Suomen ympäristökeskus
Finlands miljöcentral
Finnish Environment Institute

ILMATIETEEN LAITOS

CRUISE REPORT

R/V Aranda

Spring monitoring cruise 2025

14.4.2025 – 26.4.2025

Cruise 02/2025

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

Objectives of the cruise

The objectives of the cruise were:

1) Monitoring of the Northern Baltic Proper, Åland sea and the Southern part of the Gulf pf Bothnia. Measured variables were temperature and salinity profiles from surface to the bottom (CTD), inorganic nutrients and other hydrological variables such as pH at discrete depths.
2) Collecting and measuring sinking speed and decomposition rates of sinking particles.
3) Deployments e.g. of a benthic lander and sediment traps outside Utö.
4) Primary production measurements at selected stations

Table 1 The scientific crew

Name	Organization
Kristian Spilling	Syke
Susanna Hyvärinen	Syke
Antti Räike	Syke
Niklas Edvard Trebs	Syke
Jere Riikonen	Syke
Tanja Kinnunen	Syke
Anne-Mari Lehto	Syke
Pia Varmanen	Syke
Josephin Lemke	Syke
Sami Kielosto	Syke
Meri Smedberg	FMI
Noora Haavisto	FMI
André Welti	FMI
Linnea Mustonen	FMI
Pertti Jämsén	FMI
Heini Jalli	FMI
Joonas Virtasalo	GTK
Marine Poizat	GTK
Ana Fernández Carrera	U. Las Palmas
Taru Johanna Eskelinen	U. Helsinki
Malte Heinemann	U. Kiel

Cruise Route

We left Helsinki in the morning of 14 April. We sampled in the Gulf of Finland, first moving eastwards, and after the easternmost station was sampled, we moved westwards to the entrance of the Gulf of Finland (Fig 1). From here we sailed to Utö making a deployment there, before moving through the Archipelago Sea, ending up at Turku harbor in time for Easter (17 April). The plan was to continue the cruise after Easter, and we came back to the ship on Tuesday 22 April, but the ship had engine failure that took some time to fix, and the remaining trip was canceled on Saturday 26 April.

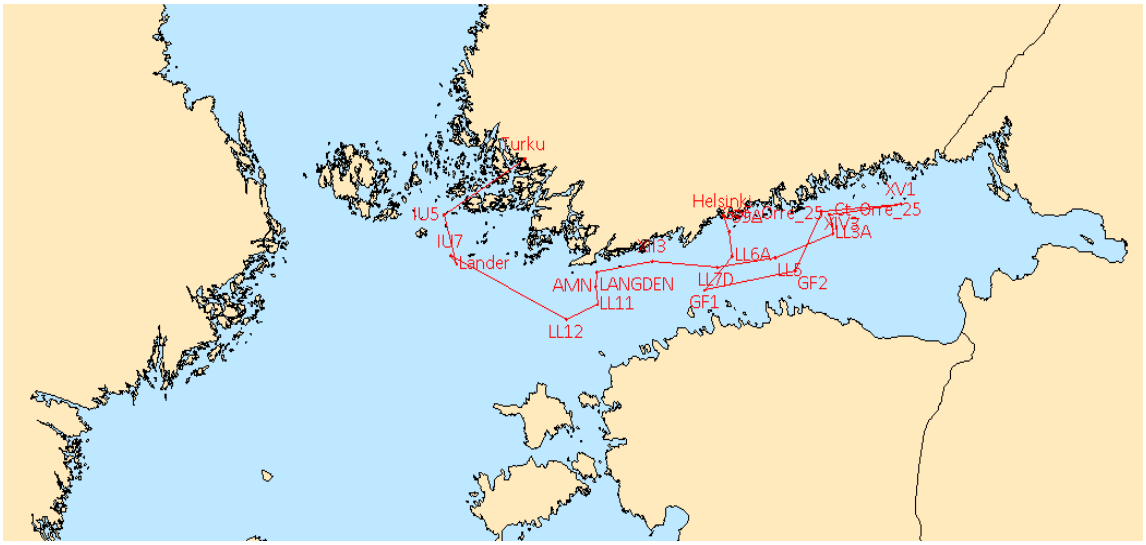

Fig 1. Cruise route. Details on sampling points are in Annex 2

Observations

The results showed considerable spatial variability across the sampling stations. At some locations, sampling occurred early in the spring bloom, as indicated by high concentrations of inorganic nutrients (Fig. 2) and relatively low chlorophyll *a* (Chl *a*) concentrations (Fig. 3). In contrast, other stations appeared to be in the midst of active phytoplankton growth, as suggested by elevated pH values (Fig. 4), although the Chl *a* concentration in the Gulf of Finland remained mostly below 10 µg Chl *a* L^{-1}, less than half the typical peak value during the spring bloom. These patterns were corroborated by data from the flow-through system, which revealed marked spatial differences in Chl *a* fluorescence (Fig. 5). Some stations (LL12) in the western Gulf of Finland were warmer than normal (Annex 1). All the CTD cast can be found in Annex 3.

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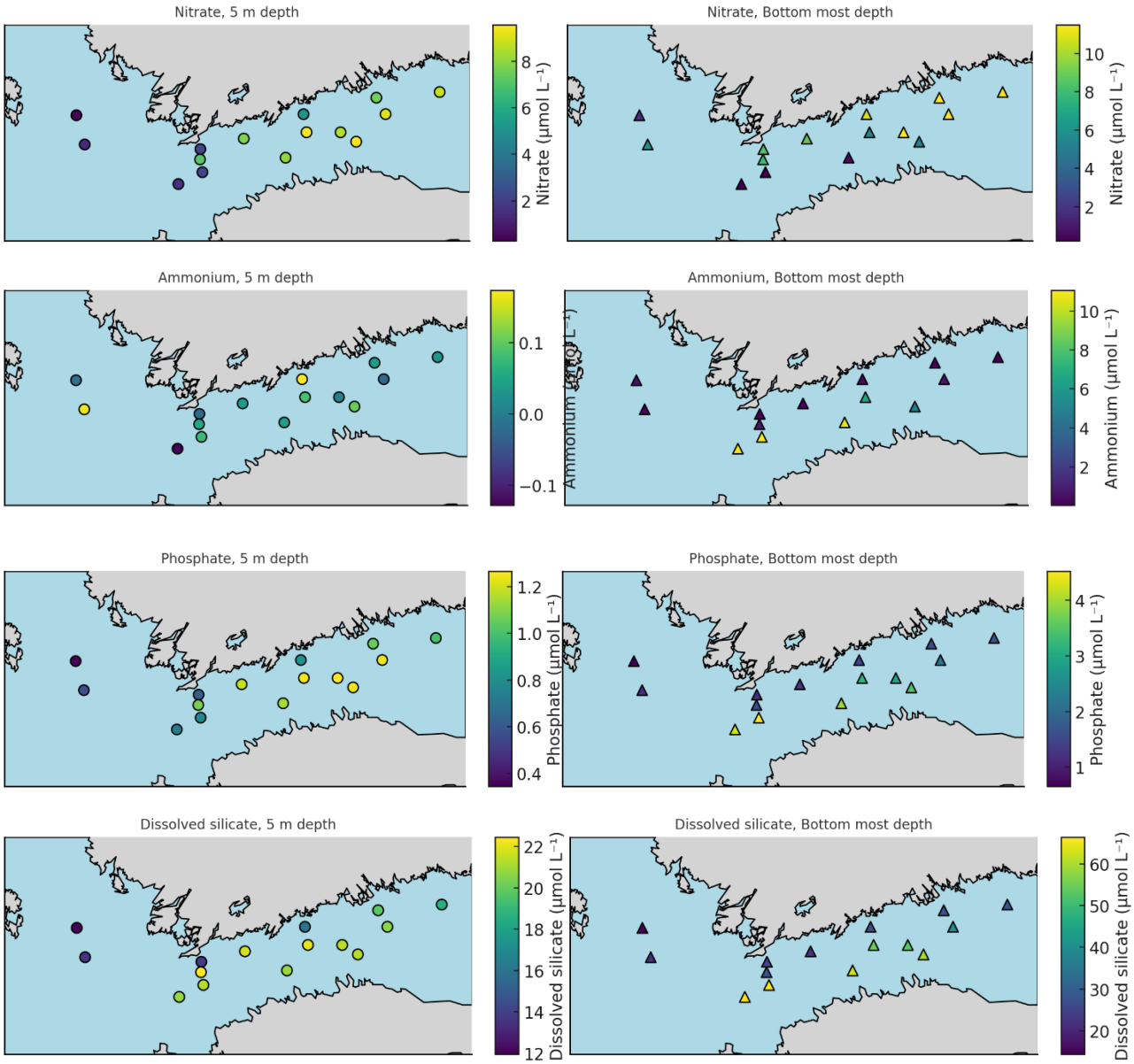

Fig 2. Inorganic nutrients at the surface (left, 5 m depth) and at the bottom most depth (right, variable according to sampling station)

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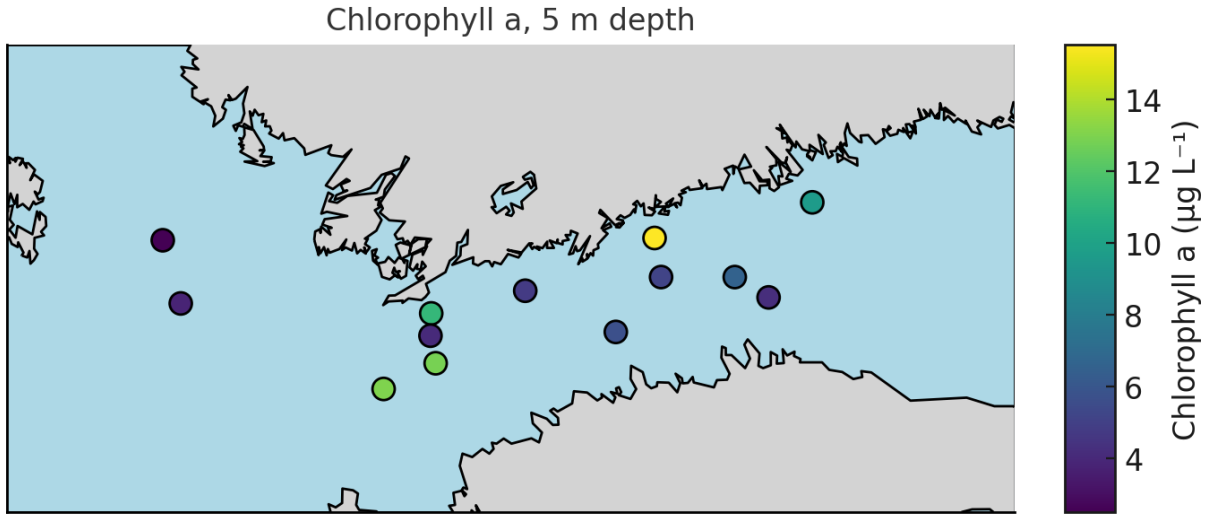

