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Swedish Meteorological and Hydrological Institute Oceanographic Laboratory 2014-07-16 Dnr: Sh-2014-112

Report from the SMHI monitoring cruise with R/V Aranda



Survey period: Survey area: Principal: 2014-07-10 - 2014-07-14 Skagerrak, Kattegat and the Baltic Proper SMHI and the Swedish Agency for Marine and Water Management

SUMMARY

The expedition was part of the Swedish regular marine monitoring programme and covered the Skagerrak, Kattegat and the Baltic Proper. Data presented in this report have been subject to preliminary quality control procedures only.

Surface water temperatures were above normal in most of the investigated areas, with the exception of the Western Baltic Proper, where temperatures were below normal. Nutrients in the surface layer showed concentrations normal for the season in all areas. The oxygen situation in the Hanö Bight and Bornholm Basins had worsened and was below acute hypoxia. In the south eastern part of the Baltic Proper signs of an earlier inflow were seen and the BY15 deep water was oxygenated for the first time since April 2007. Oxygen free conditions, anoxia, were found from 90 – 125 meters depth and acute hypoxia from ca. 80 meters. No surface accumulations of cyanobacteria were seen but analyses showed large amounts in the water. For a detailed algae report go to: http://www.smhi.se/en/Publications/algae-report-number-5-2014-1.38050

The next cruise will begin on 1st of August and will cover the Skagerrak, Kattegat and the Baltic Proper.



PRELIMINARY RESULTS

The cruise, part of the Swedish regular marine monitoring programme, began in Falkenberg on July 10^{th} and ended in Nynäshamn on July 14^{th} . Due to a wrongly dated permission, Polish waters could not be visited. The winds were weak to moderate with varying directions during the expedition. The air temperature varied between 15 to 23 °C.

The Skagerrak

The surface temperatures were normal or just above normal for the season and varied between 15.8 and 20.8 °C. The salinity in the surface layer was 21.4 - 31.0 psu which ranges from normal to below normal. The thermocline and the halocline were both found between 10 and 30 meters. All nutrients had concentrations that are normal for the season; phosphate varied between $0.02 - 0.05 \mu$ mol/l and silicate between $0.3 - 0.9 \mu$ mol/l. The amount of nitrite + nitrate was below the detection limit (< 0.10μ mol/l).

Fluorescence maxima were found at about 30 meters depth.

The Kattegat and the Sound

Also in this area surface water temperatures were above normal, around 19°C. The salinity of the surface water was normal or below normal and varied between 12.8 and 19.9 psu in the Kattegat, while it was 8.5 psu in the Sound. Thermocline and halocline coincided at depths between 10 and 15 meters in the whole area.

All nutrients in the surface layer showed, for the season, normal values, except at Anholt E where the silicate concentration had increased and was above normal at the second visit. In the Kattegat phosphate concentrations were between $0.03 - 0.14 \mu mol/l$ and in the Sound $0.26 \mu mol/l$. Silicate values were in the range 1.1 to 4.1 $\mu mol/l$ in the Kattegat, and 6.6 $\mu mol/l$ in the Sound. The amount of nitrite + nitrate was below the detection limit (< 0.10 $\mu mol/l$) in both areas.

Fluorescence maxima were found at 17 meters at stations Fladen and W Landskrona and at 30 meters depth at Anholt E.

The lowest oxygen concentration in the Kattegat area, 4.3 ml/l, was found at the station Anholt E. In the Sound, 3.6 ml/l was the lowest registered concentration.

The Baltic Proper

Surface water temperatures varied from normal to just above normal in the southern and eastern parts $(16.2 - 18.3^{\circ}C)$. In the western parts temperatures were found to be just below normal (ca. $15^{\circ}C$). The salinity in the surface layer varied between 6.6 - 8.0 psu, normal or just above normal in most areas. However, at the stations BY10 and BY15 surface salinity was below normal, at BY15 this has been the case since last summer. The halocline was found at depths between 70 and 80 meters in the Northern, Western and Eastern Gotland Basins, while it was located shallower, between 50 and 60 meters in the southern parts. A thermocline was found at depths between 15 and 30 meters.

All nutrients in the surface layer showed, for the season, normal values except in the northern and eastern parts where the silicate concentrations were enhanced. Concentrations of phosphate was in the interval 0.09-0.20 μ mol/l and silicate varied between 7.5 and 11.2 μ mol/l. Inorganic nitrogen (nitrite + nitrate) was close to or below the detection limit in the whole area. In the bottom water of the Arkona Basin, the oxygen situation was better since the previous sampling at station BY1 (0.6 ml/l), and the situation at station BY2 was still relatively good (3.58 ml/l). In the Bornholm Basin and Hanö Bight, oxygen concentrations in the bottom water had decreased and were below the limit for acute hypoxic conditions (< 2 ml/l). During February-March, inflows through the Sound occurred with a total volume of ca. 35 km³. This oxygenated water had now reached BY15 where oxygen was found in the bottom water for the first time since April 2007. At the stations BY10 and



BY15 hydrogen sulphide was present at intermediate depths between 125 - 200 meters. Completely oxygen free conditions, (anoxia) were generally found from 90 - 125 meters depth and acute hypoxia from ca. 80 meters.

No surface accumulations of cyanobacteria were observed due to winds and waves, but analyses revealed large amounts of cyanobacteria in the water that will rise and cause new surface accumulations once the weather is calmer.

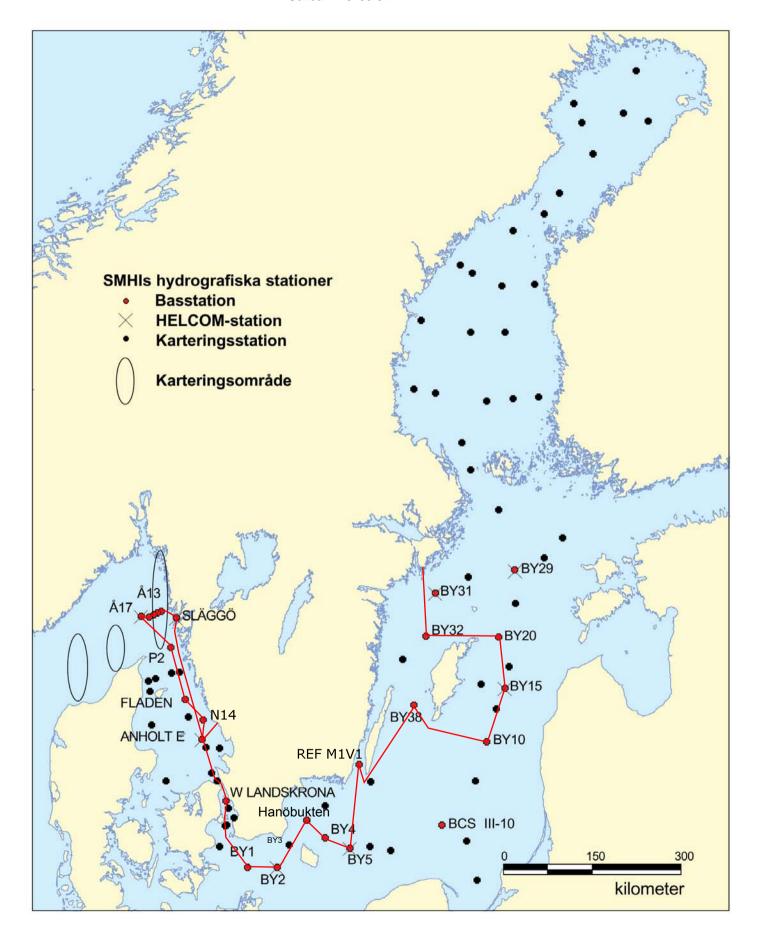
PARTICIPANTS

Name		Institute
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Kristin Andreasson		SMHI
Daniel Bergman-Sjöstrand		SMHI
Sara Johansson		SMHI
Vivi Månsson		SMHI
Ann-Turi Skjevik		SMHI
Yue Hu		KTH

APPENDICES

- Track chart
- Table over stations, parameters and sampling depths
- Map showing bottom oxygen concentrations
- Monthly average surface water plots for selected stations
- Vertical profiles for selected stations

TRACKCHART Country: Sweden Ship: R/V ARANDA Date: 20140710-20140714 Series: 0450-0471



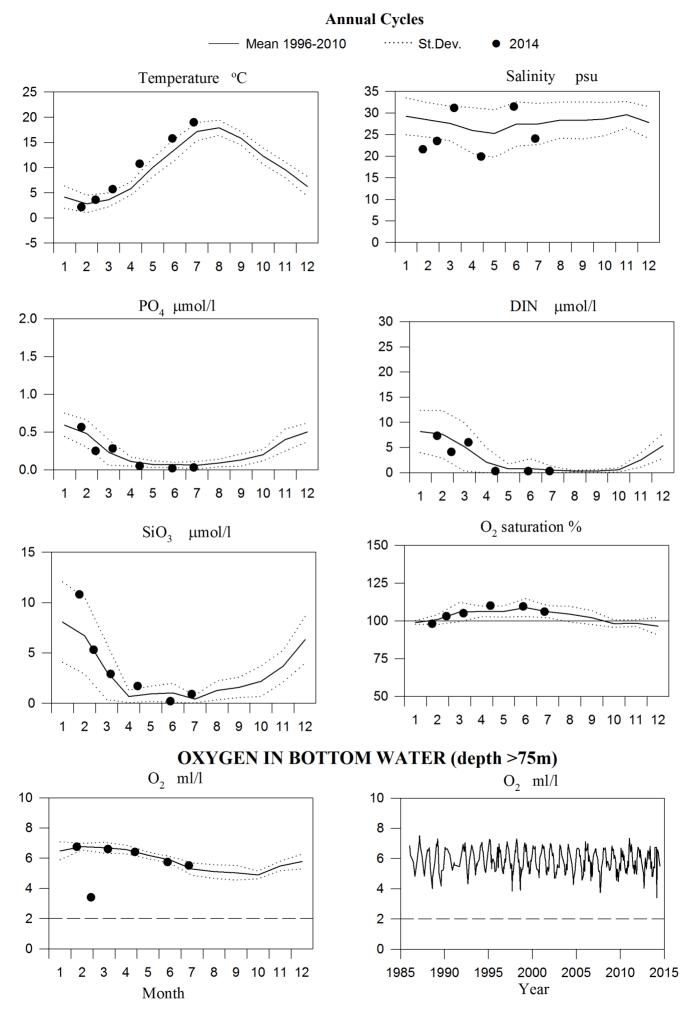
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0450 KAEX29BAS ANHOLT E	N5640.0 E1207			09		
0451 KANX50BAS N14 FALKENBERG	N5656.40 E1212			07		
0452 KANX25BAS FLADEN	N5711.5 E1140	20140711 035		7 10	20 1017 1230 xx 12 x x - x - x x x x x x - x	
0453 SKEX23BAS P2	N5752 E1118	20140711 082		8 05	19.3 1019 1120 xx 10 x x - x - x x x x x x - x	
0454 SKEX18BAS Å17	N5816.5 E1030			11 06	21.2 1019 1220 xxxx 14 x x x x - x x x x x x x x x	
0455 SKEX16BAS Å15	N5817.7 E1051	20140711 141		10 06	23.6 1018 1220 xx 12 x x - x - x x x x x x - x	
0456 SKEX14BAS Å13	N5820.2 E1102	20140711 154		09	22.9 1018 1230 xx 10 x x - x - x x x x x x - x	
0457 FIBG27BAS SLÄGGÖ	N5815.5 E1126			06	22.2 1017 1320 x -xxxx 9 x x x x - x x x x x x x x x	
0458 KAEX29BAS ANHOLT E	N5640.0 E1207			9 10	16.1 1016 1230 x -xxxx 10 x x x x - x x x x x x x x x	
0459 SOCX39BAS W LANDSKRONA	N5552.0 E1245			8 34	18.3 1011 2720 xx 9 x x - x - x x x x x x - x -	
0460 BPSA02BAS BY1	N5500 E1318	20140712 161		35	16.5 1011 6730 xx 8 x x - x - x x x x x x - x -	
0461 BPSA03BAS BY2 ARKONA	N5500 E1405	20140712 191	LO 47	03 1	15.3 1010 6840 xxxx 8 x x - x - x x x x x x x - x -	x
0462 BPSH05BAS HANÖBUKTEN	N5537 E1452	20140713 003	30 80	08	16.3 1005 5990 xx 11 x x - x - x x x x x x - x -	
0463 BPSB06BAS BY4 CHRISTIANSÖ	N5523 E1520	20140713 031	LO 92	25	15.6 1004 5840 xx 12 x x - x - x x x x x x - x	x
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0467 BPEX13BAS BY10	N5638 E1935	20140714 045	50 144	16	16.8 1008 2730 xx 15 x x - x x x x x x x x - x	x
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0469 BPEX21EXT BY15 GOTLANDSDJ	N5720 E2003	20140714 104	15 238	4 15	16.9 1010 2830 x 5 x x - x x x x x x x x - x	x
0470 BPEX26BAS BY20 FÅRÖDJ	N5800 E1953	20140714 145	50 196	4 20	16.7 1010 1330 xx 17 x x - x x x x x x x x - x	x
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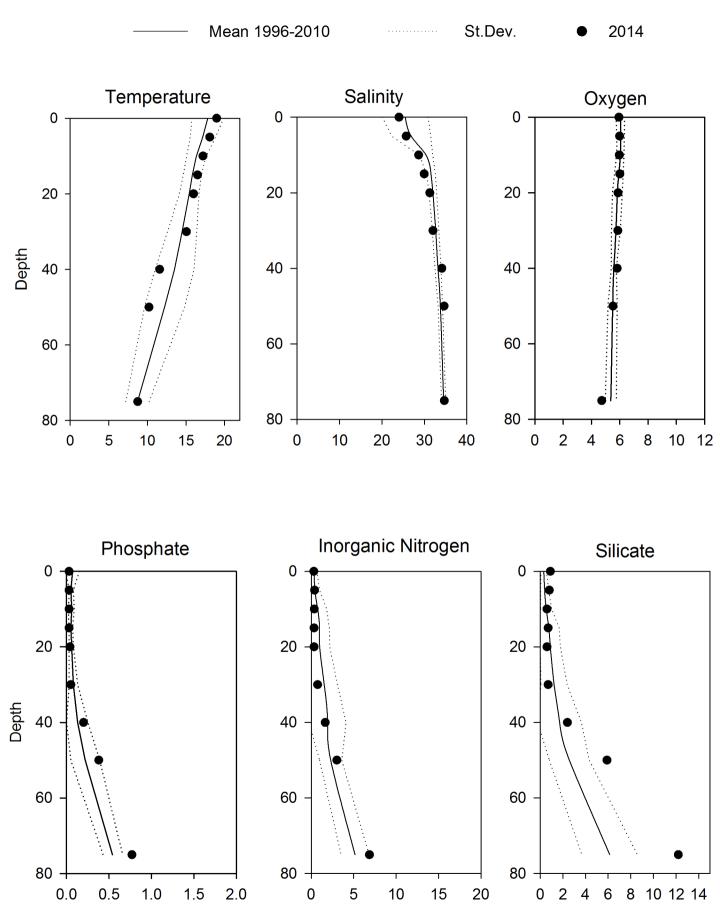
Bottom water oxygen concentration (ml/l)

