finland all the way to the Hanko Peninsula. Anoxic and hydrogen sulfide-rich deep water in the main basin was only found off the northwestern coast of Estonia. The last time a similar situation occurred was in January 2020.

The winters of 2020 and 2025 are connected by a similar type of weather. Months of mainly westerly winds pack water into the Gulf of Finland. In such a situation, the salinity gradient layer sinks deeper, the anoxic water tongue of the Baltic Sea main basin retreats westward from the sea area, and the entire Gulf of Finland water mass is allowed to mix. However, if the weather type changes, the oxygen situation in the Gulf of Finland can deteriorate again relatively quickly.

Thanks to the good oxygen situation, the phosphate phosphorus concentrations near the bottom at the deepest stations were only about half of the level of recent years. However, phosphate phosphorus concentrations in the surface layer were close to record levels. Soluble nitrogen concentrations in the marine area were higher than average.

Archipelago Sea

The warm early winter was reflected in higher than usual water temperatures. The Jari storm and windy period at the end of November broke the water stratification, and in January the entire water column from surface to bottom was completely mixed. The observed oxygen concentrations were high, over 8 ml/l. The phosphate phosphorus concentrations measured in the Archipelago Sea were higher than the long-term averages, which is probably mainly due to the more nutrient-rich water flowing from the main basin and the western parts of the Gulf of Finland, and partly to the mixing of the entire water column.

Northern Baltic Proper

There is no sign of improvement in the decades-long low oxygen situation in the Baltic Sea's main basin. The water in the main basin is still anoxic from 80–90 metres down, and the anoxic water layer extends from the Bornholm Deep to the northern parts of the main basin.

The anoxic area in the main basin now covers almost 50,000 square kilometres. The highest deep-water phosphate phosphorus concentrations of the trip were measured in the northern part of the main basin, where the concentration exceeded 120 micrograms per litre.

Gulf of Bothnia

The deterioration of the oxygen situation observed in the depths of the Bothnian Sea in recent years appears to continue, as does the increase in phosphate phosphorus concentration that began in the 2000s. The phosphate phosphorus concentrations observed in the Bothnian Sea in January exceed those observed in the Archipelago Sea in some places.

In the Kvarken, the entire water column was completely mixed and the oxygen situation was good. As in the Bothnian Sea, phosphate phosphorus concentrations were higher than the long-term averages in the southern parts of the Kvarken.

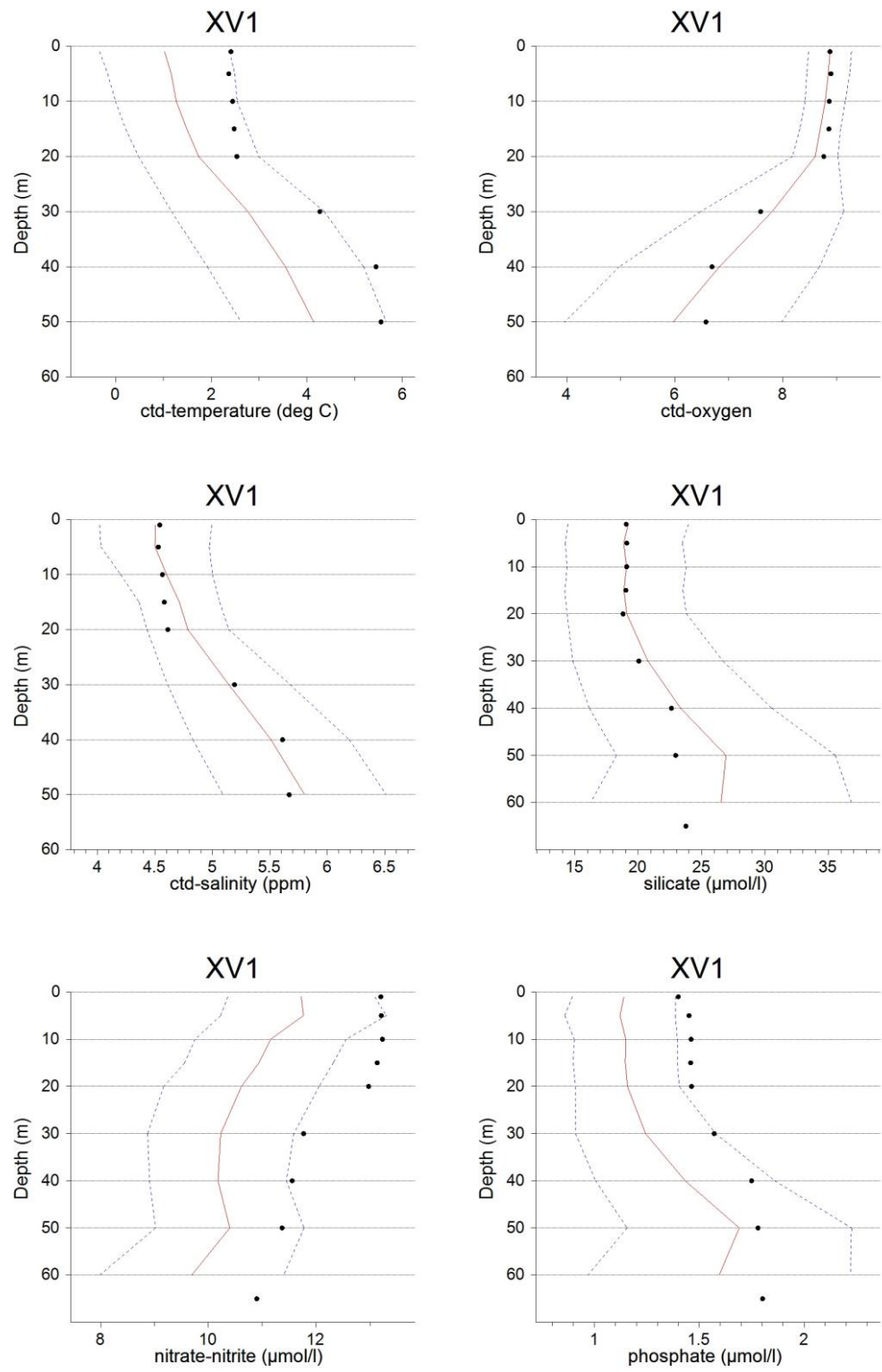
In the Bothnian Sea, the phosphate phosphorus concentration has also increased in recent years. The increased nutrient concentrations are due to the more nutrient-rich water coming from the

