

CRUISE REPORT



R/V Aranda

Cruise 01/2023

Combine 1
16.1.2023 – 29.1.2023

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

Objectives of the cruise

The objectives of the 1st leg of the cruise were:

Monitoring of underwater sound pressure, harmful substances, hydrography (pH, oxygen, total sulfide, ammonia, nutrients), and physics (temperature and salinity) in compliance with HELCOM COMBINE and EU MSFD monitoring programs.

Additionally:

- *servicing a FMI wave buoys
- *sediment trap retrieval
- *large (1 cubic metre) volume water sampling
- *further tests with hydrogen sulfide sensor

2nd leg

The COMBINE 1 2nd leg winter cruise objectives were to monitor hydrography and water chemistry of the Northern Baltic. In addition, oil concentrations in surface water and samples of hazardous substances in sediments were conducted.

One hydrophone was replaced in the Bothnian Bay and maintenance of wave buoys of FMI in the Northern Baltic Proper and current meters (ADCPs) in the Archipelago Sea were installed. Also an instrument of FMI to measure characteristics of ice in the Bothnian Bay were installed, respectively.

Table 1 The scientific crew

Name	On board	Organization
Kankaanpää Harri	16.– 20. 1. 2023	SYKE
Lehtiniemi Maiju	16.– 20. 1. 2023	SYKE
Setälä Outi	16.– 20. 1. 2023	SYKE
Ilonen Erkkä	16.– 20. 1. 2023	IL
Jalli Heini	16.– 20. 1. 2023	IL
Mattsson Riikka	16.– 29. 1. 2023	SYKE
Granlund Mira	16.– 29. 1. 2023	SYKE
Lastumäki Ilkka	16.– 29. 1. 2023	SYKE
Haavisto Noora	16.– 29. 1. 2023	SYKE
Riikonen Jere	16.– 29. 1. 2023	SYKE
Outinen Okko	16.– 29. 1. 2023	SYKE
Rantapusa Sami	16.– 29. 1. 2023	IL
Kotilainen Pekka	20. - 29. 1. 2023	SYKE

Tuomo Roine	20. - 29. 1. 2023	SYKE
Anni Jokiniemi	20. - 29. 1. 2023	IL
Jessica Haapkylä	20. - 29. 1. 2023	Journalist (freelancer)

Cruise Route

Please fill in route description.

Helsinki, Tammasaari pier, 16.1.2023 at 10.30
 via Helsinki, Hernesaari LHB pier, 16.1.2023 departure at 19.30
 via Hanko Tulliniemi 20.1.2023 at 07.30

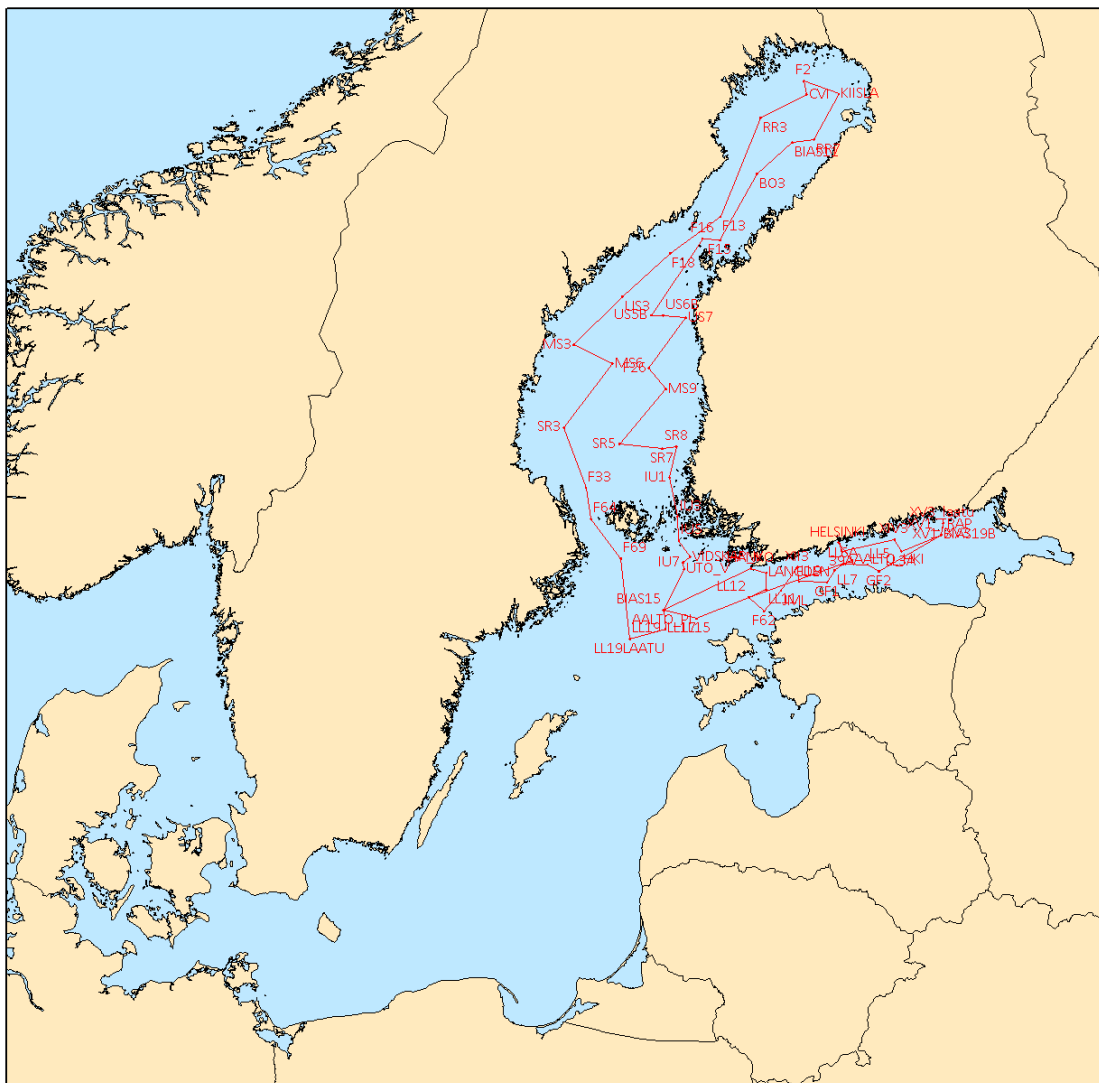
The 2nd leg of the cruise left Hanko, Tulliniemi at 19 hrs on the 20 of January.
 First the cruise headed to the automated instruments as the weather allowed to carry out the maintenance of the wave buoy of the Northern Baltic Proper.

Afterwards the cruise headed to the Archipelago Sea. Sampled stations were SR8, SR7, SR5, MS9 F26, all US -stations (US7, US6 and US5b) to reach F18 in southern part of the Kvarken.

In the Bothnian Bay stations BO3, RR7 and the northernmost station F2 were sampled. A hydrophone was recovered (BIAS11) and an ice sonde was installed in NW of Hailuoto, Oulu. Due to some heavy wind (> 20m/s in gusts) in the north, two stations CV and RR6 had to be skipped.

After the turn at F2, the cruise continued along the 'west side' of the Bothnian Bay (CVI, RR3) and Bothnian Sea (MS3, MS6, SR3, F33, F64) all the way down to the Northern Baltic Proper, station F69. Stations LL19, LL17 and LL15 were sampled among the last ones. In between the stations LL17 and LL15 it was tried to relocate once more one of the hydrophones with no success.

