CRUISE REPORT

R/V Aranda

Cruise 06/2021

COMBINE 2/2021

31.5.2021 – 11.6.2021

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

Objectives of the cruise

The COMBINE 2 cruise contributed to the HELCOM Baltic Sea integrated physical, chemical and biological monitoring programme and the Finnish national marine management plan. The objectives of the cruise were:

1) Long-term monitoring of hydrography, nutrient concentrations, macrozoobenthos and zooplankton.
2) Monitoring of radioactive substances in water and sediment (HELCOM MORS program).
3) Deployment of mussel cages for monitoring effects of hazardous substances on blue mussels.
4) Deployment and retrieval of drifting floats, as well as installation of a wave buouy.
5) Collect research samples for eDNA and stoichiometry analyses of sediment and benthic animals.

Table 1. The scientific crew on COMBINE 2/2021

Name	On board	Organization
Nygård Henrik	31.5.2021-11.6.2021	SYKE
Haavisto Noora	31.5.2021-11.6.2021	SYKE
Lindgren Elisa	31.5.2021-11.6.2021	IL
Lastumäki Ilkka	31.5.2021-11.6.2021	SYKE
Riikonen Jere	31.5.2021-11.6.2021	SYKE
Kovru Olga	31.5.2021-11.6.2021	SYKE
Granlund Mira	31.5.2021-11.6.2021	SYKE
Roine Tuomo	31.5.2021-11.6.2021	IL
Lehto Anne-Mari	31.5.2021-11.6.2021	SYKE
Tasala Siru	31.5.2021-3.6.2021	SYKE
Katajisto Tarja	31.5.2021-11.6.2021	SYKE
Rissanen Jouko	31.5.2021-11.6.2021	SYKE
Näkki Pinja	31.5.2021-11.6.2021	SYKE
Mustonen Anna-Riina	31.5.2021-11.6.2021	SYKE

Cruise Route

The cruise started in Helsinki 31.5.2021 and first headed towards the easternmost sampling stations in the Gulf of Finland. After sampling in the Gulf of Finland the cruise continued through the Archipelago Sea and north in the eastern part of Bothnian Sea and Bothnian Bay, before returning south along the western parts of the Bothnian Bay and Bothnian Sea to the Åland Sea. The stations in the Northern Baltic Proper were then sampled, before returning to Helsinki 11.6.2021. A map of the cruise route is shown in Figure 1.

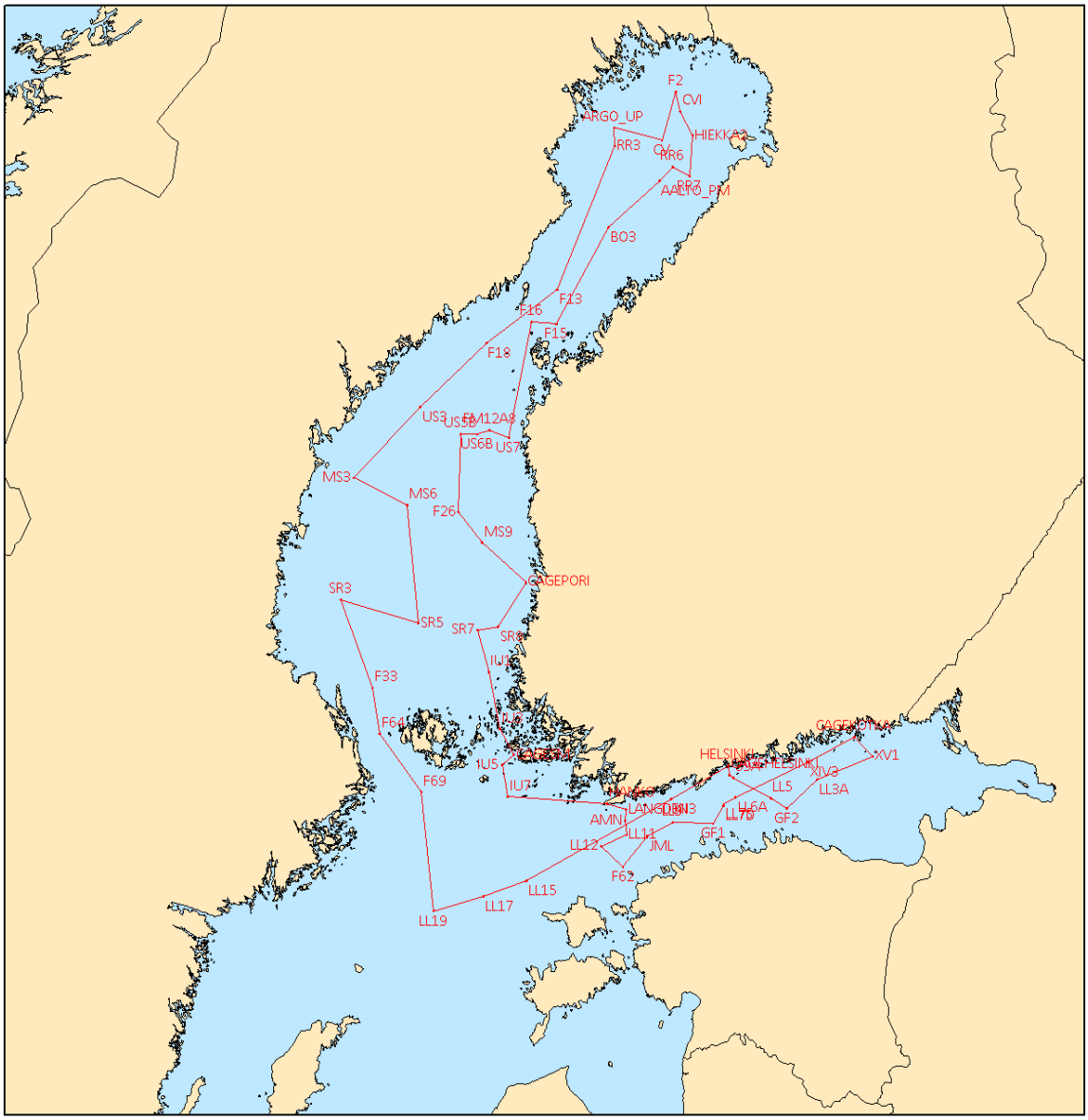

Figure 1. COMBINE 2/2021 cruise route.

Sampling

A list of sampled stations and samples collected during the cruise is found in Annex 1. At each station a CTD profile was taken and when water samples were collected, the nutrient concentrations (NO_2, NO_X, NH_3, PO_4, SiO_4, Total N, Total P), chlorophyll-*a*, O_2 and pH were measured. If anoxic conditions were observed, also H_2S was measured. The standard sampling depths were 1, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150, 175, 200, 225 and 250 m, depending on the sampling station's depth. A water sample 1 m above the sea bottom was also taken. Chlorophyll-*a* were analysed at 1, 5, 10, 15 and 20 m depth. Zooplankton samples were collected using a 100 µm WP-2 net, whereas macrozoobenthos were collected with van Veen grab. Sediment samples were collected using Gemax-corer. Samples for total nitrogen, total phosphorus and chlorophyll-*a*, as well as the biological samples will be analysed after the cruise. Thus, no results from these are persented in this report.

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Observations

CTD profiles from selected stations can be found in Annex 2. Results for oxygen and nutrient parameters from the standard sampling depths can be found in Annex 3 for selected stations. In annex 3 also a comparison to the average of values measured since 2000 during the same season is made. When referred to average values in the following section, the reference period is 2000-2020, using station specific measurements done in May and June.

Hydrography
The warm and calm weather during the cruise allowed the surface temperature to rise from around +8 °C in the start to more than +15 °C towards the end of the cruise. In the water column, the temperature was higher than the average in the Gulf of Finland and less pronounced also in the Northern Baltic Proper, Åland Sea and Bothnian Sea. The salinity of the water mass was close to average in whole Gulf of Finland, but in the western part the surface salinity was higher compared to the average. At most sampling stations in the Gulf of Finland there was a gradual increase in salinity through the water column without a clearly defined halocline. In the Northern Baltic Proper, the salinity was close to the average, with the halocline situated around 60-80 m depth. In the Åland Sea, the surface water was slightly fresher than the average, but deeper waters were more saline than the average. In the southern Bothnian Sea surface salinities were slightly above the average, but apart from that the salinity profiles in the Bothnian Sea were close to the average with a weak halocline around 70-100 m. In the Quark, the surface water was quite fresh with a salinity only around 3 ppm. In the Bothnian Bay, salinity conditions varied between stations, with for example fresher bottom water at BO3 than the average, but at F2 the bottom water was more saline than the average.

Nutrient concentrations
Nutrient levels were close to the average in the Gulf of Finland, Northern Baltic Proper and the Åland Sea, with nitrate and nitrite nitrogen almost depleted in the surface, but excess phosphate (0.1-0.3 µmol/l) present in the surface waters. In the Bothnian Sea and the Quark, nitrate and nitrite nitrogen were depleted in the surface water, but phosphate concentrations in the surface water (0.1-0.2 µmol/l) were in general slightly above the average. In the Bothnian Bay, nitrate and nitrite nitrogen concentrations were generally lower than on average in the surface water. Phosphate concentrations were high throughout the water column at all sampling stations in the Bothnian Bay, generally twice as high as the average concentrations. It is unclear if this was a consequence of water flowing in from the Bothnian Sea, as no such indications were seen in the hydrographic profiles.

Oxygen conditions
In the Gulf of Finland, oxygen concentration in the water column were slightly below the average at most stations, but only one station, F62, was anoxic at the bottom. At F62, H_2S was found from the bottom (97 m) up to 70 m depth. At GF1, only 0.1 ml/l oxygen was measured in the bottom water, but no hydrogen sulphide was noted. In the Northern Baltic Proper, anoxic conditions with hydrogen sulphide occurring were generally found below 80 m. At LL12, both oxygen and hydrogen sulphide were found in the bottom water. At F69 in the Åland Sea, oxygen conditions were worse than previously seen, with only 2.2 ml/l oxygen measured in the bottom water. In the Bothnian Bay the oxygen conditions were close to the average and generally good. However, at SR5 in the southern Bothnian Sea, the oxygen saturation was only around 50%.

Conclusions

The lack of a clear halocline in the Gulf of Finland indicate that there has been a mixing of the water column during the winter, although not strong enough to ventilate the bottom. Excess phosphate measured in the surface waters of Gulf of Finland, Northern Baltic Proper, Åland Sea, Bothnian Sea and the Quark make these areas prone to cyanobacterial blooms, depending on the summer weather conditions. The exceptionally high concentrations of phosphate measured in the

Bothnian Bay need further attention, as its origin remain unclear. However, the availability of inorganic nitrogen in the Bothnian Bay reduce the risk for cyanobacterial blooms. The degraded oxygen conditions in the Åland Sea is further a concern that needs to be followed up on.

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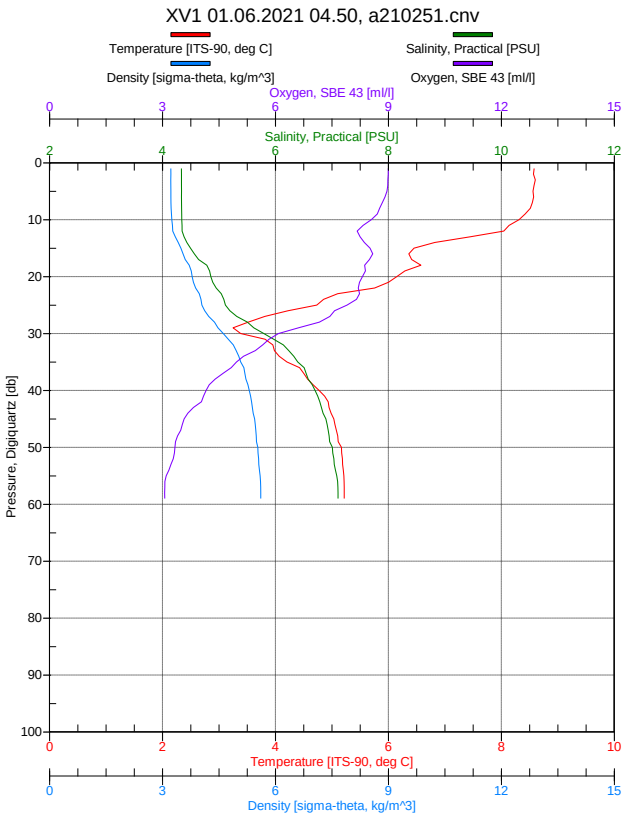
Annex 1. List of sampled stations and parameter sampled during the cruise. Time is given in UTC.

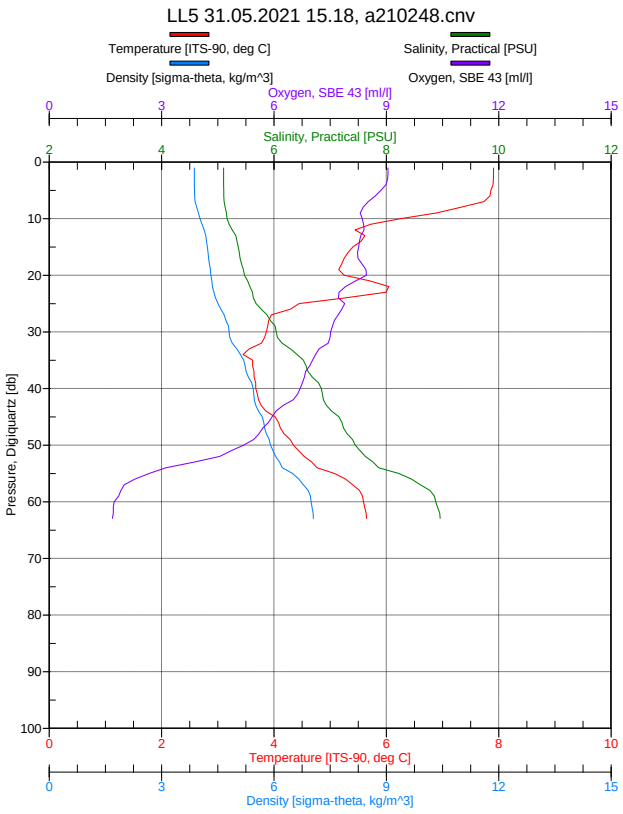
INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	zo	be	chl	secchi
HELSINKI	HELSINKI	60.16178	24.90158		2021-05-31	06:27								
2021010246	*CAGEHELSINKI	60.08677	24.91307	23	2021-05-31	10:01	x							x
2021010247	39A	60.06685	24.98022	42	2021-05-31	11:45	x	x	x	x			x	x
2021010248	LL5	59.91682	25.59698	69	2021-05-31	15:25	x	x	x	x	x	x	x	x
2021010249	GF2	59.83853	25.85682	85	2021-05-31	18:56	x	x	x	x		x	x	x
2021010250	LL3A	60.06712	26.34670	68	2021-05-31	22:21	x	x	x	x	x	x	x	
2021010251	XV1	60.25002	27.24697	66	2021-06-01	04:50	x	x	x	x	x	x	x	x
2021010252	*CAGEKOTKA	60.40098	26.95423	21	2021-06-01	08:15	x							x
2021010253	XIV3	60.20318	26.19302	79	2021-06-01	13:56	x	x	x	x			x	x
2021010254	LL6A	59.91682	25.02998	73	2021-06-01	20:03	x	x	x	x		x	x	x
2021010255	LL7S	59.85853	24.83823	77	2021-06-01	22:22	x	x	x	x	x	x	x	
2021010256	LL7D	59.84647	24.83775	102	2021-06-02	01:34	x	x	x	x				
2021010257	GF1	59.70502	24.68220	84	2021-06-02	03:18	x	x	x	x	x	x	x	
2021010258	LL9	59.70012	24.02995	66	2021-06-02	07:00	x	x	x	x	x	x	x	x
2021010259	JML	59.58185	23.62675	80	2021-06-02	10:06	x	x	x	x		x	x	x
2021010260	F62	59.33347	23.26343	97	2021-06-02	15:00	x	x		x			x	x
2021010261	LL12	59.48350	22.89682	83	2021-06-02	18:26	x	x	x	x	x	x	x	x
2021010262	LL11	59.58352	23.29678	67	2021-06-02	21:10	x	x	x	x		x	x	
2021010263	AMN	59.69047	23.25717	55	2021-06-03	00:03	x	x	x	x		x	x	
2021010264	LANGDEN	59.77675	23.26272	57	2021-06-03	02:53	x	x	x	x	x	x	x	
HANKO	HANKO	59.81390	22.95133		2021-06-03	06:09								
2021010265	IU7	59.81515	21.33655	92	2021-06-03	11:54	x	x	x	x	x		x	x
2021010266	IU5	60.05818	21.19835	89	2021-06-03	15:46	x	x	x	x		x	x	x
2021010267	*CAGESM	60.14475	21.37973	27	2021-06-03	17:57	x							x
2021010268	IU3	60.33332	21.11332	51	2021-06-03	20:58	x	x	x	x		x	x	
2021010269	IU1	60.76683	20.84660	34	2021-06-04	01:06	x	x	x	x			x	
2021010270	SR7	61.08352	20.59645	78	2021-06-04	04:09	x	x	x	x		x	x	x
2021010271	SR8	61.12645	20.92998	48	2021-06-04	06:28	x	x	x	x			x	x
2021010272	*CAGEPORI	61.49797	21.34363	23	2021-06-04	10:12	x							x
2021010273	MS9	61.76682	20.53055	101	2021-06-04	14:28	x	x	x	x		x	x	x
2021010274	F26	61.98352	20.06307	138	2021-06-04	17:41	x	x	x	x		x	x	x
2021010275	US5B	62.58620	19.96898	222	2021-06-04	23:01	x	x	x	x	x	x	x	
2021010276	US6B	62.60012	20.26297	82	2021-06-05	04:53	x	x	x	x		x	x	x
2021010277	FM12A8	62.64313	20.47263	38	2021-06-05	07:03	x	x	x	x		x	x	x
2021010278	US7	62.60022	20.82972	28	2021-06-05	09:12	x	x	x	x			x	x
2021010279	F16	63.51677	21.06298	48	2021-06-05	17:12	x	x	x	x	x	x	x	x
2021010280	F15	63.51687	21.51303	48	2021-06-05	20:02	x	x	x	x		x	x	x
2021010281	BO3	64.30202	22.34325	110	2021-06-06	01:58	x	x	x	x	x	x	x	x
2021010282	**AALTO_PM	64.68462	23.23987	80	2021-06-06	08:19								
2021010283	RR6	64.80033	23.47947	86	2021-06-06	09:55	x	x	x	x		x	x	x
2021010284	RR7	64.73365	23.81282	39	2021-06-06	12:28	x	x	x	x			x	x
2021010285	HIEKKA2	65.04998	23.83322	22	2021-06-06	15:23	x	x	x	x		x	x	x
2021010286	CVI	65.23365	23.56280	69	2021-06-06	17:43	x	x	x	x		x	x	x
2021010287	F2	65.38363	23.46272	83	2021-06-06	20:48	x	x	x	x	x		x	
2021010288	CV	65.00035	23.24613	86	2021-06-07	00:42	x	x	x	x		x	x	x
2021010289	***ARGO_UP	65.07497	22.30915	43	2021-06-07	05:20								x
2021010290	RR3	64.93370	22.34597	93	2021-06-07	06:31	x	x	x	x		x	x	x
2021010291	F13	63.78348	21.47950	64	2021-06-07	14:58	x	x	x	x			x	x
2021010292	F18	63.31438	20.27270	103	2021-06-07	20:25	x	x	x	x		x	x	
2021010293	US3	62.75883	19.19577	177	2021-06-08	02:43	x	x	x	x		x	x	x
2021010294	MS3	62.13453	18.16297	84	2021-06-08	09:05	x	x	x	x		x	x	x
2021010295	MS6	61.98363	19.16345	72	2021-06-08	13:43	x	x	x	x		x	x	x
2021010296	SR5	61.08333	19.57967	125	2021-06-08	20:51	x	x	x	x	x	x		
2021010297	SR3	61.18330	18.23007	73	2021-06-09	04:24	x	x	x	x		x	x	x
2021010298	F33	60.53320	18.93763	135	2021-06-09	10:34	x	x	x	x			x	x
2021010299	F64	60.18895	19.14253	286	2021-06-09	15:01	x	x	x	x	x	x	x	x
2021010300	F69	59.78337	19.93008	192	2021-06-09	22:33	x	x	x	x		x	x	
2021010301	LL19	58.88068	20.31082	166	2021-06-10	07:40	x	x	x	x		x	x	x
2021010302	LL17	59.03335	21.07957	172	2021-06-10	11:58	x	x	x	x	x	x	x	x
2021010303	LL15	59.18337	21.74677	131	2021-06-10	17:42	x	x	x	x		x	x	x
2021010304	XII3	59.88083	23.98563	35	2021-06-11	03:26	x	x	x	x			x	x
HELSINKI	HELSINKI	60.16182	24.90158		2021-06-11	09:12								