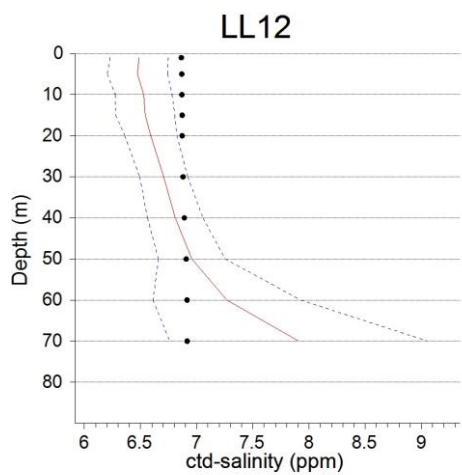
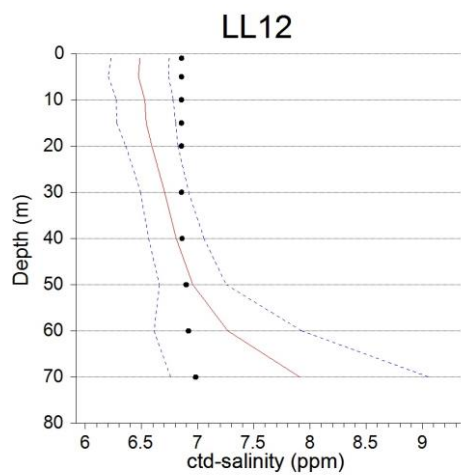
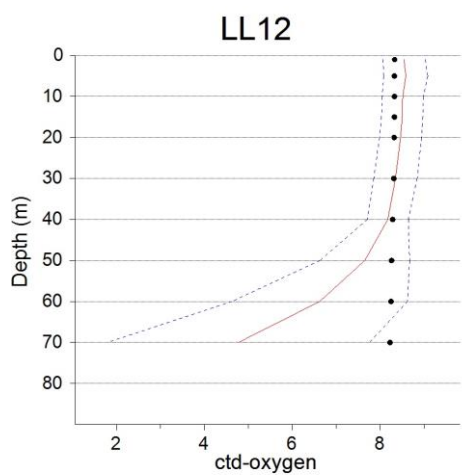
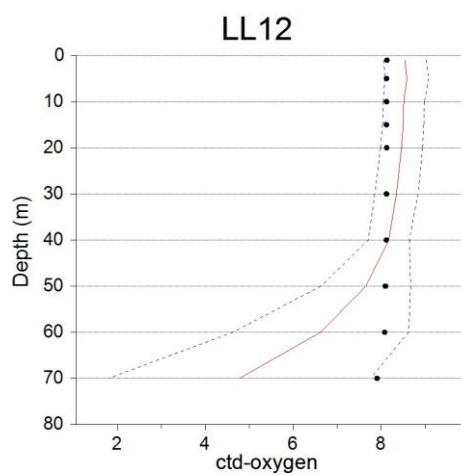
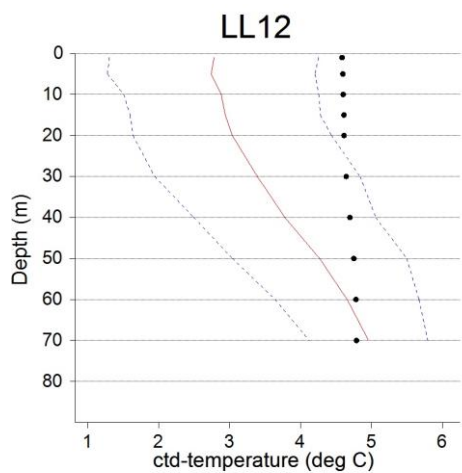
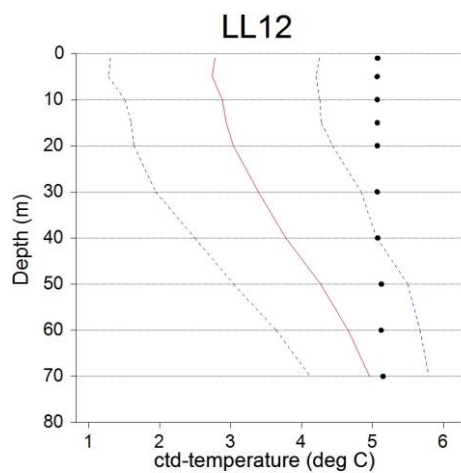
Bothnian Sea via the Kvarken. The oxygen situation in the Bothnian Sea is at the usual good level.