The sampling of LL12 was repeated (ref to the 1st leg). and the cruise was timed to the remove the wave buoy off Helsinki (as a precaution for possible icing), Finally, the cruise ended up to Helsinki in the morning of the 29th of January 2023.



Cruise route

Observations

Gulf of Finland was well ventilated throughout the water column with oxygen. Mixed layer was approximately 0-20 m. Anomalically high concentrations of phosphate occurred in surface water everywhere east of Helsinki. Record-high near-bottom concentration of phosphate occurred in the easternmost monitoring station XV1 and was associated with large silicate and nitrate concentrations.

The deep water in the Northern Baltic Proper >80m was typically anoxic and high dissolved phosphorus concentrations (> 4µmol/l) were observed.

The observed nutrient concentrations in deep waters of the Bothnian Sea were higher than before.

In the Kvarken the observed phosphate concentrations were at a fairly low level, being in between 0.2-0.4 µmol/l and in the Bothnian Bay concentrations were close to limit of detection.

Conclusions**Gulf of Finland**

The state of the Gulf of Finland regarding oxygen is good, and regarding phosphate is not good.

Northern Baltic Proper

There is no improvement in sight as regards the oxygen or nutrient concentrations.

Bothnian Sea

Oxygen condition in deep waters have slowly worsened, though the concentrations were still > 5 ml/l. The area of a lower concentration was wider than in the last year.

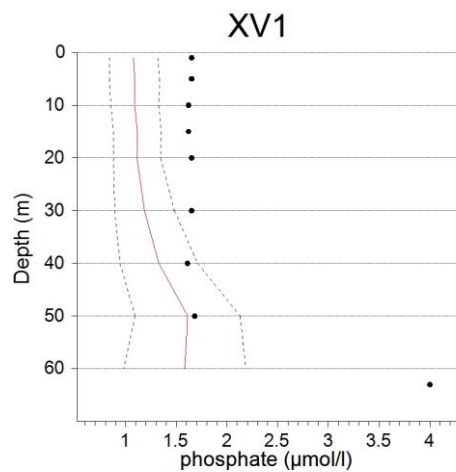
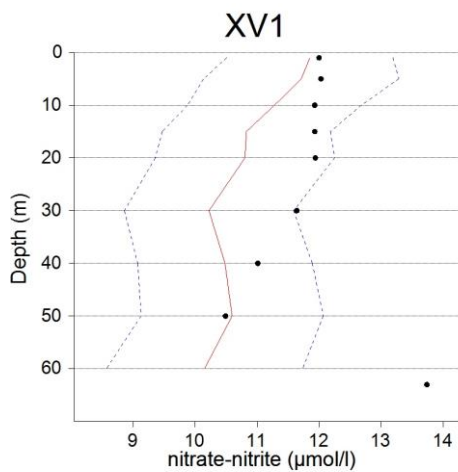
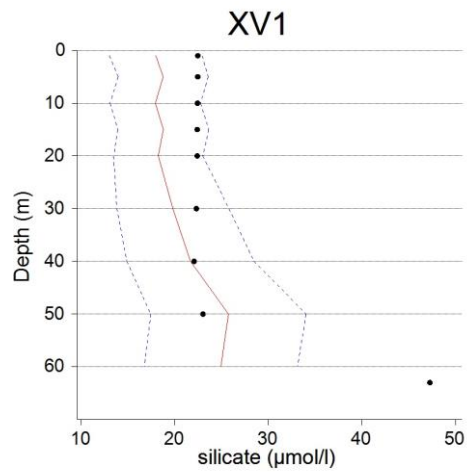
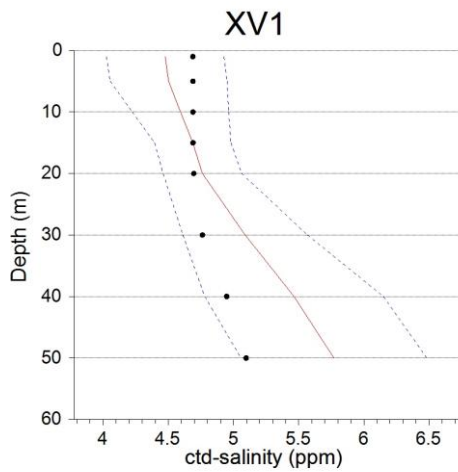
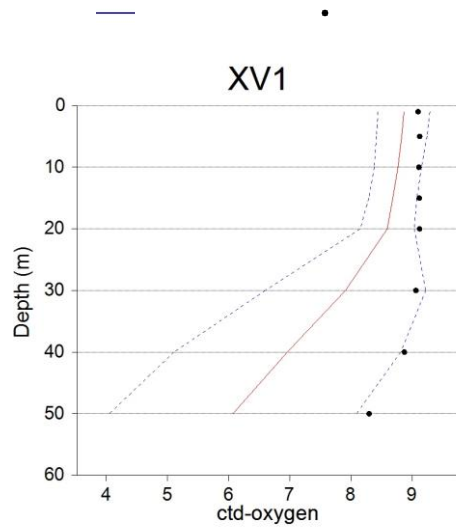
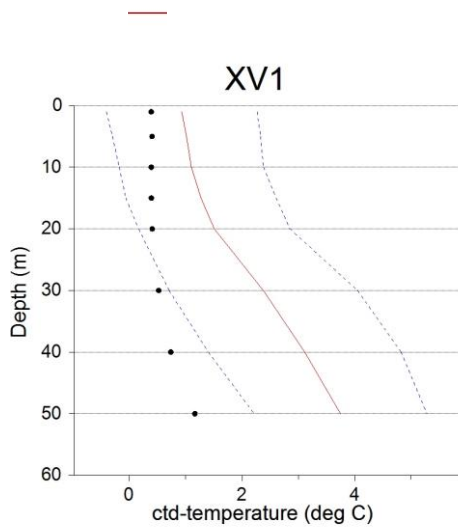
Archipelago Sea