Finland
Aranda
20140710-20140714
0450-0471



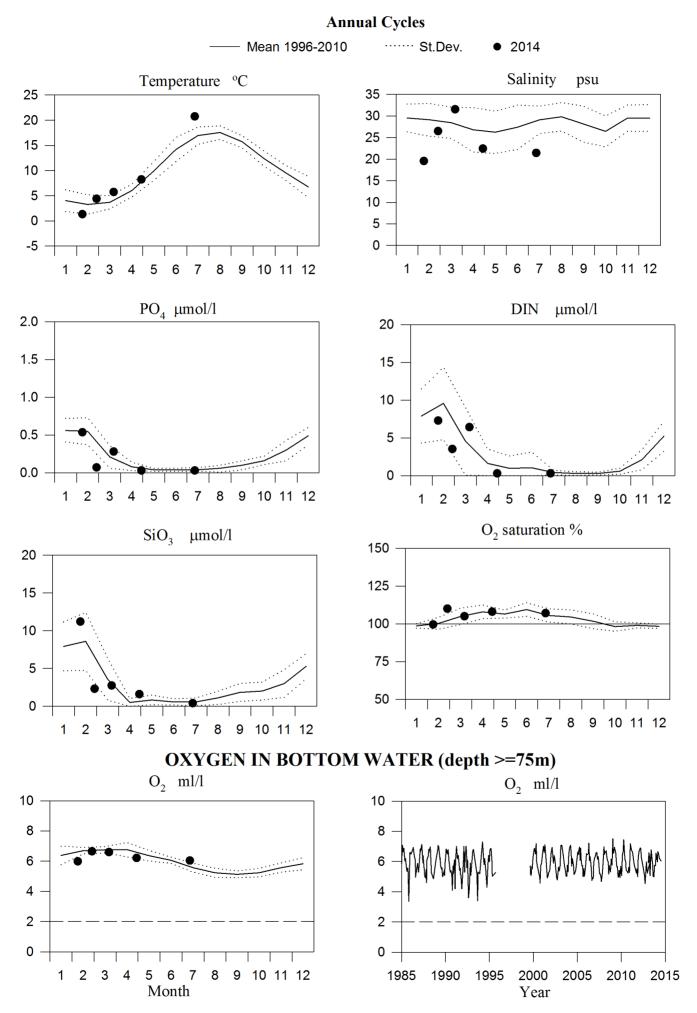
STATION P2 SURFACE WATER

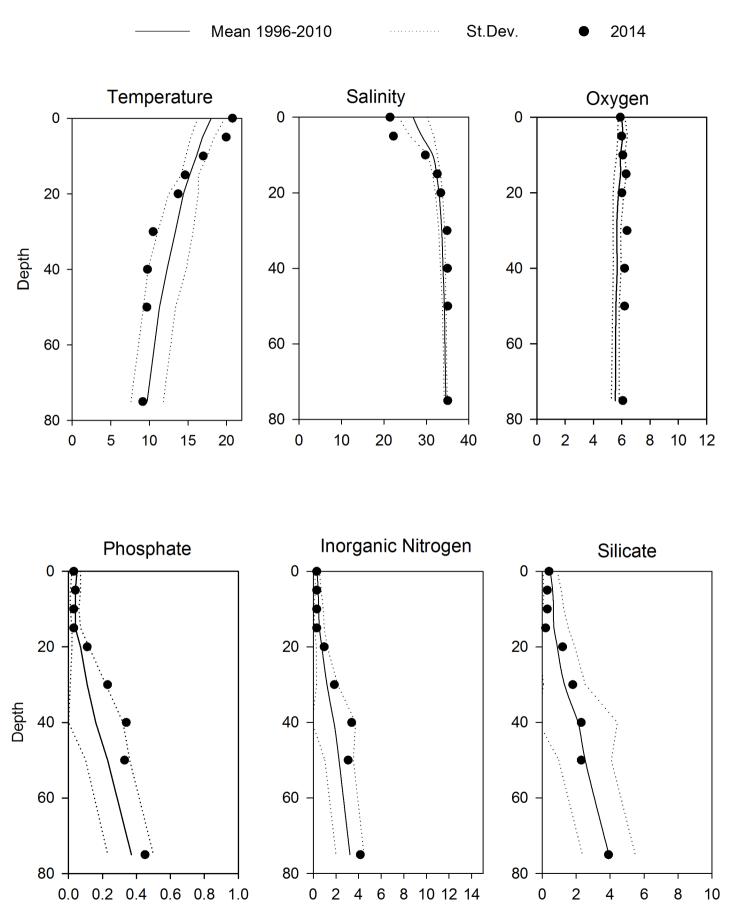




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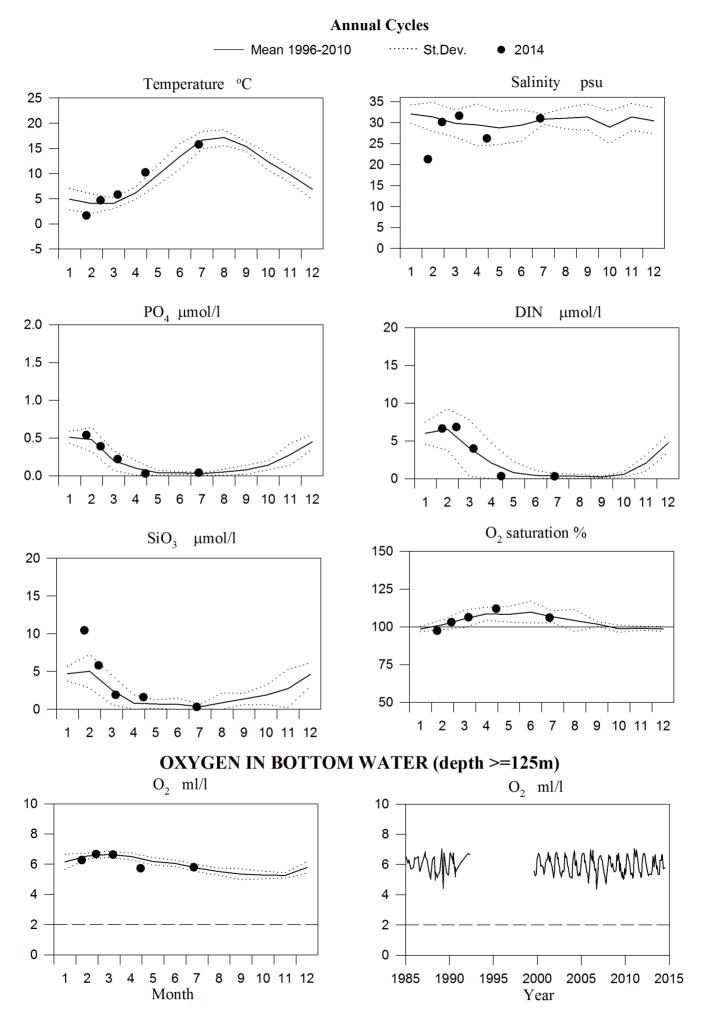
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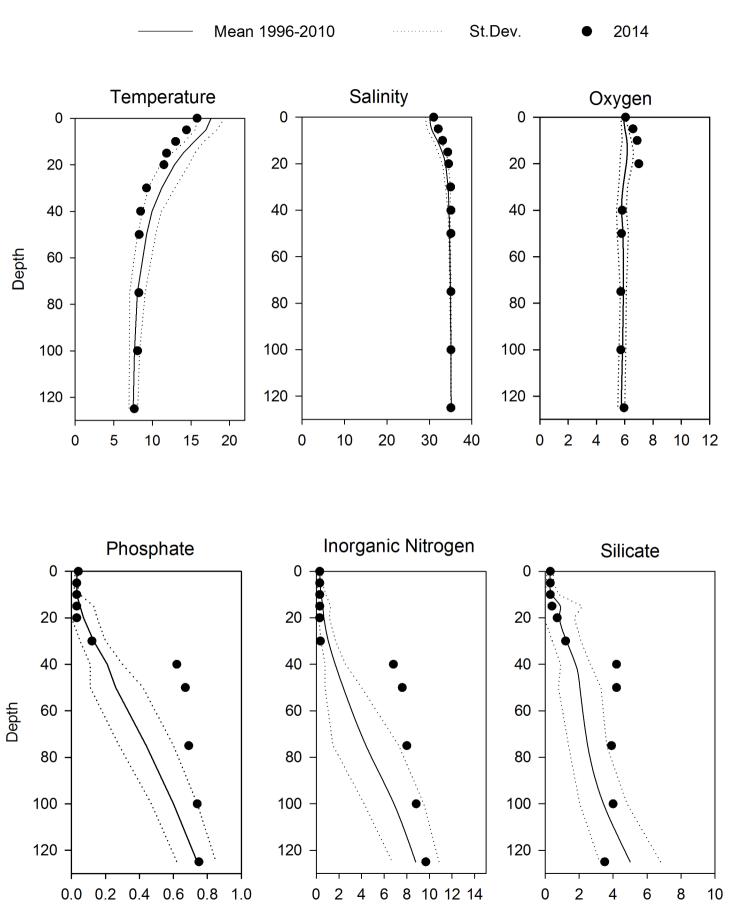