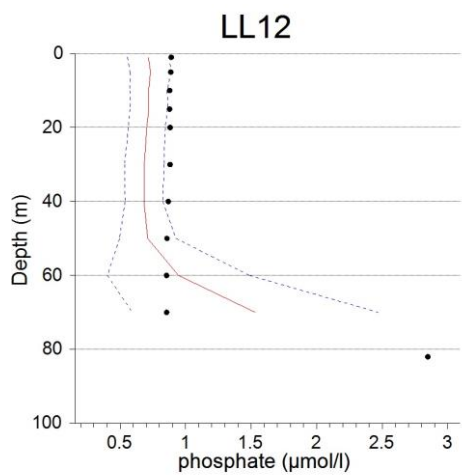
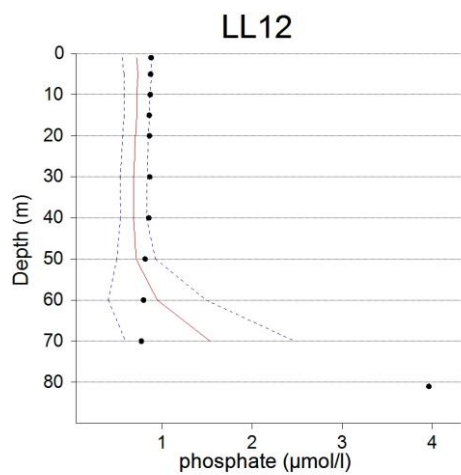
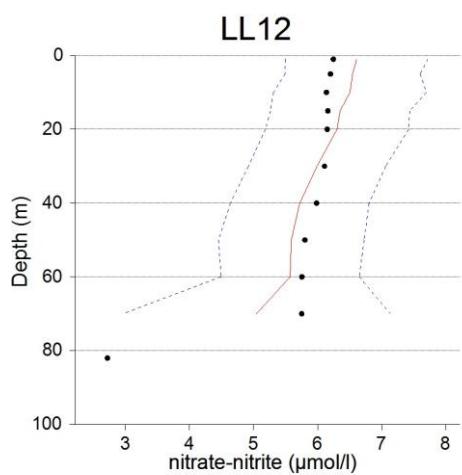
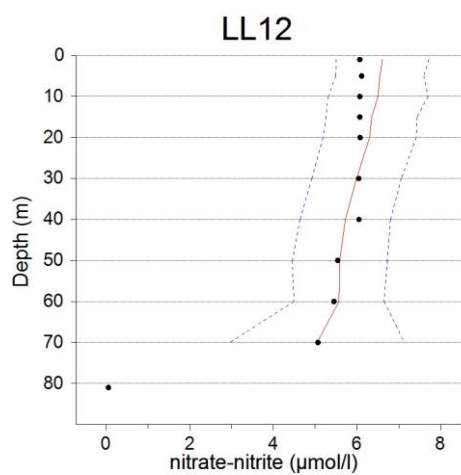
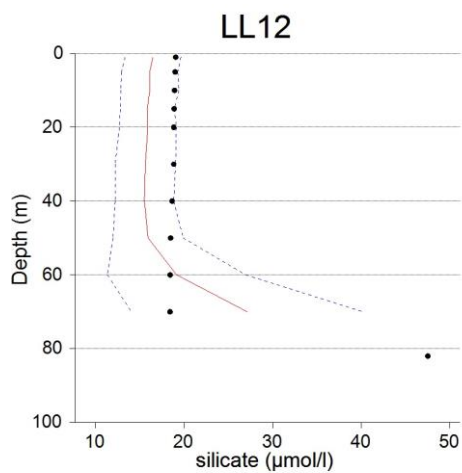
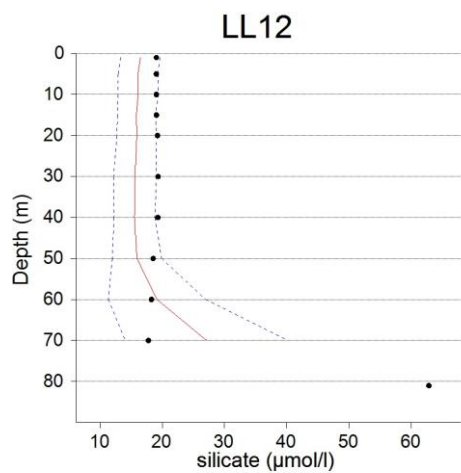
Conclusions

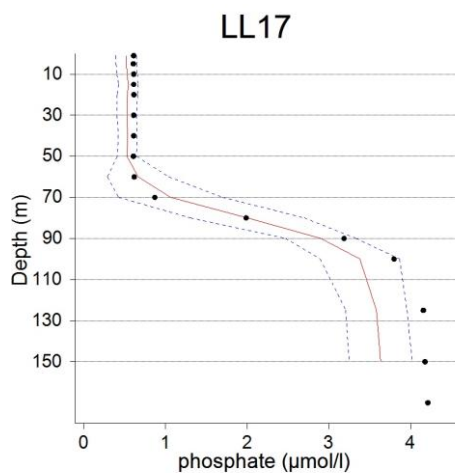
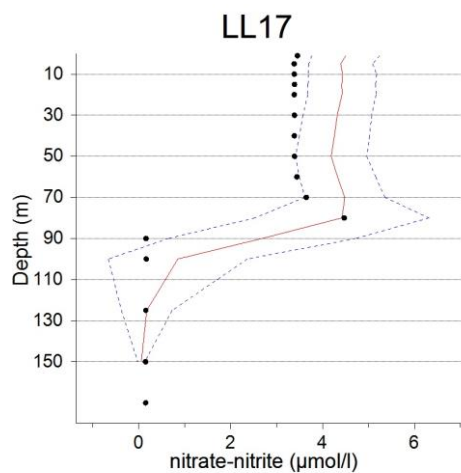
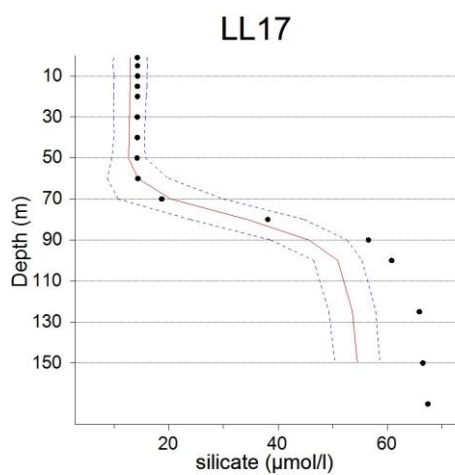
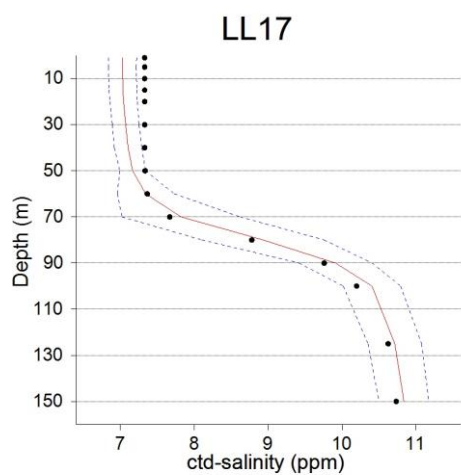
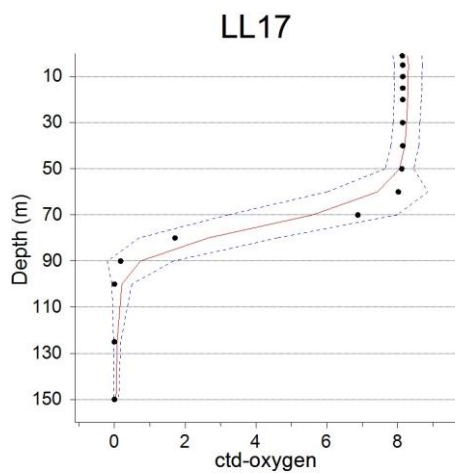
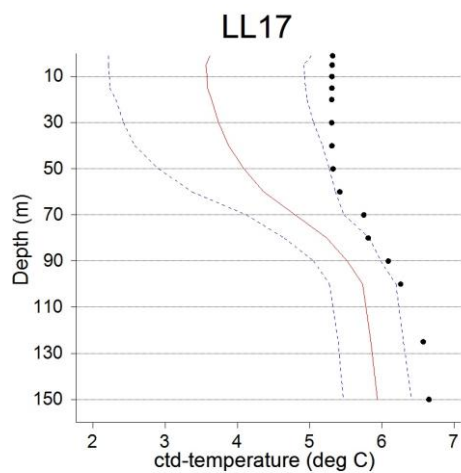
Observations made by the marine research vessel Aranda during its January voyage showed that the oxygen situation in the Gulf of Finland was the best in the last five winters. In contrast, oxygen problems persist in the main basin of the Baltic Sea and deep-water phosphate phosphorus concentrations are high. The oxygen situation in the depths of the Bothnian Sea is still reasonably good, but gradually deteriorating. Phosphorus flows into the Gulf of Bothnia from the main basin, and this is reflected in the increased concentrations in the sea area.