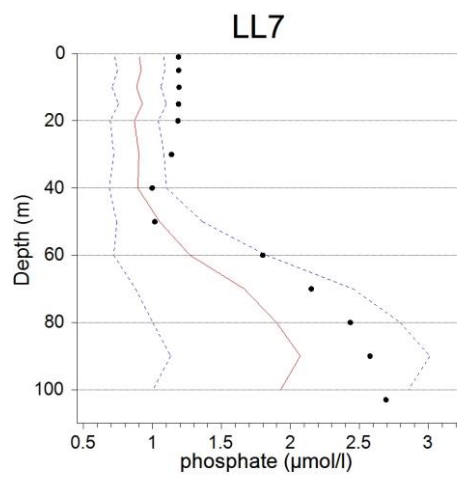
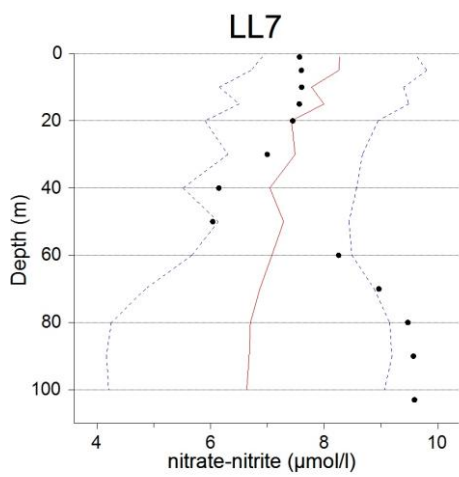
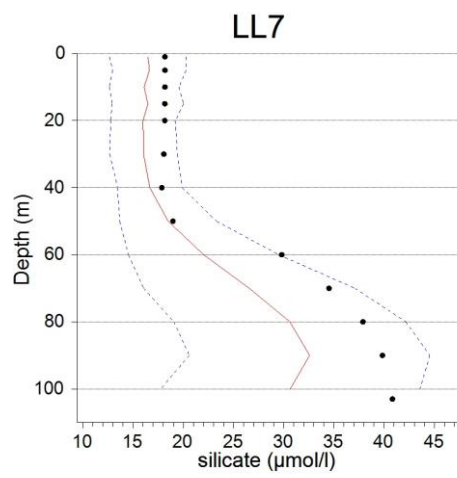
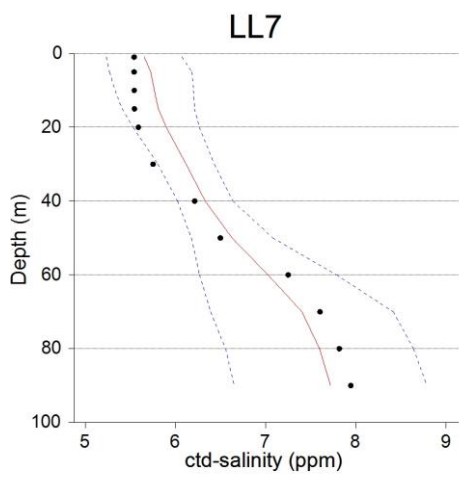
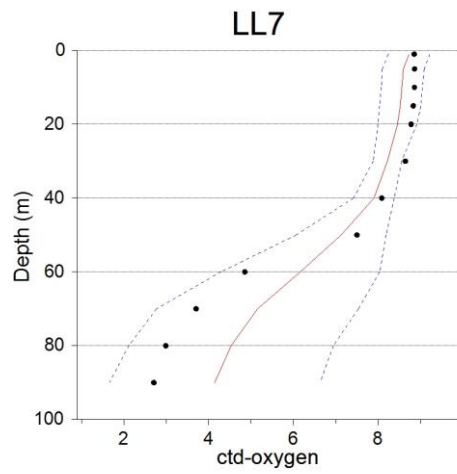
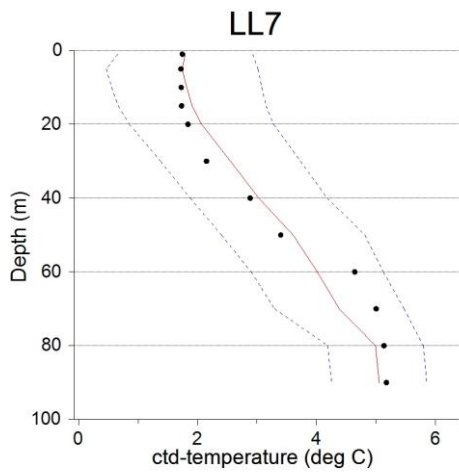
In the Archipelago Sea the water column was completely mixed, and the observed nutrient and oxygen concentrations were typical for the season and the region, respectively.

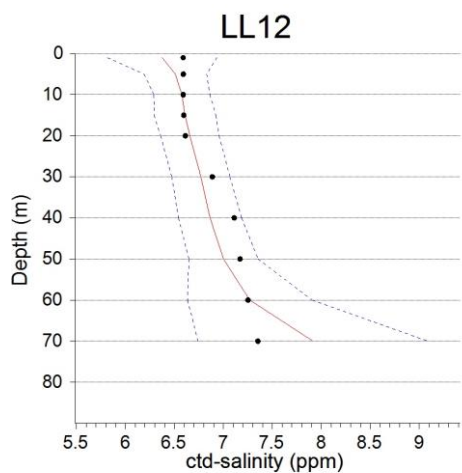
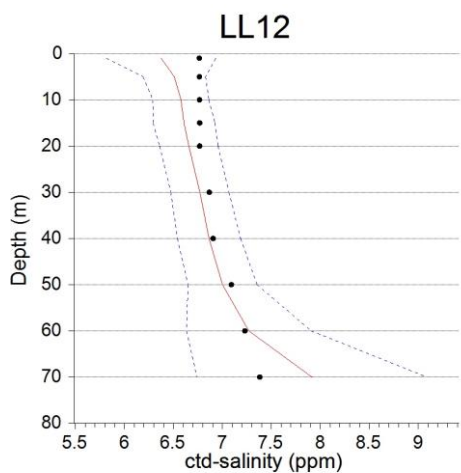
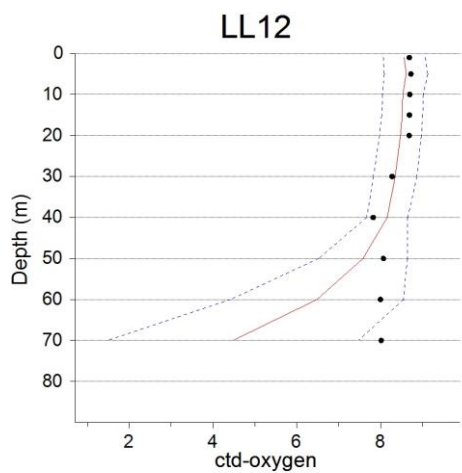
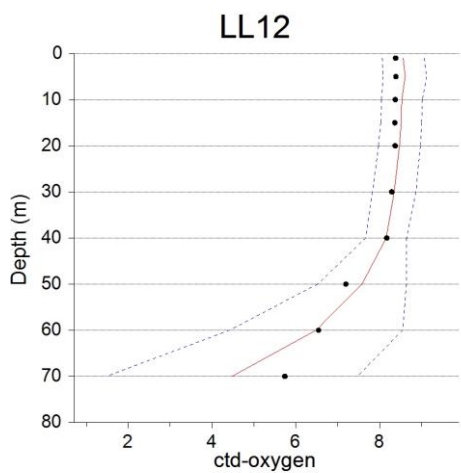
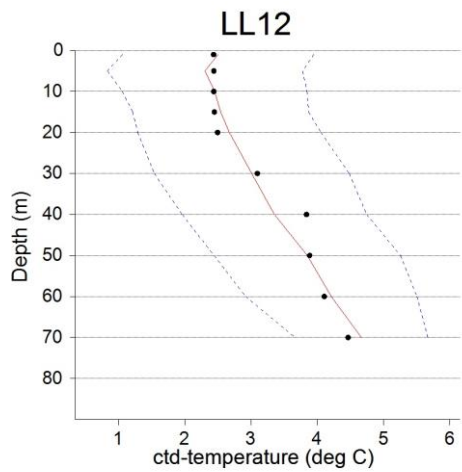
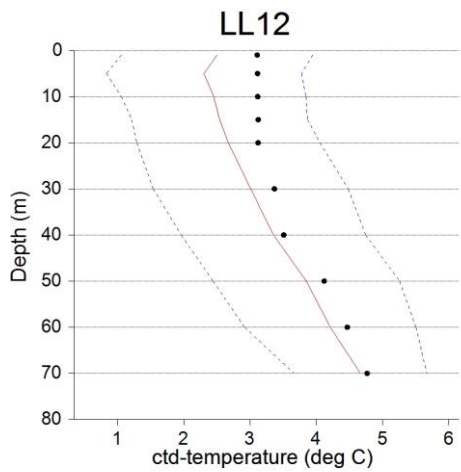
Kvarken and Bothnian Bay