Fig 3. Chlorophyll a concentration at the surface (5 m depth)

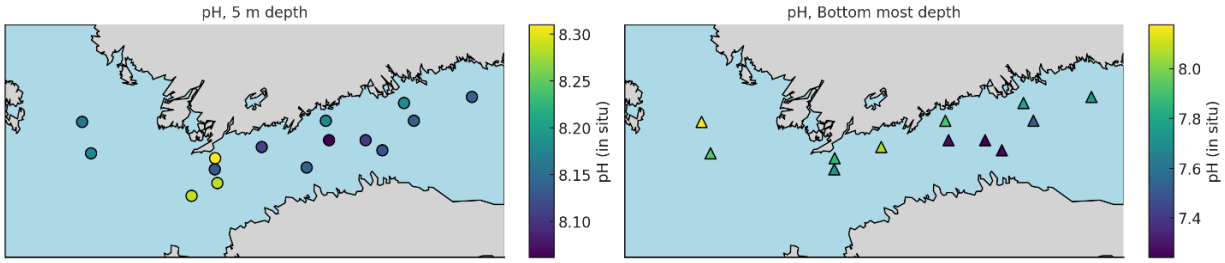

Fig 4. The pH at surface (left, 5 m depth) and bottom (right, depth depending on the sampling station)

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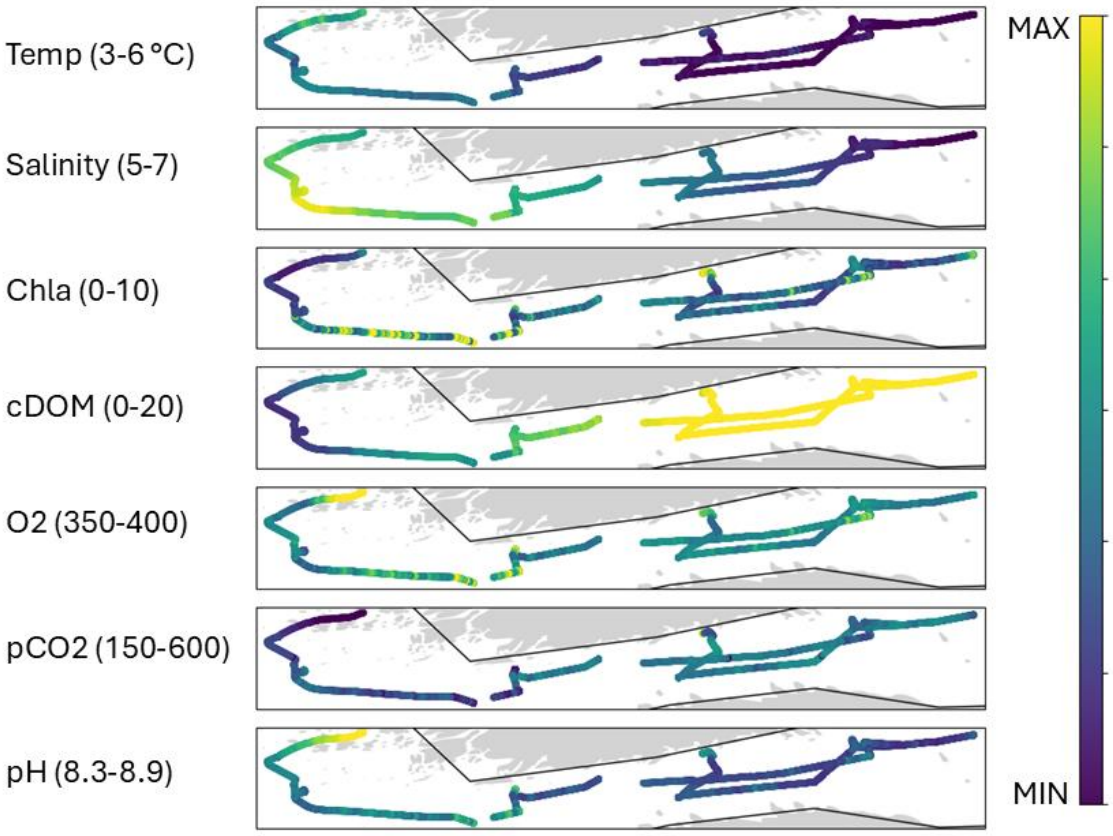

Fig 5. Variables from the flow through system, range indicated in parenthesis. The flow through system had some periods when it did not work, and this is the reason for the gaps in the data.

Conclusions

Sampling occurred relatively early in the spring bloom period, as indicated by moderate biomass concentrations and the presence of remaining inorganic nutrients in surface waters. Nevertheless, the phytoplankton community was actively growing. Spatial heterogeneity was evident, consistent with the patchy distribution typically observed during the onset of the spring bloom, which often develops as a mosaic of actively growing areas. Vertical profiles of temperature and salinity were mostly within the expected seasonal range, but with some stations in western Gulf of Finland being warmer than normal at the end of April.

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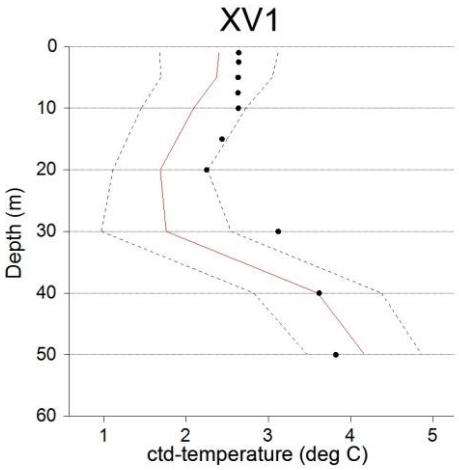
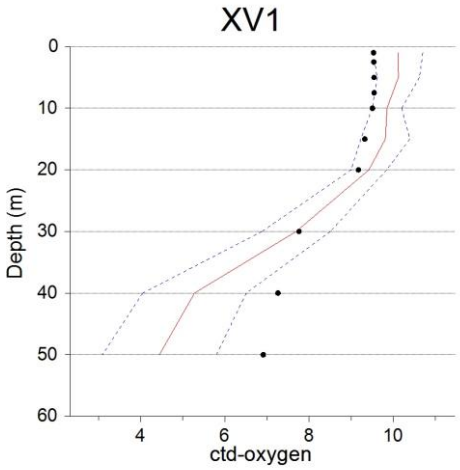
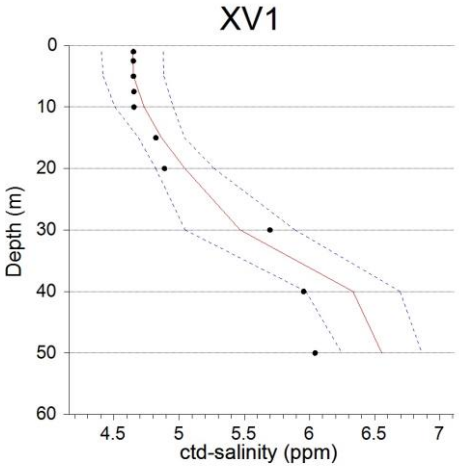
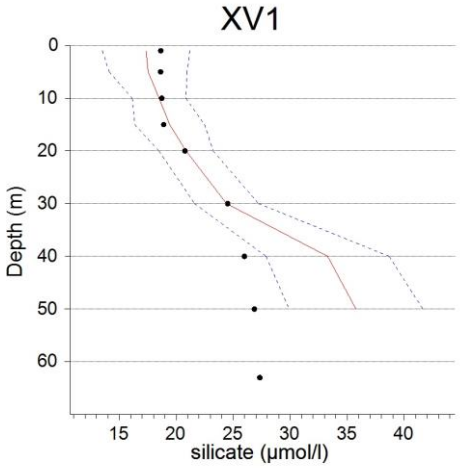
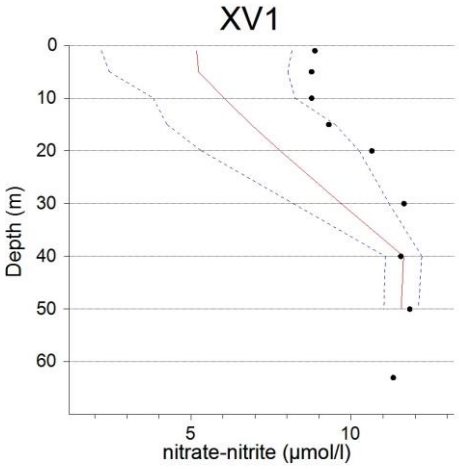
Annex 1. Selected variables at the stations XV1 and LL12. Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season since the year 2000.