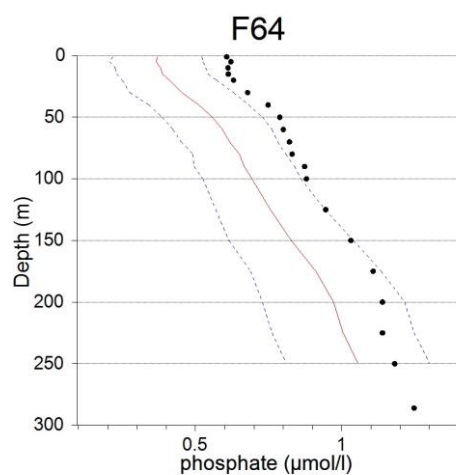
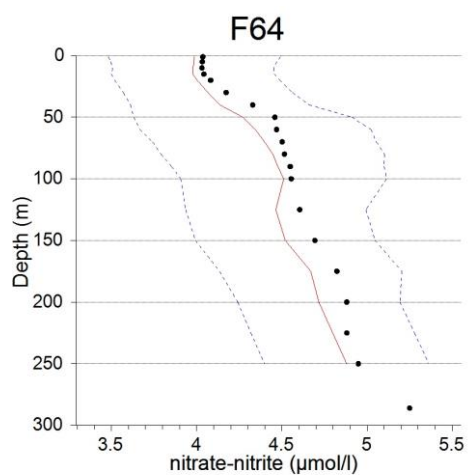
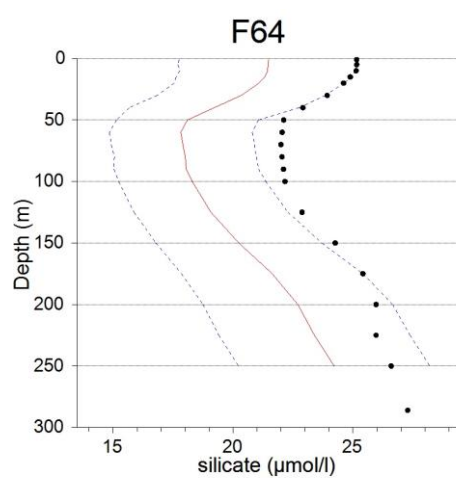
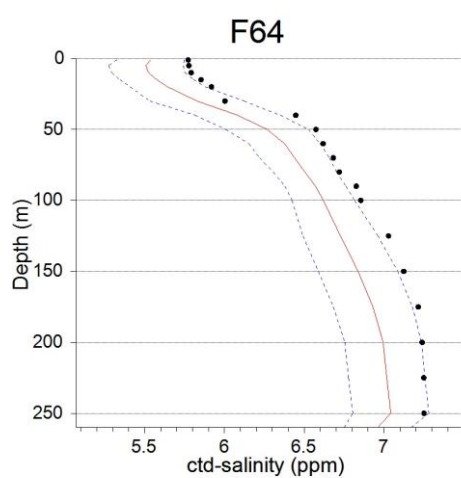
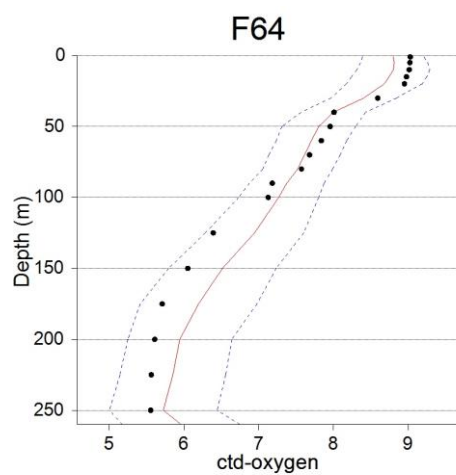
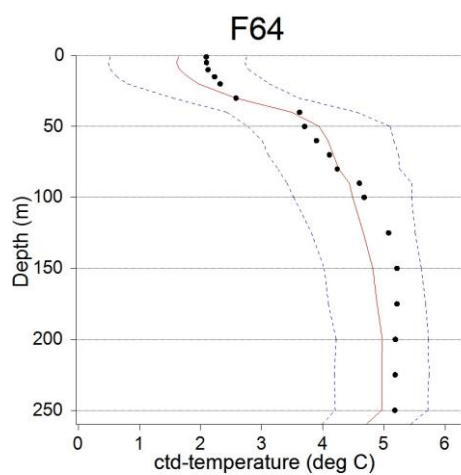
Annex 1. Selected variables at the stations XV1, LL12, LL17, F64, SR5, US5B, BO3 and F2. Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season since the year 2000.