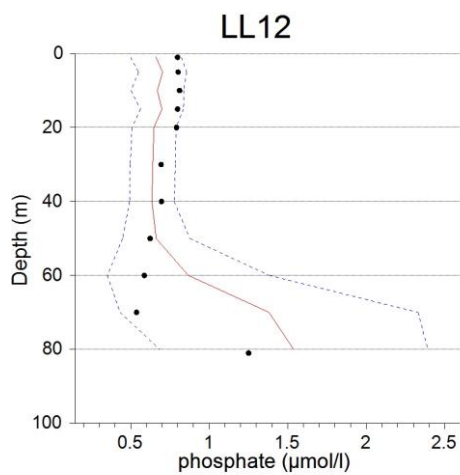
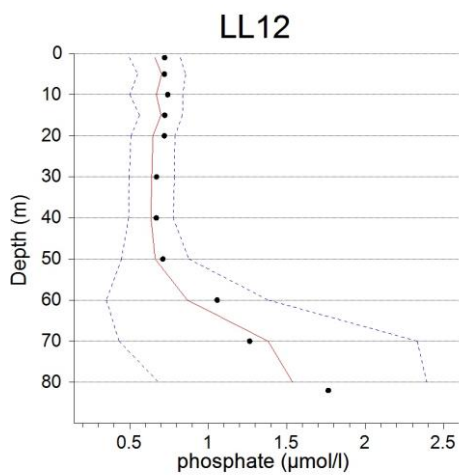
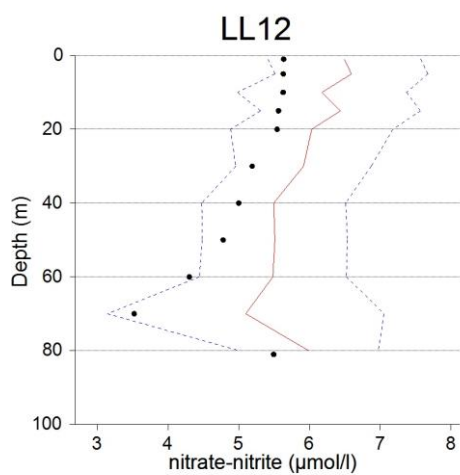
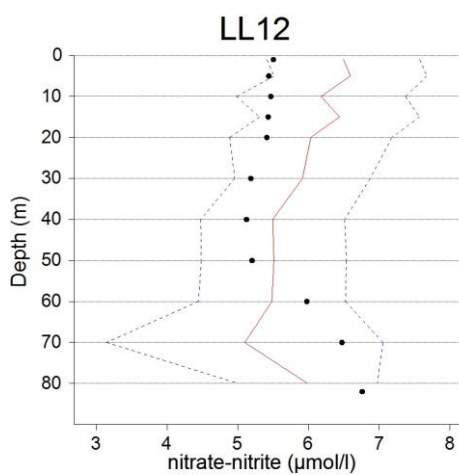
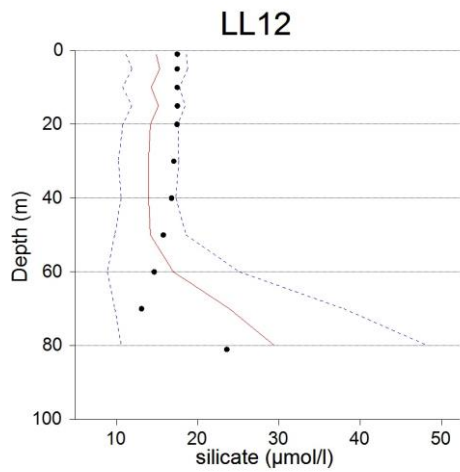
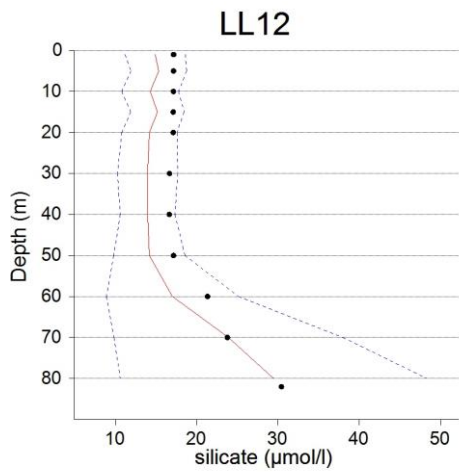
The nutrient concentrations of the Kvarken and the Bothnian Bay continued increasing.

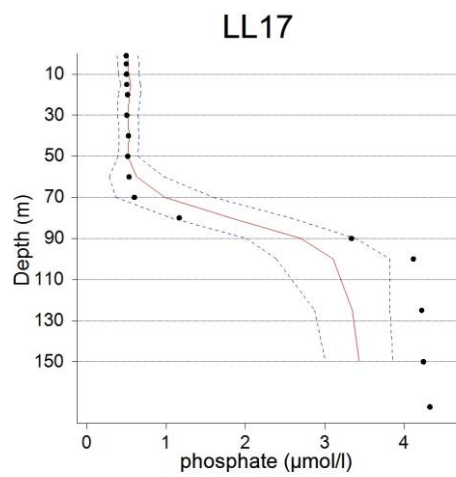
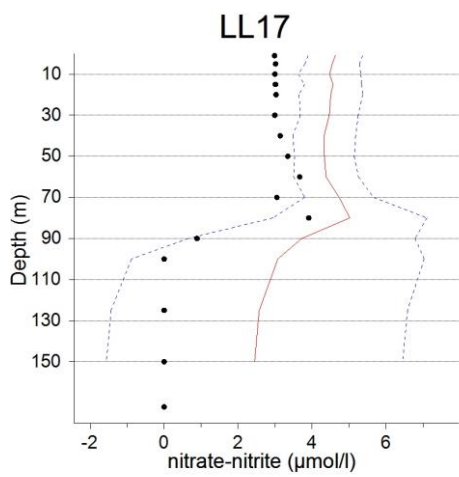
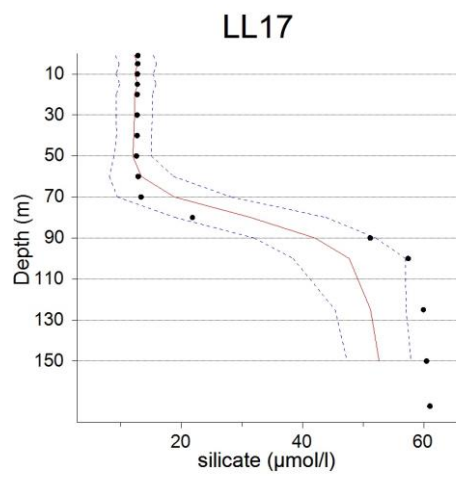
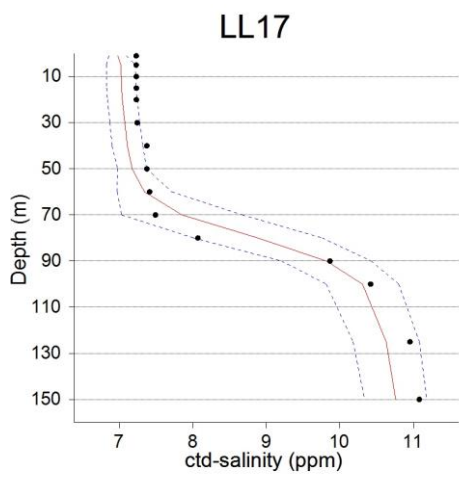
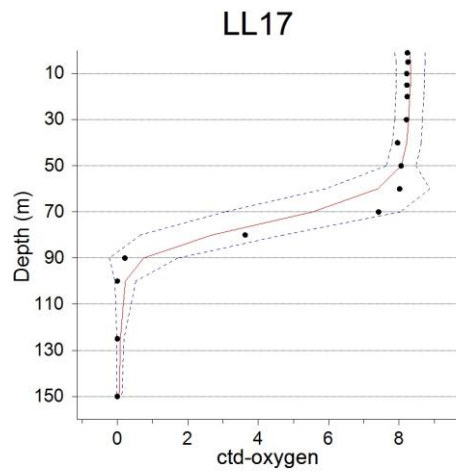
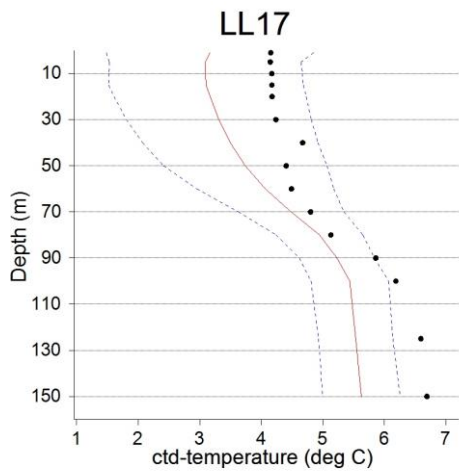
Annex 1. Selected variables at the stations XV1, LL7, LL12, LL17, F64, SR5, US5B, BO3 and F2. Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season since the year 1960.