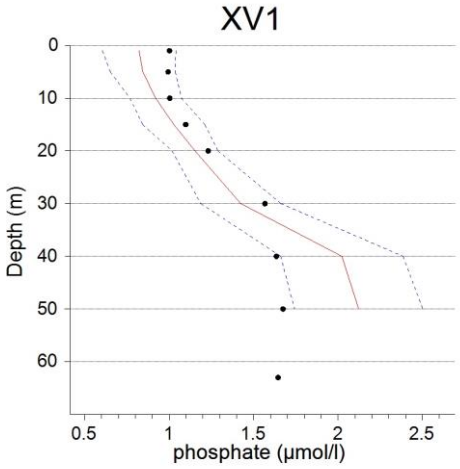


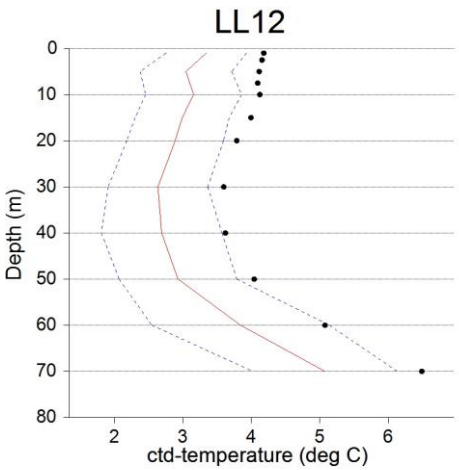


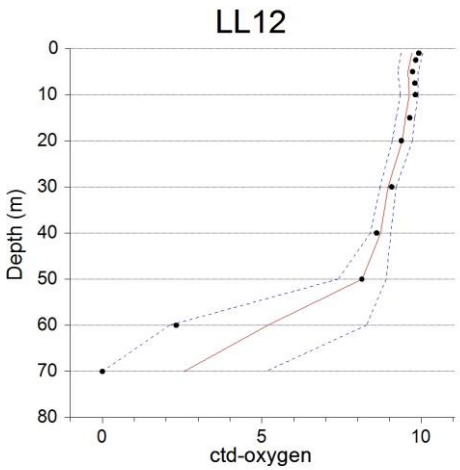


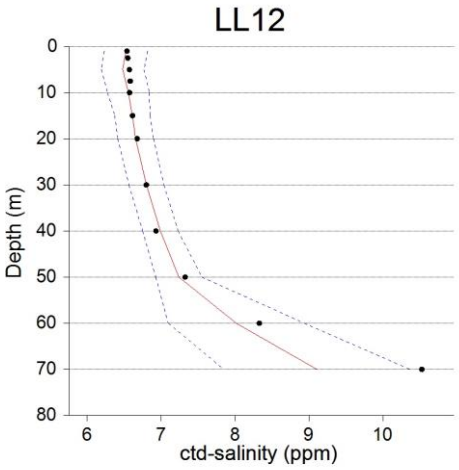


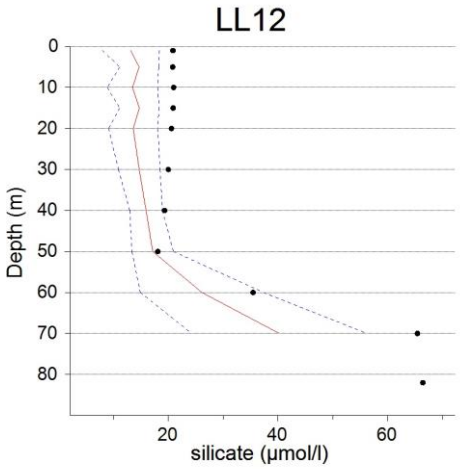


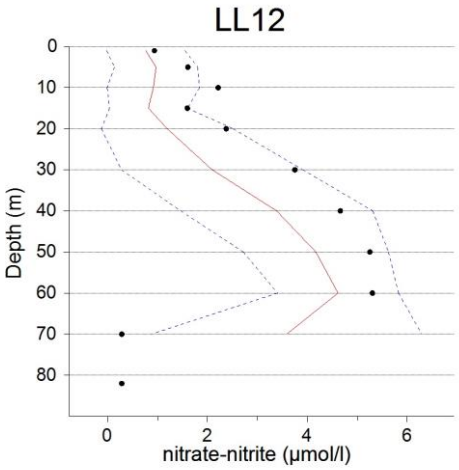


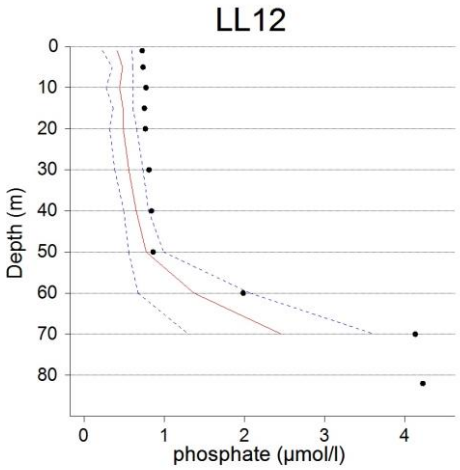

LL12
Depth (m)
0
10
20
30
40
50
60
70
80
2
3
4
5
6
ctd-temperature (deg C)


LL12
Depth (m)
0
10
20
30
40
50
60
70
80
0
5
10
ctd-oxygen


LL12
Depth (m)
0
10
20
30
40
50
60
70
80
6
7
8
9
10
ctd-salinity (ppm)


LL12
Depth (m)
0
10
20
30
40
50
60
70
80
20
40
60
silicate (µmol/l)


LL12
Depth (m)
0
10
20
30
40
50
60
70
80
0
2
4
6
nitrate-nitrite (µmol/l)


LL12
Depth (m)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
phosphate (µmol/l)

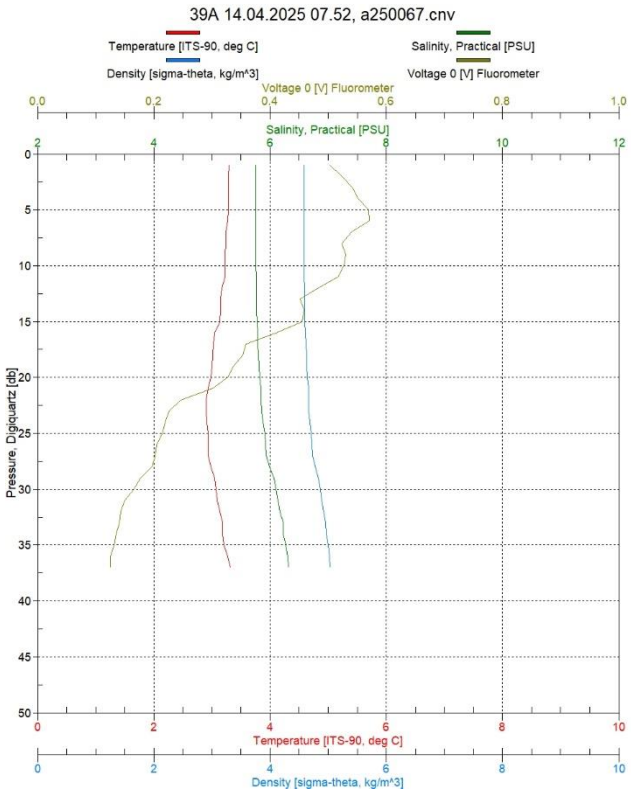
Annex 2. List of sampled stations of the cruise

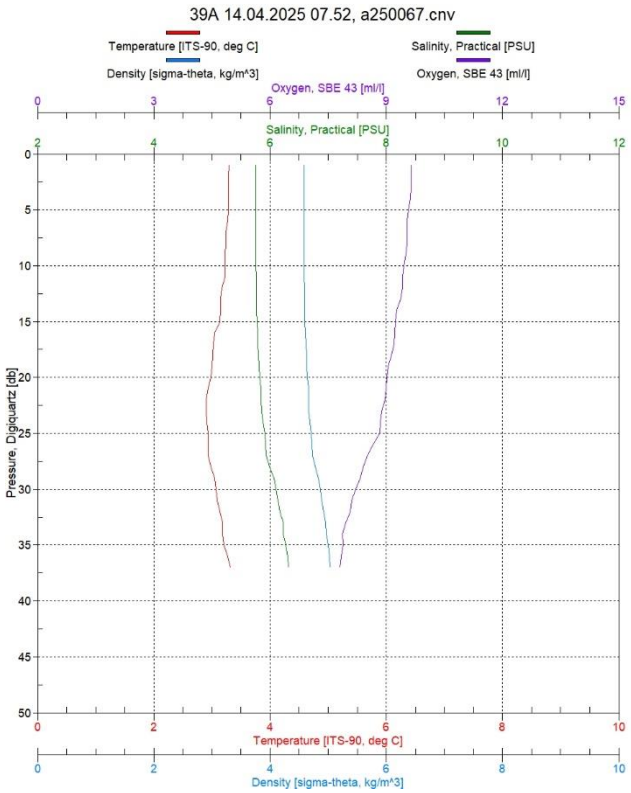
INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
Helsinki	Helsinki	60.16180	24.90157		2025-04-14	06.03											
2025010067	39A	60.06687	24.98023	42	2025-04-14	07.26	x	x	x	x				x			x
2025010068	LL6A	59.91688	25.03022	73	2025-04-14	09.54	x	x	x	x				x			x
2025010069	GF1	59.70500	24.68225	84	2025-04-14	14.02	x	x	x	x	x			x			x
2025010070	GF2	59.83848	25.85692	85	2025-04-14	18.49	x	x	x	x				x			
2025010071	XIV3	60.20318	26.19288	78	2025-04-14	22.51	x	x	x	x				x			
2025010072	XV1	60.24995	27.24700	64	2025-04-15	03.53	x	x	x	x	x			x			x
2025010073	GoF_Orre_25	60.18350	26.29802	57	2025-04-15	08.30											
2025010074	Ct_Orre_25	60.12568	26.33553	69	2025-04-15	10.14											
2025010075	LL3A	60.06720	26.34663	69	2025-04-15	14.39	x	x	x	x	x			x			x
2025010076	LL5	59.91682	25.59695	70	2025-04-15	18.16	x	x	x	x				x			
2025010077	LL7D	59.84627	24.83715	74	2025-04-15	21.37	x	x	x	x	x			x			
2025010078	XII3	59.86418	23.98568	35	2025-04-16	01.36	x	x	x	x				x			
2025010079	LANGDEN	59.77682	23.26272	58	2025-04-16	05.23	x	x	x	x	x			x			x
2025010080	AMN	59.69048	23.25710	55	2025-04-16	08.16	x	x	x	x				x			x
2025010081	LL11	59.58350	23.29682	67	2025-04-16	10.32	x	x	x	x				x			x
2025010082	LL12	59.48348	22.89670	83	2025-04-16	13.10	x	x	x	x	x			x			x
2025010083	IU7	59.81518	21.33675	92	2025-04-17	01.02	x	x	x	x	x			x			
2025010084	Lander	59.76862	21.42072	64	2025-04-17	03.24											
2025010085	IU5	60.05818	21.19833	89	2025-04-17	09.58	x	x	x	x				x			x
Turku (Abo)	Turku	60.43978	22.21913		2025-04-17	15.08											