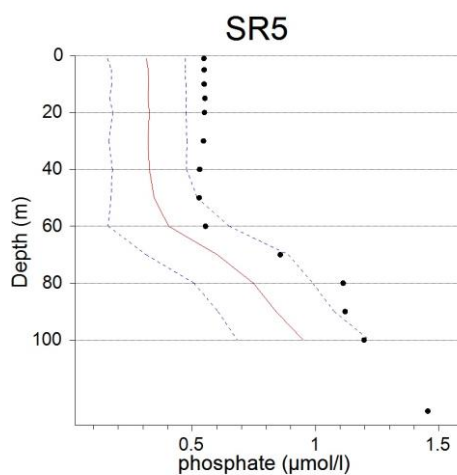
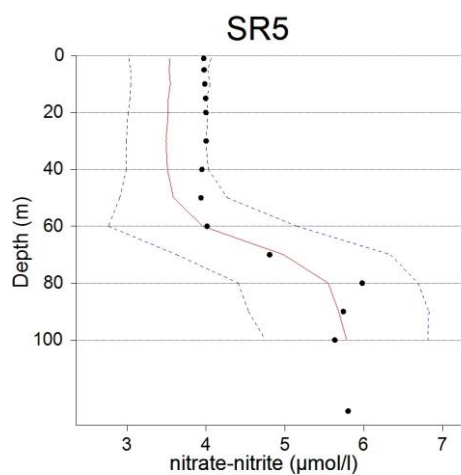
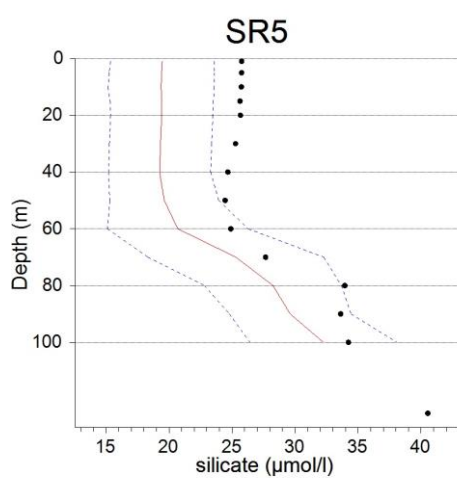
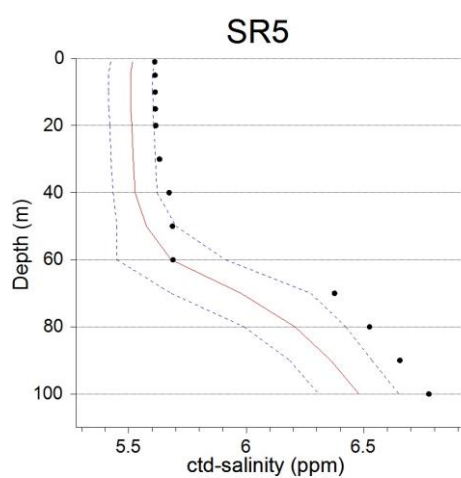
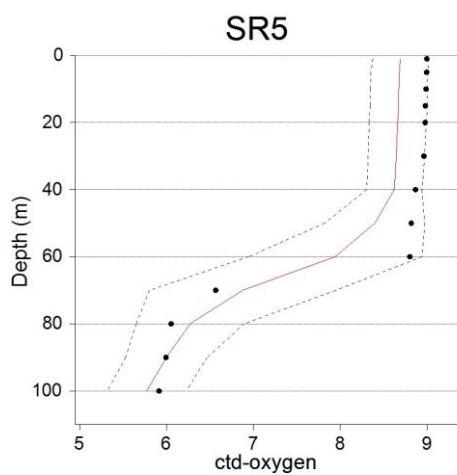
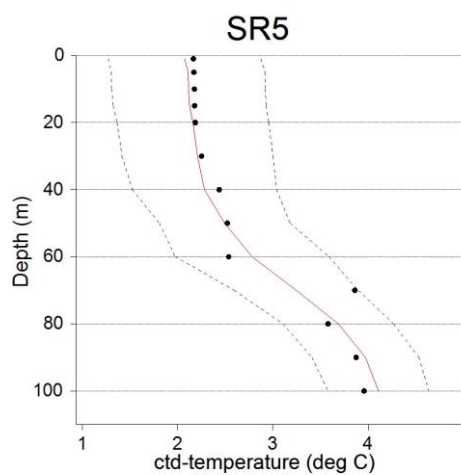