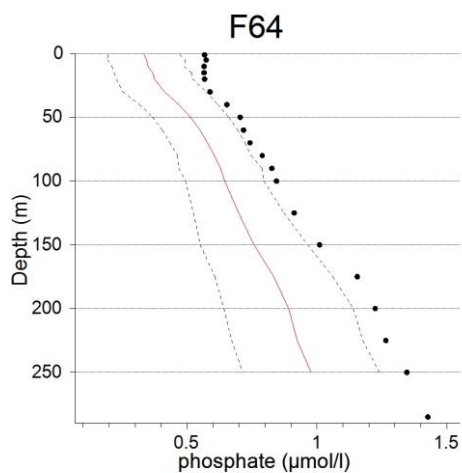
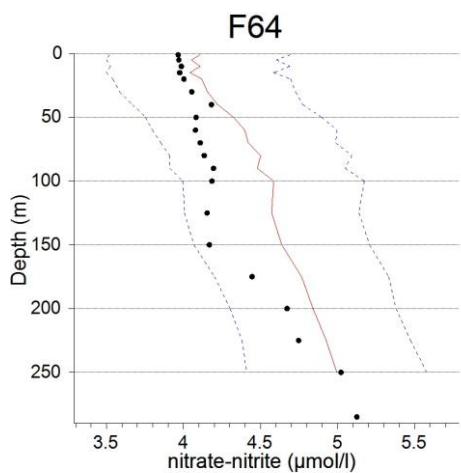
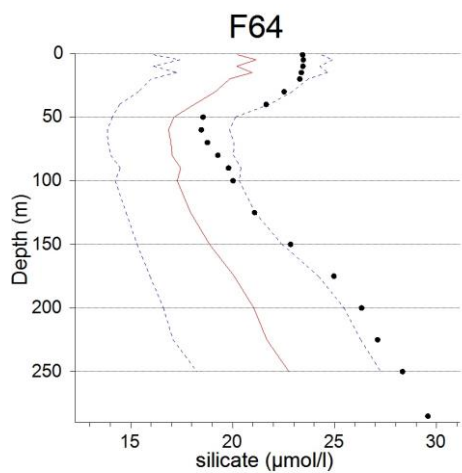
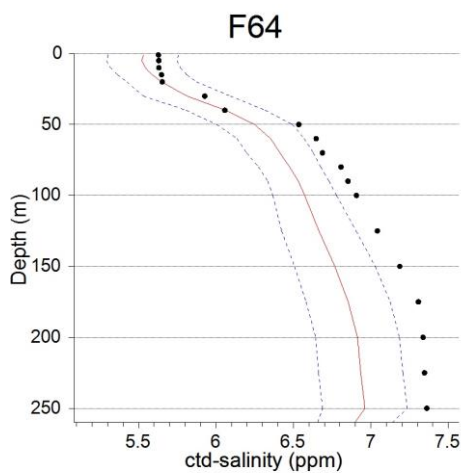
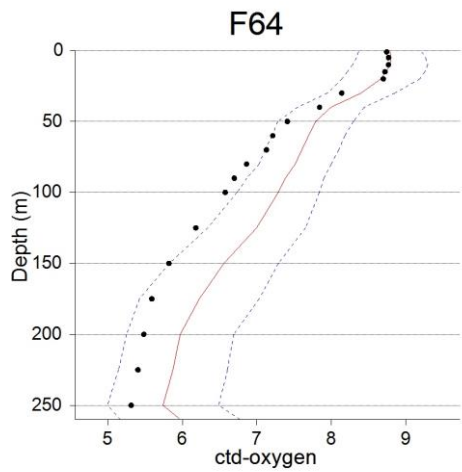
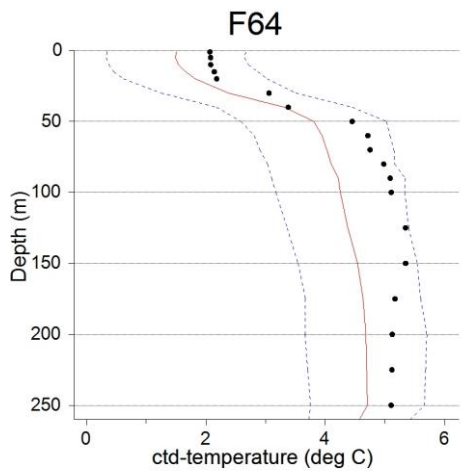