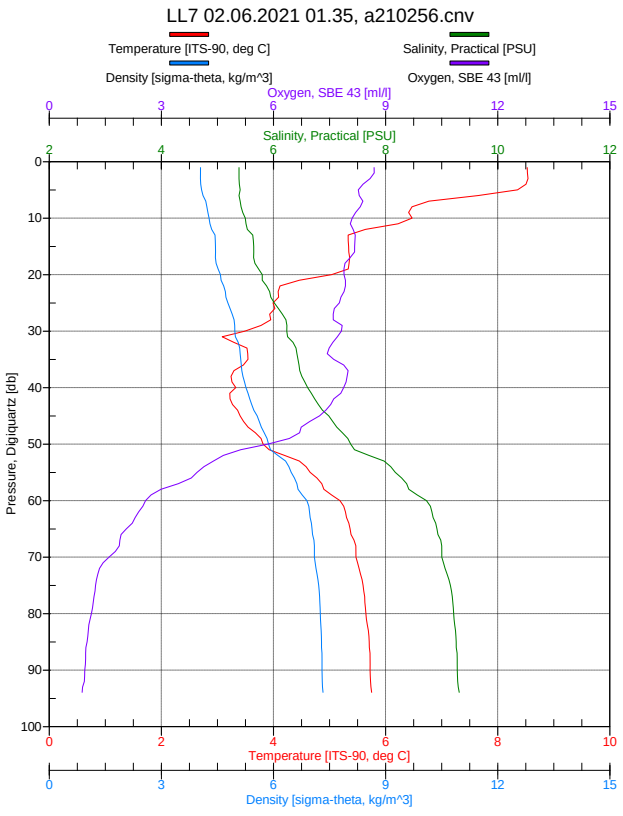
Parameters: ox = oxygen, nu = nutrients, zo = zooplankton, be = benthos, chl = chlorophyll a. * = mussel cage deployment, ** = wave buouy installation, *** = retrieval of drifting float

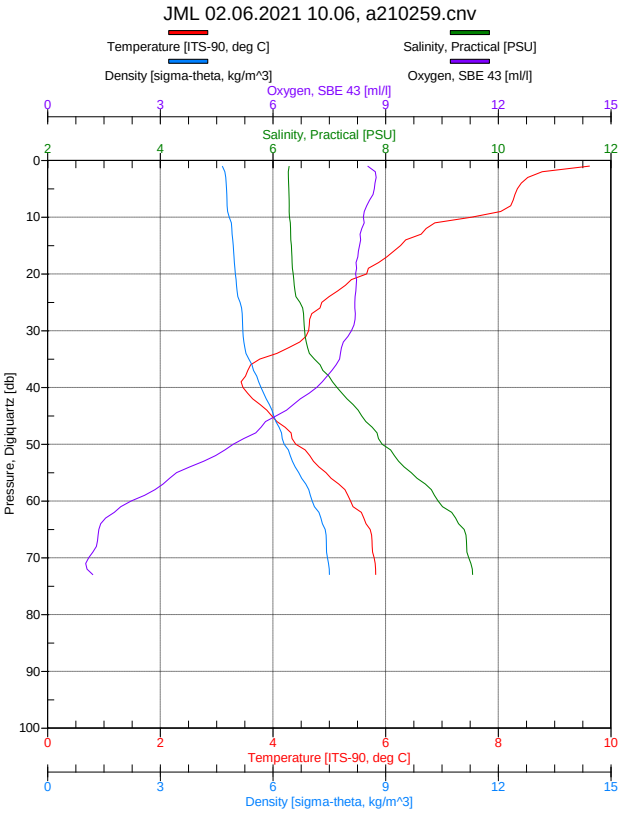
Annex 2. CTD profiles, including oxygen profiles, from selected stations.

Gulf of Finland (stations XVI, LL5, LL7D and JML)

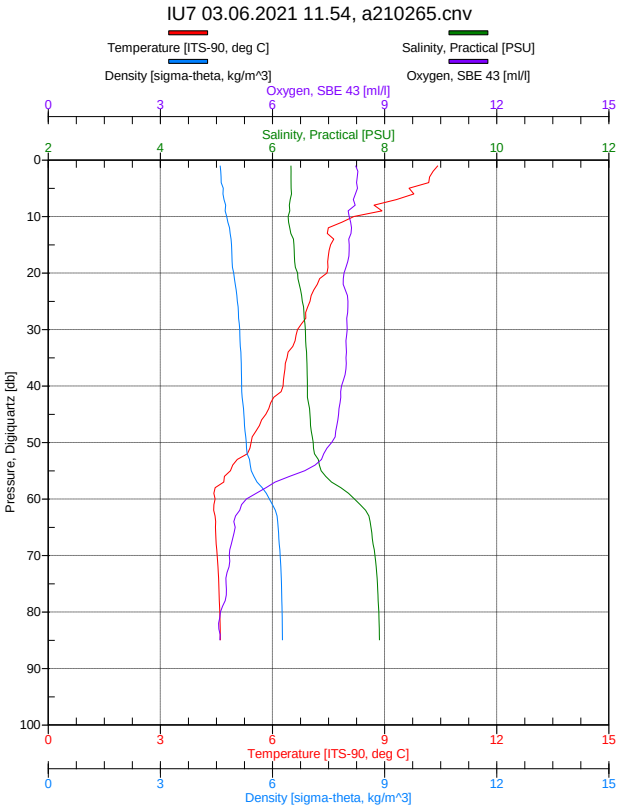


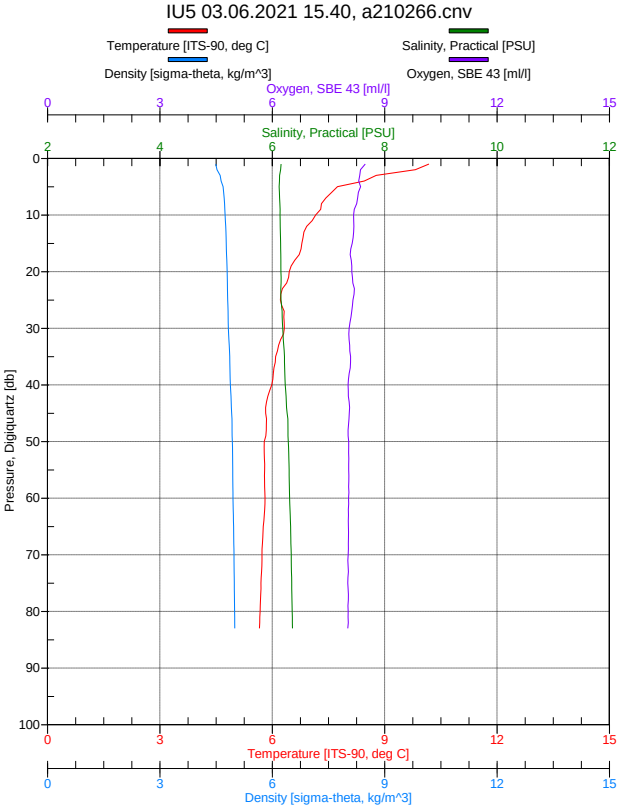




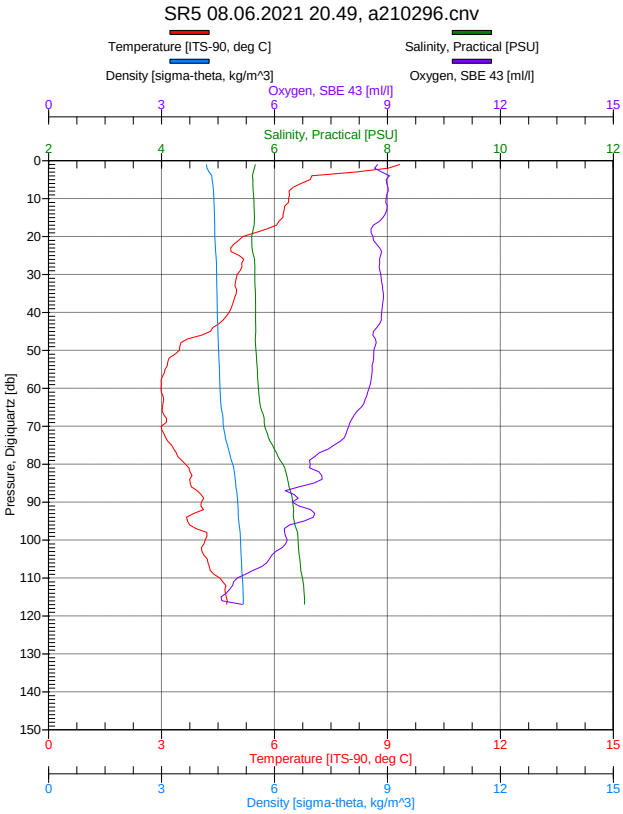


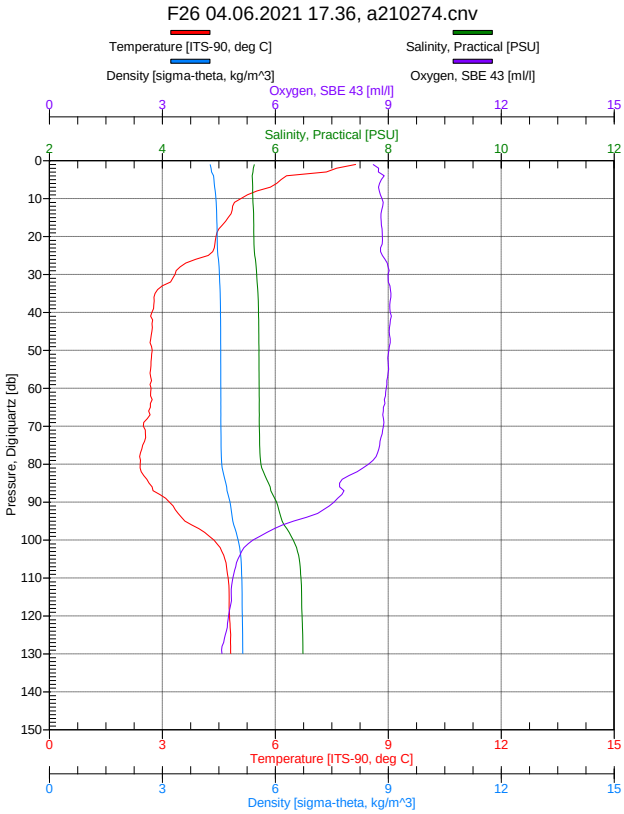
Archipelago Sea (stations IU7 and IU5)

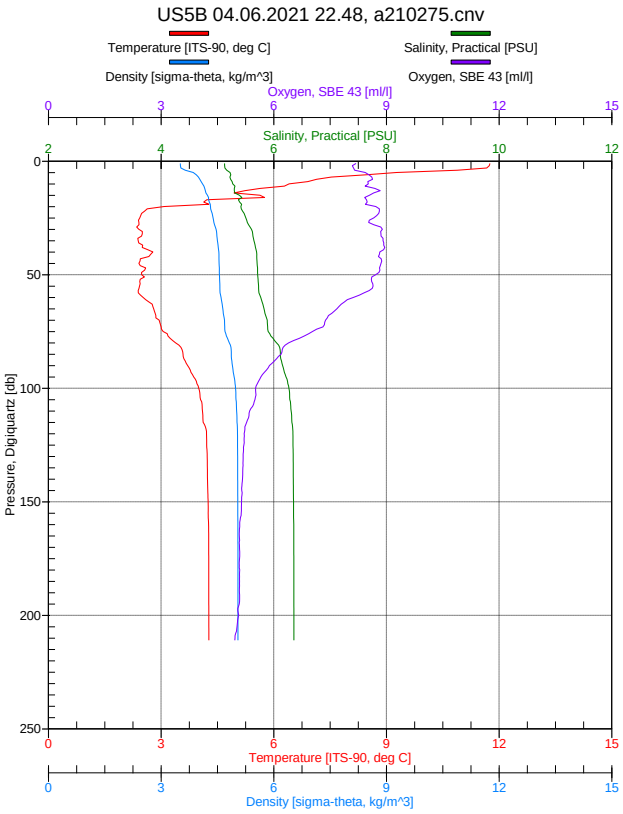


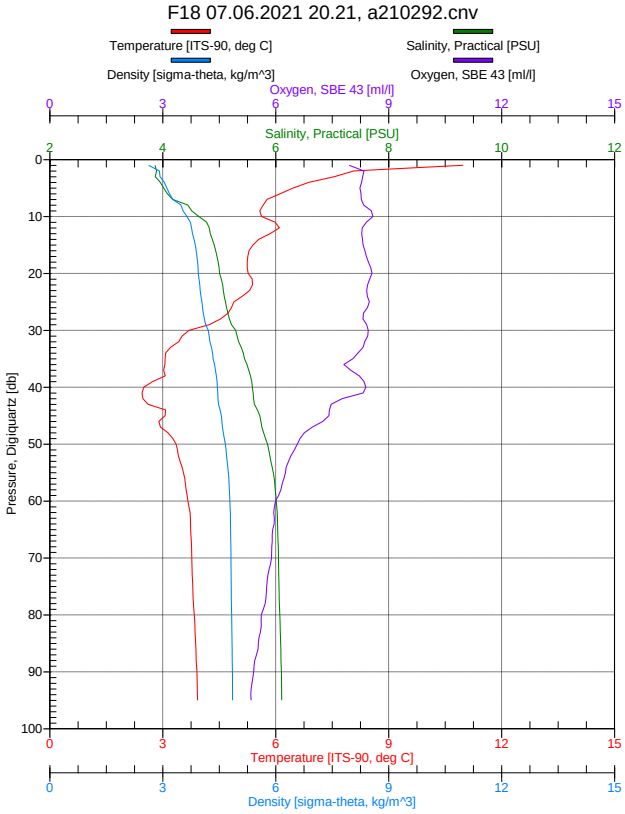


Bothnian Sea (stations SR5, F26, US5B and F18)