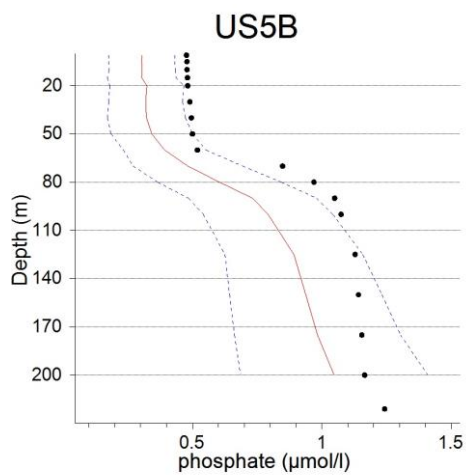
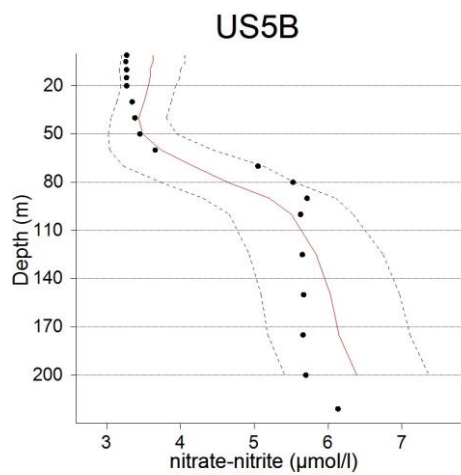
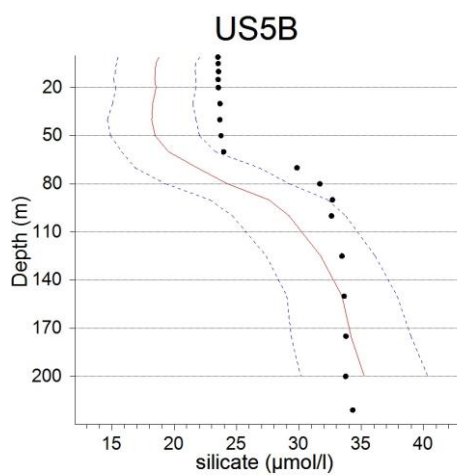
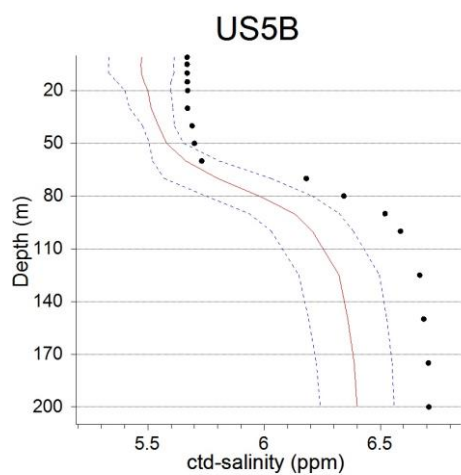
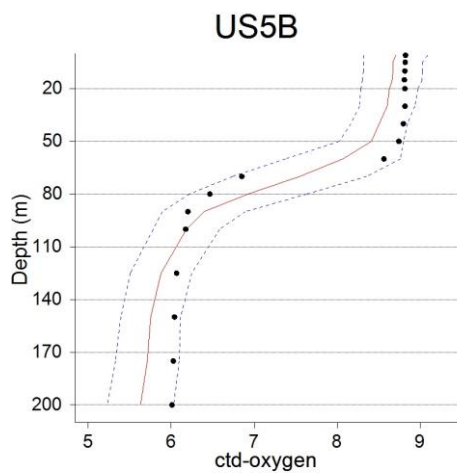
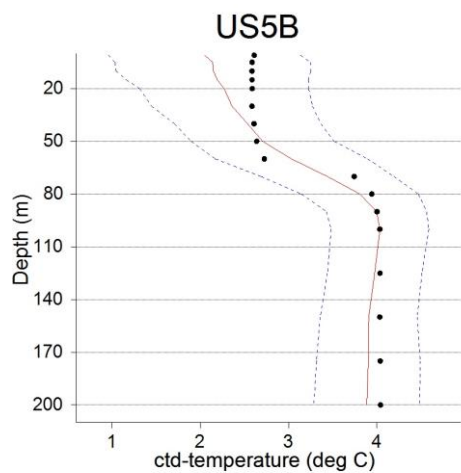


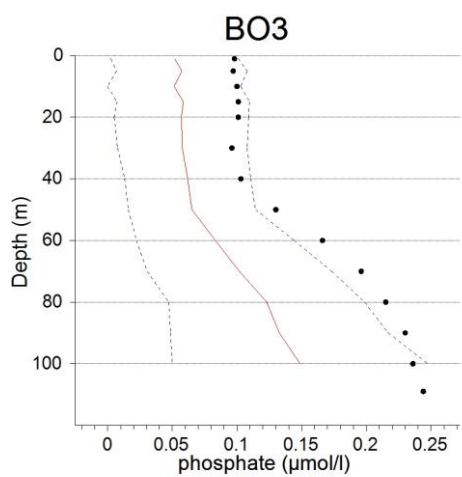
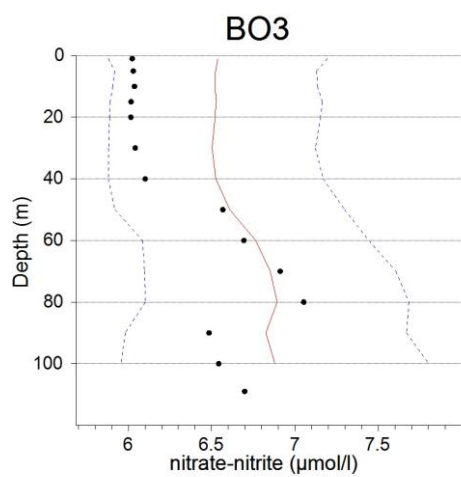
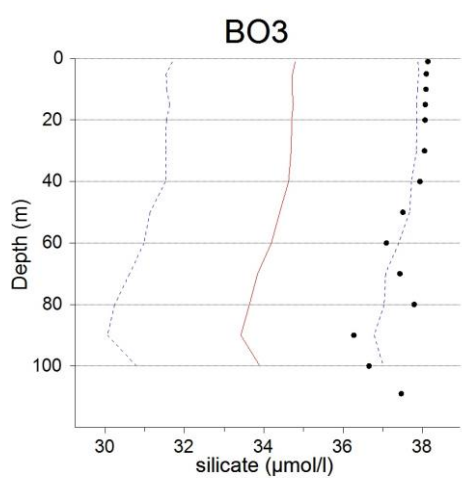
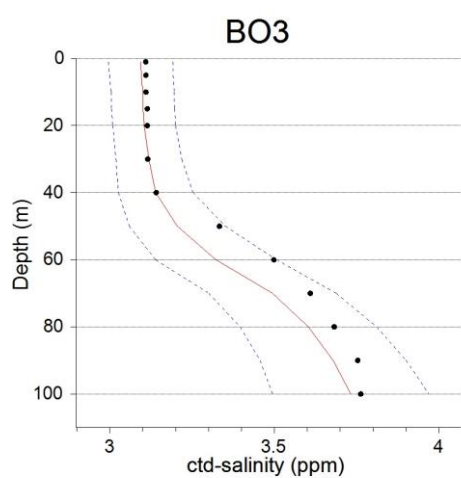
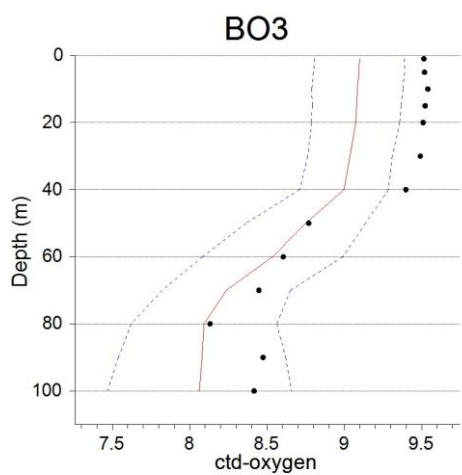
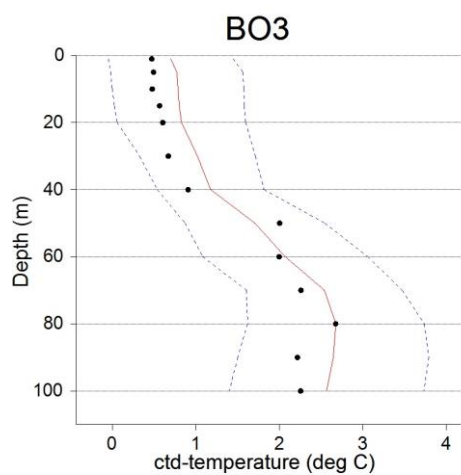