Vertical profiles Å13 July

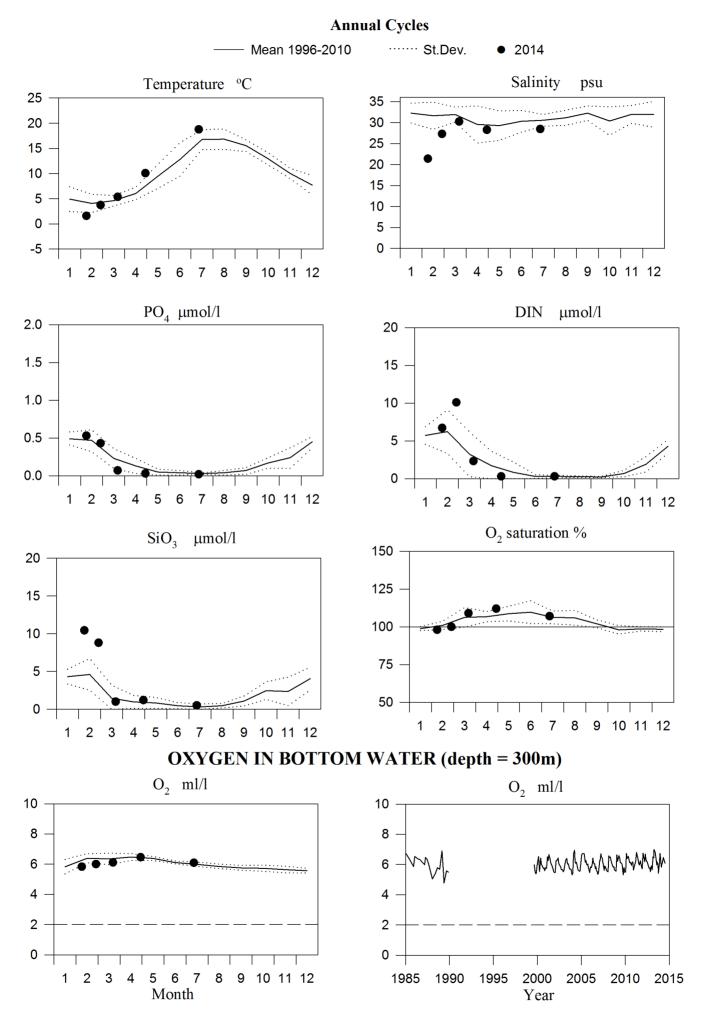
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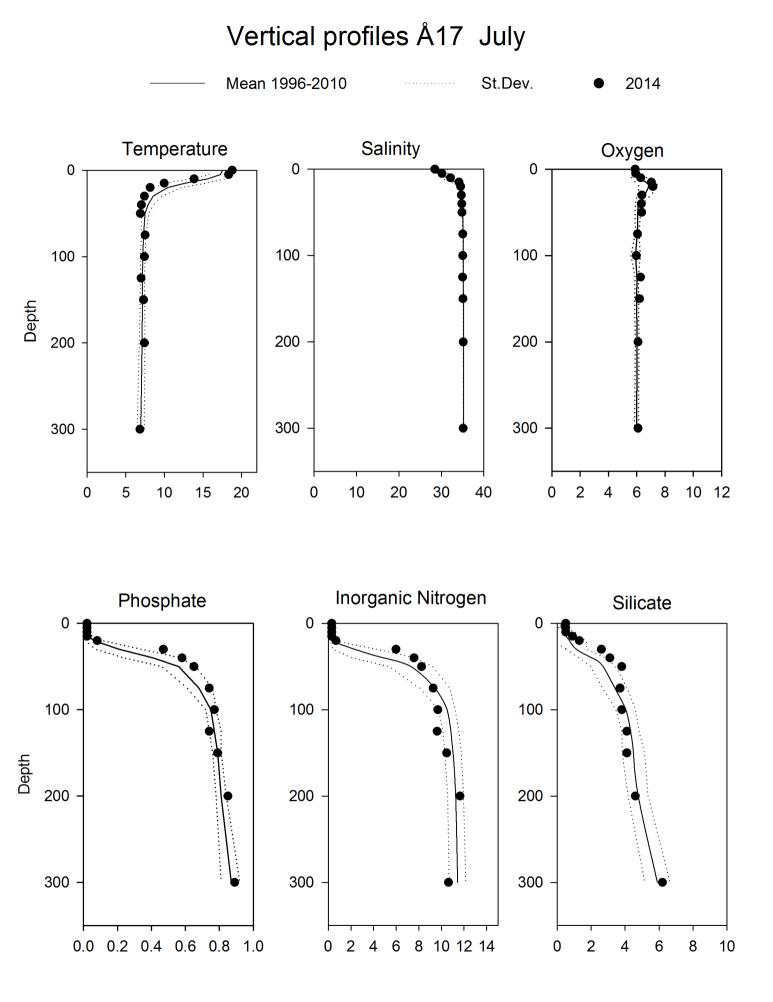




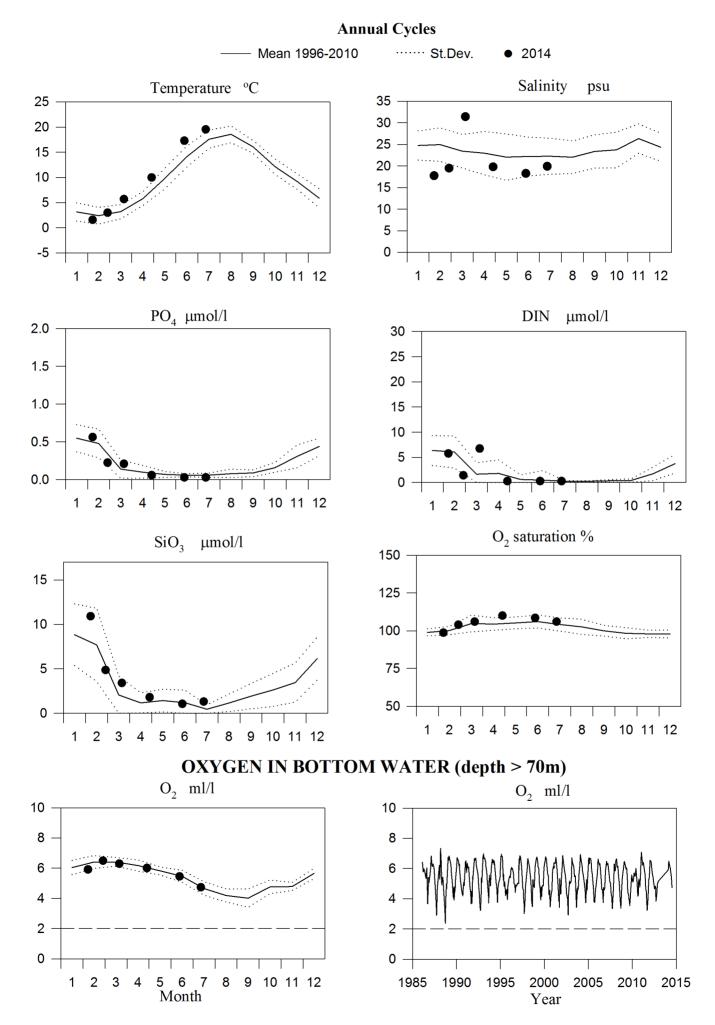
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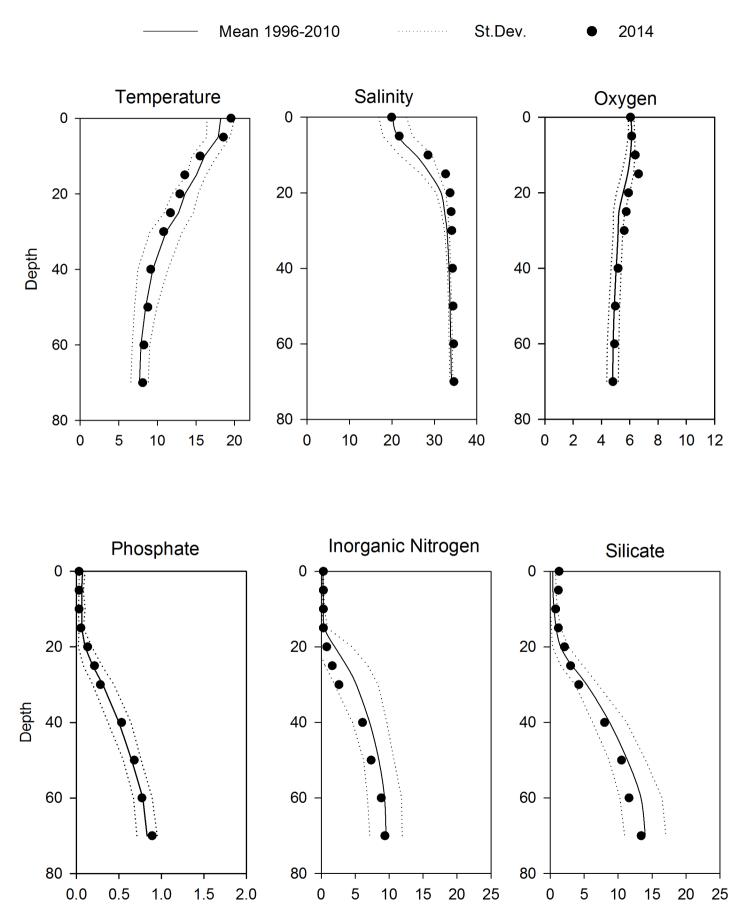
STATION Å17 SURFACE WATER