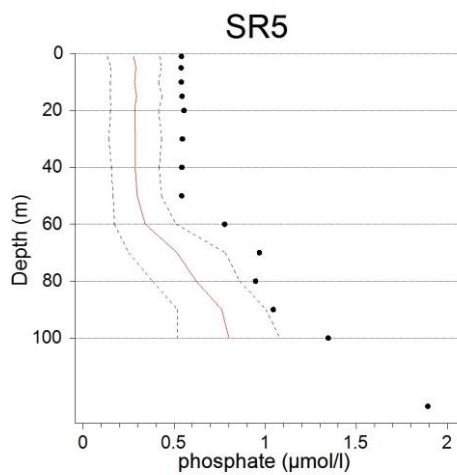
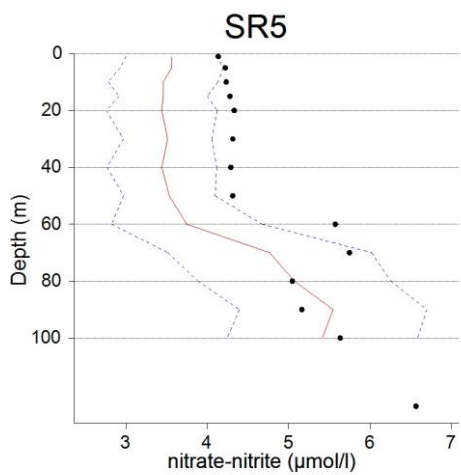
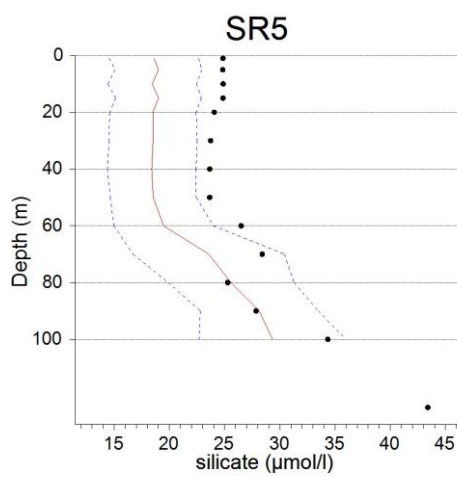
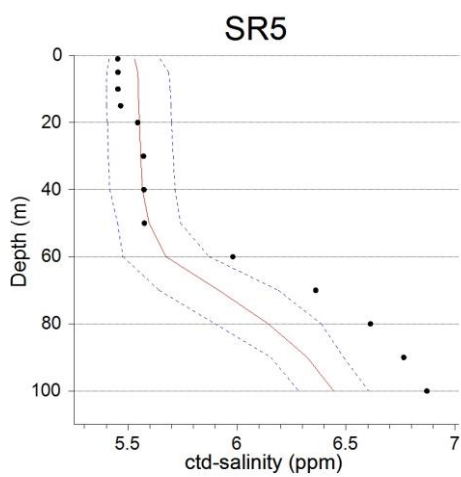
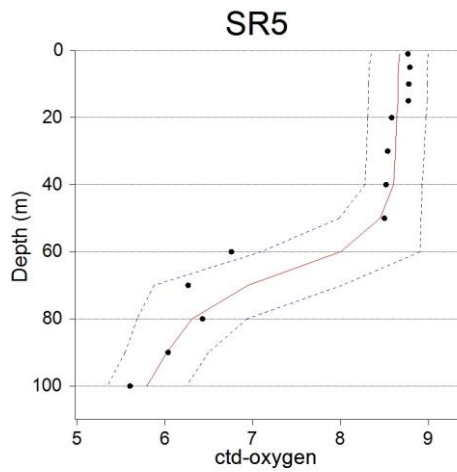
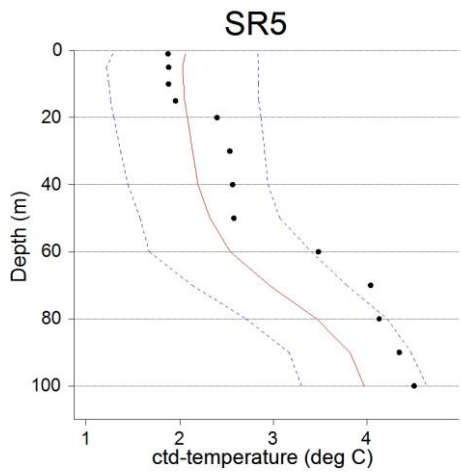


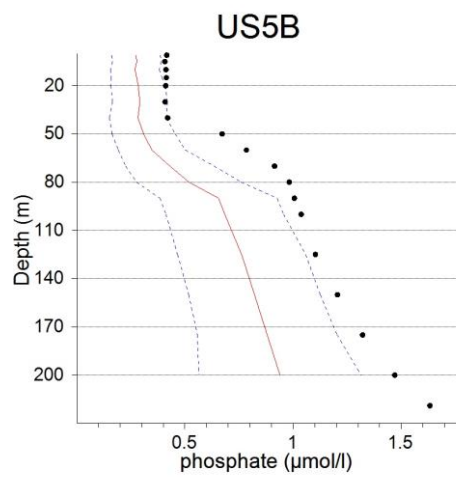
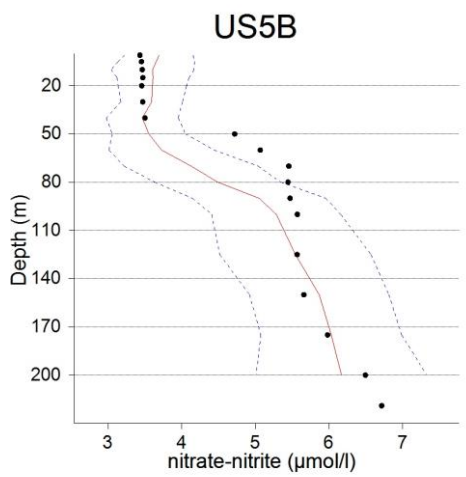
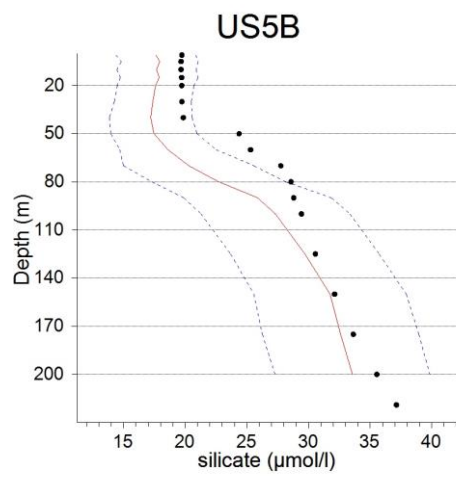
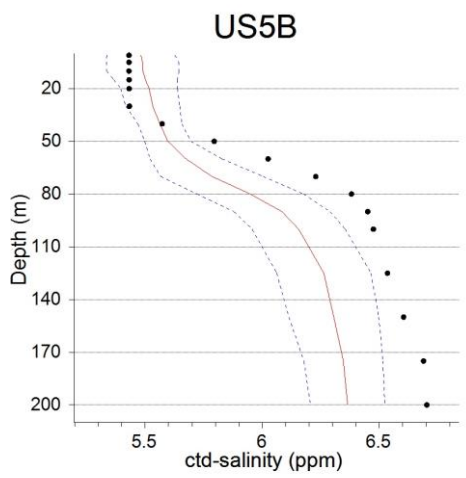
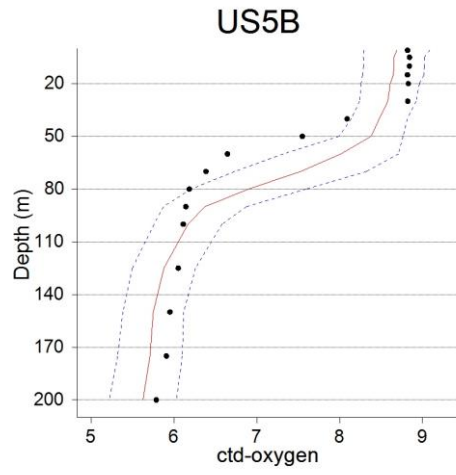
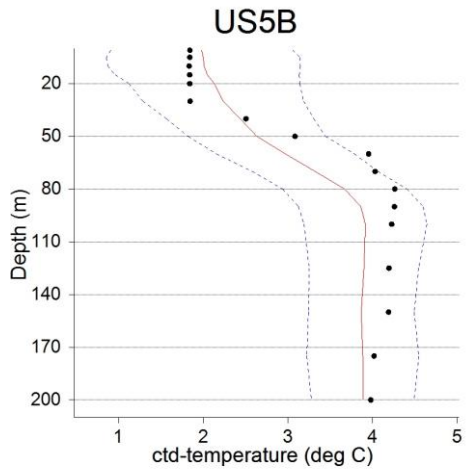