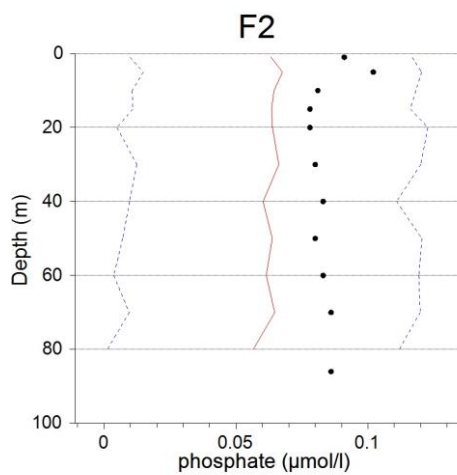
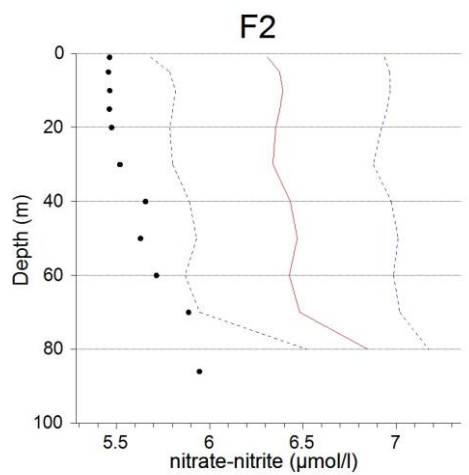
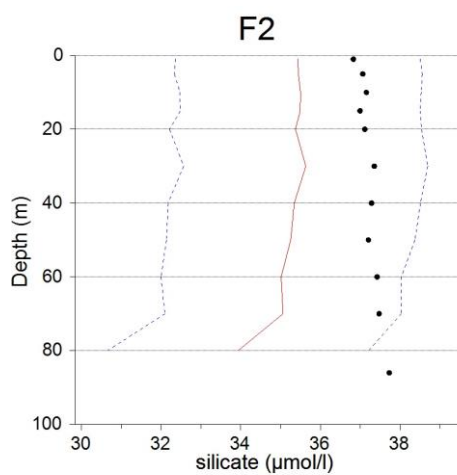
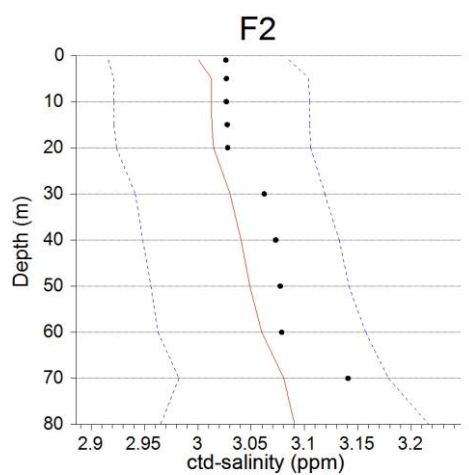
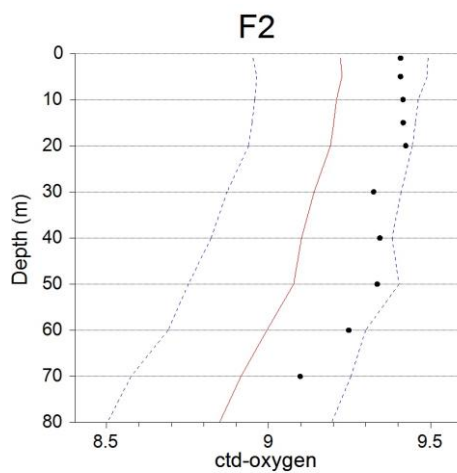
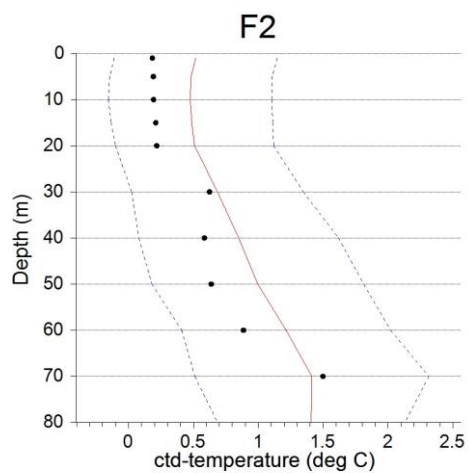