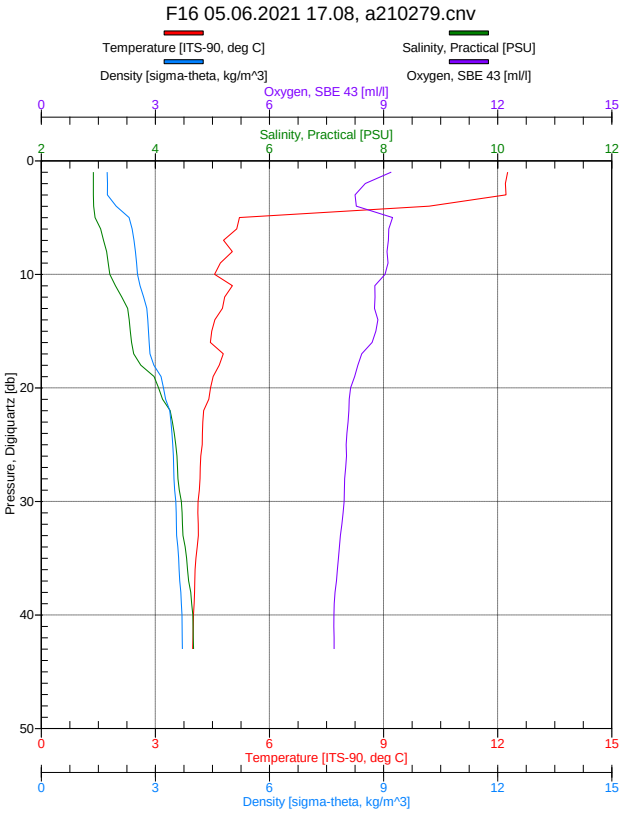


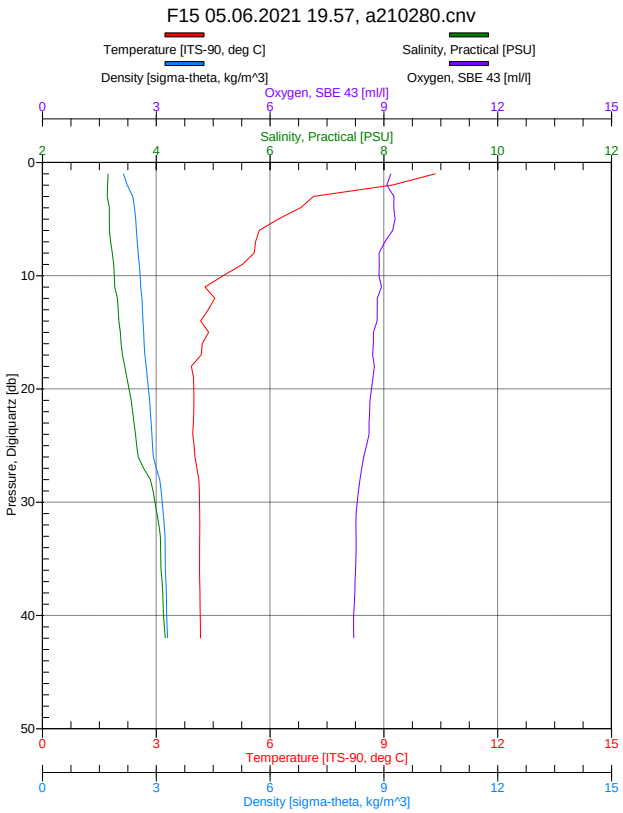




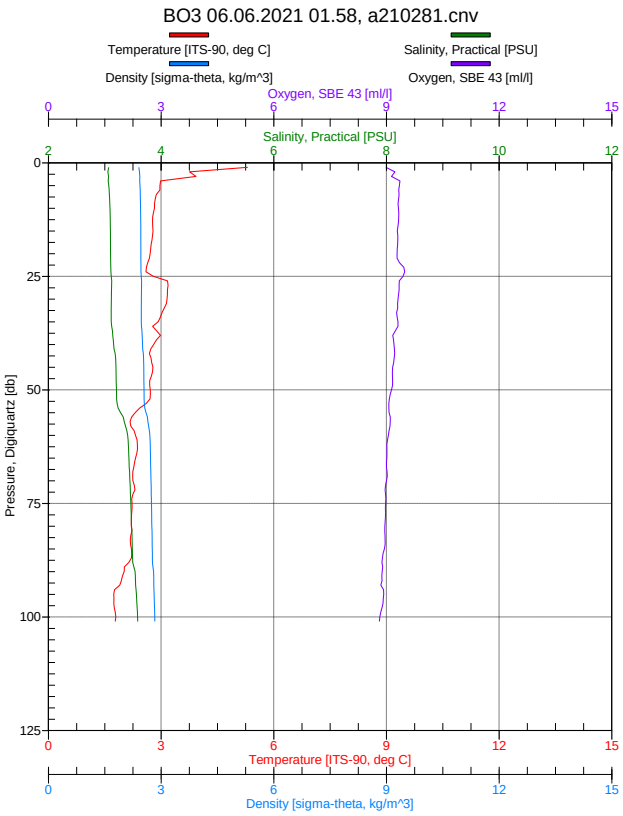


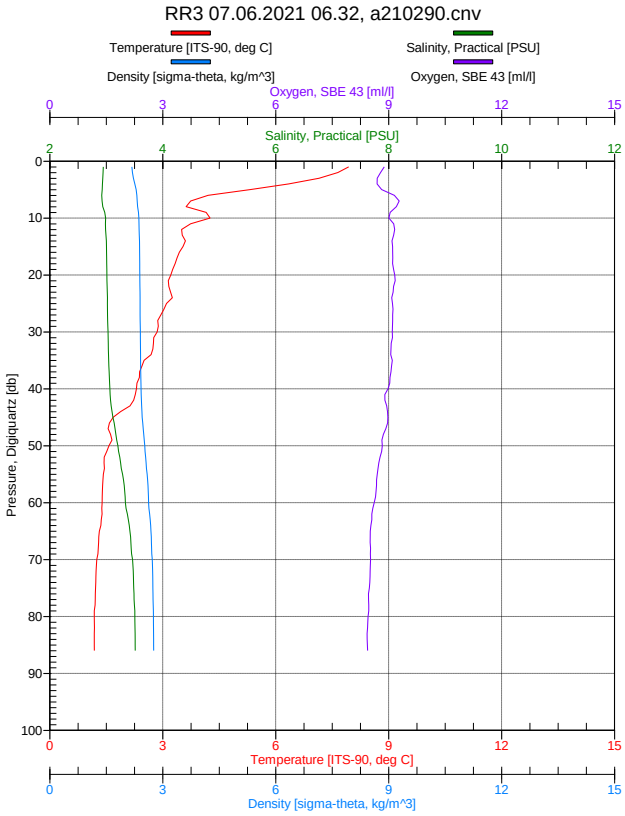
The Quark (stations F16 and F15)

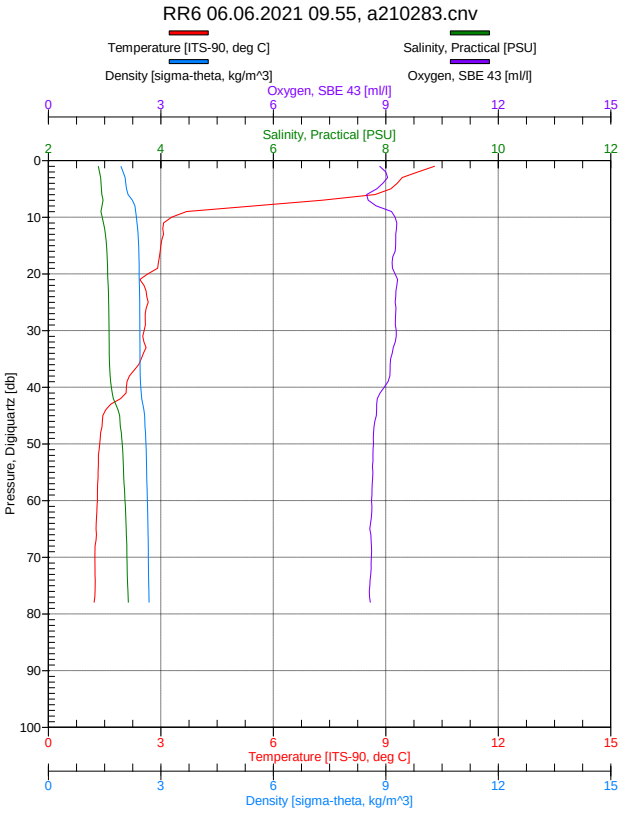


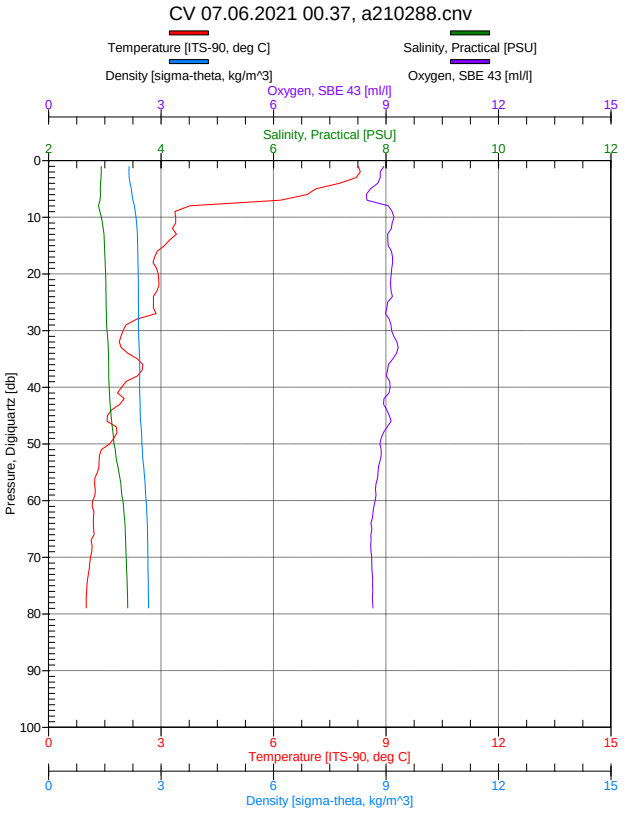


Bothnian Bay (BO3, RR3, RR6 and CV)

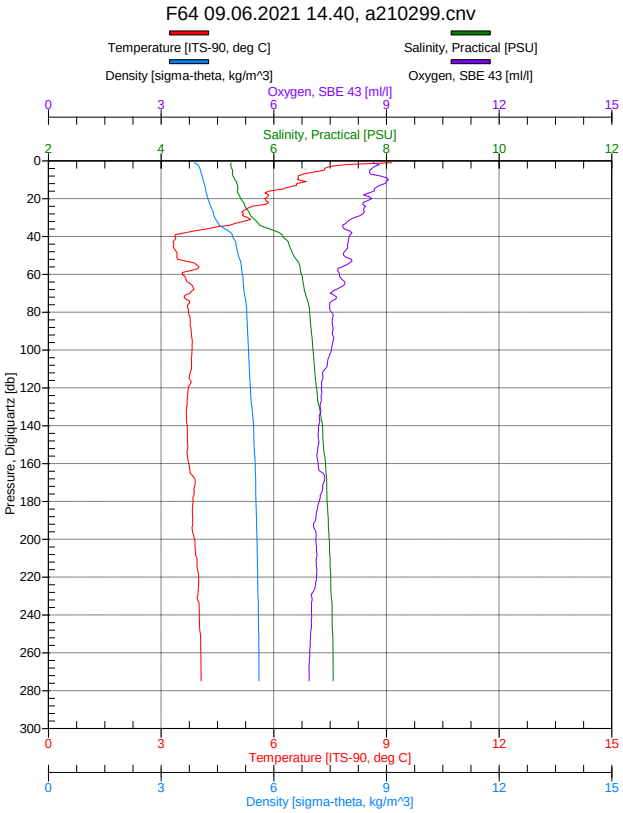


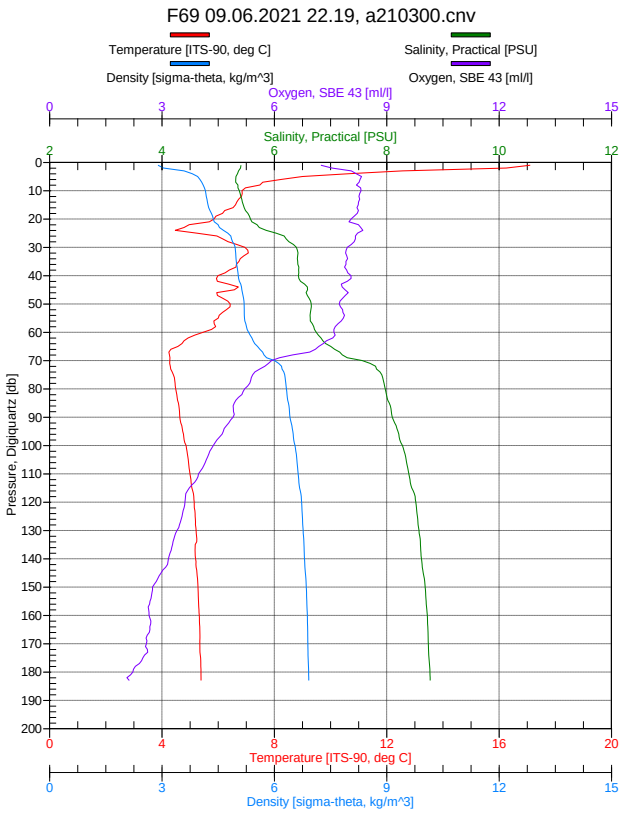




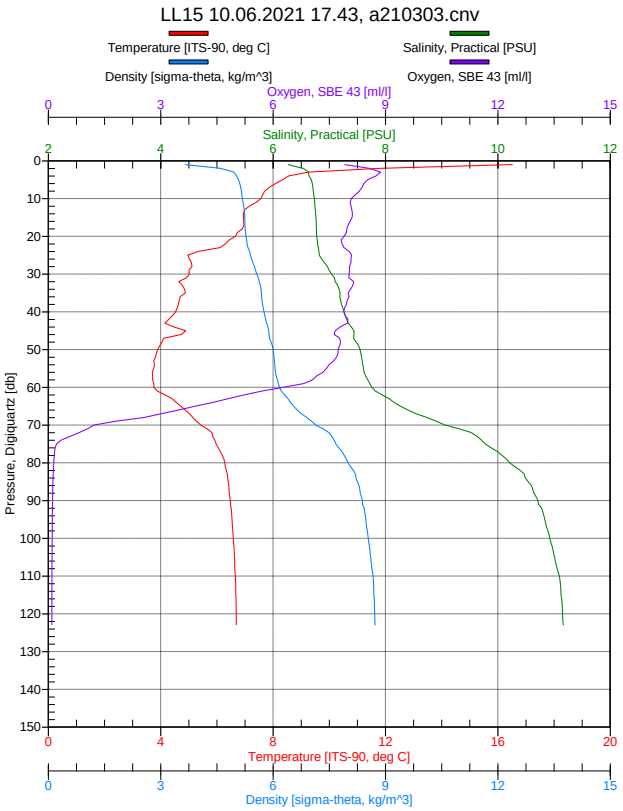


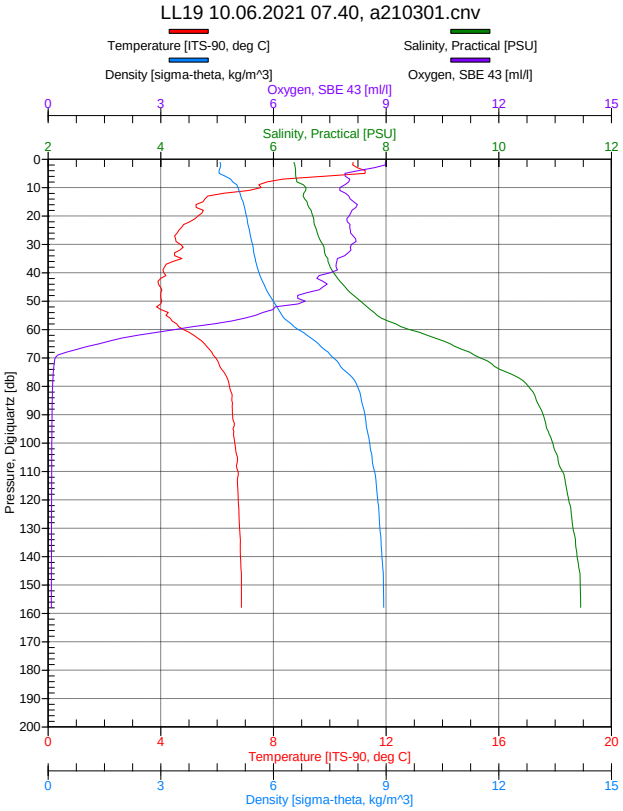
Åland Sea (stations F64 and F69)





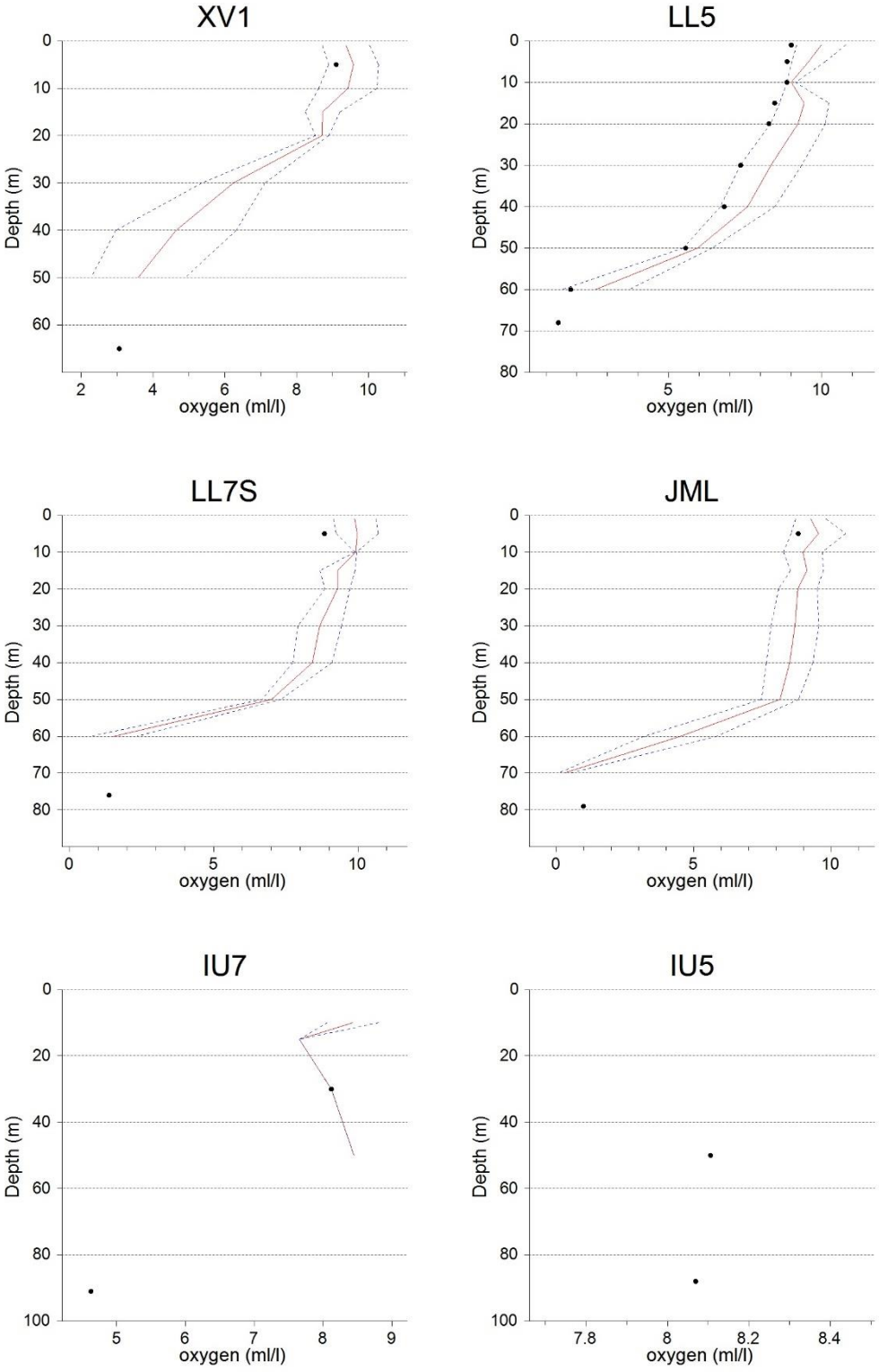
Northern Baltic Proper (stations LL15 and LL19)

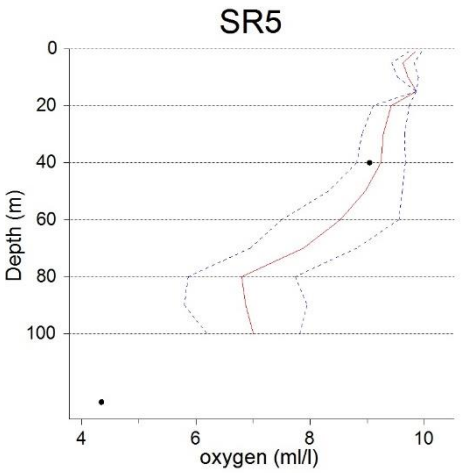


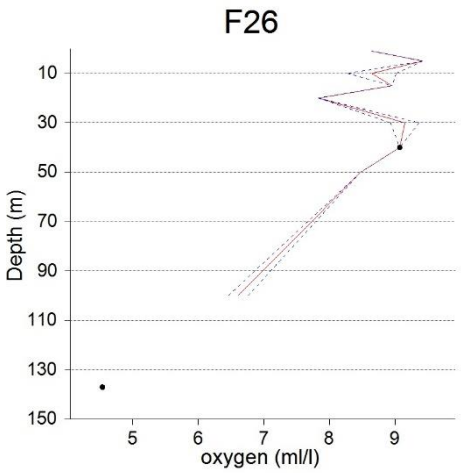


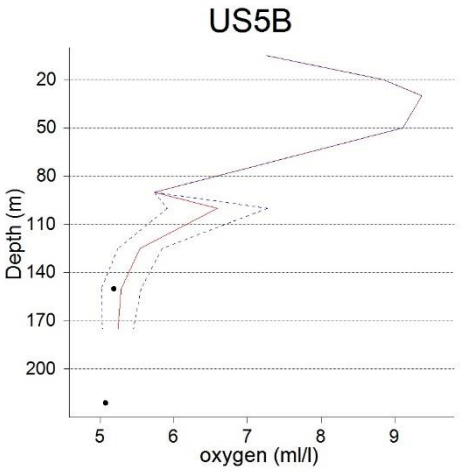
Annex 3. Selected variables at the stations XV1, LL5, LL7S, JML, IU7, IU5, SR5, F26, US5B, F18, F16, F15, BO3, RR3, RR6, CV, F64, F69, LL15 and LL19 measured at the standard sampling depths (black dots). Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season (May-June) since the year 2000.