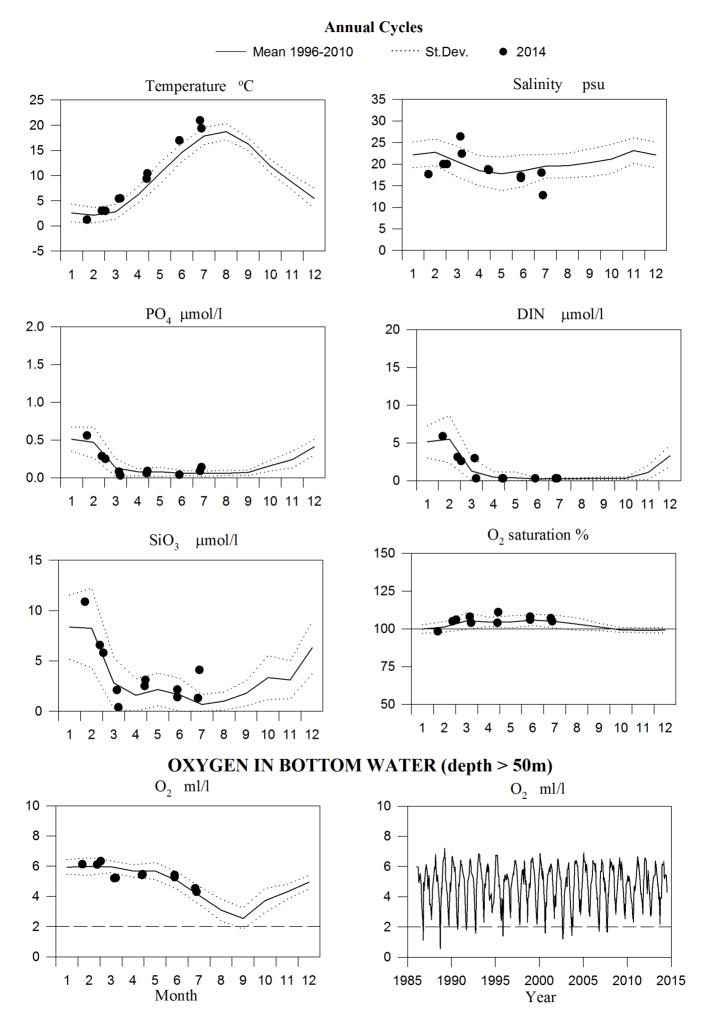
STATION FLADEN SURFACE WATER

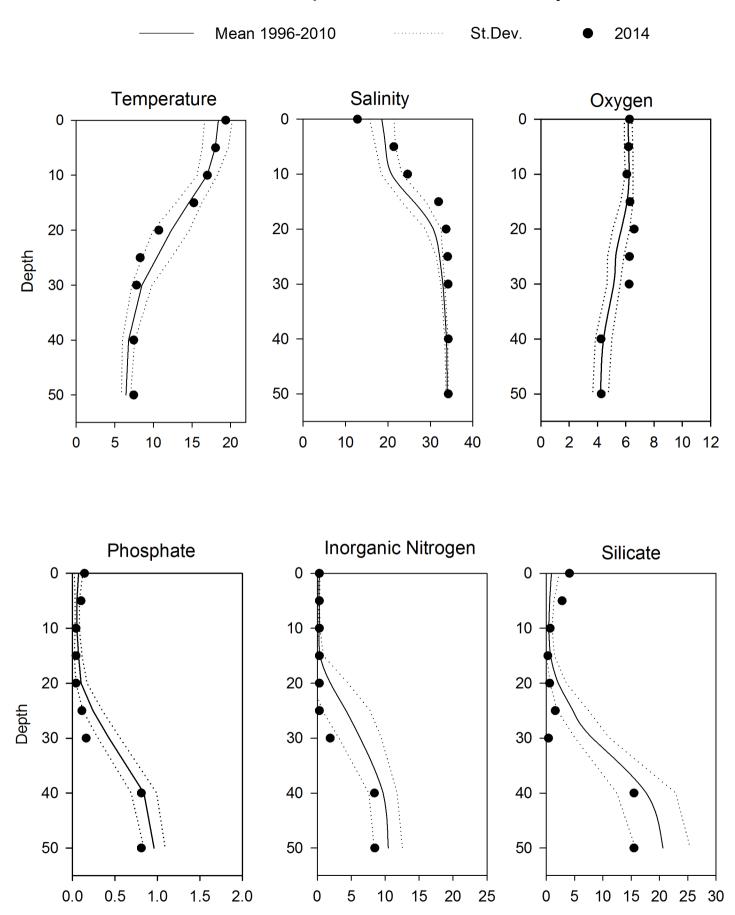




Vertical profiles Fladen July

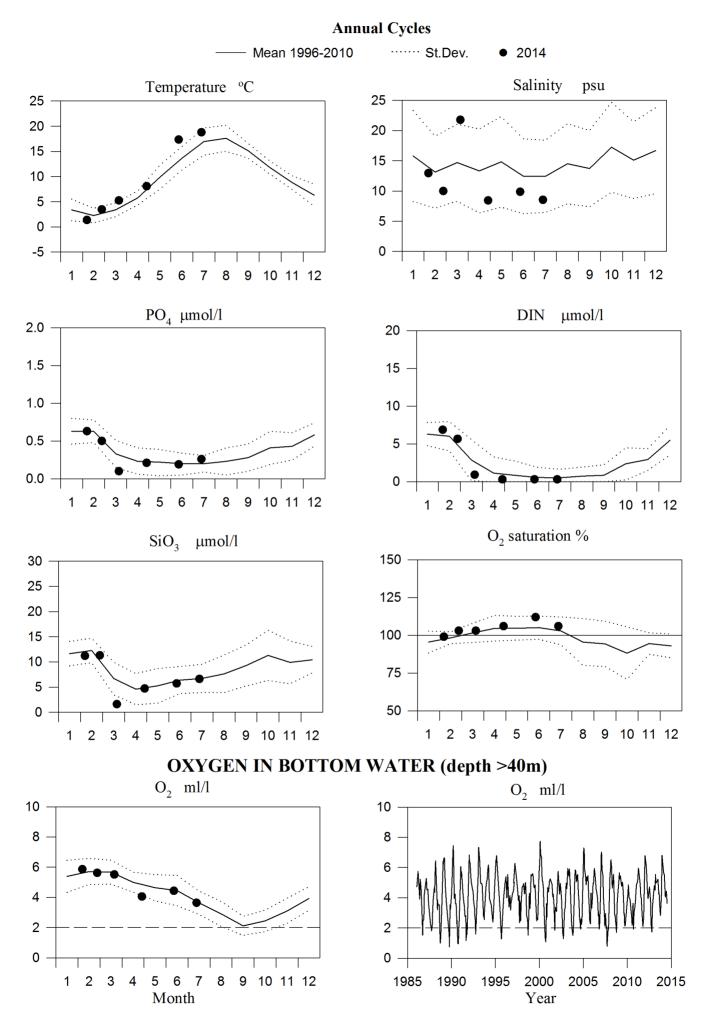
STATION ANHOLT E SURFACE WATER

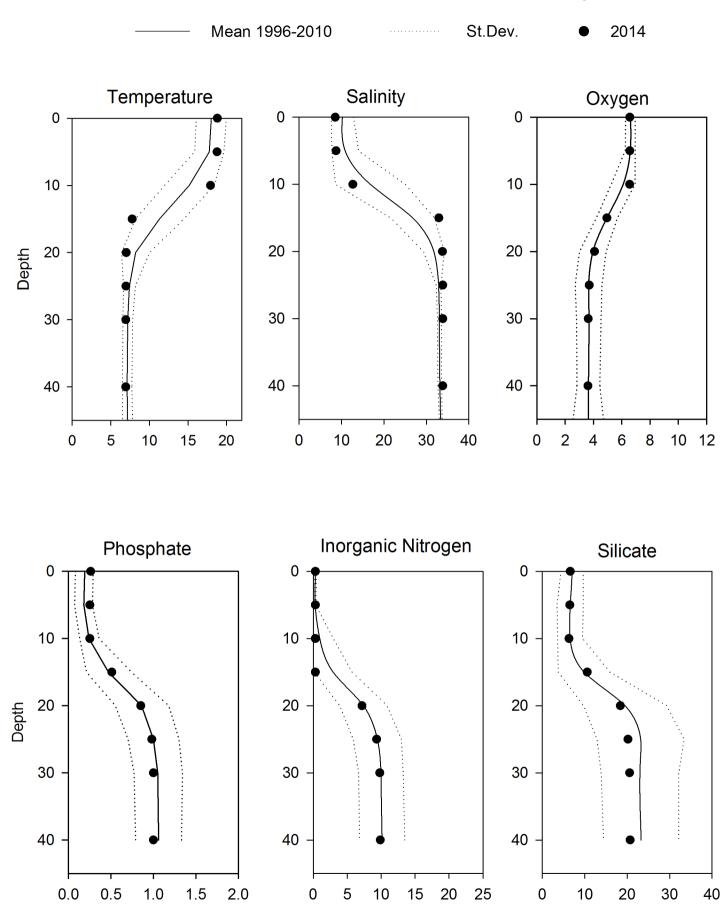




Vertical profiles Anholt E July

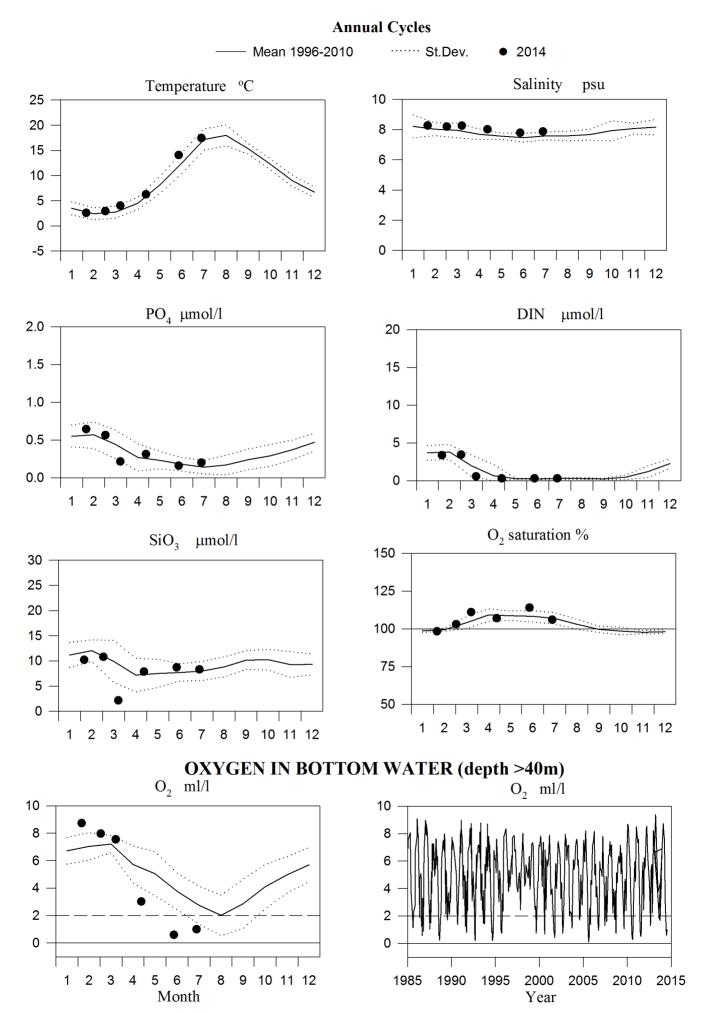
STATION W LANDSKRONA SURFACE WATER