Annex 2. List of sampled stations of the cruise

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
Helsinki	Helsinki	60.16182	24.90157		2025-01-14	07.09											
2025010001	39A	60.06683	24.98010	42	2025-01-14	09.25	x	x	x	x							x
2025010002	XIV3	60.20317	26.19280	78	2025-01-14	16.28	x	x	x	x							
2025010003	XV1	60.25000	27.24708	66	2025-01-14	21.17	x	x	x	x							
2025010004	LL3A	60.06722	26.34663	69	2025-01-15	03.18	x	x	x	x				x	x		
2025010005	GF2	59.83855	25.85680	85	2025-01-15	07.54	x	x	x	x							x
2025010006	LL5	59.91720	25.59707	69	2025-01-15	10.39	x	x	x	x							x
2025010007	AALTO HKI	59.96515	25.23933	63	2025-01-15	12.59											
2025010008	LL6A	59.91683	25.03010	73	2025-01-15	14.43	x	x	x	x							
2025010009	LL7D	59.84648	24.83792	102	2025-01-15	18.08	x	x	x	x					x		
2025010010	GF1	59.70497	24.68195	84	2025-01-15	21.17	x	x	x	x							
2025010011	LL9	59.70013	24.03085	67	2025-01-16	01.32	x	x	x	x							
2025010012	XII3	59.86417	23.98565	36	2025-01-16	03.51	x	x	x	x							
2025010013	JML	59.58192	23.62688	80	2025-01-16	06.56	x	x	x	x							
2025010014	F62	59.33347	23.26350	97	2025-01-16	11.32	x	x	x	x							x
2025010015	LL12	59.48348	22.89687	82	2025-01-16	15.43	x	x	x	x					x		
2025010016	LL11	59.58347	23.29675	68	2025-01-16	19.05	x	x	x	x							
2025010017	AMN	59.69052	23.25715	55	2025-01-16	21.11	x	x	x	x							
2025010018	LANGDEN	59.77678	23.26282	58	2025-01-17	04.50	x	x	x	x							
HANKO4	HANKO4	59.82093	22.95348		2025-01-17	07.50											
HANKO	HANKO	59.81943	22.94062		2025-01-17	12.15											
2025010019	LL15	59.18332	21.74693	131	2025-01-17	19.55	x	x	x	x							
2025010020	VV23 ADCP	59.67023	20.65523	115	2025-01-18	03.16											
2025010021	UTO WAVERIDER	59.71338	21.37110	82	2025-01-18	07.20											
2025010022	UTO HYDROFONI	59.71518	21.44732	96	2025-01-18	10.29											
2025010023	UTO OBS	59.73667	21.37990	79	2025-01-18	11.44											
2025010024	IU7	59.81515	21.33668	93	2025-01-18	13.06	x	x	x	x							x
2025010025	IU5	60.05818	21.19835	89	2025-01-18	16.24	x	x	x	x				x			
2025010026	IU3	60.33333	21.11330	52	2025-01-18	20.08	x	x	x	x							
2025010027	IU2 ADCP	60.58147	21.13293	-9	2025-01-18	23.33											
2025010028	ISOKARI	60.72703	20.88188		2025-01-19	01.05											
2025010029	IU1	60.76682	20.84667	34	2025-01-19	02.29	x	x	x	x							
2025010030	SR8	61.12650	20.93010	48	2025-01-19	05.55	x	x	x	x							
2025010031	SR7	61.08350	20.59650	79	2025-01-19	07.46	x	x	x	x							x
2025010032	SR7 LAATU	61.08353	20.59660	79	2025-01-19	09.07	x	x	x	x							x
2025010033	ARGO SM	61.56657	20.28342	125	2025-01-19	13.24											
2025010034	MS9	61.76683	20.53053	101	2025-01-19	15.46	x	x	x	x							
2025010035	AALTO SM	61.79922	20.23752		2025-01-19	18.07											
2025010036	F26	61.98345	20.06303	138	2025-01-19	21.07	x	x	x	x							
2025010037	US7	62.60018	20.82960	28	2025-01-20	03.01	x	x	x	x							
2025010038	US6B	62.60018	20.26298	82	2025-01-20	05.47	x	x	x	x							
2025010039	US5B	62.58620	19.96880	222	2025-01-20	08.10	x	x	x	x				x	x		x
2025010040	US3	62.75885	19.19572	175	2025-01-20	12.41	x	x	x	x							x
2025010041	F16	63.51677	21.06282	48	2025-01-20	21.52	x	x	x	x							
2025010042	F15	63.51667	21.51308	49	2025-01-20	23.48	x	x	x	x							
2025010043	PIETARINKANTA	63.98387	22.83123	19	2025-01-21	06.05											
KOKKOLA	KOKKOLA	63.86095	23.03225		2025-01-21	13.09											
2025010044	RR7	64.73438	23.81180	40	2025-01-21	19.50	x	x	x	x							
2025010045	RR6	64.80040	23.47960	87	2025-01-21	21.55	x	x	x	x							
2025010046	KIISLA	65.26255	24.43267	18	2025-01-22	03.02											
2025010047	F2	65.38383	23.46182	87	2025-01-22	08.39	x	x	x	x				x			x
2025010048	CVI	65.23370	23.56282	69	2025-01-22	11.03	x	x	x	x					x		x
2025010049	CV	65.00040	23.24612	86	2025-01-22	13.35	x	x	x	x							
2025010050	RR3	64.93367	22.34597	96	2025-01-22	16.53	x	x	x	x							
2025010051	BO3	64.30208	22.34308	110	2025-01-22	21.57	x	x	x	x					x		
2025010052	F13	63.78348	21.47950	65	2025-01-23	03.00	x	x	x	x							
2025010053	F18	63.31432	20.27273	105	2025-01-23	08.06	x	x	x	x							
2025010054	MS3	62.13452	18.16293	84	2025-01-23	17.34	x	x	x	x							
2025010055	MS6	61.98370	19.16365	73	2025-01-23	21.44	x	x	x	x				x			
2025010056	SR3	61.18337	18.22997	72	2025-01-24	04.29	x	x	x	x							
2025010057	SR5	61.08338	19.57967	126	2025-01-24	09.34	x	x	x	x				x	x		x
2025010058	F33	60.53320	18.93767	135	2025-01-24	16.23	x	x	x	x							
2025010059	F64	60.18893	19.14282	287	2025-01-24	20.33	x	x	x	x					x		
2025010060	F69	59.78333	19.93010	193	2025-01-25	17.37	x	x	x	x							
2025010061	LL19	58.88067	20.31090	166	2025-01-26	02.36	x	x	x	x							
2025010062	LL19LAATU	58.88068	20.31095	166	2025-01-26	03.49	x										

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
2025010063	LL17	59.03350	21.07975	171	2025-01-26	08.07	x	x	x	x					x		x
2025010064	BIAS15	59.24973	21.01707	94	2025-01-26	12.17											
2025010065	AALTO_PI	59.24575	20.99843	111	2025-01-26	12.49											
2025010066	LL12	59.48347	22.89700	83	2025-01-26	20.26	x	x	x	x							
HELSINKI	HELSINKI	60.16182	24.90152		2025-01-27	05.02											

Parameters: ox = oxygen, nu = nutrients, ph = phytoplankton, zo = zooplankton, be = benthos, chl = chlorophyll a, oil = dissolved oil, tox = phytotoxins.