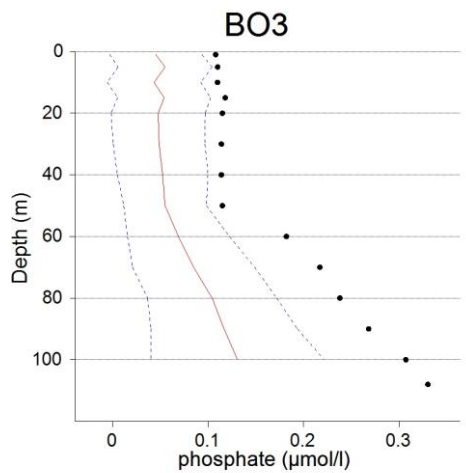
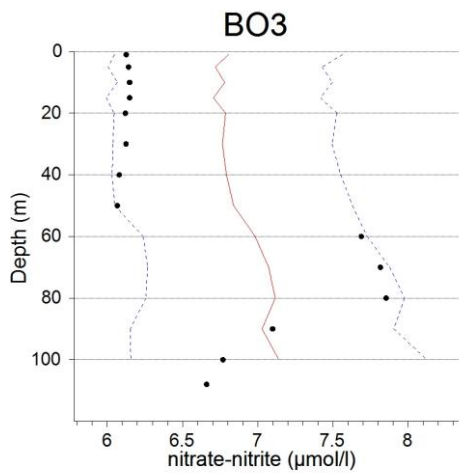
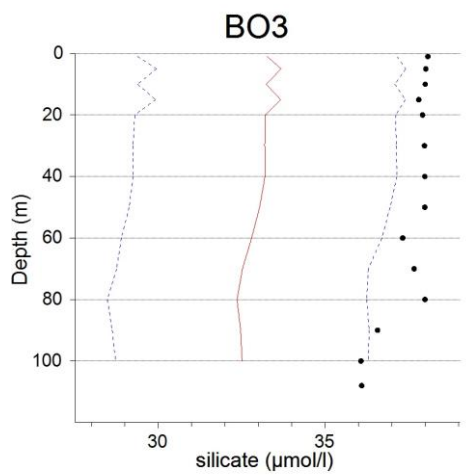
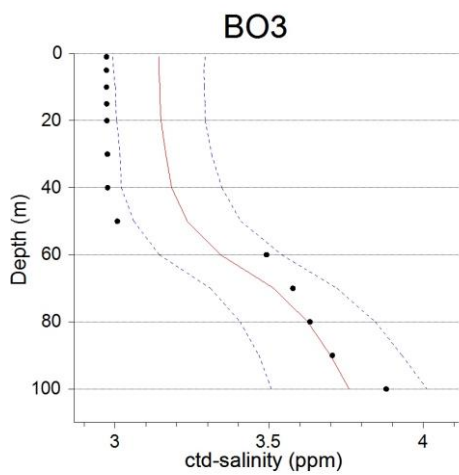
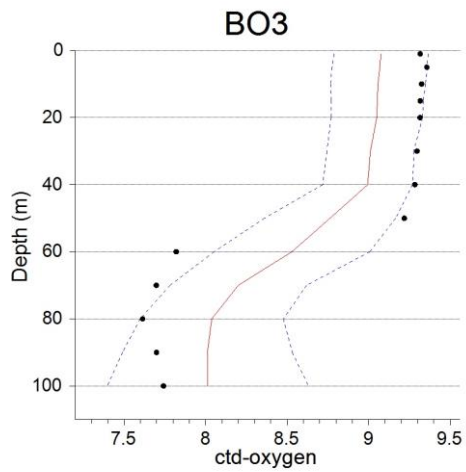
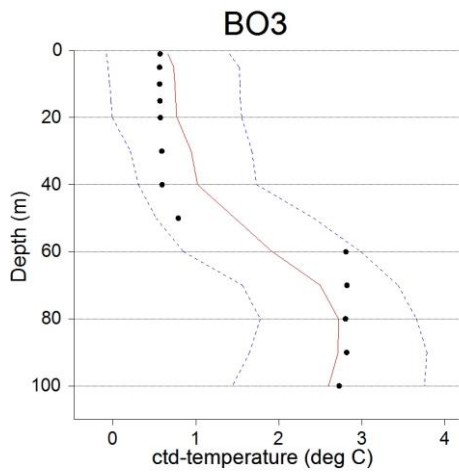


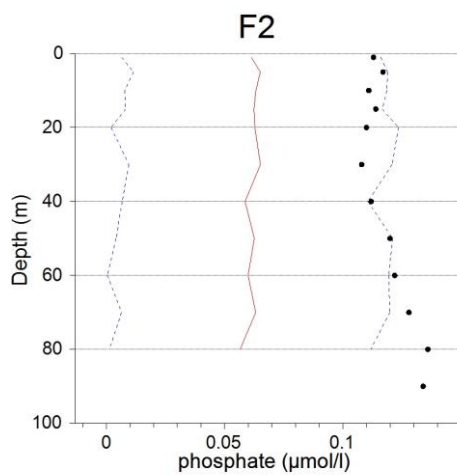
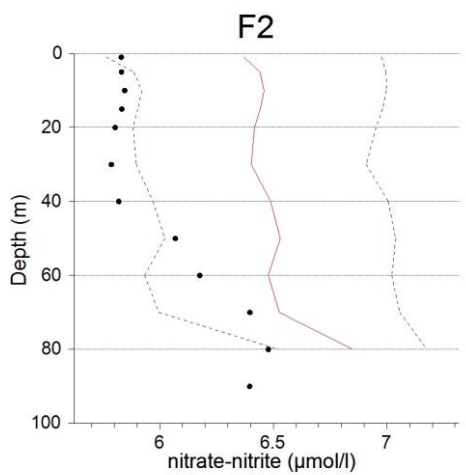
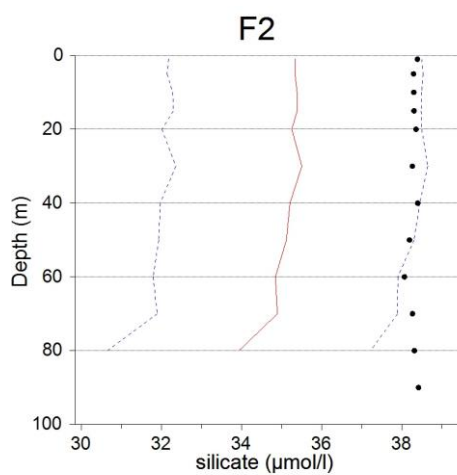
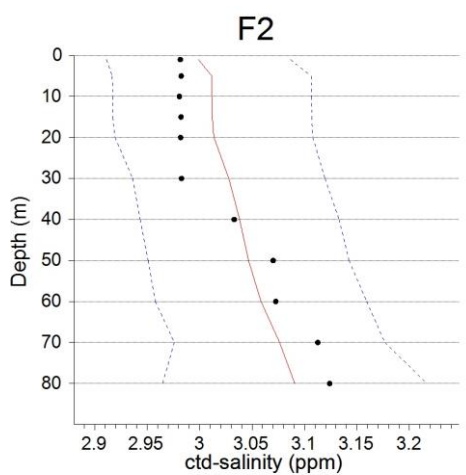
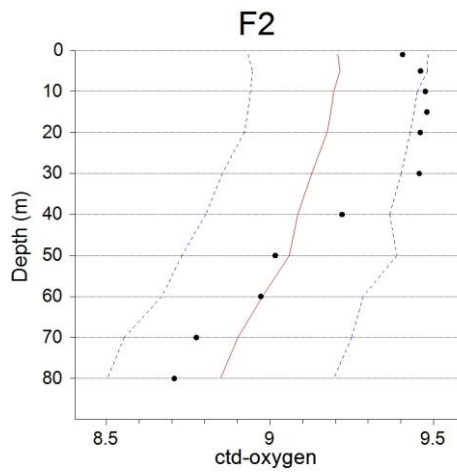
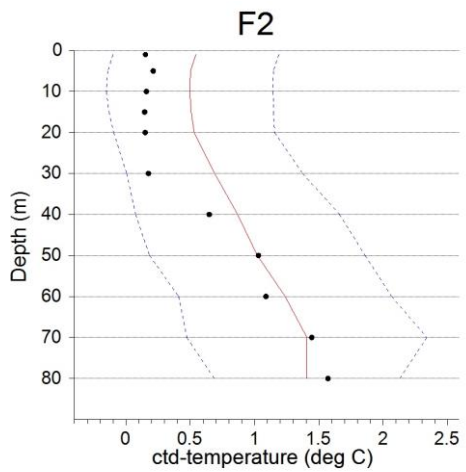