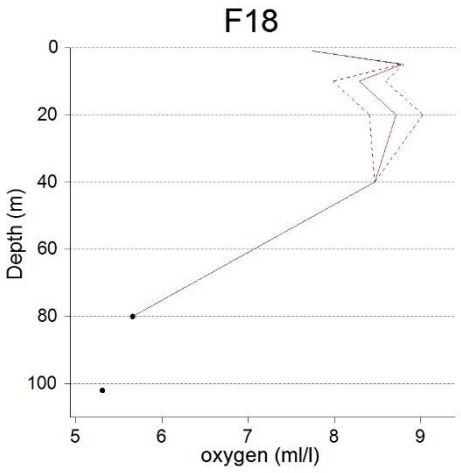
Oxygen:

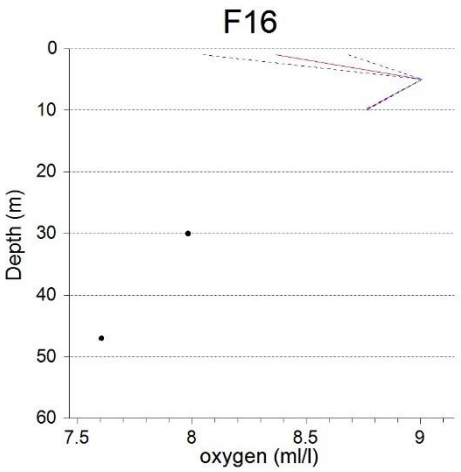


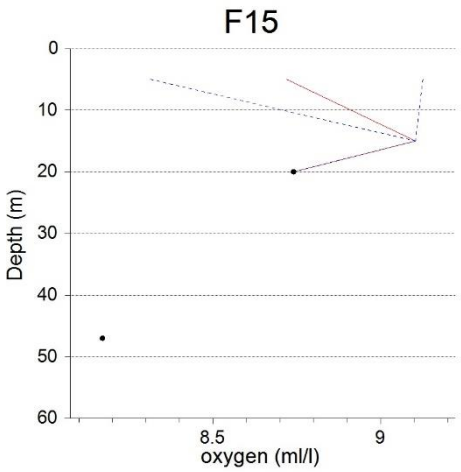

SR5
Depth (m)
0
20
40
60
80
100
4
6
8
10
oxygen (ml/l)

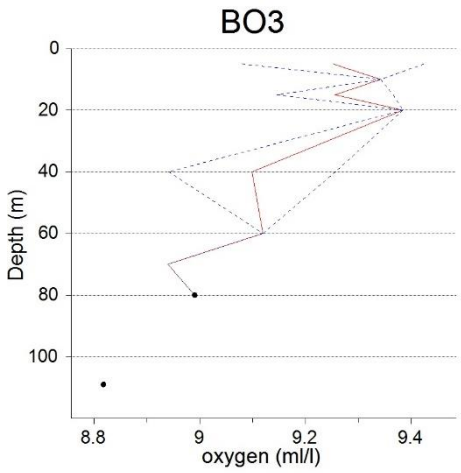

F26
Depth (m)
10
30
50
70
90
110
130
150
5
6
7
8
9
oxygen (ml/l)

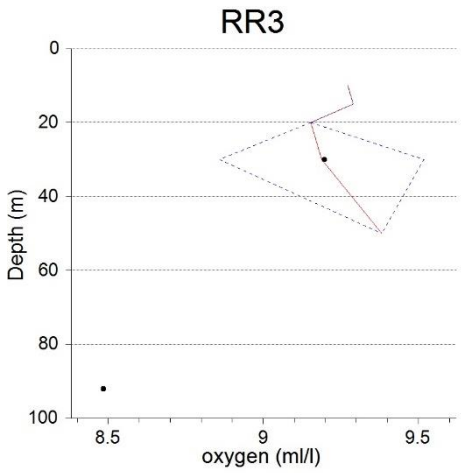

US5B
Depth (m)
20
50
80
110
140
170
200
5
6
7
8
9
oxygen (ml/l)

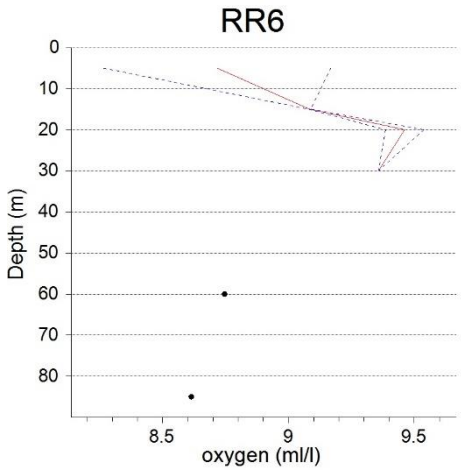

F18
Depth (m)
0
20
40
60
80
100
5
6
7
8
9
oxygen (ml/l)

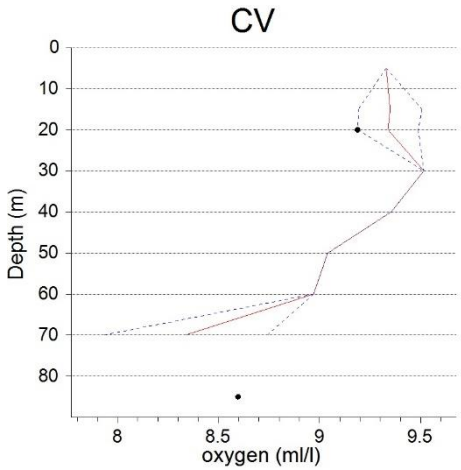

F16
Depth (m)
0
10
20
30
40
50
60
7.5
8
8.5
9
oxygen (ml/l)

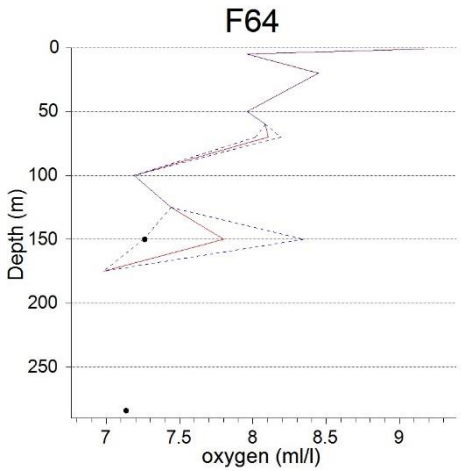

F15
Depth (m)
0
10
20
30
40
50
60
8.5
9
oxygen (ml/l)

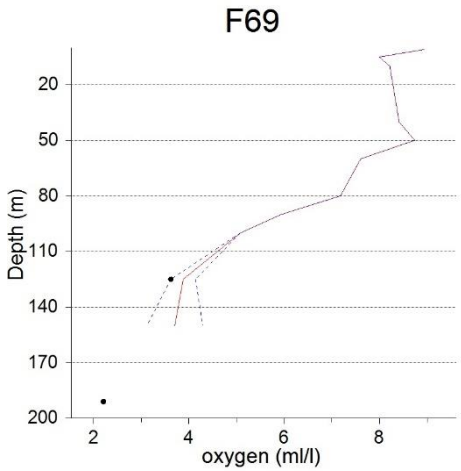

BO3
Depth (m)
0
20
40
60
80
100
8.8
9
9.2
9.4
oxygen (ml/l)

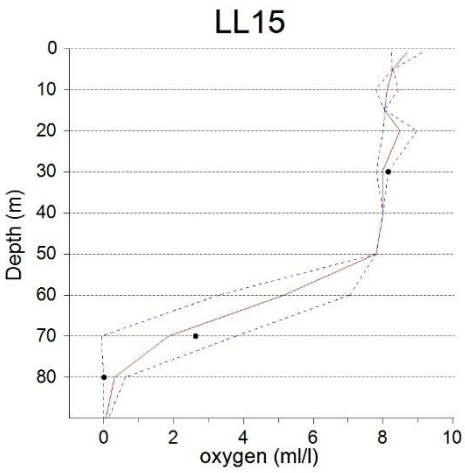

RR3
Depth (m)
0
20
40
60
80
100
8.5
9
9.5
oxygen (ml/l)

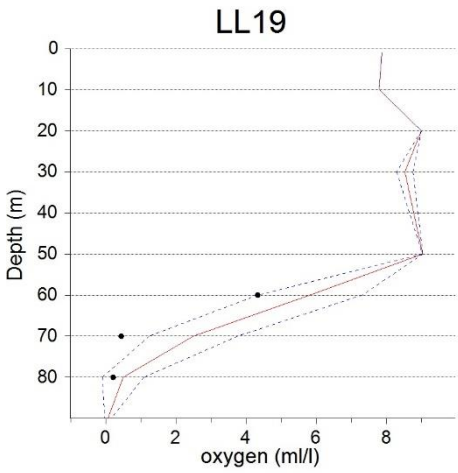

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
8.5
9
9.5
oxygen (ml/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
8
8.5
9
9.5
oxygen (ml/l)

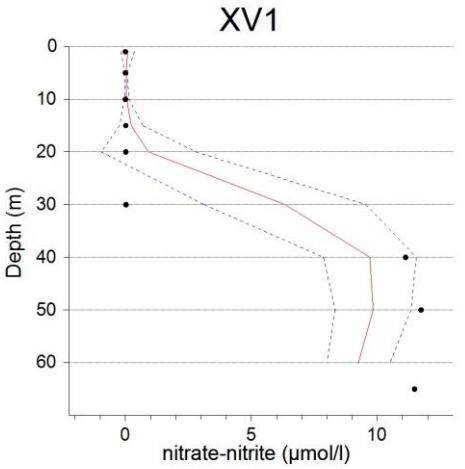

F64
Depth (m)
0
50
100
150
200
250
7
7.5
8
8.5
9
oxygen (ml/l)

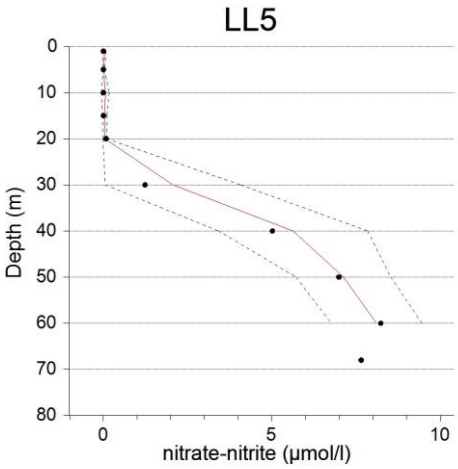

F69
Depth (m)
20
50
80
110
140
170
200
2
4
6
8
oxygen (ml/l)

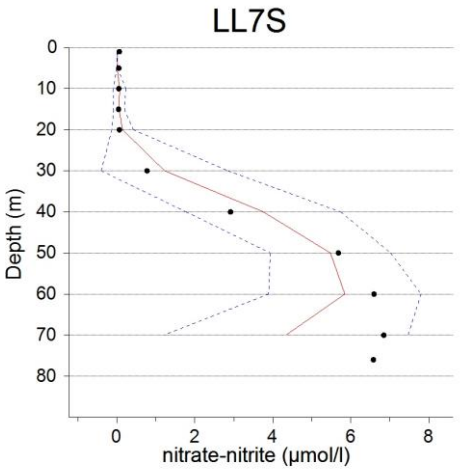


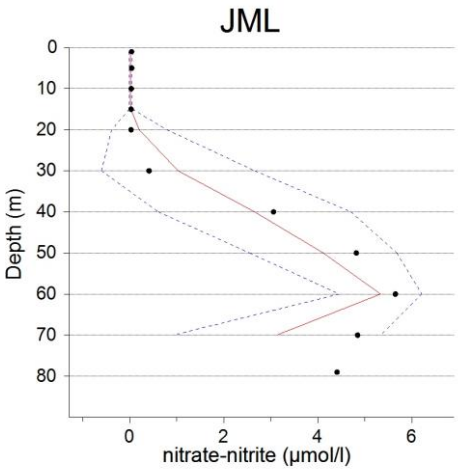


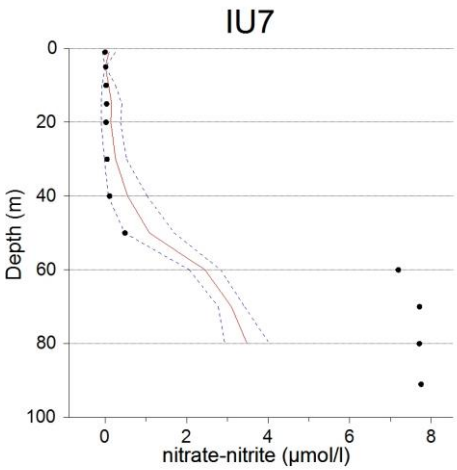
Nitrate-nitrite:

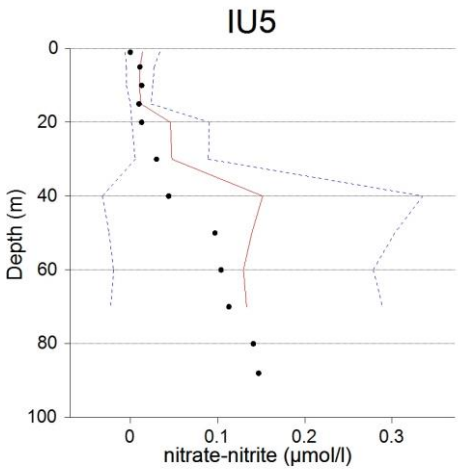


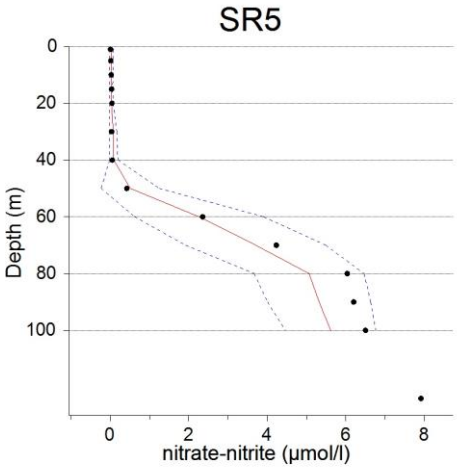


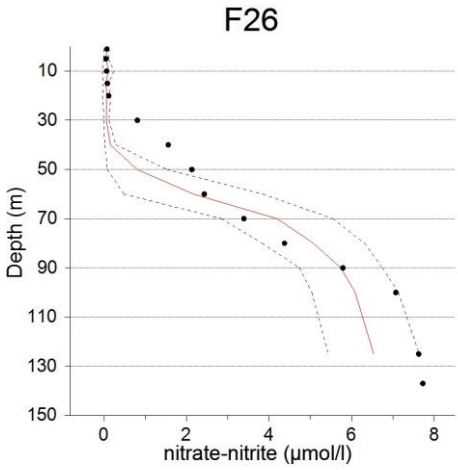


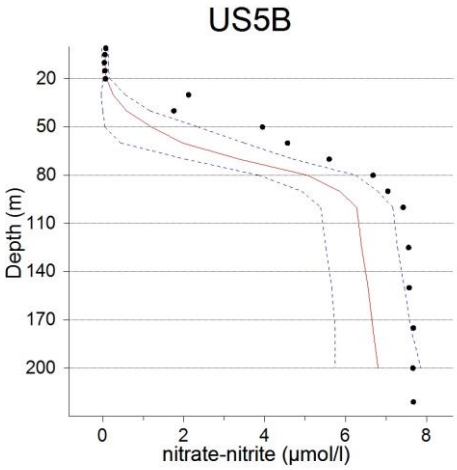


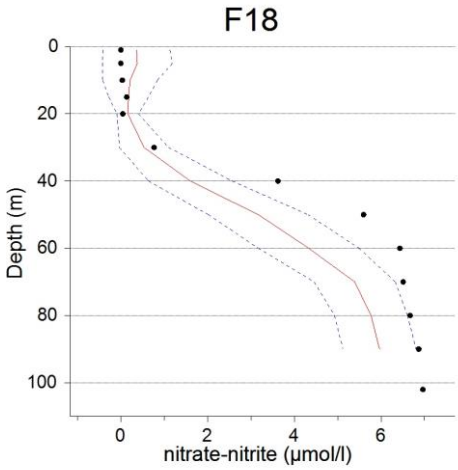

IU7
Depth (m)
0
20
40
60
80
100
0
2
4
6
8
nitrate-nitrite (µmol/l)