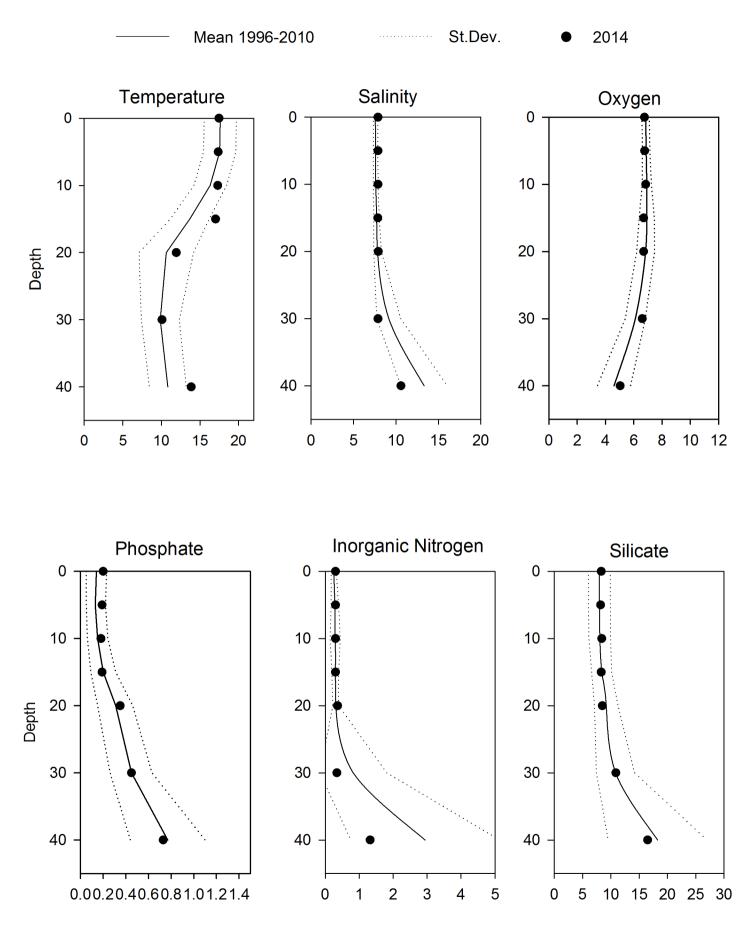




Vertical profiles W Landskrona July

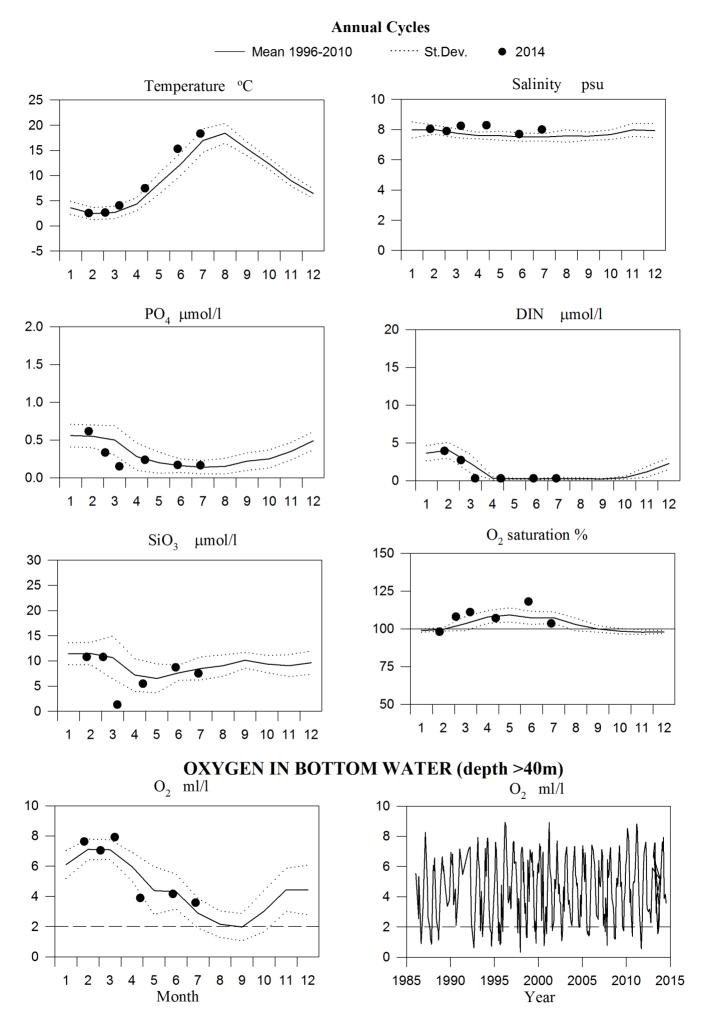
STATION BY1 SURFACE WATER

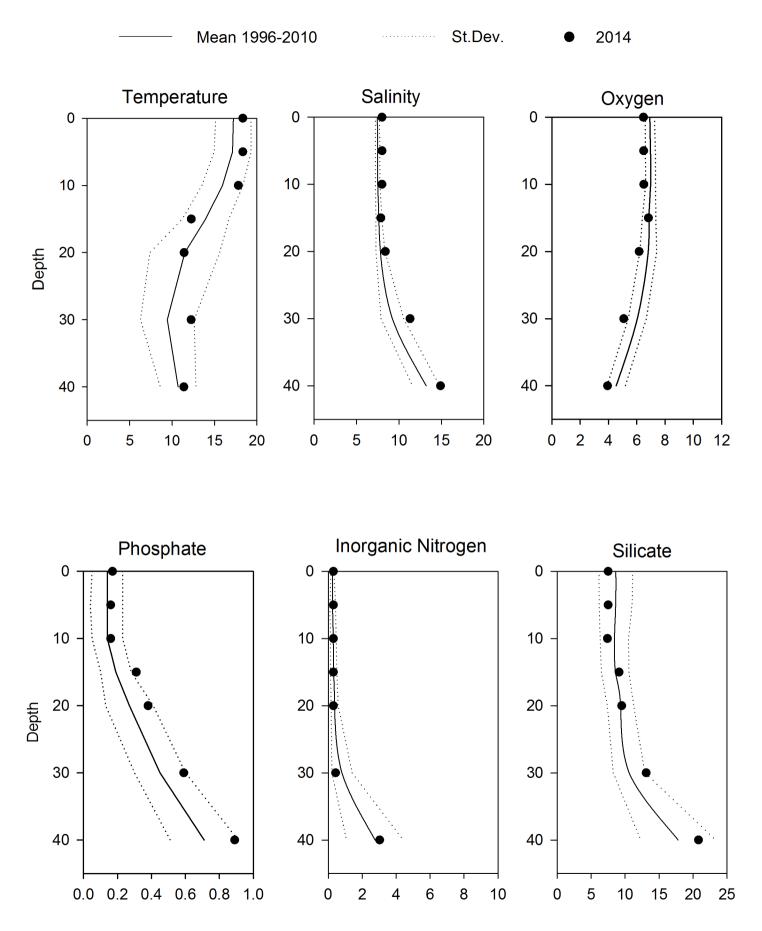




Vertical profiles BY1 July

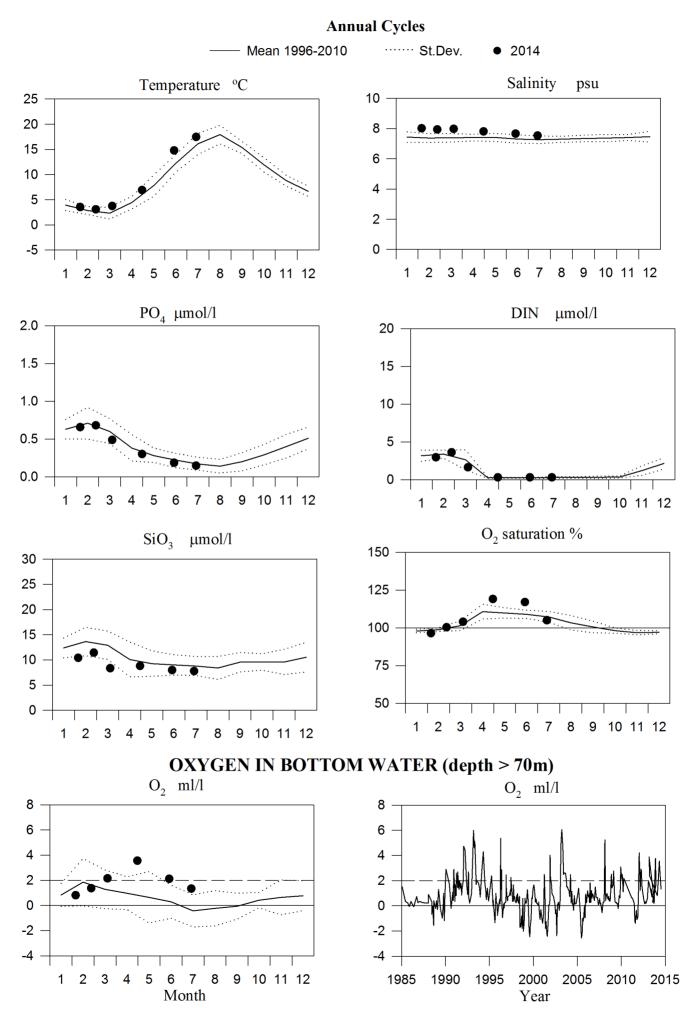
STATION BY2 SURFACE WATER

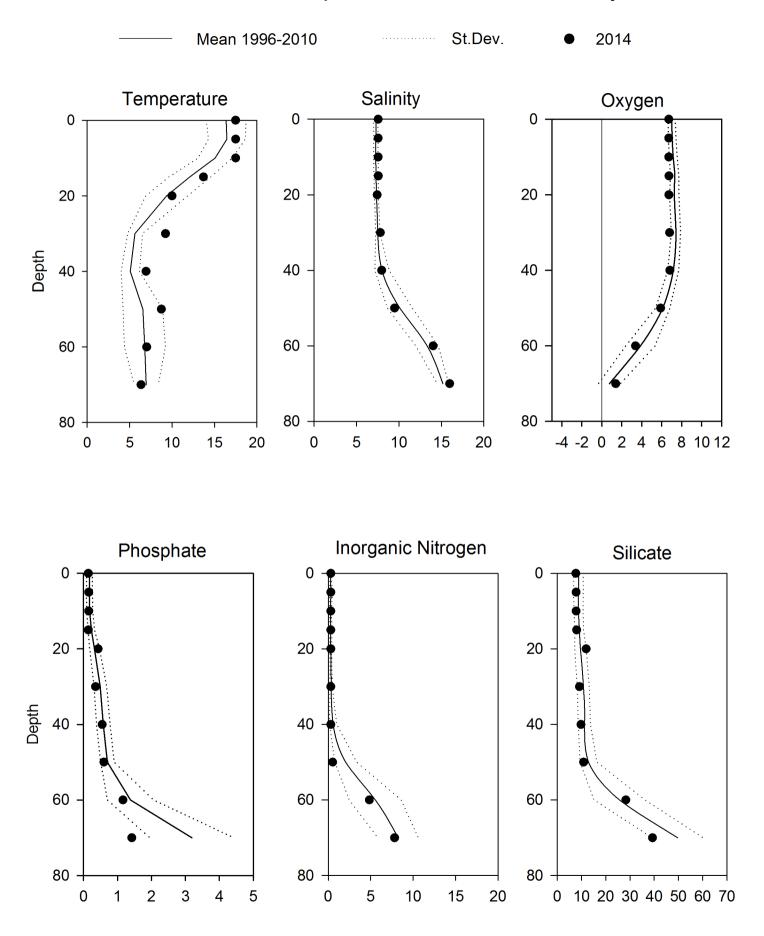




Vertical profiles BY2 July

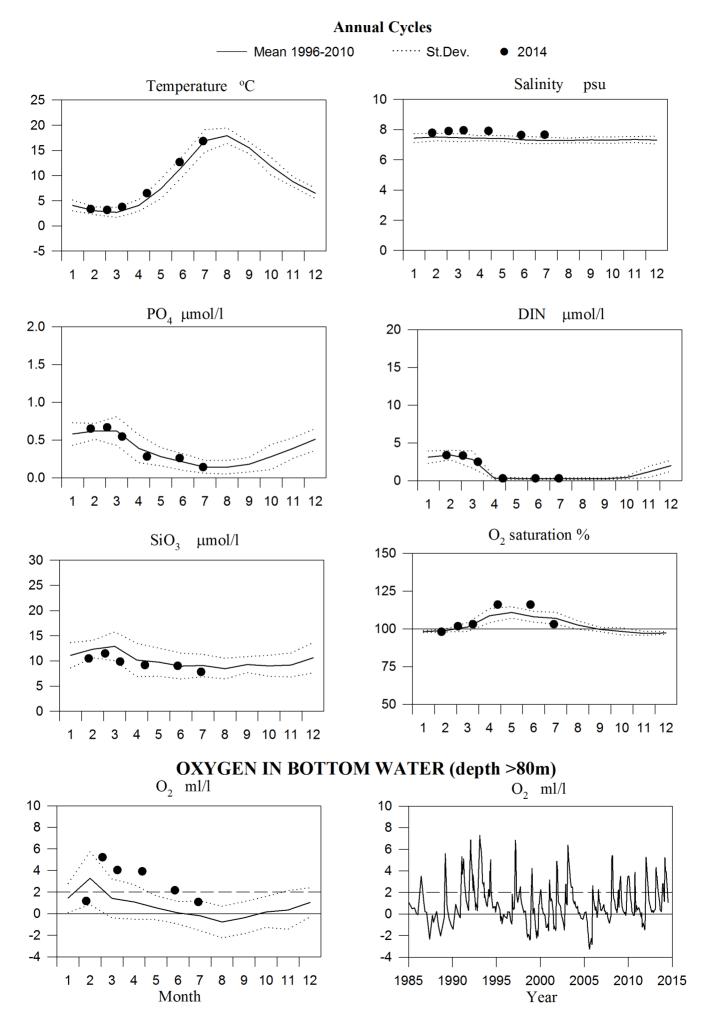