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

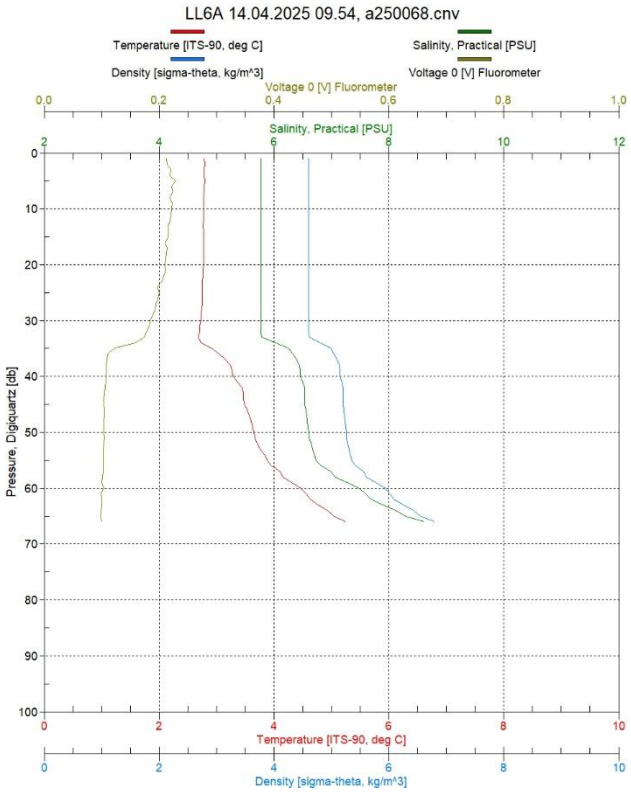
Annex 3. CTD profiles

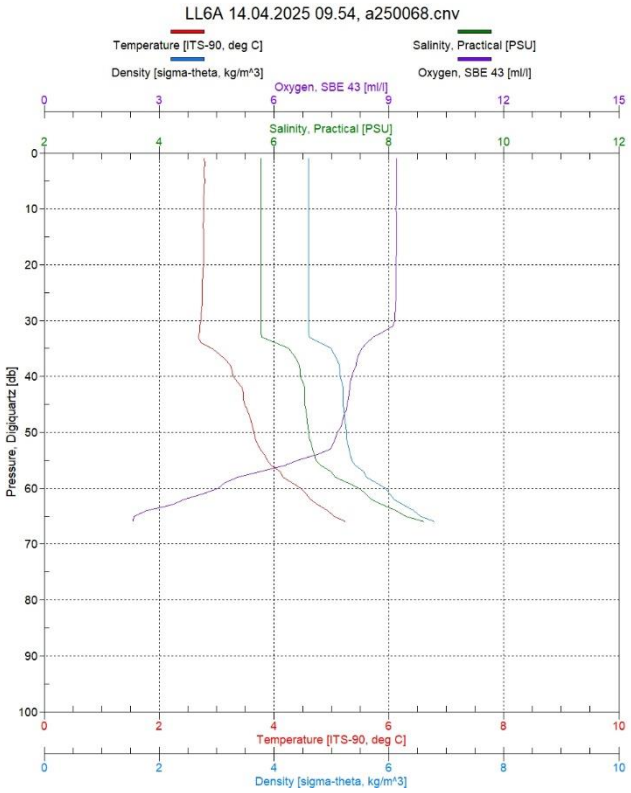
39A



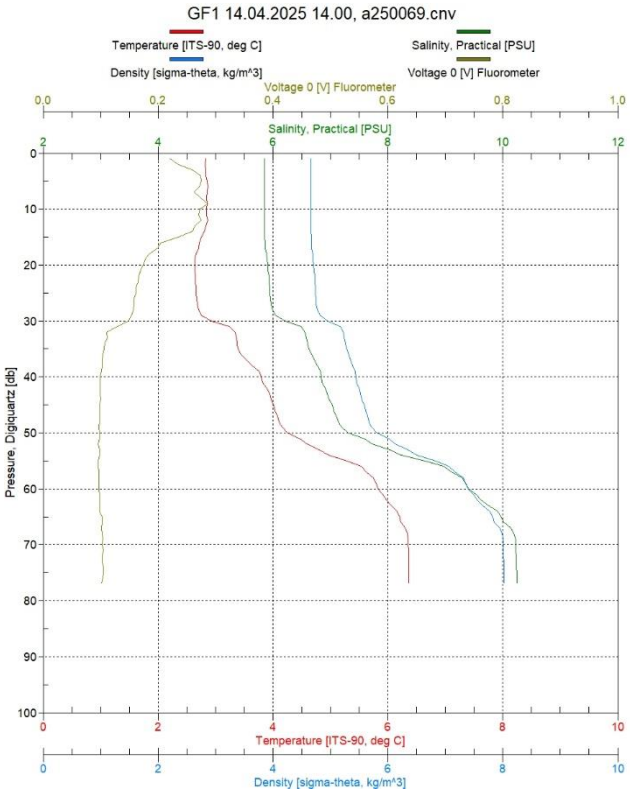


LL6A





GF1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Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
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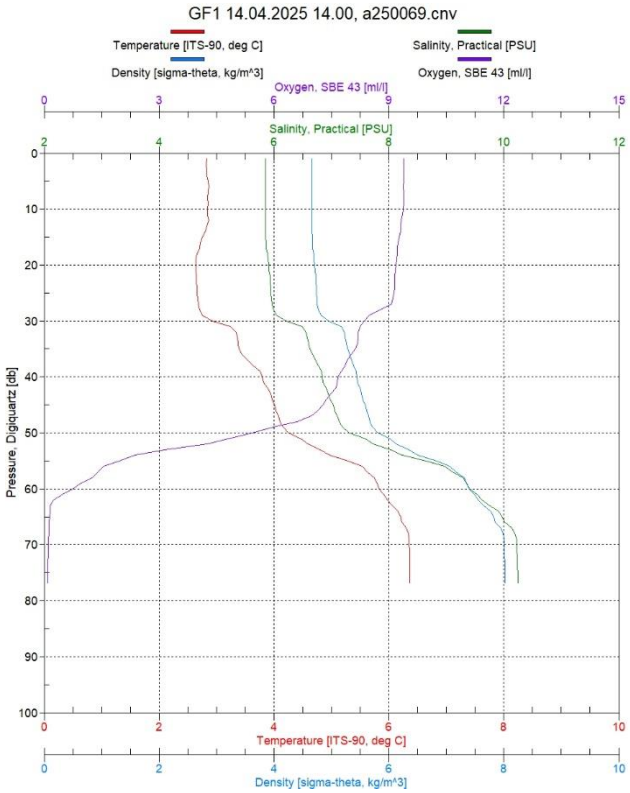
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]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Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
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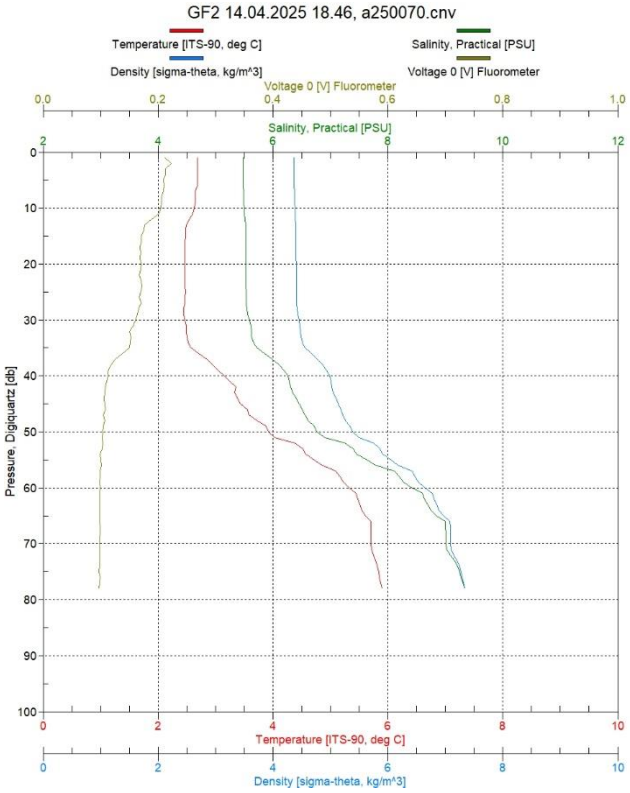
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

GF2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Voltage 0 [V] Fluorometer
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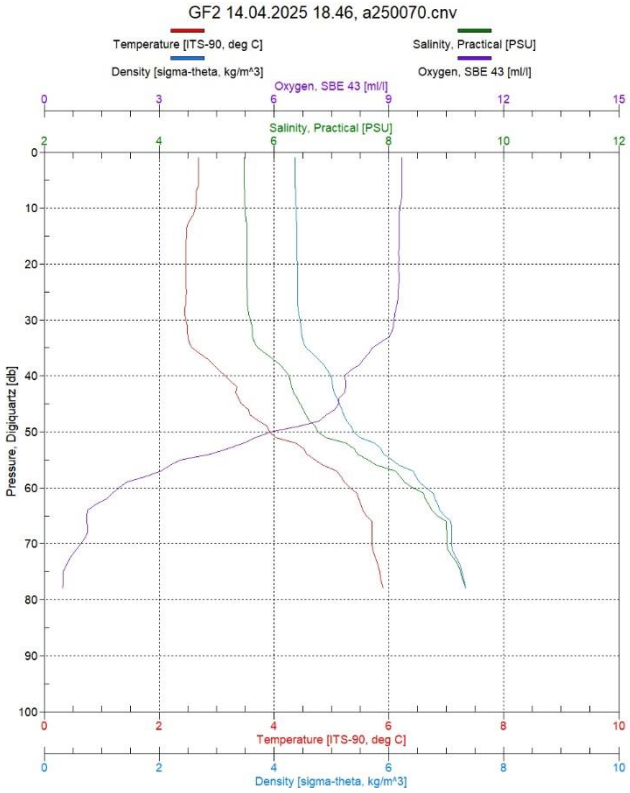
Density [sigma-theta, kg/m^3]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Density [sigma-theta, kg/m^3]
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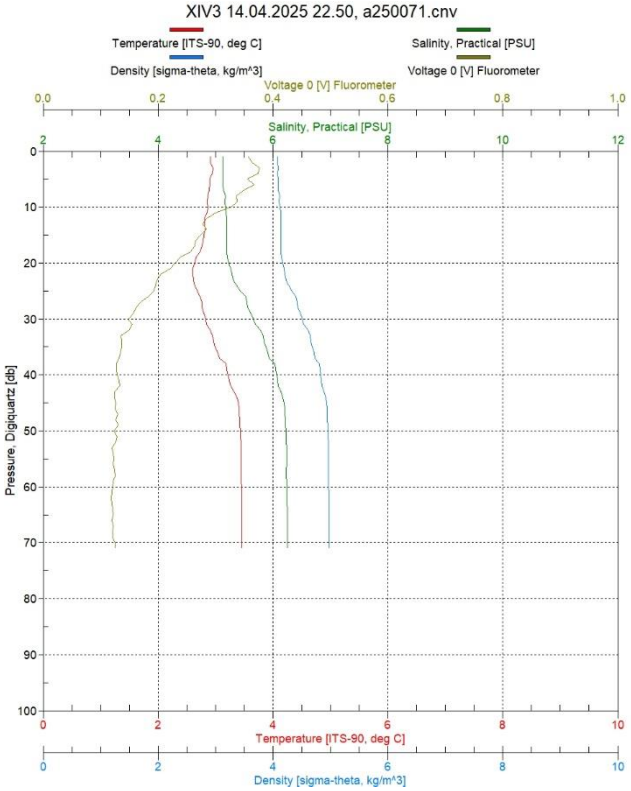
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