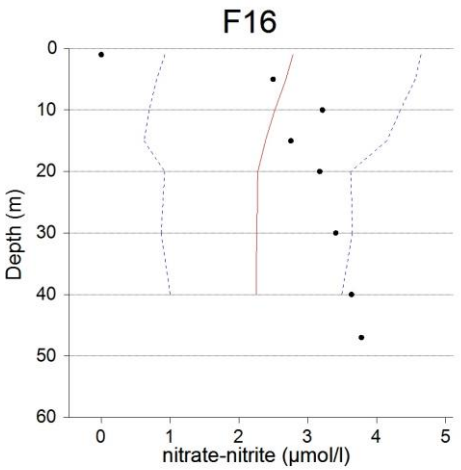

IU5
Depth (m)
0
20
40
60
80
100
0
0.1
0.2
0.3
nitrate-nitrite (µmol/l)

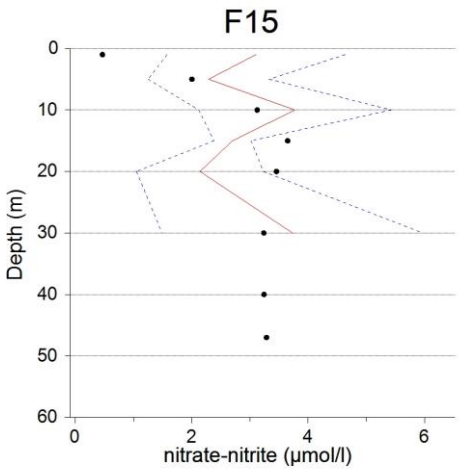

SR5
Depth (m)
0
20
40
60
80
100
0
2
4
6
8
nitrate-nitrite (µmol/l)

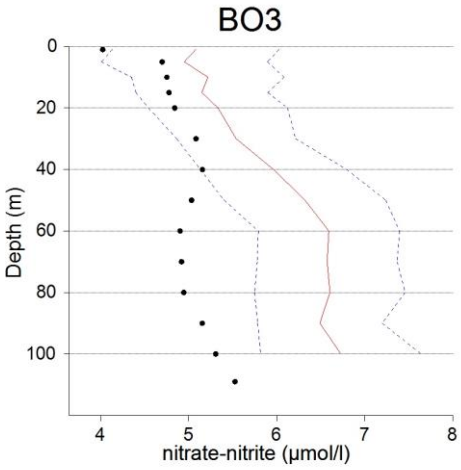

F26
Depth (m)
10
30
50
70
90
110
130
150
0
2
4
6
8
nitrate-nitrite (µmol/l)

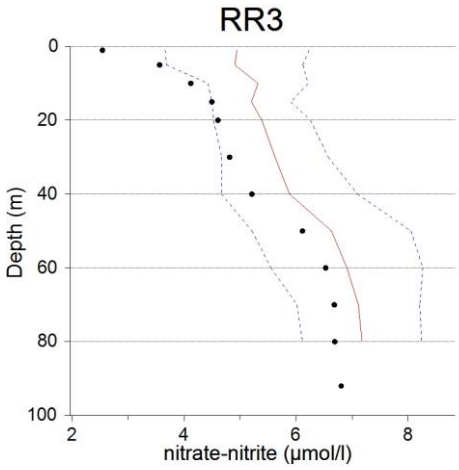

US5B
Depth (m)
20
50
80
110
140
170
200
0
2
4
6
8
nitrate-nitrite (µmol/l)

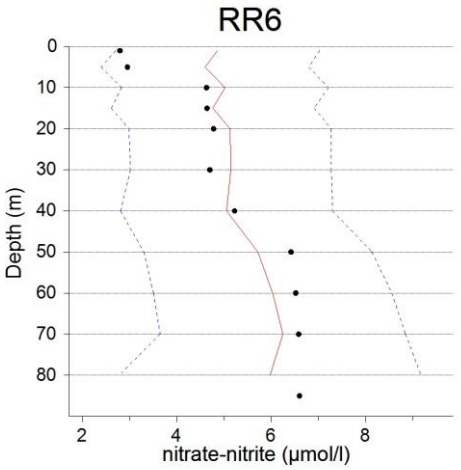

F18
Depth (m)
0
20
40
60
80
100
0
2
4
6
nitrate-nitrite (µmol/l)

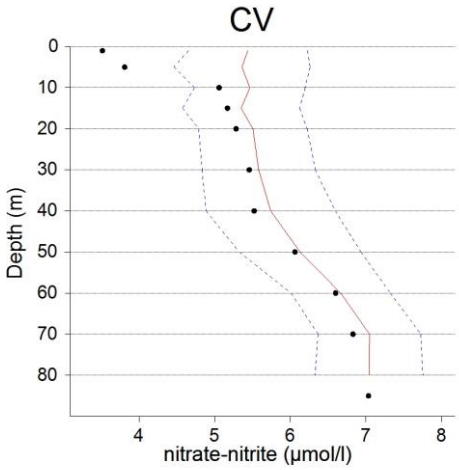

F16
Depth (m)
0
10
20
30
40
50
60
0
1
2
3
4
5
nitrate-nitrite (µmol/l)

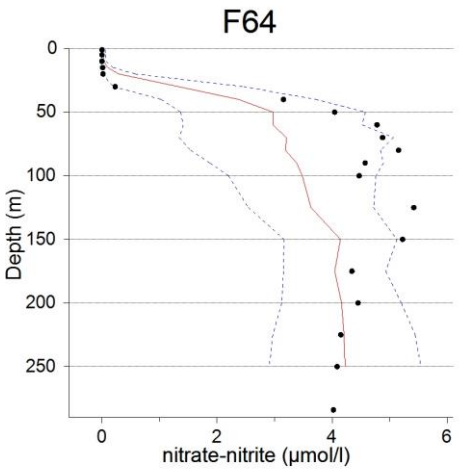

F15
Depth (m)
0
10
20
30
40
50
60
0
2
4
6
nitrate-nitrite (µmol/l)

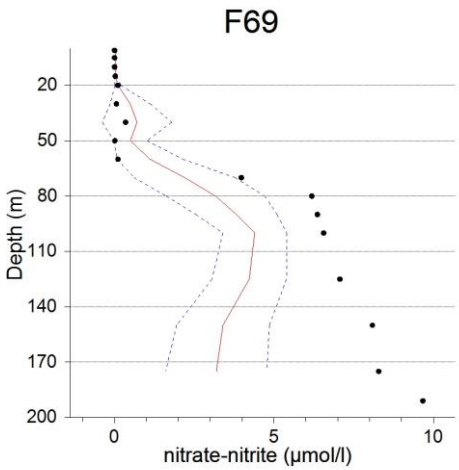

BO3
Depth (m)
0
20
40
60
80
100
4
5
6
7
8
nitrate-nitrite (µmol/l)

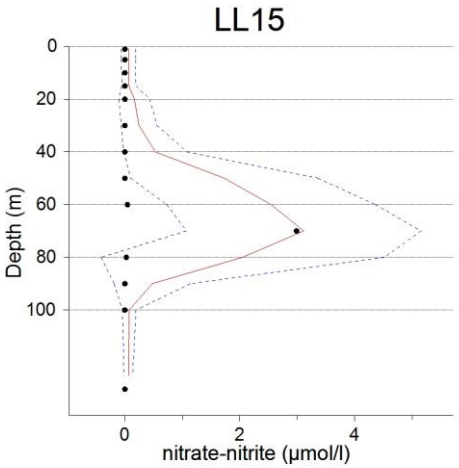

RR3
Depth (m)
0
20
40
60
80
100
2
4
6
8
nitrate-nitrite (µmol/l)

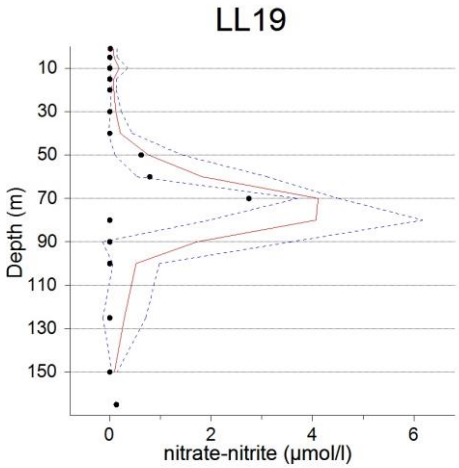

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
2
4
6
8
nitrate-nitrite (µmol/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
4
5
6
7
8
nitrate-nitrite (µmol/l)

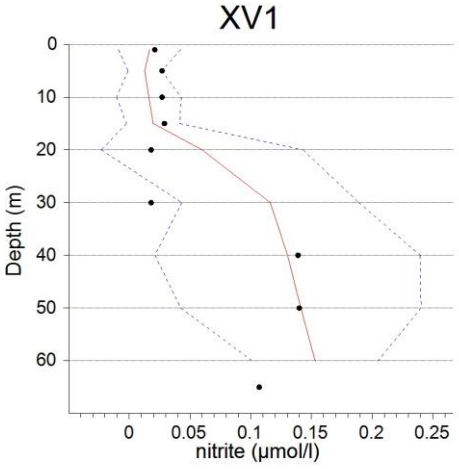

F64
Depth (m)
0
50
100
150
200
250
0
2
4
6
nitrate-nitrite (µmol/l)

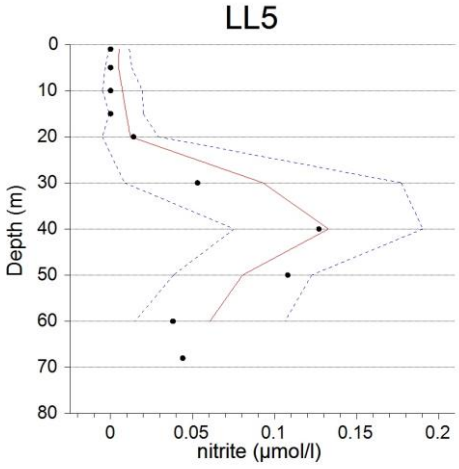

F69
Depth (m)
20
50
80
110
140
170
200
0
5
10
nitrate-nitrite (µmol/l)

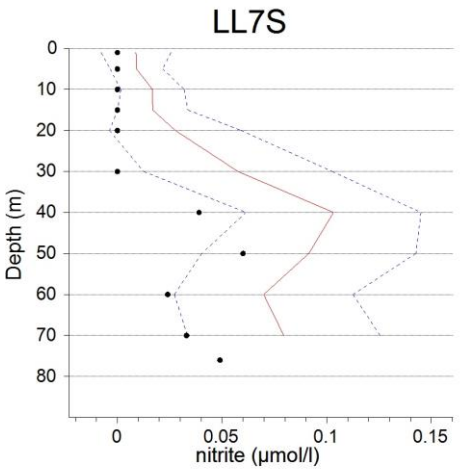

LL15
Depth (m)
0
20
40
60
80
100
0
2
4
nitrate-nitrite (µmol/l)

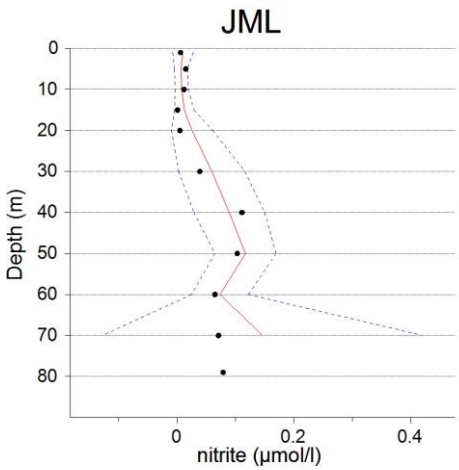

LL19
Depth (m)
10
30
50
70
90
110
130
150
0
2
4
6
nitrate-nitrite (µmol/l)

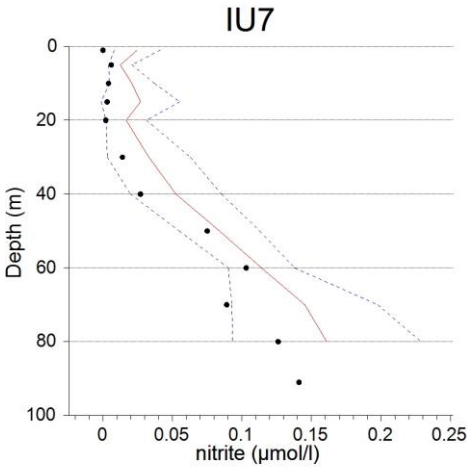
Nitrite:

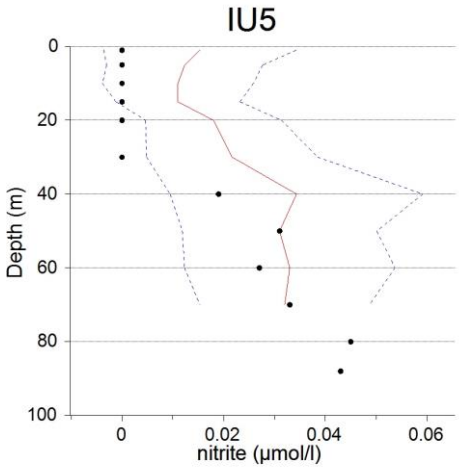

XV1
Depth (m)
0
10
20
30
40
50
60
0
0.05
0.1
0.15
0.2
0.25
nitrite (µmol/l)

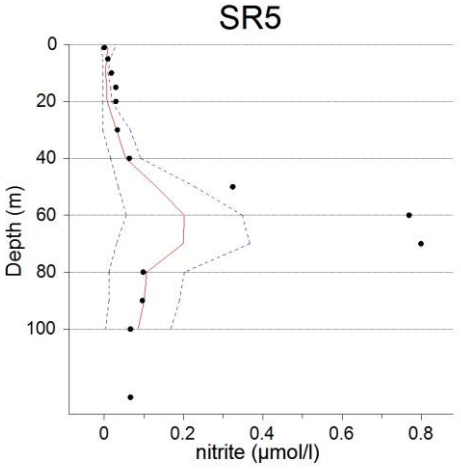

LL5
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
nitrite (µmol/l)

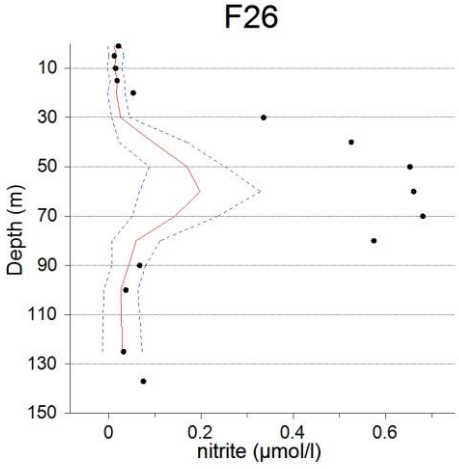

LL7S
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
nitrite (µmol/l)

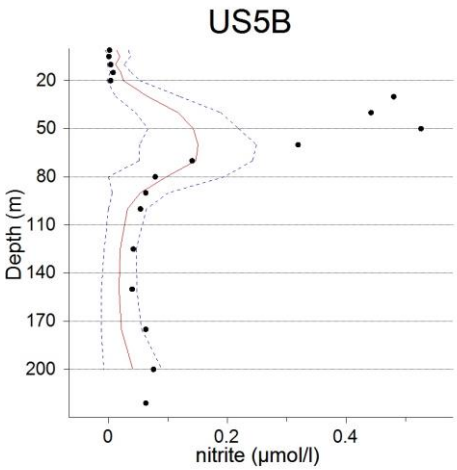

JML
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.2
0.4
nitrite (µmol/l)

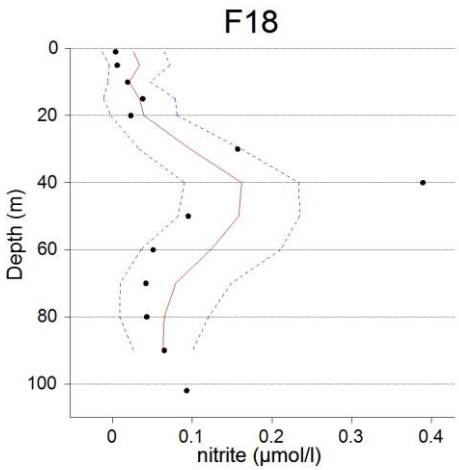

IU7
Depth (m)
0
20
40
60
80
100
0
0.05
0.1
0.15
0.2
0.25
nitrite (µmol/l)

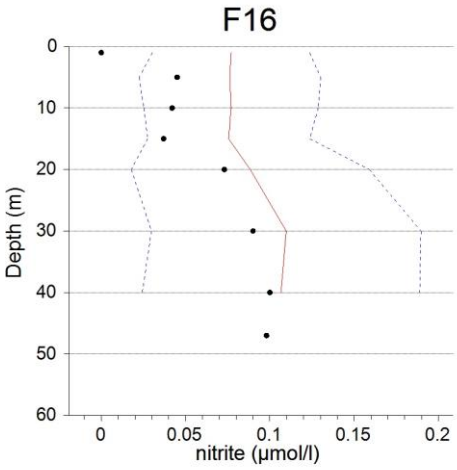

IU5
Depth (m)
0
20
40
60
80
100
0
0.02
0.04
0.06
nitrite (µmol/l)

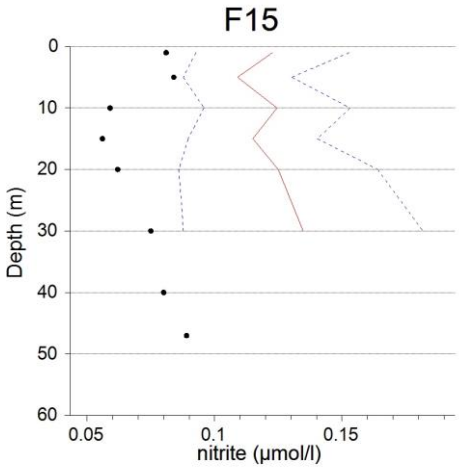

SR5
Depth (m)
0
20
40
60
80
100
0
0.2
0.4
0.6
0.8
nitrite (µmol/l)