STATION HANÖBUKTEN SURFACE WATER

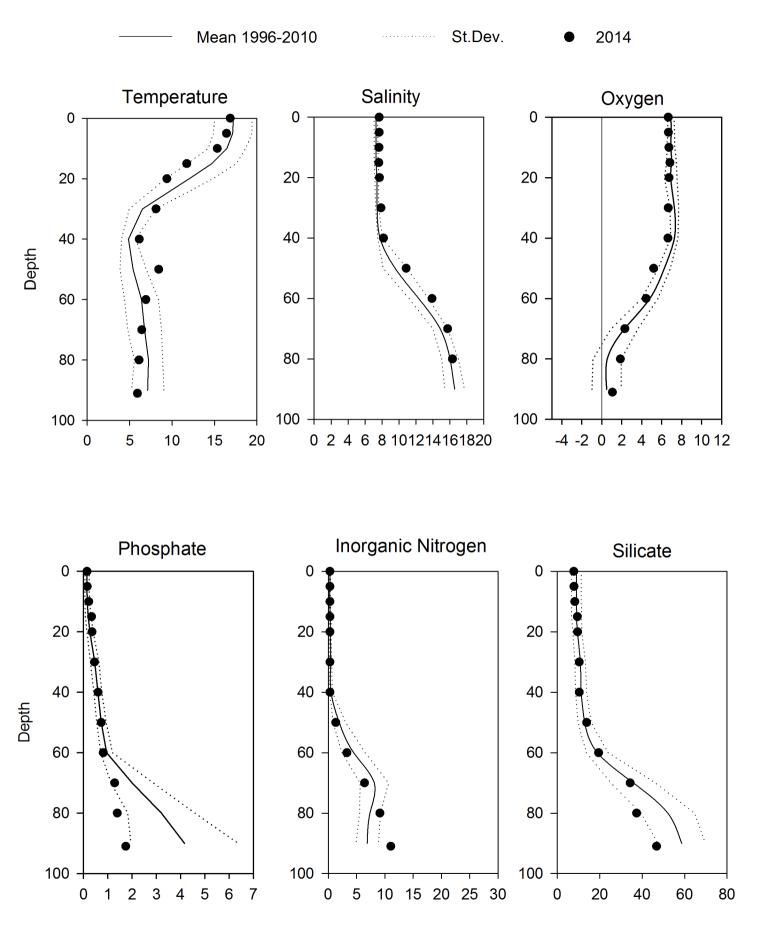




Vertical profiles Hanöbukten July

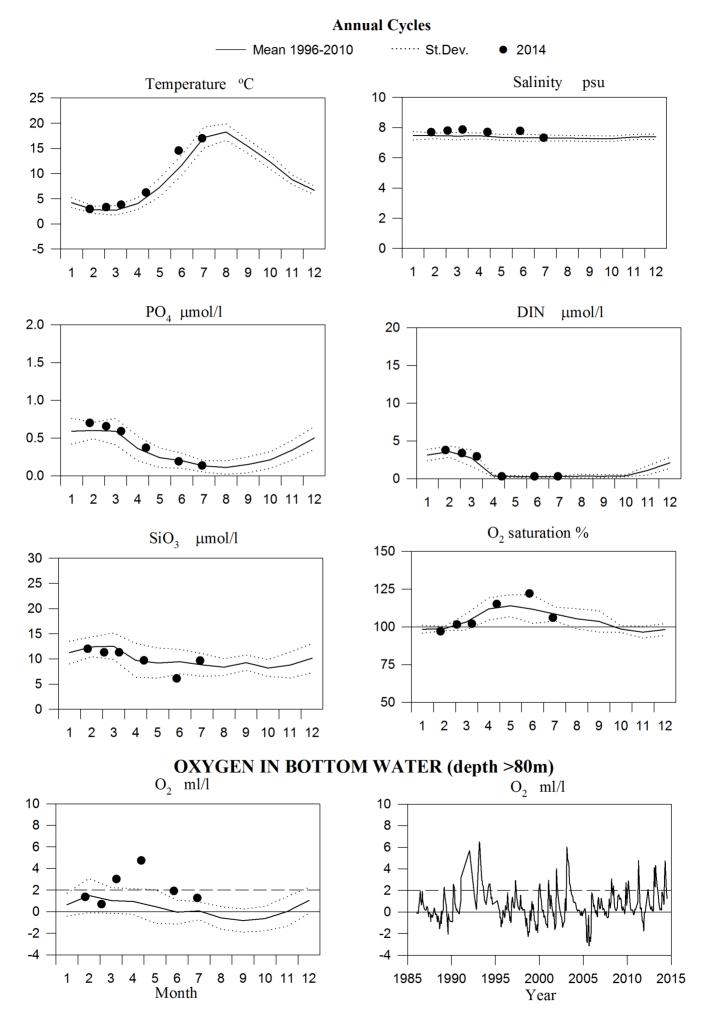
STATION BY4 SURFACE WATER

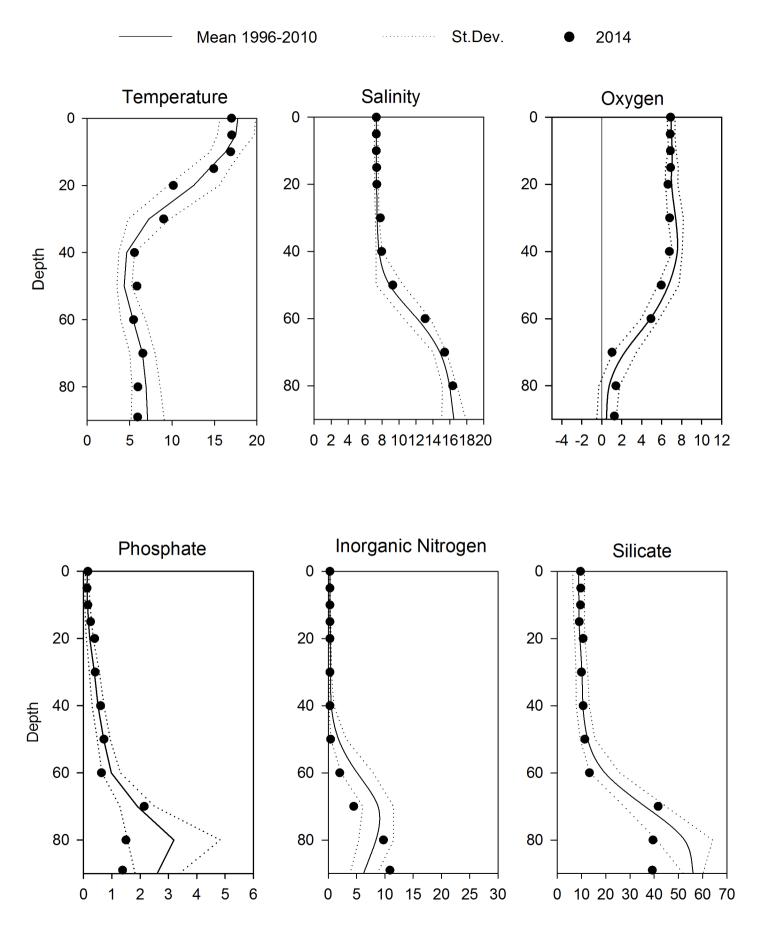




Vertical profiles BY4 July

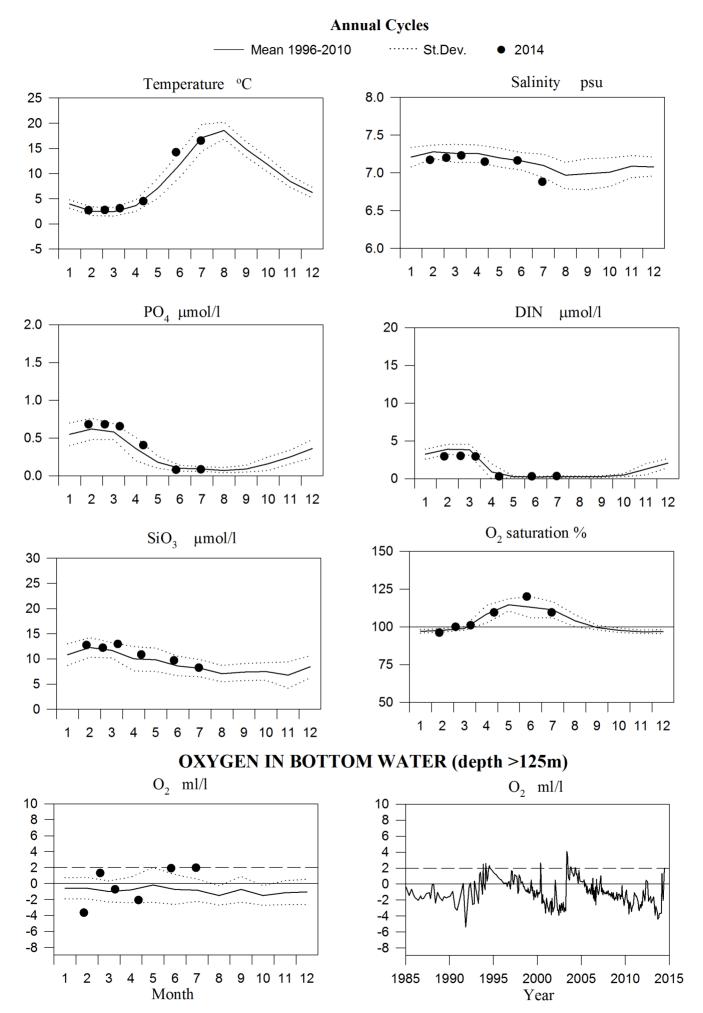
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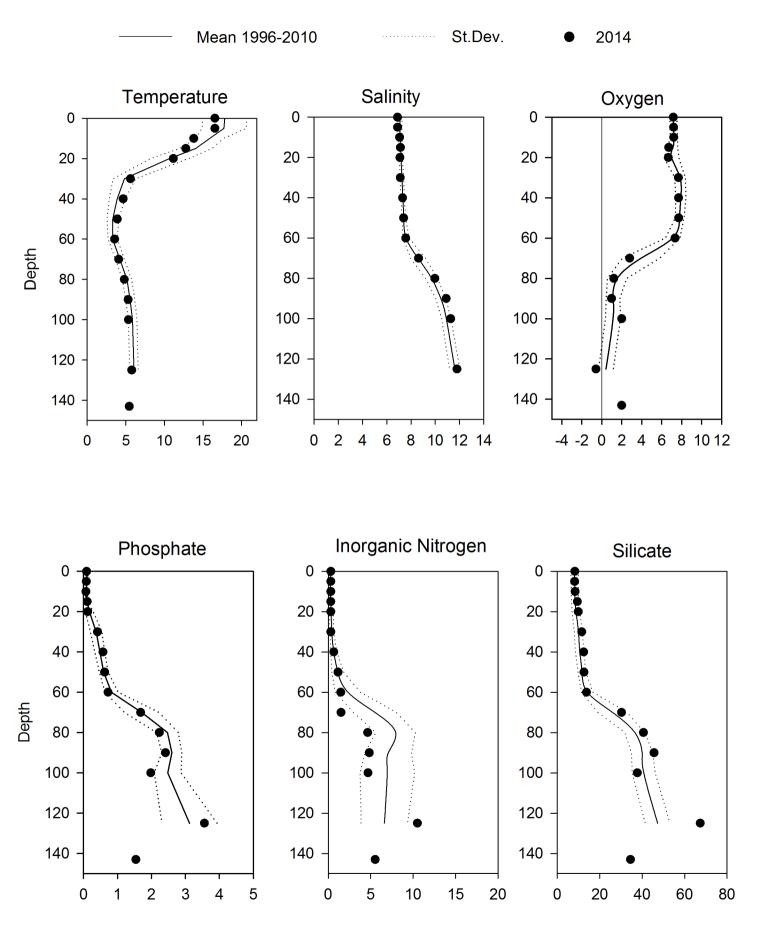