XIV3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Voltage 0 [V] Fluorometer
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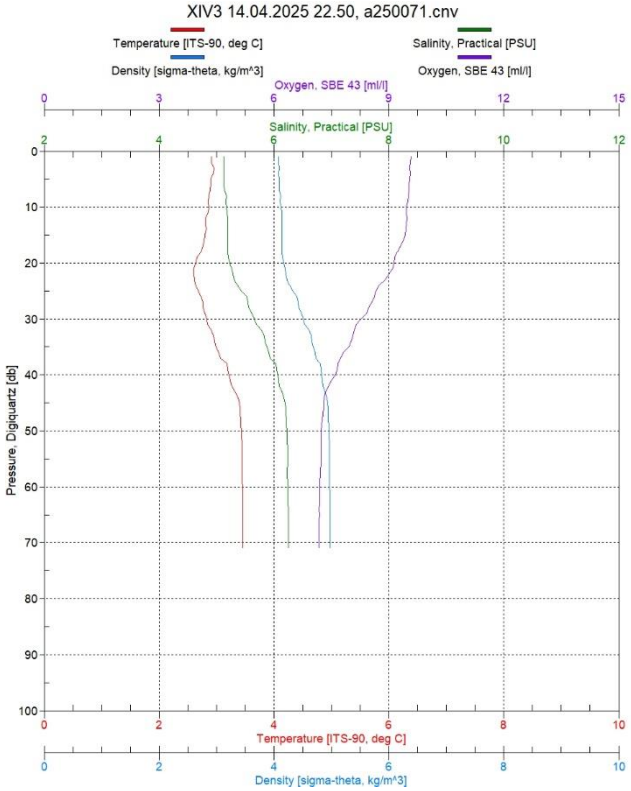
Density [sigma-theta, kg/m^3]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Oxygen, SBE 43 [ml/l]
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Salinity, Practical [PSU]
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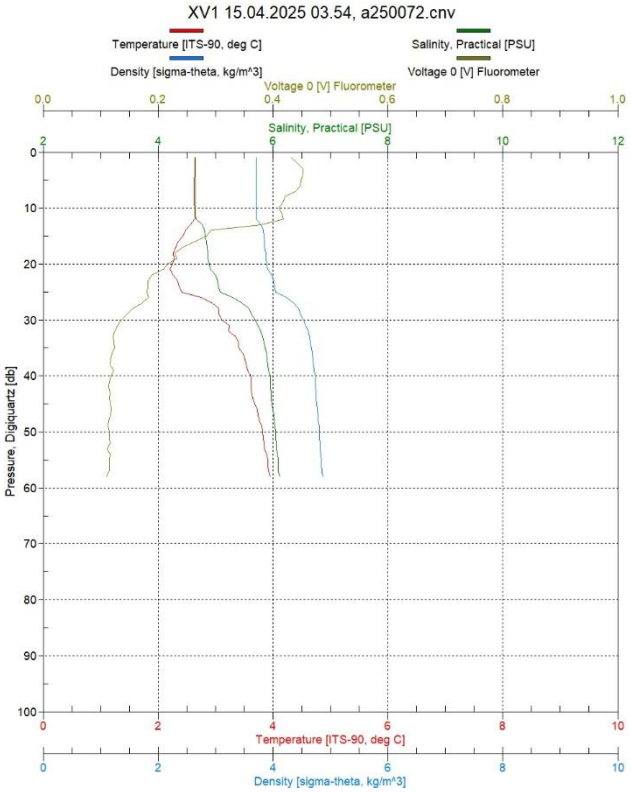
Density [sigma-theta, kg/m^3]

XV1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Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
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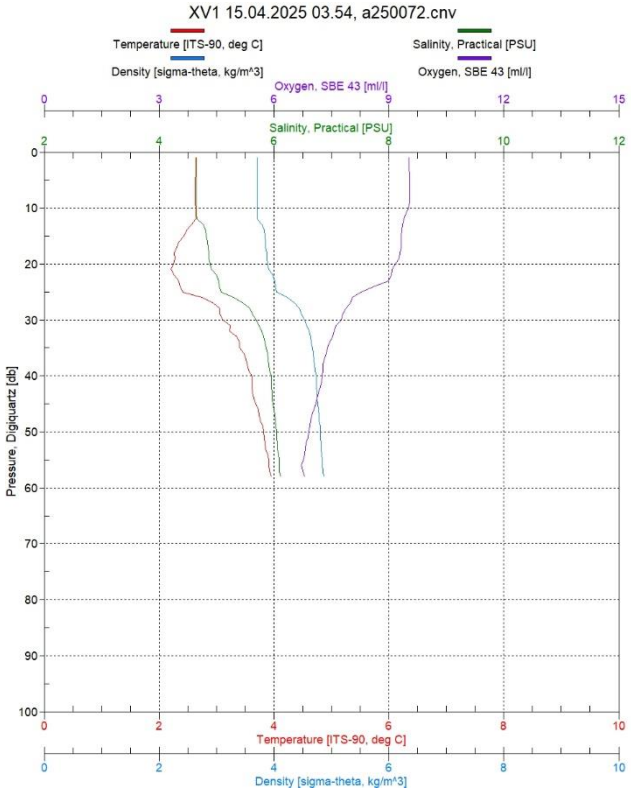
Density [sigma-theta, kg/m^3]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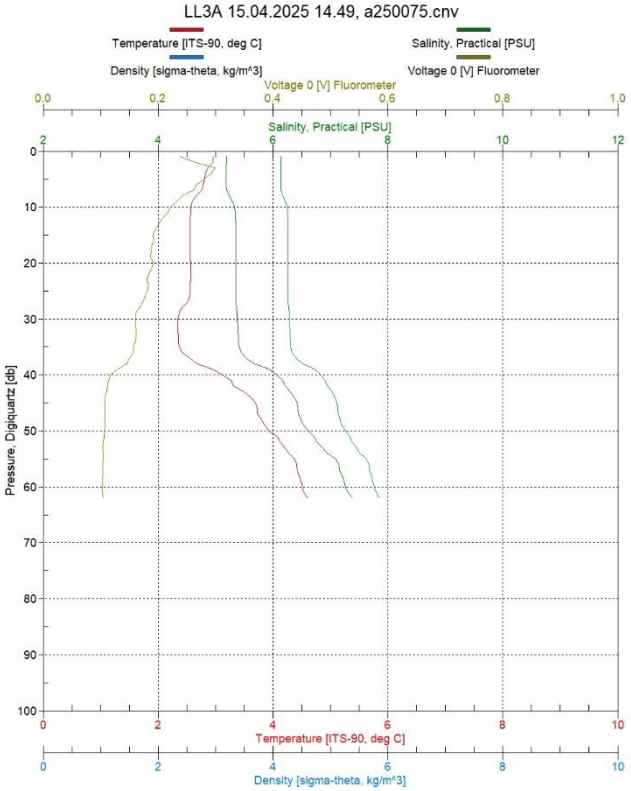
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