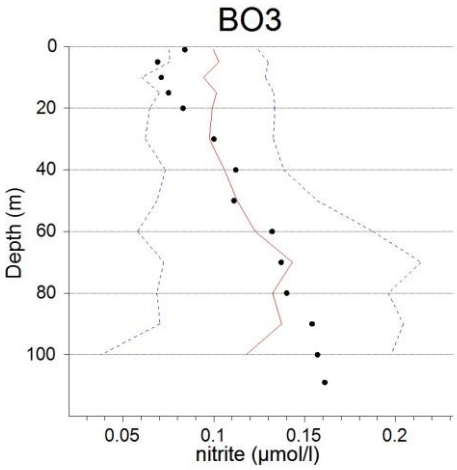

F26
Depth (m)
10
30
50
70
90
110
130
150
0
0.2
0.4
0.6
nitrite (µmol/l)

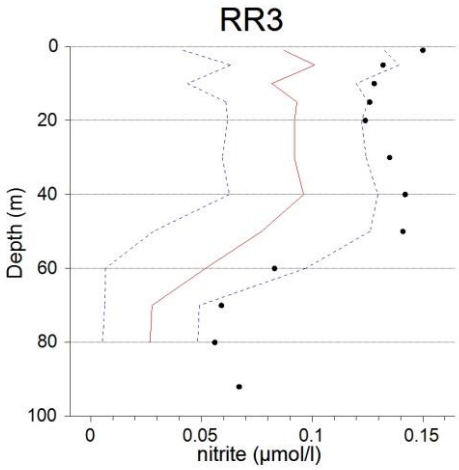

US5B
Depth (m)
20
50
80
110
140
170
200
0
0.2
0.4
nitrite (µmol/l)

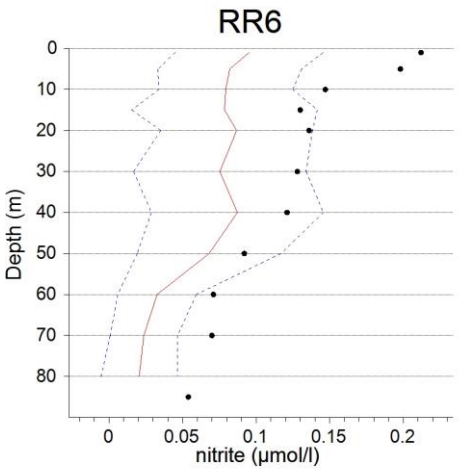

F18
Depth (m)
0
20
40
60
80
100
0
0.1
0.2
0.3
0.4
nitrite (µmol/l)

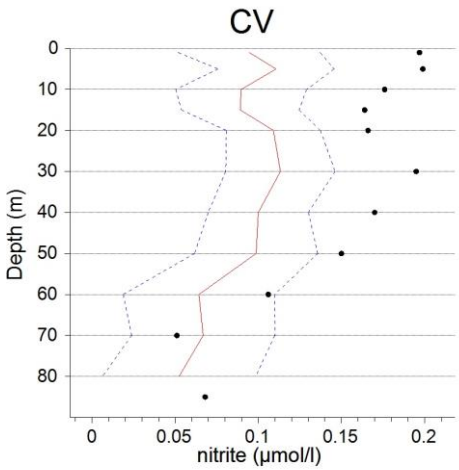

F16
Depth (m)
0
10
20
30
40
50
60
0
0.05
0.1
0.15
0.2
nitrite (µmol/l)

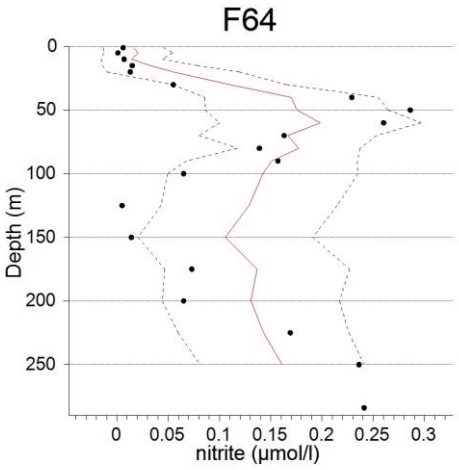

F15
Depth (m)
0
10
20
30
40
50
60
0.05
0.1
0.15
nitrite (µmol/l)

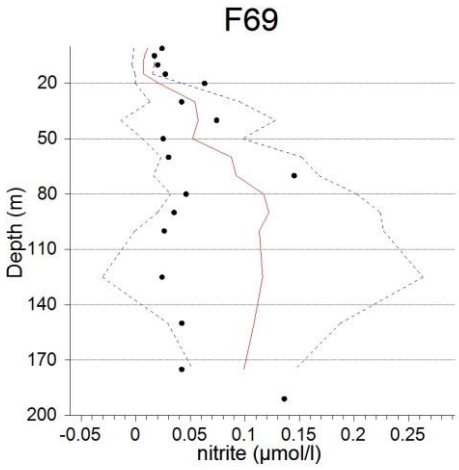

BO3
Depth (m)
0
20
40
60
80
100
0.05
0.1
0.15
0.2
nitrite (µmol/l)

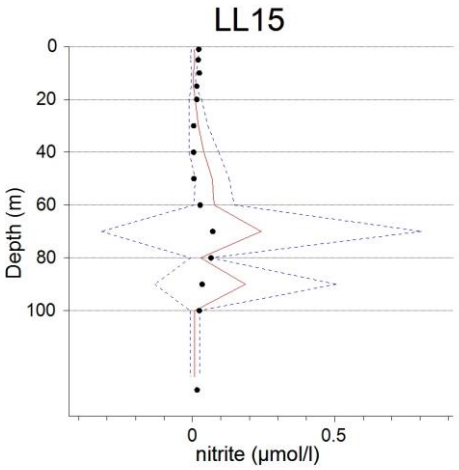

RR3
Depth (m)
0
20
40
60
80
100
0
0.05
0.1
0.15
nitrite (µmol/l)

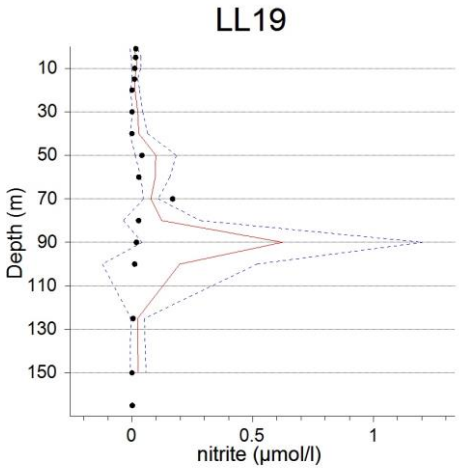

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
nitrite (µmol/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
nitrite (µmol/l)

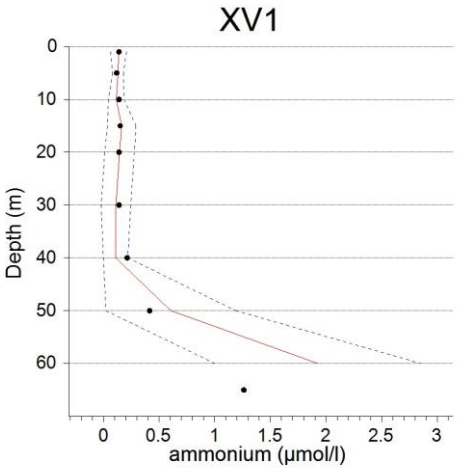

F64
Depth (m)
0
50
100
150
200
250
0
0.05
0.1
0.15
0.2
0.25
0.3
nitrite (µmol/l)

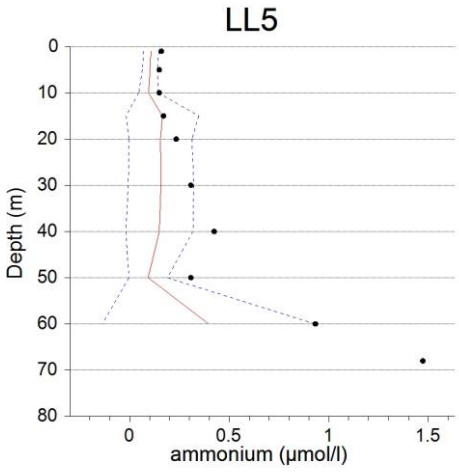

F69
Depth (m)
20
50
80
110
140
170
200
-0.05
0
0.05
0.1
0.15
0.2
0.25
nitrite (µmol/l)

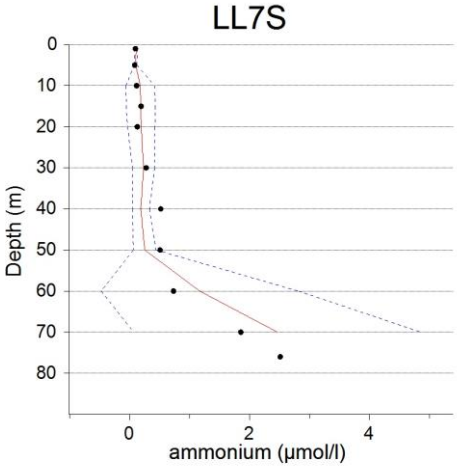

LL15
Depth (m)
0
20
40
60
80
100
0
0.5
nitrite (µmol/l)

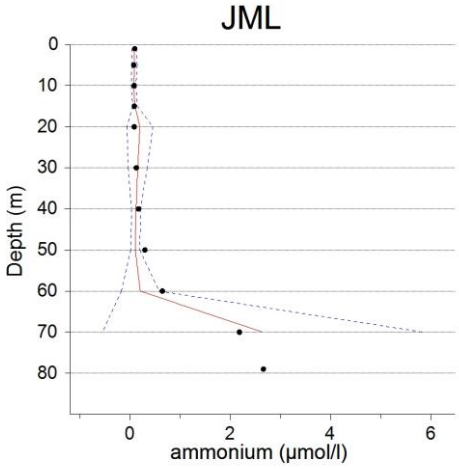

LL19
Depth (m)
10
30
50
70
90
110
130
150
0
0.5
1
nitrite (µmol/l)

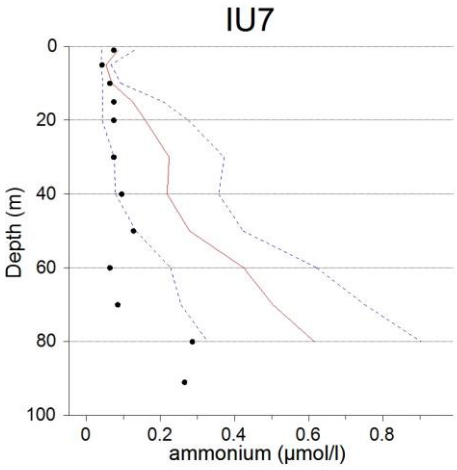
Ammonium:

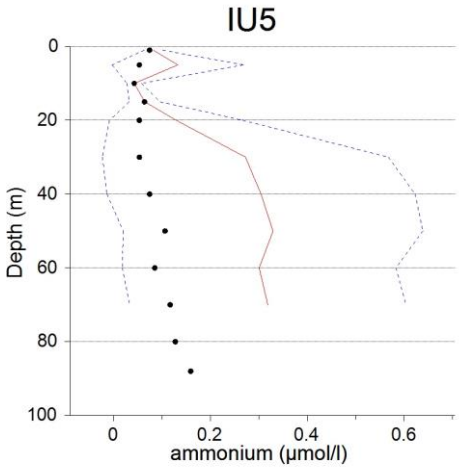

XV1
Depth (m)
0
10
20
30
40
50
60
0
0.5
1
1.5
2
2.5
3
ammonium (µmol/l)

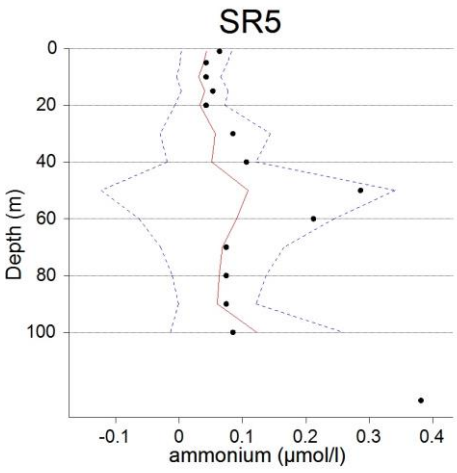

LL5
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.5
1
1.5
ammonium (µmol/l)

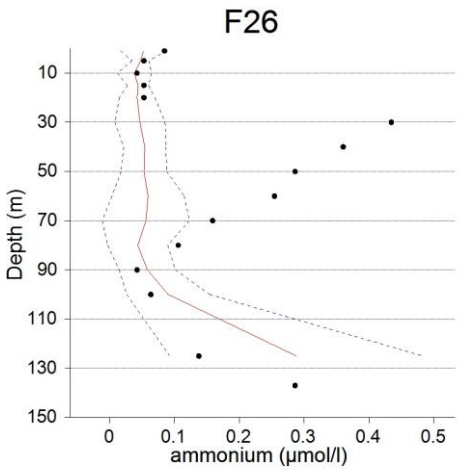

LL7S
Depth (m)
0
10
20
30
40
50
60
70
80
0
2
4
ammonium (µmol/l)

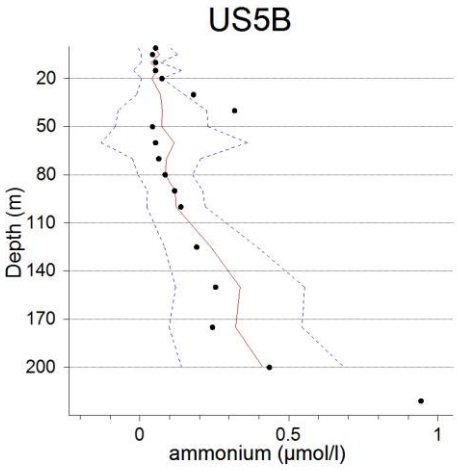

JML
Depth (m)
0
10
20
30
40
50
60
70
80
0
2
4
6
ammonium (µmol/l)

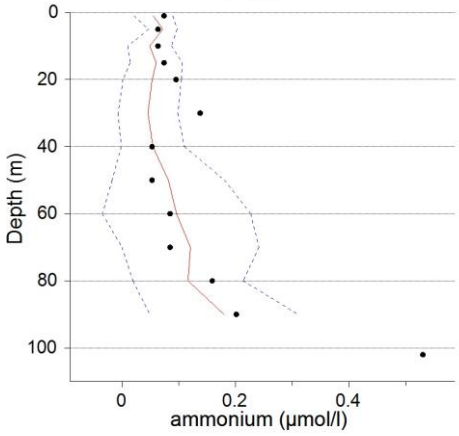

IU7
Depth (m)
0
20
40
60
80
100
0
0.2
0.4
0.6
0.8
ammonium (µmol/l)

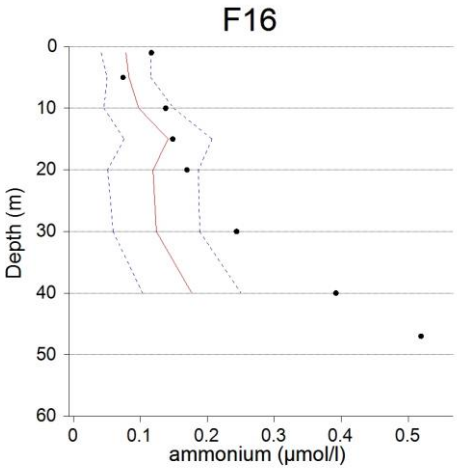

IU5
Depth (m)
0
20
40
60
80
100
0
0.2
0.4
0.6
ammonium (µmol/l)

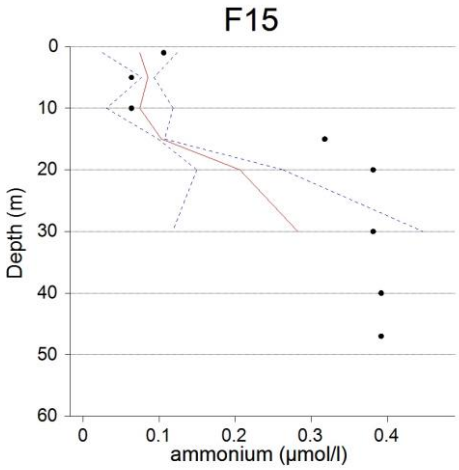

SR5
Depth (m)
0
20
40
60
80
100
-0.1
0
0.1
0.2
0.3
0.4
ammonium (µmol/l)

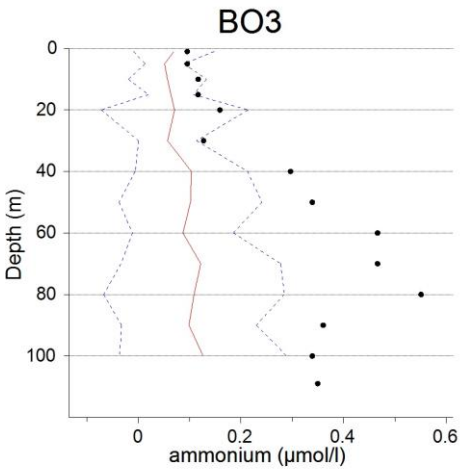

F26
Depth (m)
10
30
50
70
90
110
130
150
0
0.1
0.2
0.3
0.4
0.5
ammonium (µmol/l)

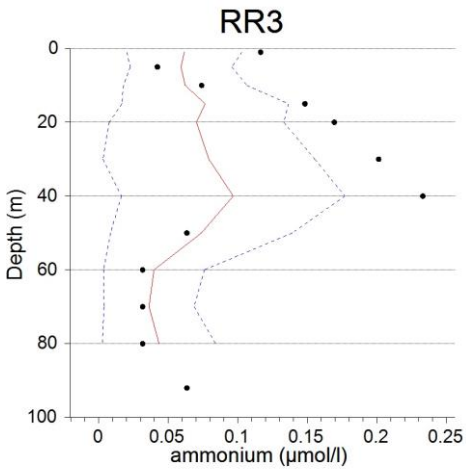

US5B
Depth (m)
20
50
80
110
140
170
200
0
0.5
1
ammonium (µmol/l)

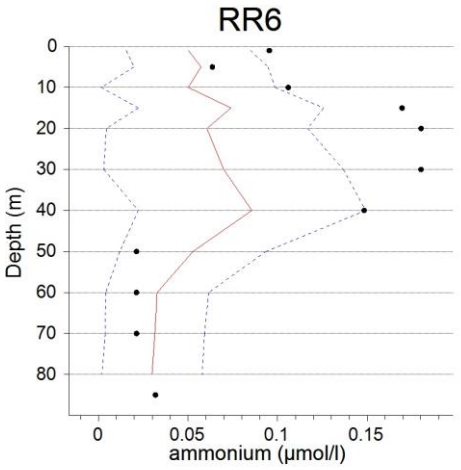

F18
Depth (m)
0
20
40
60
80
100
0
0.2
0.4
ammonium (µmol/l)