Vertical profiles BY5 July

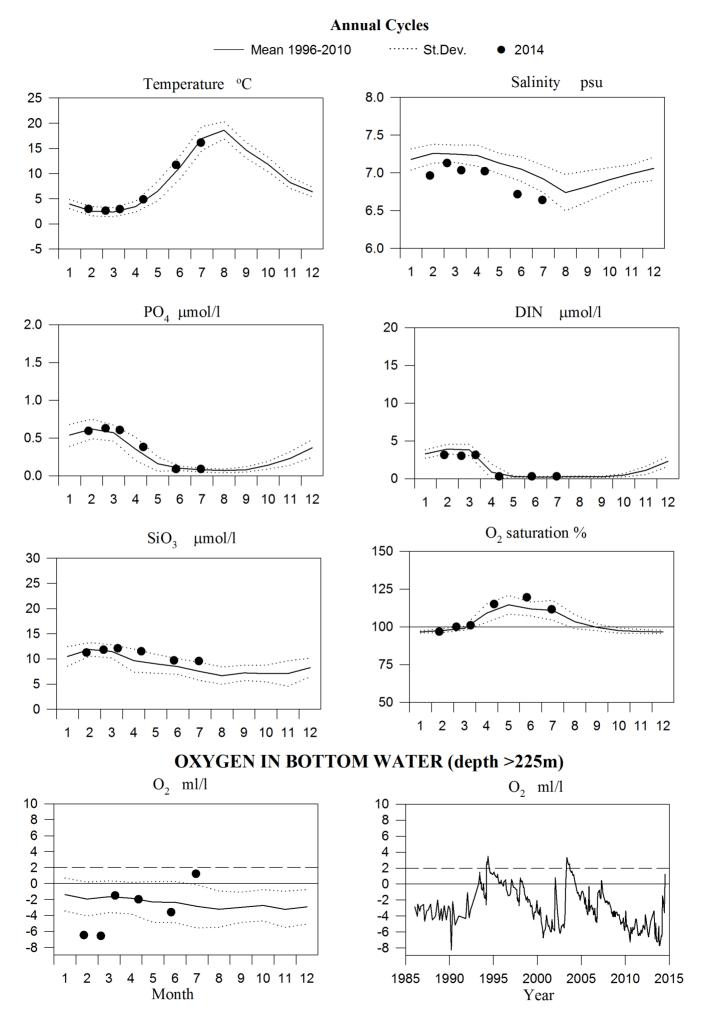
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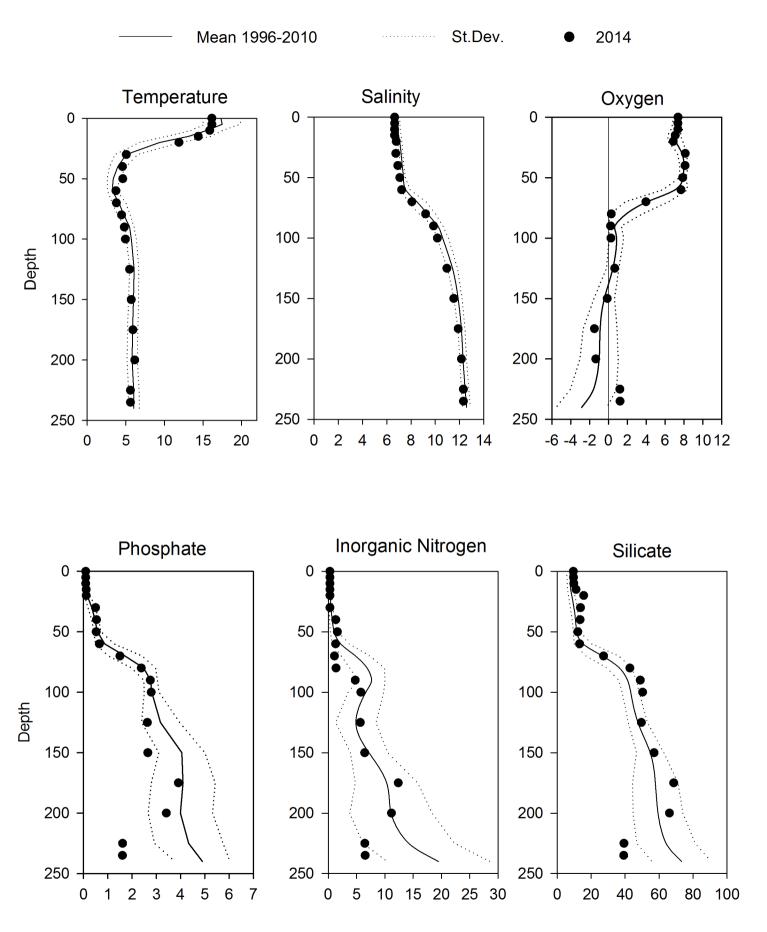




Vertical profiles BY10 July

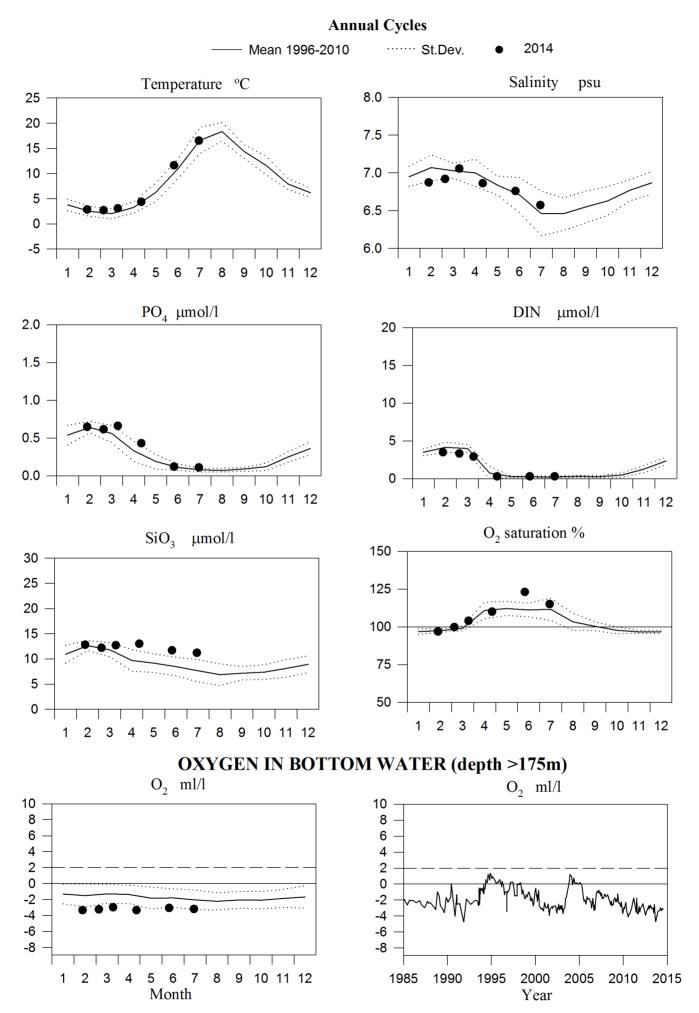
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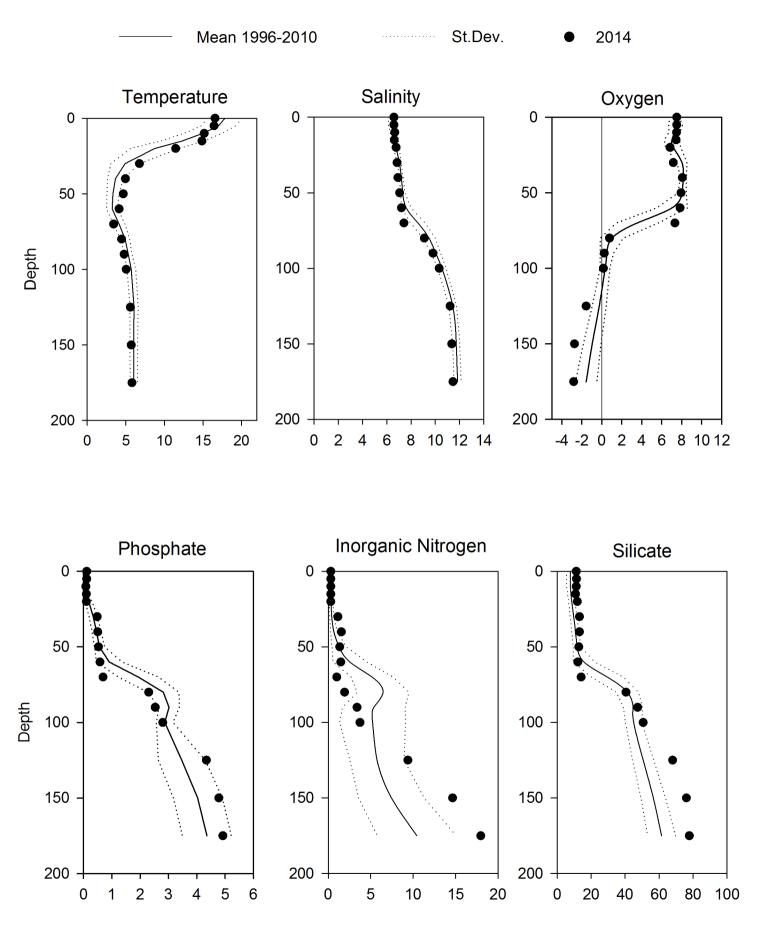




Vertical profiles BY15 July

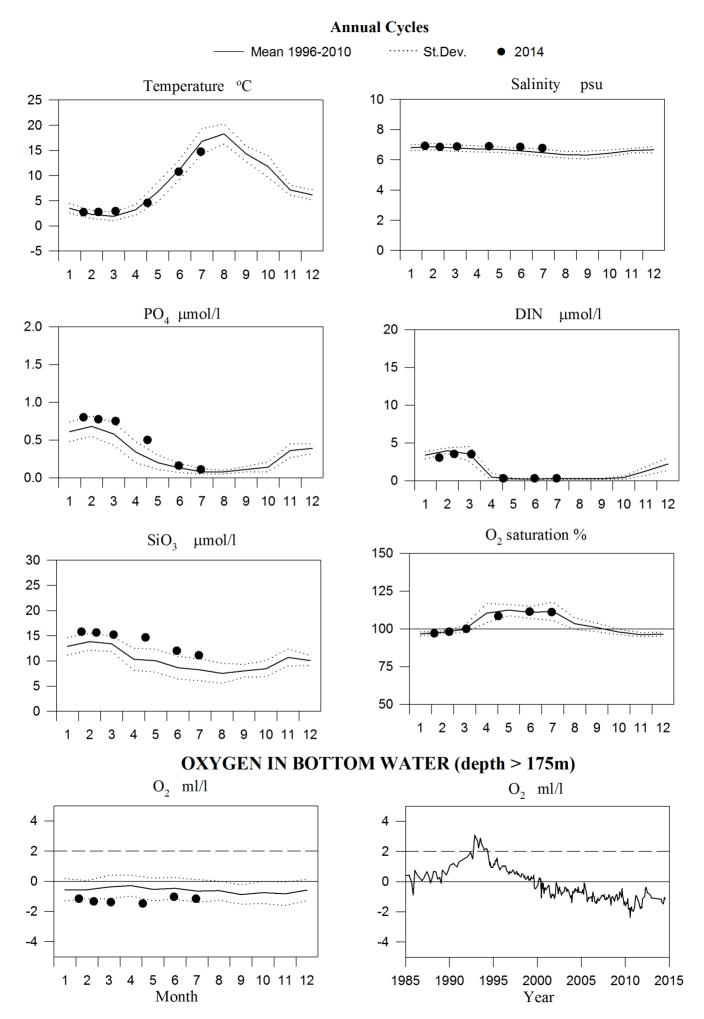
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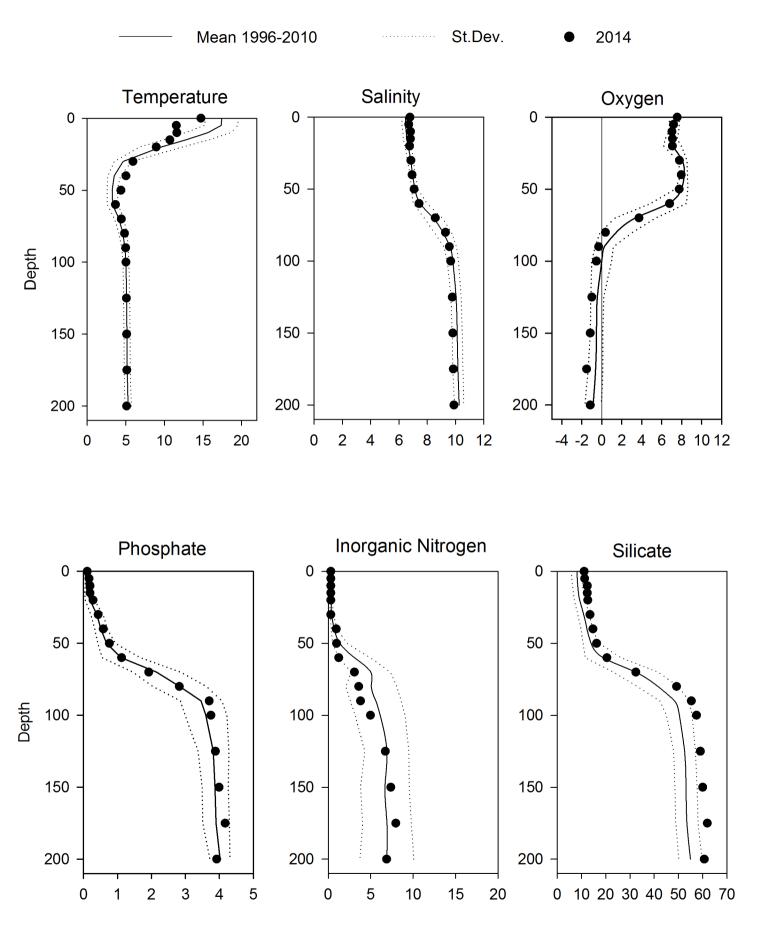