Annex 2. List of sampled stations of the cruise

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
HELSINKI	HELSINKI	60.15193	24.92325		2023-01-16	09:03											
2023010001	39A	60.06678	24.98030	43	2023-01-16	19:14	x	x	x	x							
2023010002	XIV3	60.20305	26.19288	79	2023-01-17	02:07	x	x	x	x							
2023010003	LL3A	60.06907	26.35300	69	2023-01-17	04:47	x	x	x	x					x		
2023010004	XV1_TRAP	60.25150	27.24867	64	2023-01-17	10:30											
2023010005	XV1	60.25003	27.24700	64	2023-01-17	15:28	x	x	x	x							
2023010006	XV3	60.38403	27.29640	39	2023-01-17	18:45	x	x	x	x							
2023010007	XV3_laatu	60.38403	27.29650	39	2023-01-17	19:29	x	x	x	x							
2023010008	XV1	60.25008	27.24683	64	2023-01-18	04:09											
2023010009	BIAS19B	60.24852	27.24767	81	2023-01-18	05:27											
2023010010	GF2	59.83848	25.85683	85	2023-01-18	12:27	x	x	x	x							x
2023010011	LL5	59.91683	25.59728	70	2023-01-18	15:08	x	x	x	x							
2023010012	LL6A	59.91678	25.03038	73	2023-01-18	17:56	x	x	x	x							
2023010013	LL7	59.84652	24.83777	104	2023-01-18	21:39	x	x	x	x					x		
2023010014	GF1	59.70500	24.68202	84	2023-01-19	01:12	x	x	x	x							
2023010015	LL9	59.70010	24.03025	67	2023-01-19	04:06	x	x	x	x							
2023010016	XII3	59.86423	23.98568	37	2023-01-19	06:24	x	x	x	x							
2023010017	JML	59.58187	23.62675	80	2023-01-19	09:27	x	x	x	x							x
2023010018	F62	59.33350	23.26353	97	2023-01-19	14:06	x	x	x	x							
2023010019	LL12	59.48352	22.89685	83	2023-01-19	17:07	x	x	x	x					x		
2023010020	LL11	59.58335	23.28453	69	2023-01-19	20:58	x	x	x	x							
2023010021	LANGDEN	59.77682	23.26282	57	2023-01-20	02:35	x	x	x	x							
	HANKO	59.81092	22.90395		2023-01-20	05:29											
2023010022	AALTO_PI	59.24757	20.99530	98	2023-01-21	03:54											
2023010023	BIAS15	59.24983	21.01562	92	2023-01-21	06:25											
2023010024	UTO_V	59.74028	21.37477	74	2023-01-21	10:47	x										
2023010025	IU7	59.81523	21.33667	93	2023-01-21	12:34	x	x	x	x							x
2023010026	VIDSKAR_V	59.88545	21.48738	76	2023-01-21	14:49											
2023010027	IU5	60.05815	21.19835	89	2023-01-21	17:05	x	x	x	x							
2023010028	IU3	60.33340	21.11327	51	2023-01-21	20:57	x	x	x	x							
2023010029	IU1	60.76688	20.84677	33	2023-01-22	01:02	x	x	x	x							
2023010030	SR8	61.12660	20.93005	47	2023-01-22	04:21	x	x	x	x							
2023010031	SR7	61.08352	20.59658	78	2023-01-22	06:33	x	x	x	x							x
2023010032	SR5	61.08320	19.57962	125	2023-01-22	11:15	x	x	x	x					x		x
2023010033	MS9	61.76778	20.53207	101	2023-01-22	19:59	x	x	x	x							
2023010034	F26	61.98373	20.06317	139	2023-01-22	23:34	x	x	x	x							
2023010035	US7	62.60038	20.82947	26	2023-01-23	05:28	x	x	x	x							
2023010036	US6B	62.60005	20.26268	82	2023-01-23	09:03	x	x	x	x							
2023010037	US5B	62.58592	19.96855	220	2023-01-23	11:53	x	x	x	x					x		
2023010038	F16	63.51668	21.06253	49	2023-01-23	20:35	x	x	x	x							
2023010039	F15	63.51657	21.51278	48	2023-01-23	23:01	x	x	x	x							
2023010040	BO3	64.30212	22.34335	109	2023-01-24	05:20	x	x	x	x					x		
2023010041	BIAS11	64.68497	23.23883	78	2023-01-24	10:02											
2023010042	RR7	64.73370	23.81282	39	2023-01-24	12:30	x	x	x	x							x
2023010043	KIISLA	65.26258	24.43108	23	2023-01-24	17:24											
2023010044	F2	65.38358	23.46237	91	2023-01-24	20:37	x	x	x	x					x		
2023010045	CVI	65.23505	23.55608	75	2023-01-24	23:41	x	x	x	x							
2023010046	RR3	64.93337	22.34598	94	2023-01-25	06:38	x	x	x	x							
2023010047	F13	63.78345	21.47983	64	2023-01-25	17:35	x	x	x	x							
2023010048	F18	63.31433	20.27218	103	2023-01-25	22:56	x	x	x	x							
2023010049	US3	62.75895	19.19550	177	2023-01-26	04:31	x	x	x	x							
2023010050	MS3	62.13447	18.16295	85	2023-01-26	10:46	x	x	x	x							x
2023010051	MS6	61.98380	19.16352	72	2023-01-26	14:37	x	x	x	x							
2023010052	SR3	61.18333	18.22975	73	2023-01-26	20:54	x	x	x	x							
2023010053	F33	60.53322	18.93753	134	2023-01-27	02:19	x	x	x	x							
2023010054	F64	60.18902	19.14255	286	2023-01-27	06:40	x	x	x	x					x		
2023010055	F69	59.78342	19.92965	192	2023-01-27	12:38	x	x	x	x							x
2023010056	LL19	58.88078	20.31095	165	2023-01-27	20:37	x	x	x	x					x		
2023010057	LL19LAATU	58.88078	20.31098	165	2023-01-27	23:33	x										
2023010058	LL17	59.03335	21.08022	173	2023-01-28	04:03	x	x	x	x					x		
2023010059	BIAS15	59.24993	21.01632	93	2023-01-28	07:44											
2023010060	LL15	59.18337	21.74738	130	2023-01-28	10:28	x	x	x	x							
2023010061	LL12	59.48362	22.89643	82	2023-01-28	17:04	x	x	x	x					x		
2023010062	AALTO_HKI	59.96445	25.23597	61	2023-01-29	06:07											
HELSINKI	HELSINKI	60.16182	24.90157		2023-01-29	09:05											

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