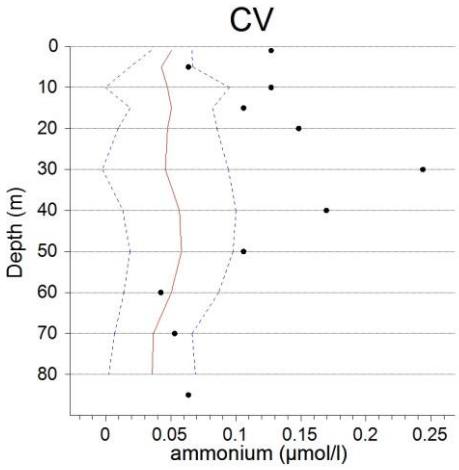

F16
Depth (m)
0
10
20
30
40
50
60
0
0.1
0.2
0.3
0.4
0.5
ammonium (µmol/l)

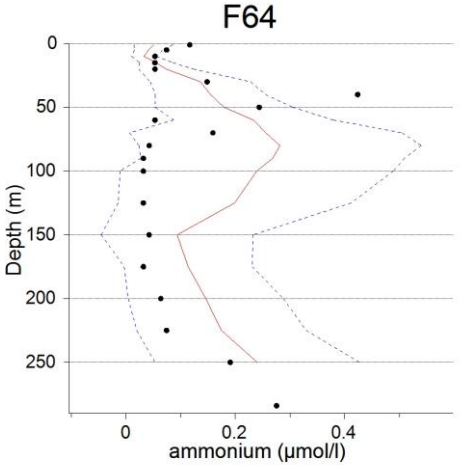

F15
Depth (m)
0
10
20
30
40
50
60
0
0.1
0.2
0.3
0.4
ammonium (µmol/l)

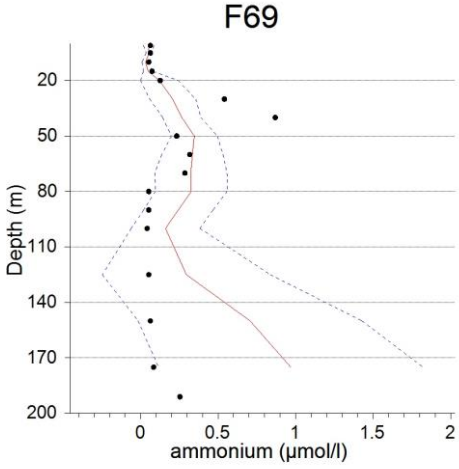

BO3
Depth (m)
0
20
40
60
80
100
0
0.2
0.4
0.6
ammonium (µmol/l)

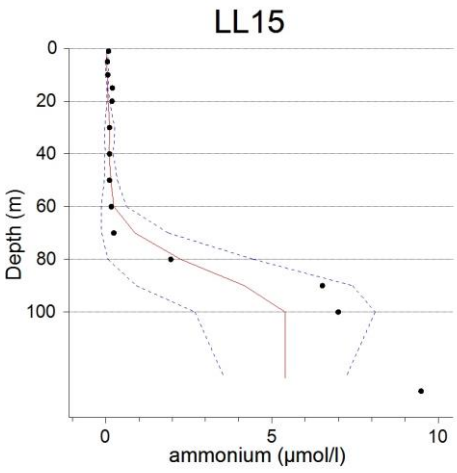

RR3
Depth (m)
0
20
40
60
80
100
0
0.05
0.1
0.15
0.2
0.25
ammonium (µmol/l)

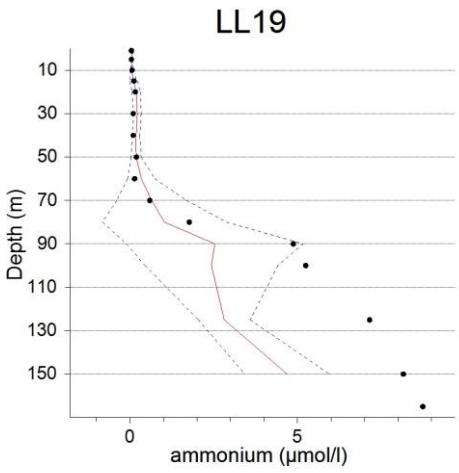

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
ammonium (µmol/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
0.25
ammonium (µmol/l)

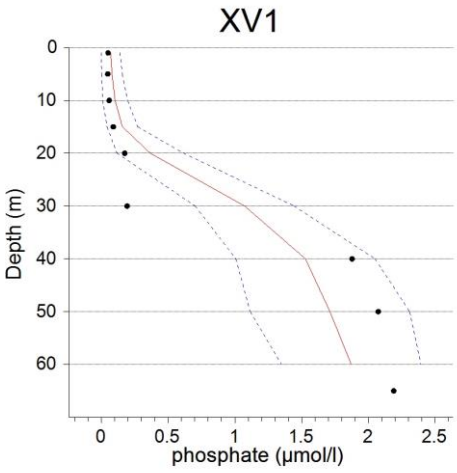

F64
Depth (m)
0
50
100
150
200
250
0
0.2
0.4
ammonium (µmol/l)

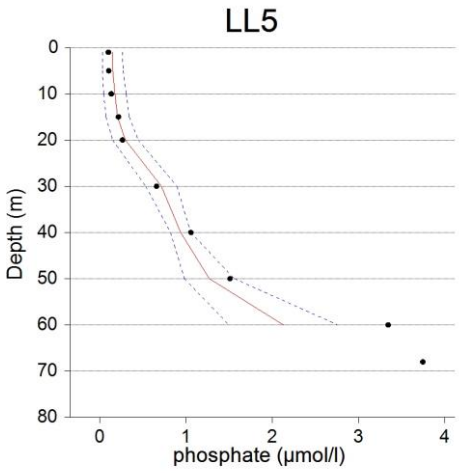

F69
Depth (m)
20
50
80
110
140
170
200
0
0.5
1
1.5
2
ammonium (µmol/l)

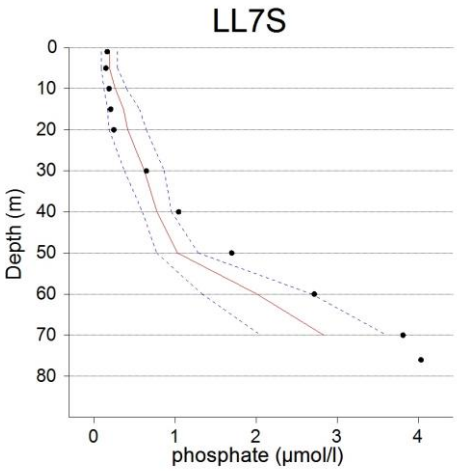

LL15
Depth (m)
0
20
40
60
80
100
0
5
10
ammonium (µmol/l)

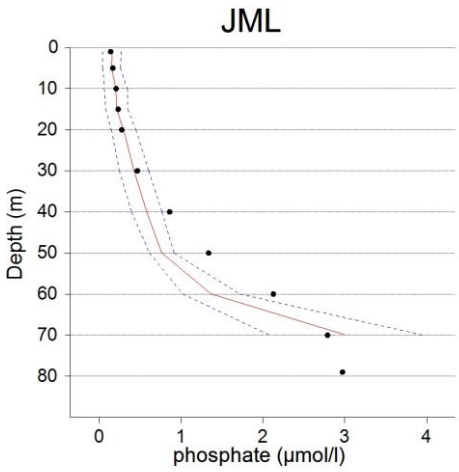

LL19
Depth (m)
10
30
50
70
90
110
130
150
0
5
ammonium (µmol/l)

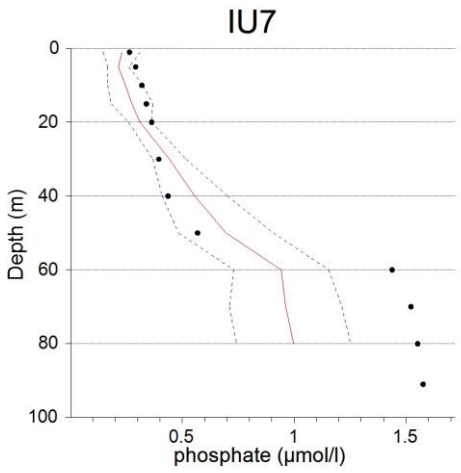
Phosphate:

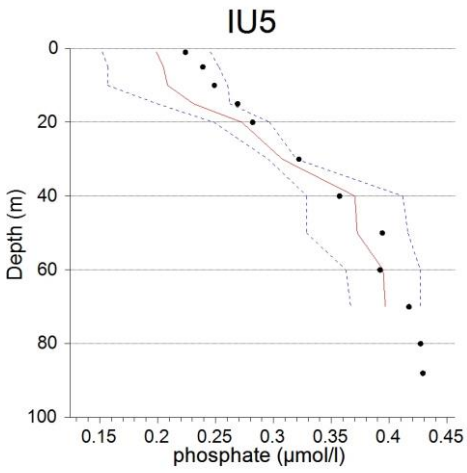

XV1
Depth (m)
0
10
20
30
40
50
60
0
0.5
1
1.5
2
2.5
phosphate (µmol/l)

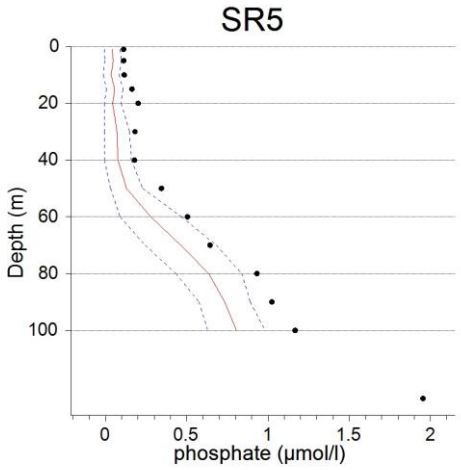

LL5
Depth (m)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
phosphate (µmol/l)

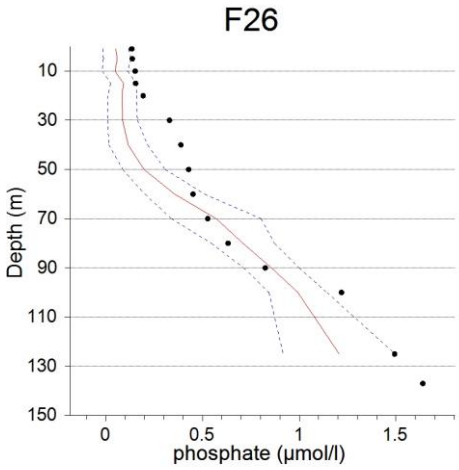

LL7S
Depth (m)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
phosphate (µmol/l)

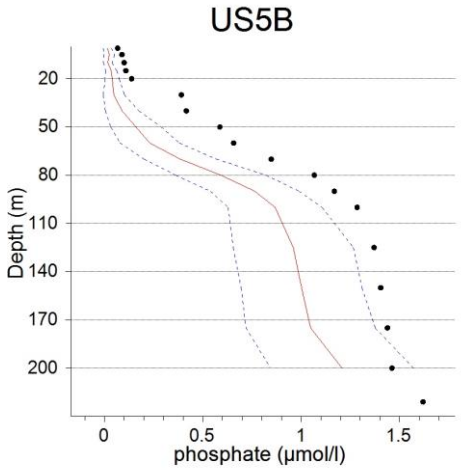

JML
Depth (m)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
phosphate (µmol/l)

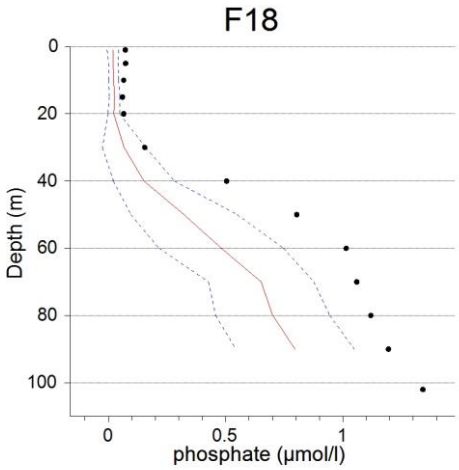

IU7
Depth (m)
0
20
40
60
80
100
0.5
1
1.5
phosphate (µmol/l)

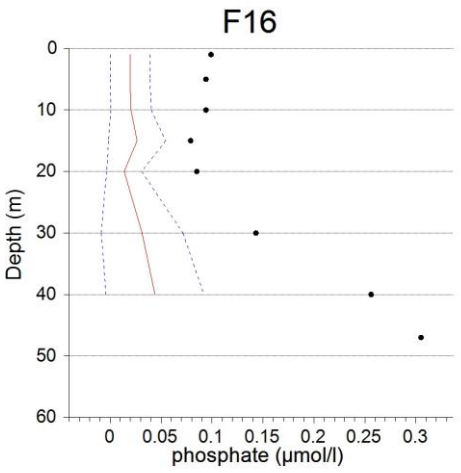

IU5
Depth (m)
0
20
40
60
80
100
0.15
0.2
0.25
0.3
0.35
0.4
0.45
phosphate (µmol/l)

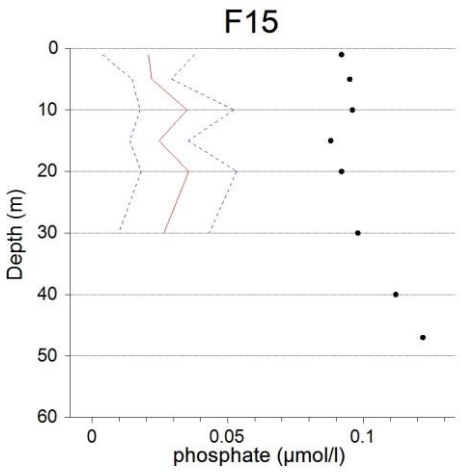

SR5
Depth (m)
0
20
40
60
80
100
0
0.5
1
1.5
2
phosphate (µmol/l)

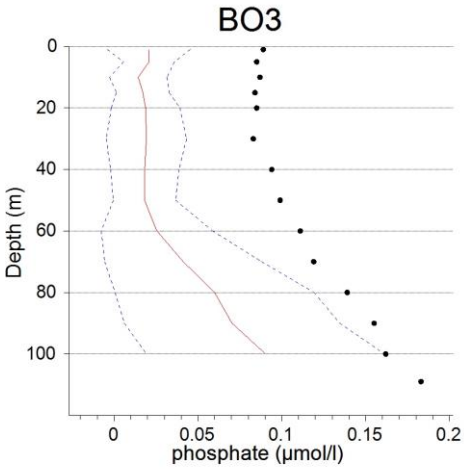

F26
Depth (m)
10
30
50
70
90
110
130
150
0
0.5
1
1.5
phosphate (µmol/l)

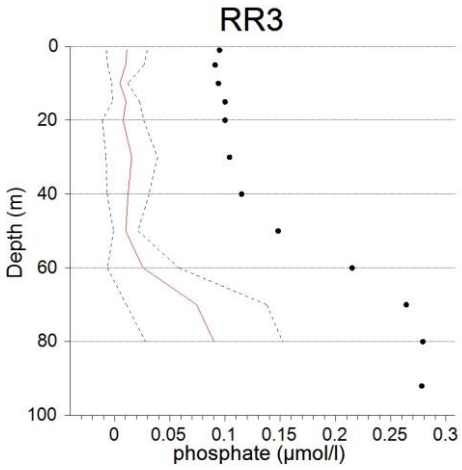

US5B
Depth (m)
20
50
80
110
140
170
200
0
0.5
1
1.5
phosphate (µmol/l)

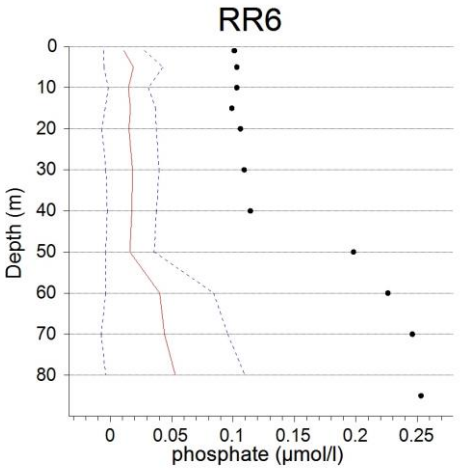

F18
Depth (m)
0
20
40
60
80
100
0
0.5
1
phosphate (µmol/l)

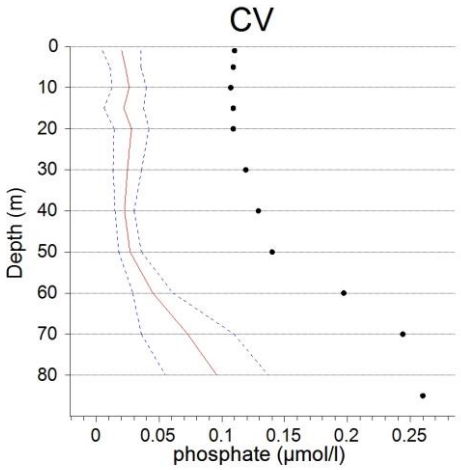

F16
Depth (m)
0
10
20
30
40
50
60
0
0.05
0.1
0.15
0.2
0.25
0.3
phosphate (µmol/l)

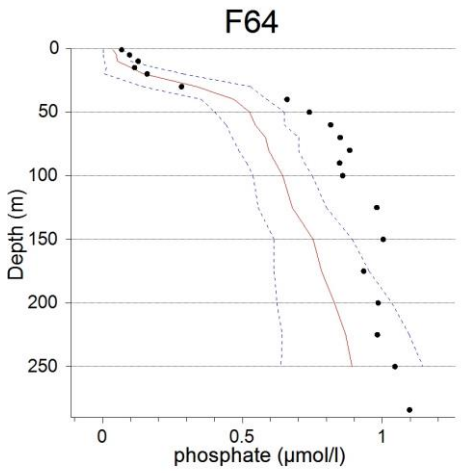

F15
Depth (m)
0
10
20
30
40
50
60
0
0.05
0.1
phosphate (µmol/l)

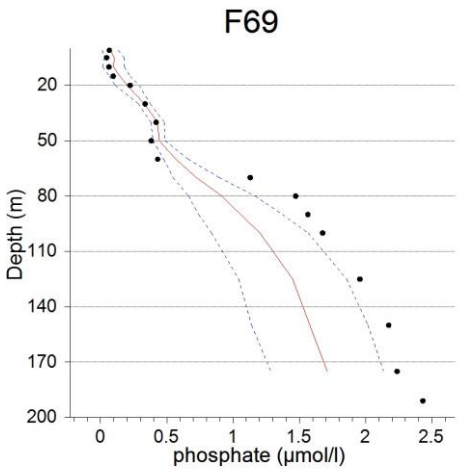

BO3
Depth (m)
0
20
40
60
80
100
0
0.05
0.1
0.15
0.2
phosphate (µmol/l)