LL3A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Density [sigma-theta, kg/m^3]
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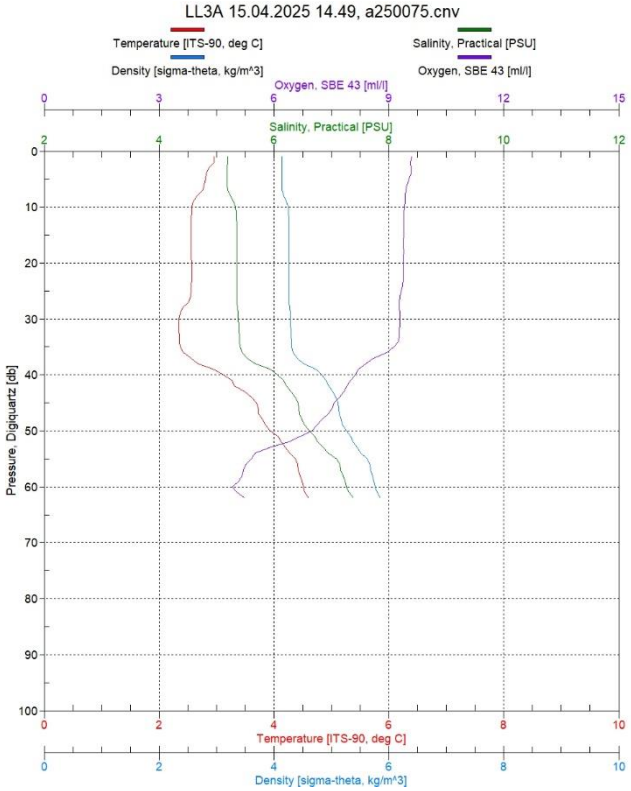
Density [sigma-theta, kg/m^3]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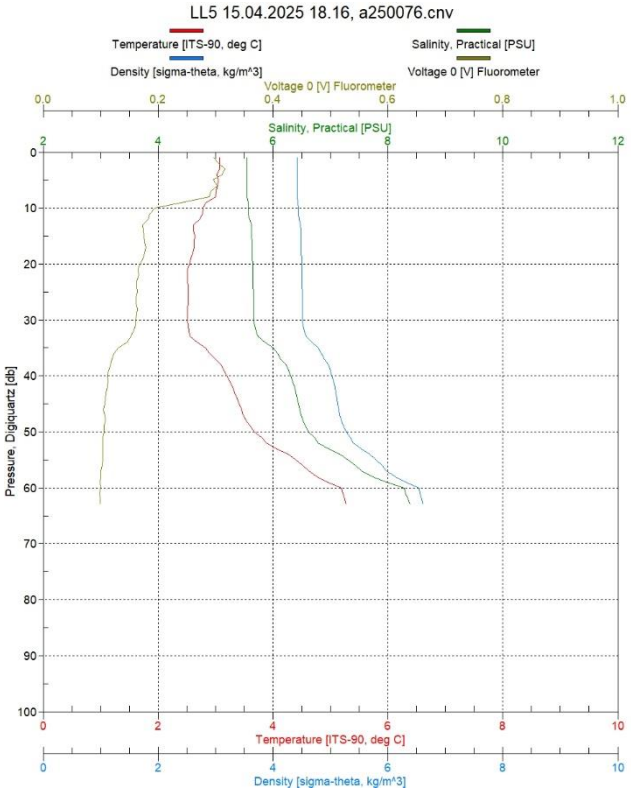
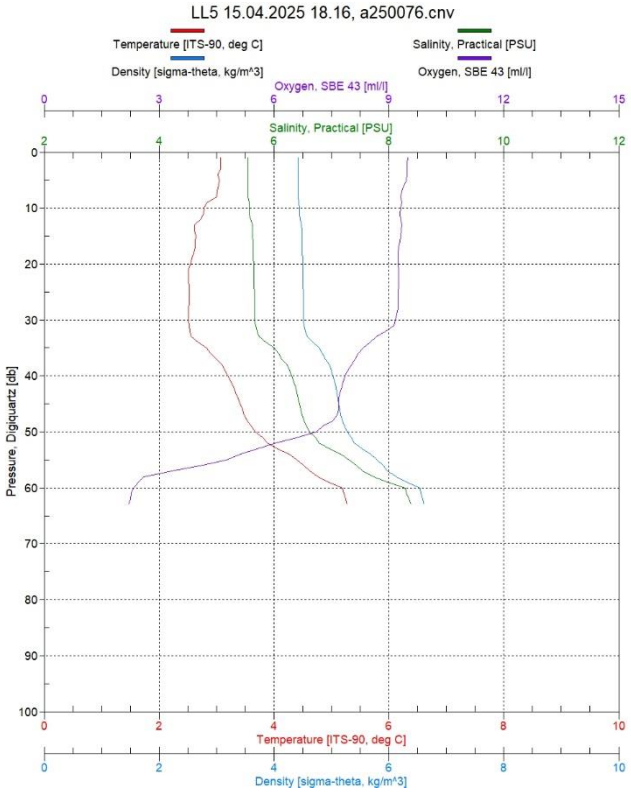
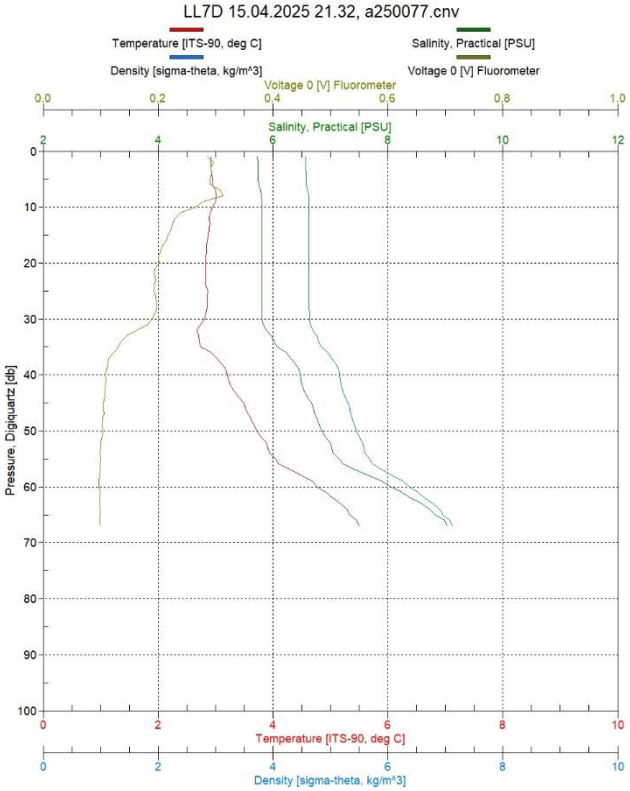
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

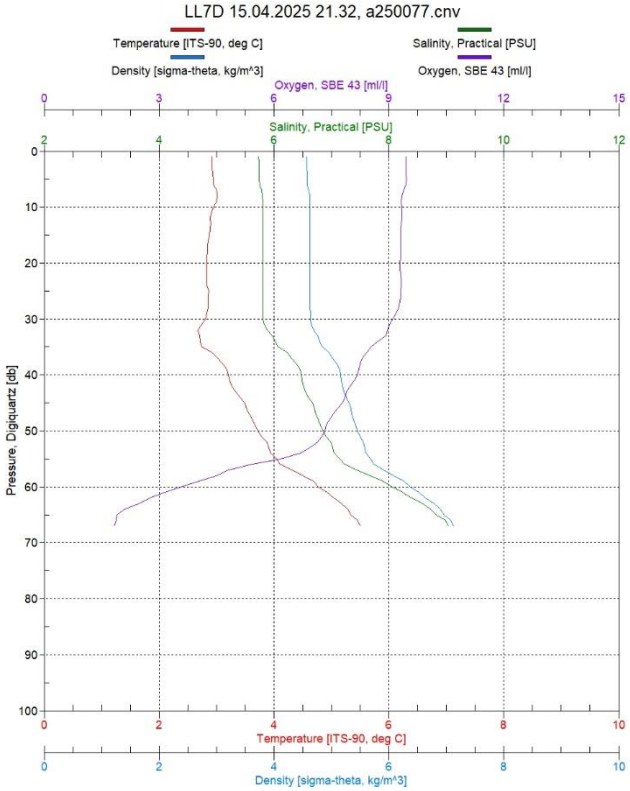
LL5


LL5 15.04.2025 18.16, a250076.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

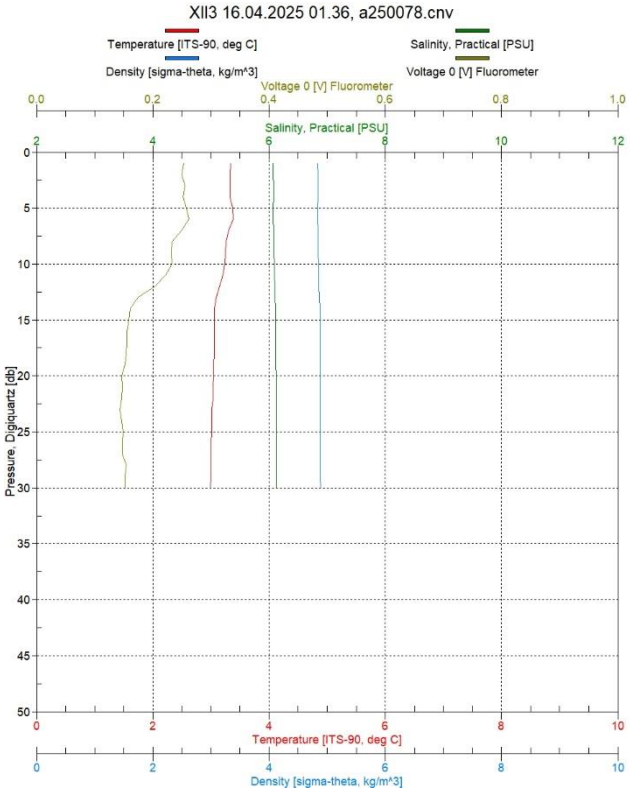

LL5 15.04.2025 18.16, a250076.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

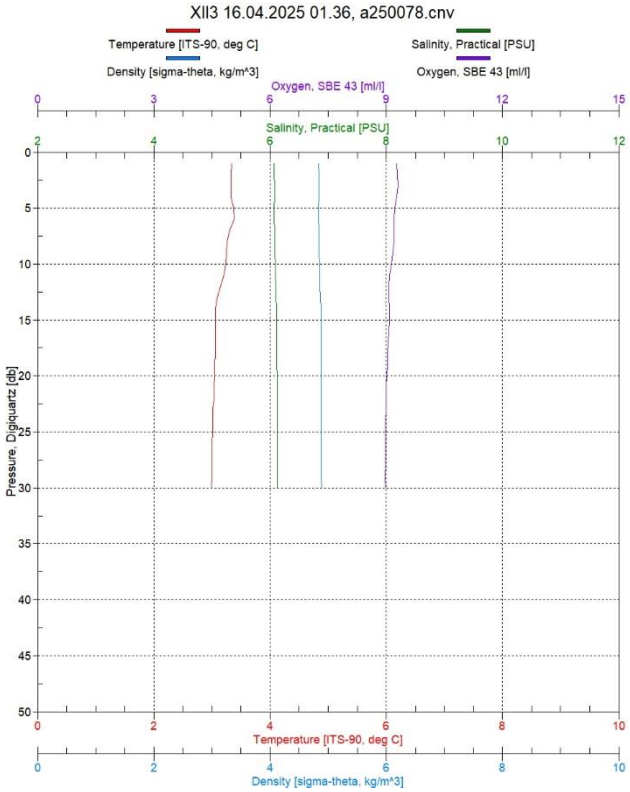
LL7D


LL7D 15.04.2025 21.32, a250077.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

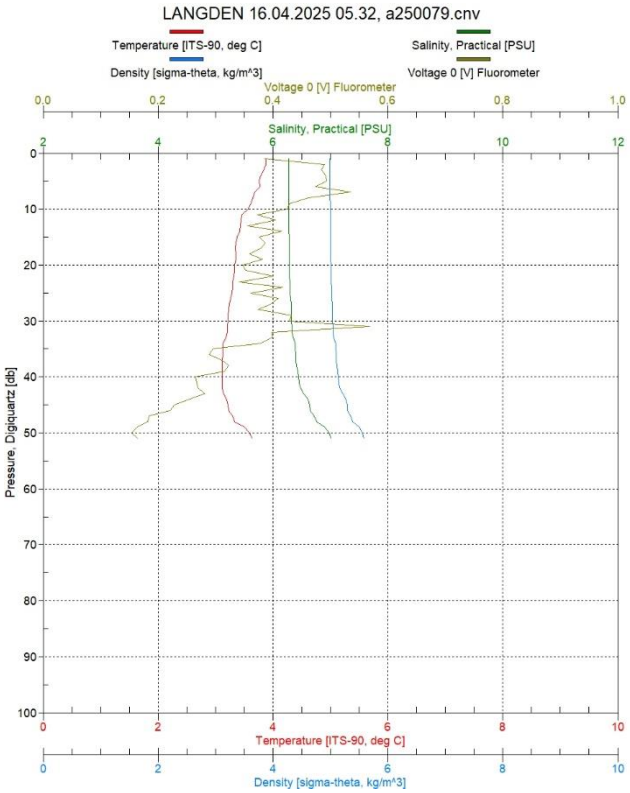

LL7D 15.04.2025 21.32, a250077.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

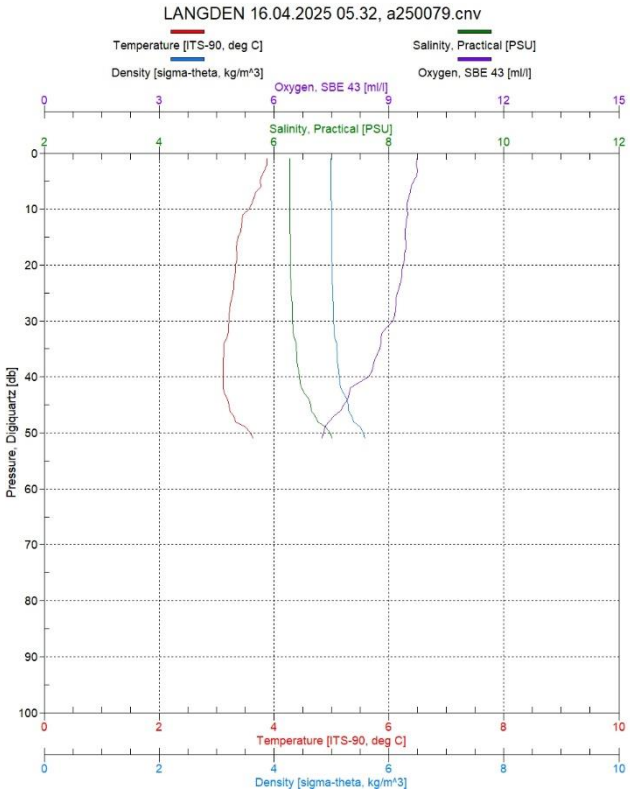
XII3


XII3 16.04.2025 01.36, a250078.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

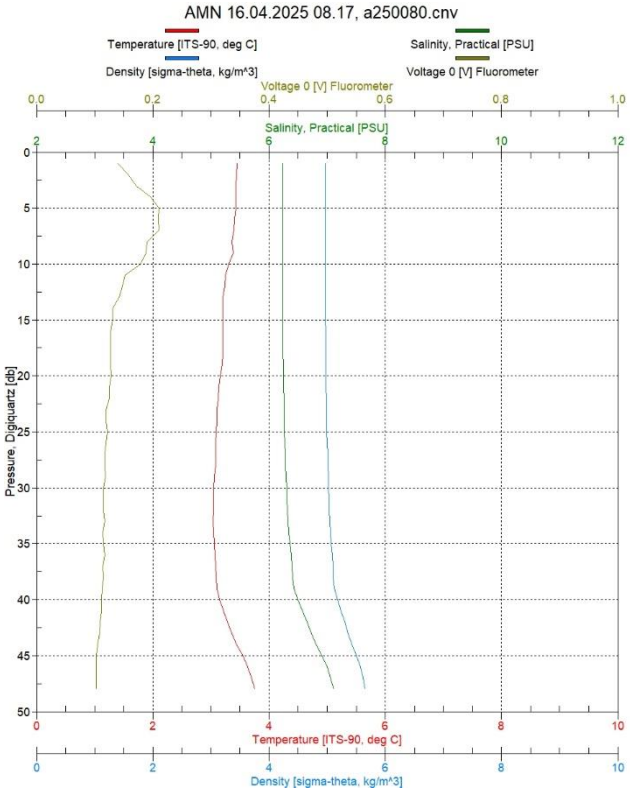

XII3 16.04.2025 01.36, a250078.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

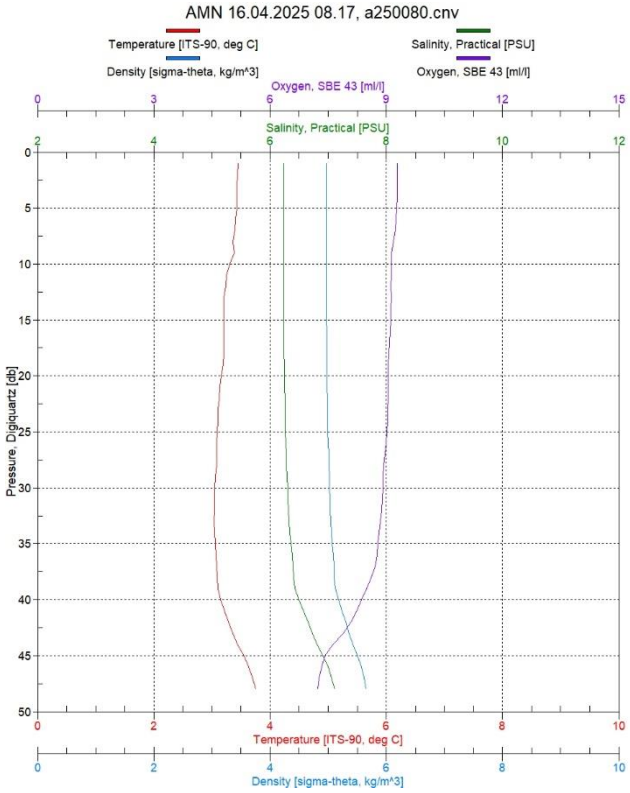
LANGDEN


LANGDEN 16.04.2025 05.32, a250079.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

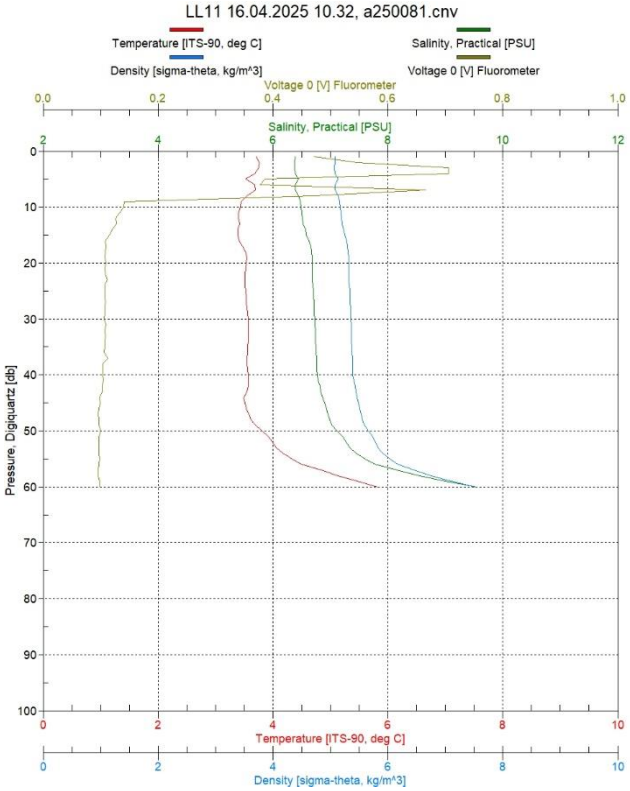

LANGDEN 16.04.2025 05.32, a250079.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

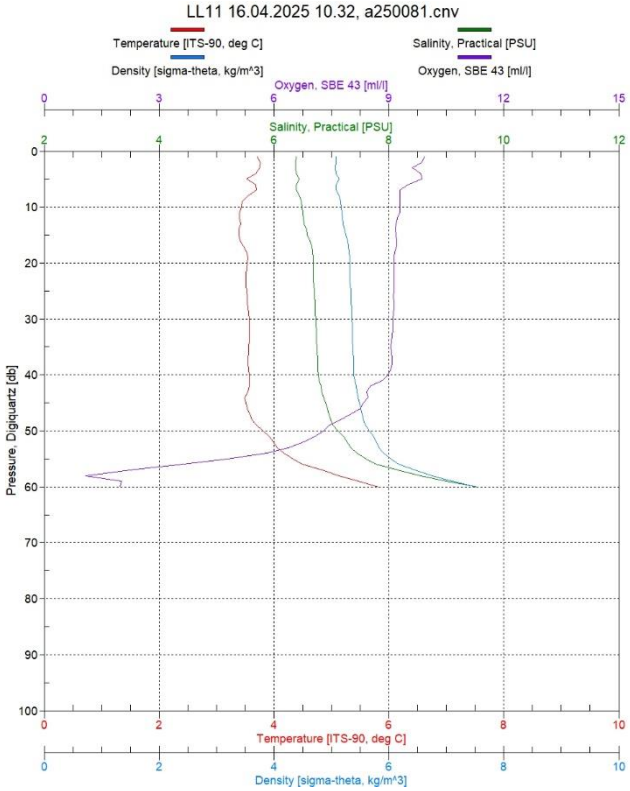
AMN


AMN 16.04.2025 08.17, a250080.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