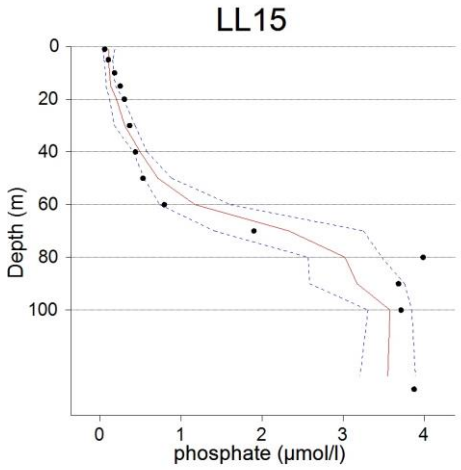

RR3
Depth (m)
0
20
40
60
80
100
0
0.05
0.1
0.15
0.2
0.25
0.3
phosphate (µmol/l)

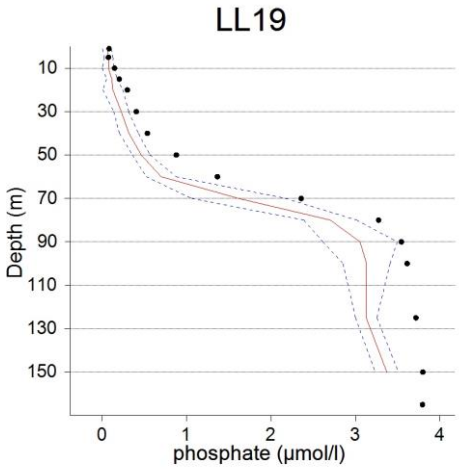

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
0.25
phosphate (µmol/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
0
0.05
0.1
0.15
0.2
0.25
phosphate (µmol/l)

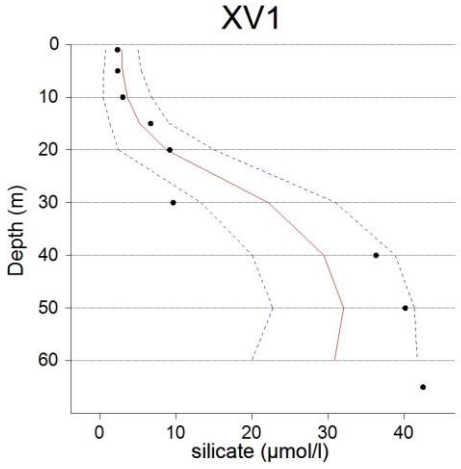

F64
Depth (m)
phosphate (µmol/l)

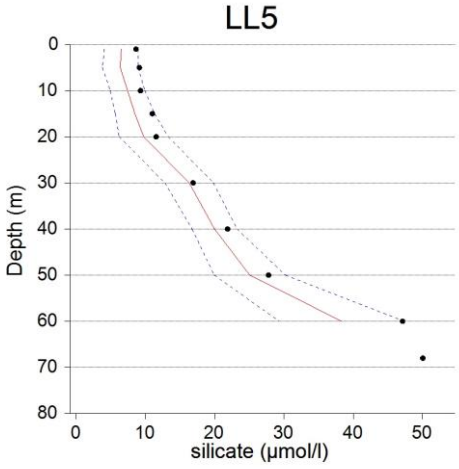

F69
Depth (m)
phosphate (µmol/l)

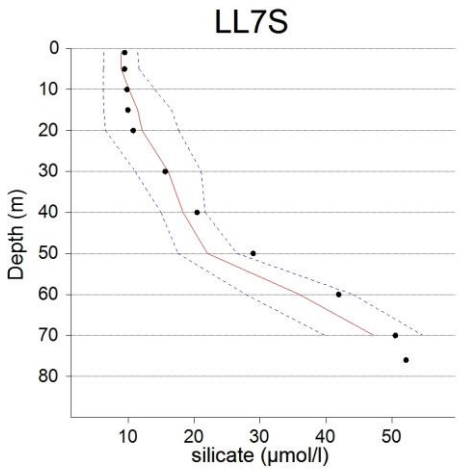

LL15
Depth (m)
phosphate (µmol/l)

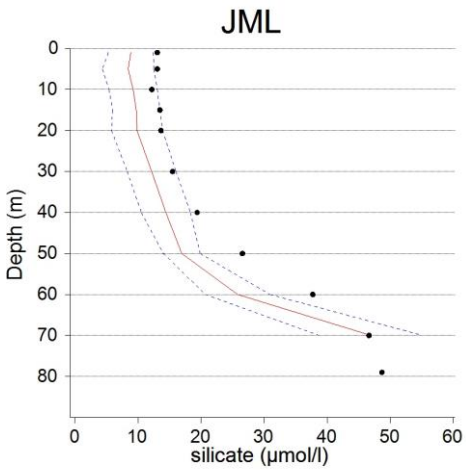

LL19
Depth (m)
phosphate (µmol/l)

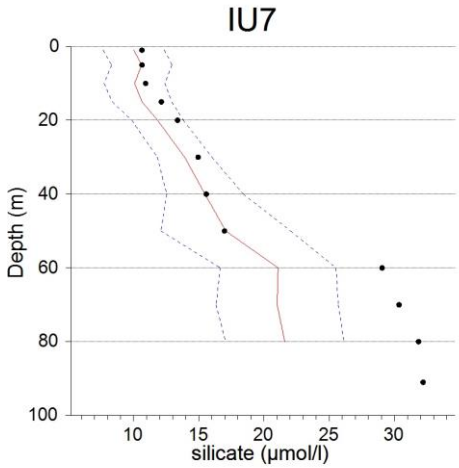
Silicate:

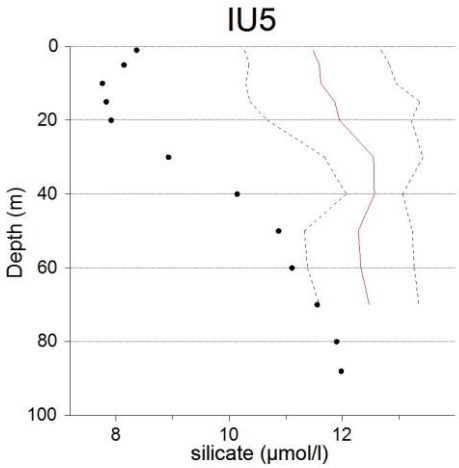

XV1
Depth (m)
silicate (µmol/l)

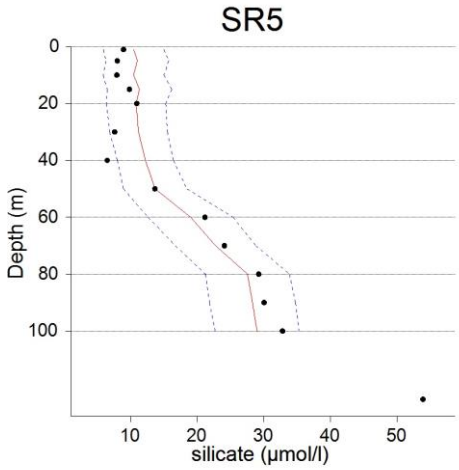

LL5
Depth (m)
silicate (µmol/l)

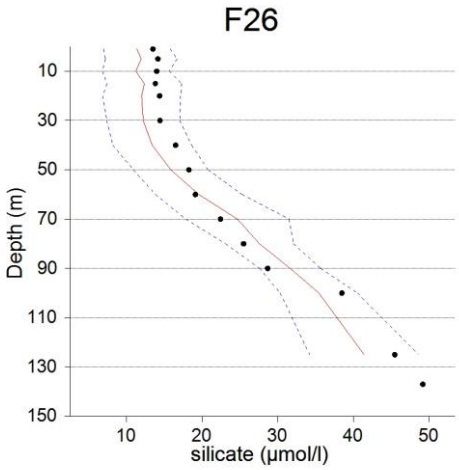

LL7S
Depth (m)
0
10
20
30
40
50
60
70
80
10
20
30
40
50
silicate (µmol/l)

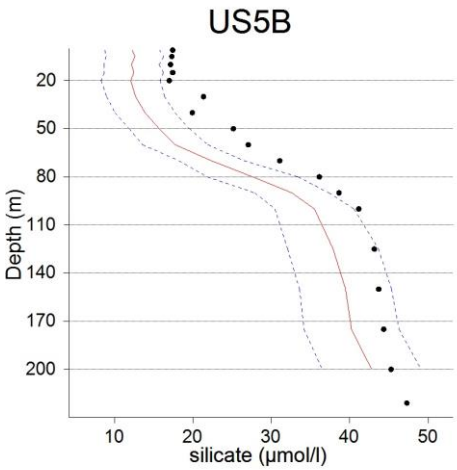

JML
Depth (m)
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
60
silicate (µmol/l)

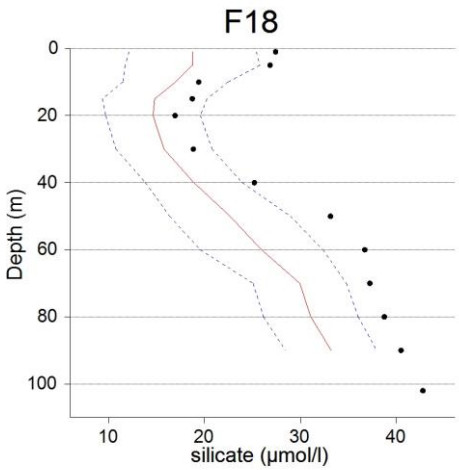

IU7
Depth (m)
0
20
40
60
80
100
10
15
20
25
30
silicate (µmol/l)

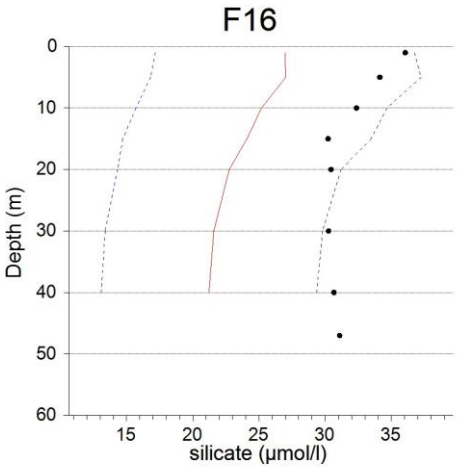

IU5
Depth (m)
0
20
40
60
80
100
8
10
12
silicate (µmol/l)

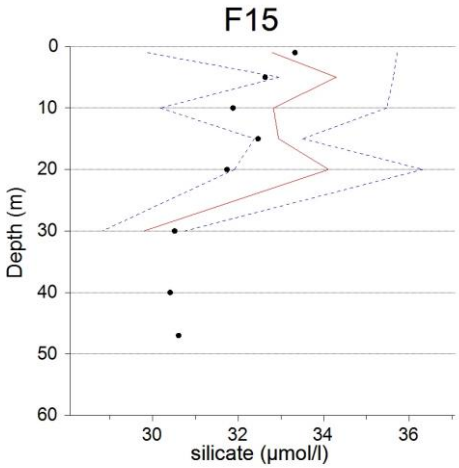

SR5
Depth (m)
0
20
40
60
80
100
10
20
30
40
50
silicate (µmol/l)

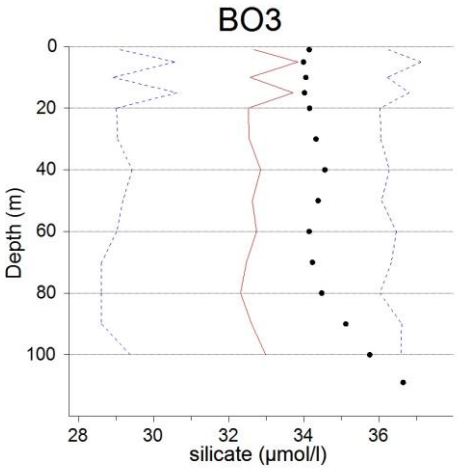

F26
Depth (m)
10
30
50
70
90
110
130
150
10
20
30
40
50
silicate (µmol/l)

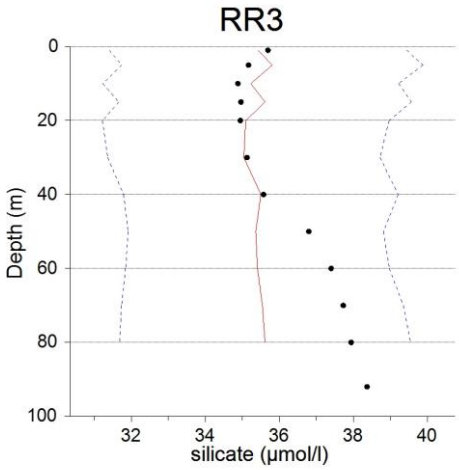

US5B
Depth (m)
20
50
80
110
140
170
200
10
20
30
40
50
silicate (µmol/l)

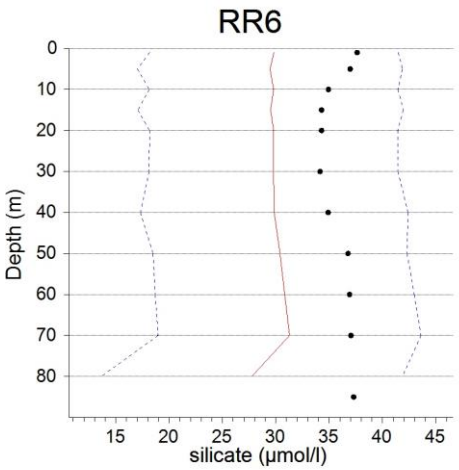

F18
Depth (m)
0
20
40
60
80
100
10
20
30
40
silicate (µmol/l)

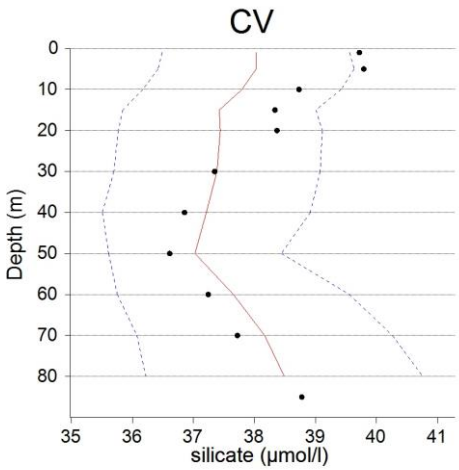

F16
Depth (m)
0
10
20
30
40
50
60
15
20
25
30
35
silicate (µmol/l)

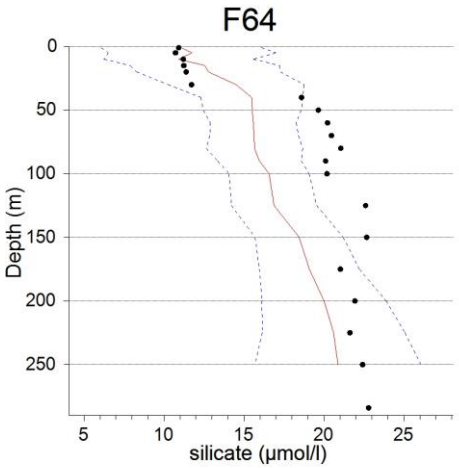

F15
Depth (m)
0
10
20
30
40
50
60
30
32
34
36
silicate (µmol/l)

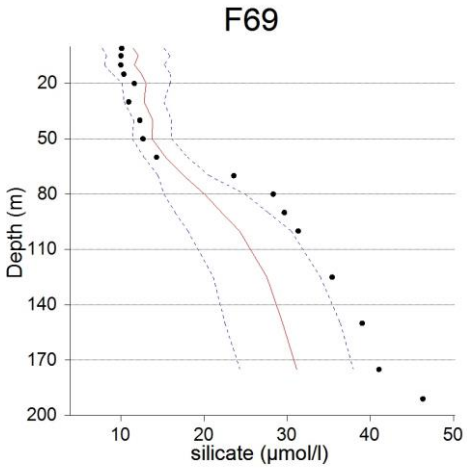

BO3
Depth (m)
0
20
40
60
80
100
28
30
32
34
36
silicate (µmol/l)

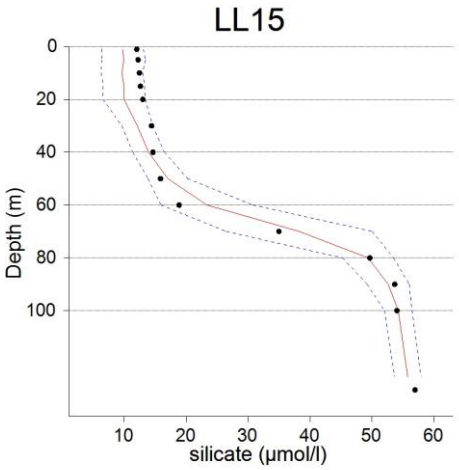

RR3
Depth (m)
0
20
40
60
80
100
32
34
36
38
40
silicate (µmol/l)

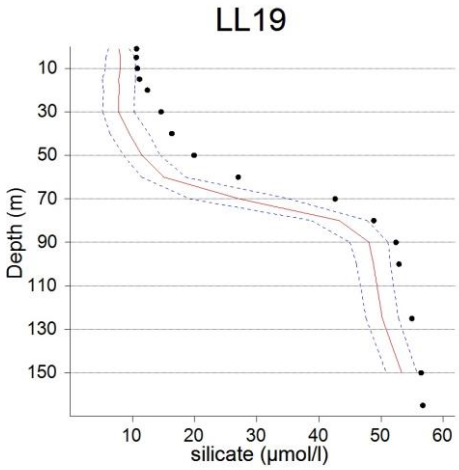

RR6
Depth (m)
0
10
20
30
40
50
60
70
80
15
20
25
30
35
40
45
silicate (µmol/l)


CV
Depth (m)
0
10
20
30
40
50
60
70
80
35
36
37
38
39
40
41
silicate (µmol/l)


F64
Depth (m)
0
50
100
150
200
250
5
10
15
20
25
silicate (µmol/l)


F69
Depth (m)
20
50
80
110
140
170
200
10
20
30
40
50
silicate (µmol/l)


LL15
Depth (m)
0
20
40
60
80
100
10
20
30
40
50
60
silicate (µmol/l)


LL19
Depth (m)
10
30
50
70
90
110
130
150
10
20
30
40
50
60
silicate (µmol/l)