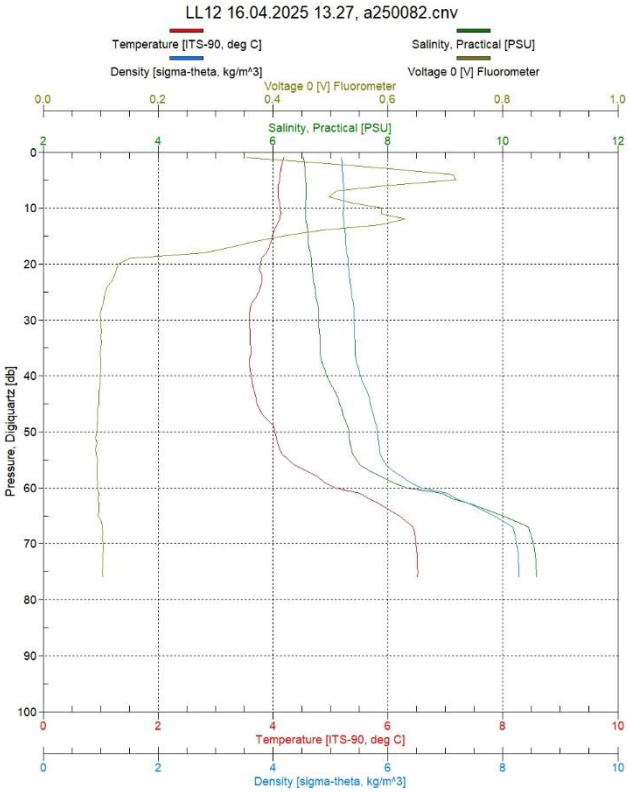

AMN 16.04.2025 08.17, a250080.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

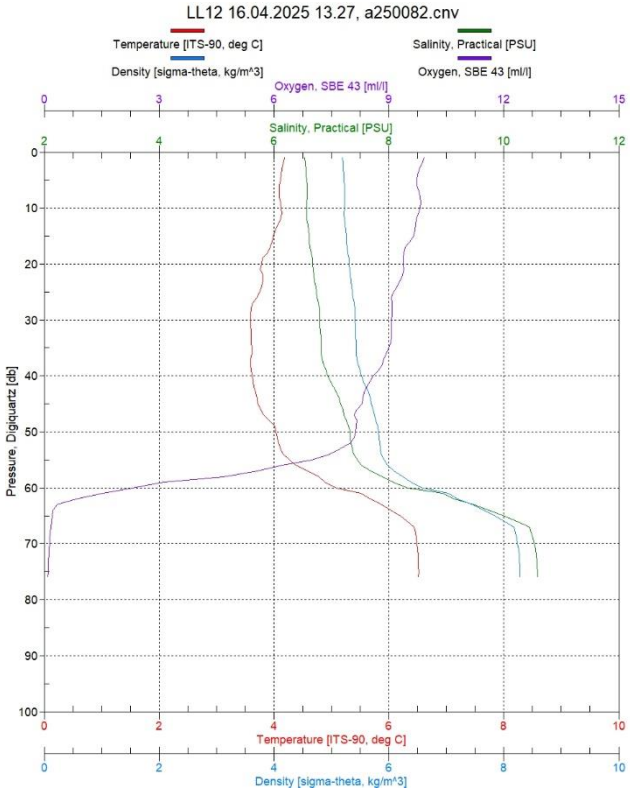
LL11


LL11 16.04.2025 10.32, a250081.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

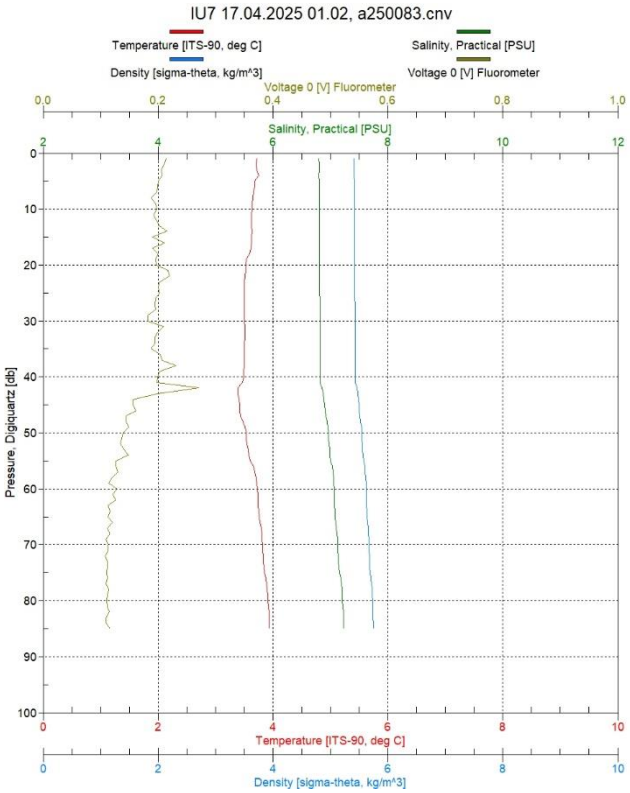

LL11 16.04.2025 10.32, a250081.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

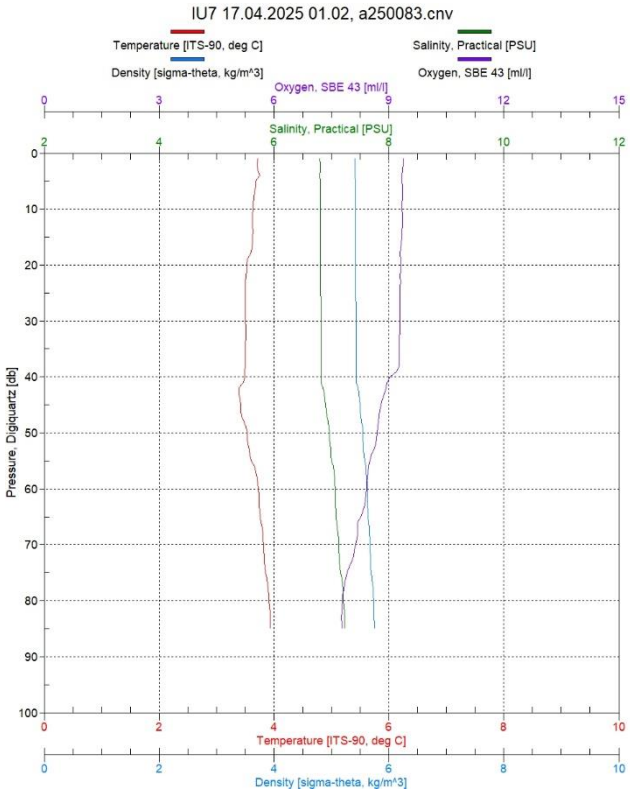
LL12


LL12 16.04.2025 13.27, a250082.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

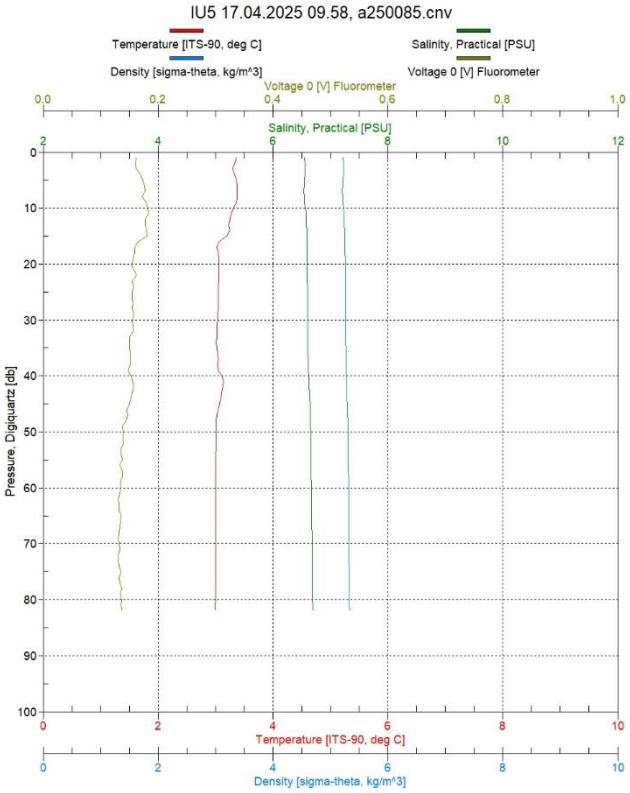

LL12 16.04.2025 13.27, a250082.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

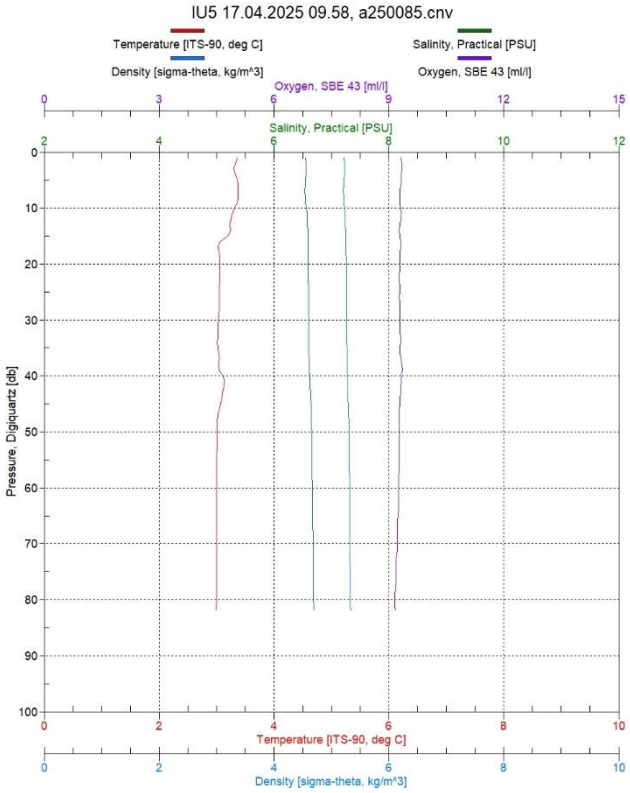
IU7


IU7 17.04.2025 01.02, a250083.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]


IU7 17.04.2025 01.02, a250083.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]

IU5


IU5 17.04.2025 09.58, a250085.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Voltage 0 [V] Fluorometer
Voltage 0 [V] Fluorometer
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]


IU5 17.04.2025 09.58, a250085.cnv
Temperature [ITS-90, deg C]
Salinity, Practical [PSU]
Density [sigma-theta, kg/m^3]
Oxygen, SBE 43 [ml/l]
Oxygen, SBE 43 [ml/l]
Salinity, Practical [PSU]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Density [sigma-theta, kg/m^3]