Vertical profiles BY20 July

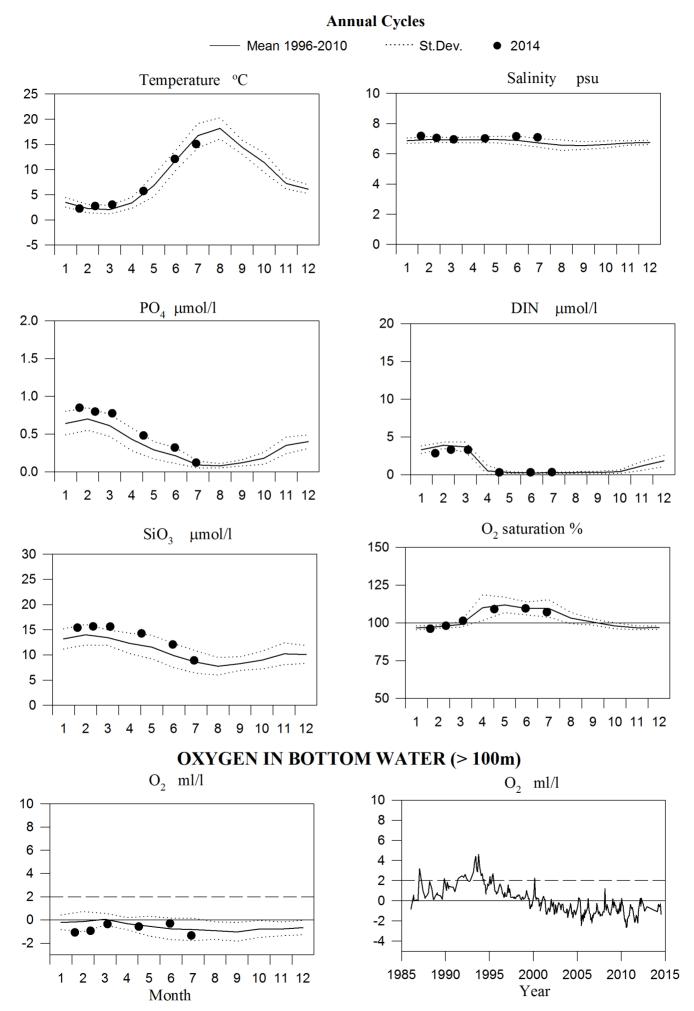
STATION BY32 SURFACE WATER

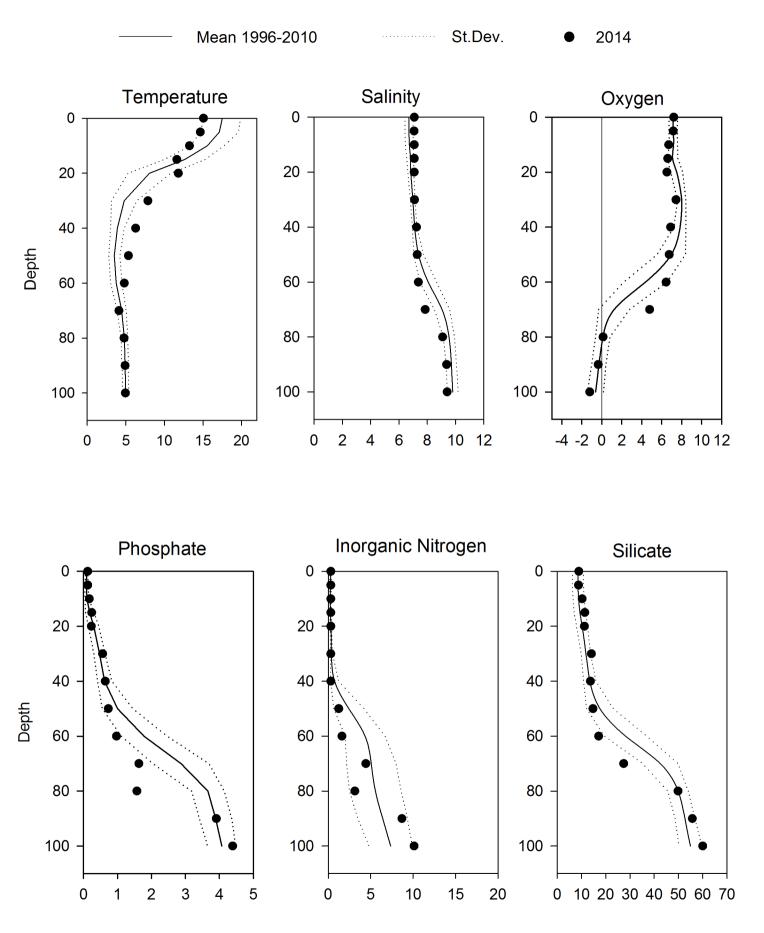




Vertical profiles BY32 July

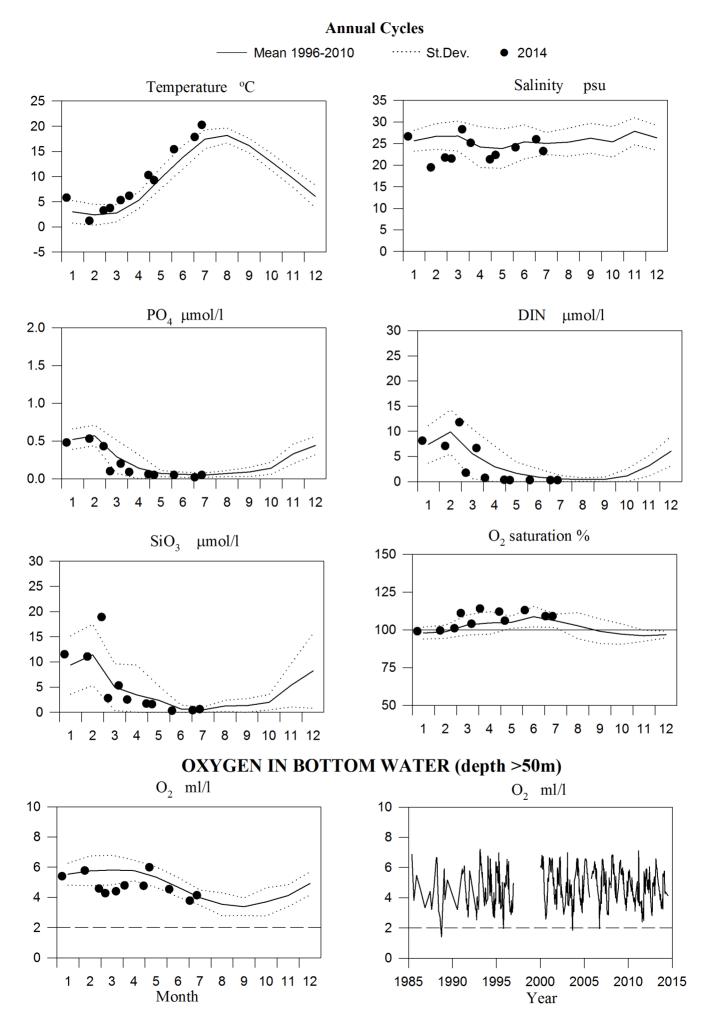
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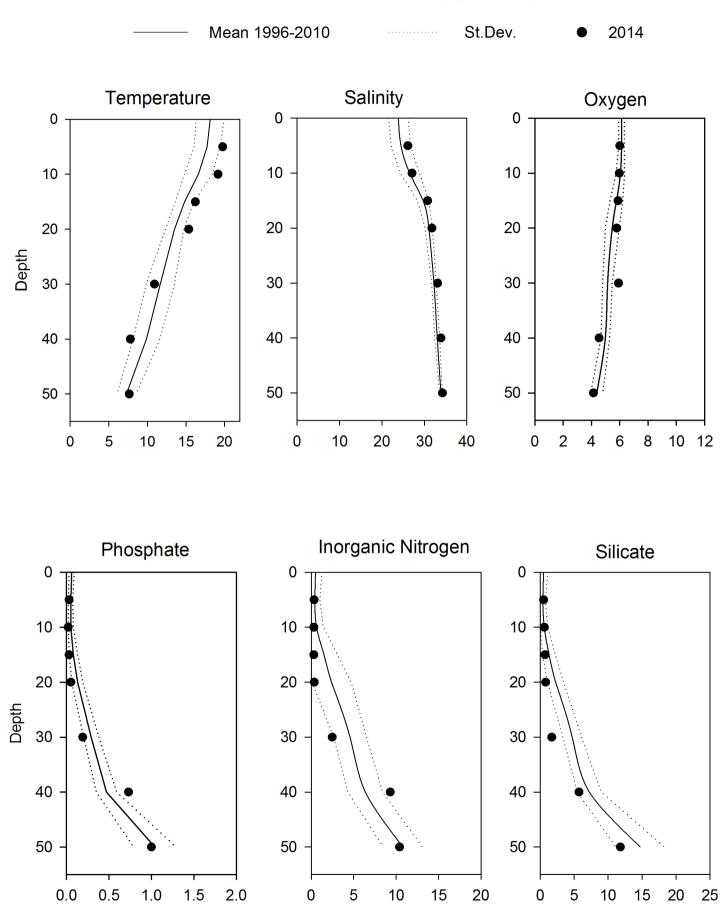




Vertical profiles BY38 July

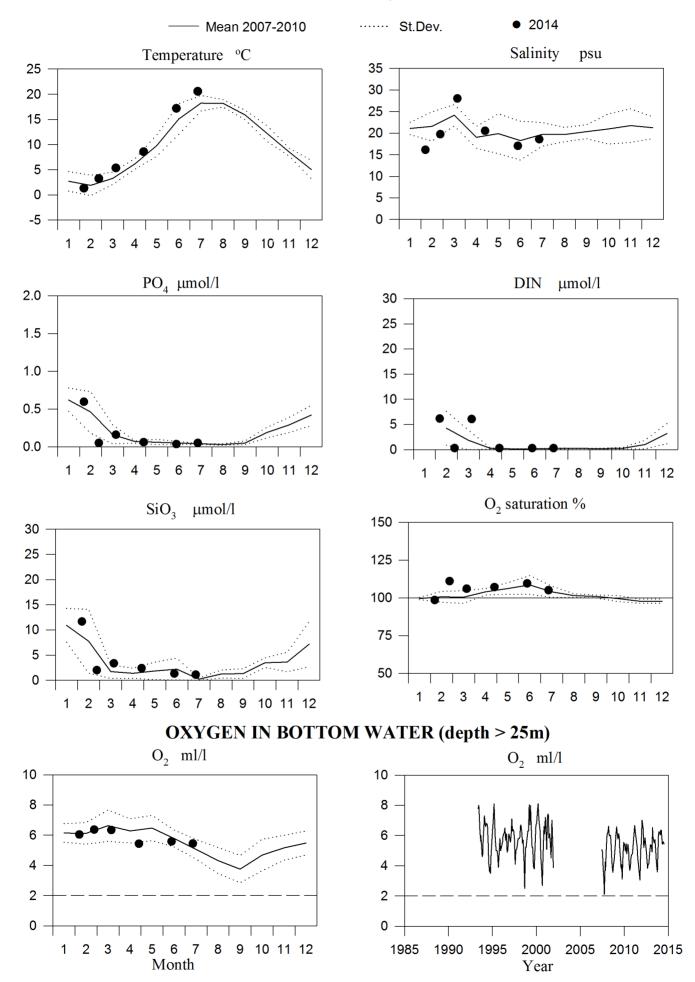
STATION SLÄGGÖ SURFACE WATER





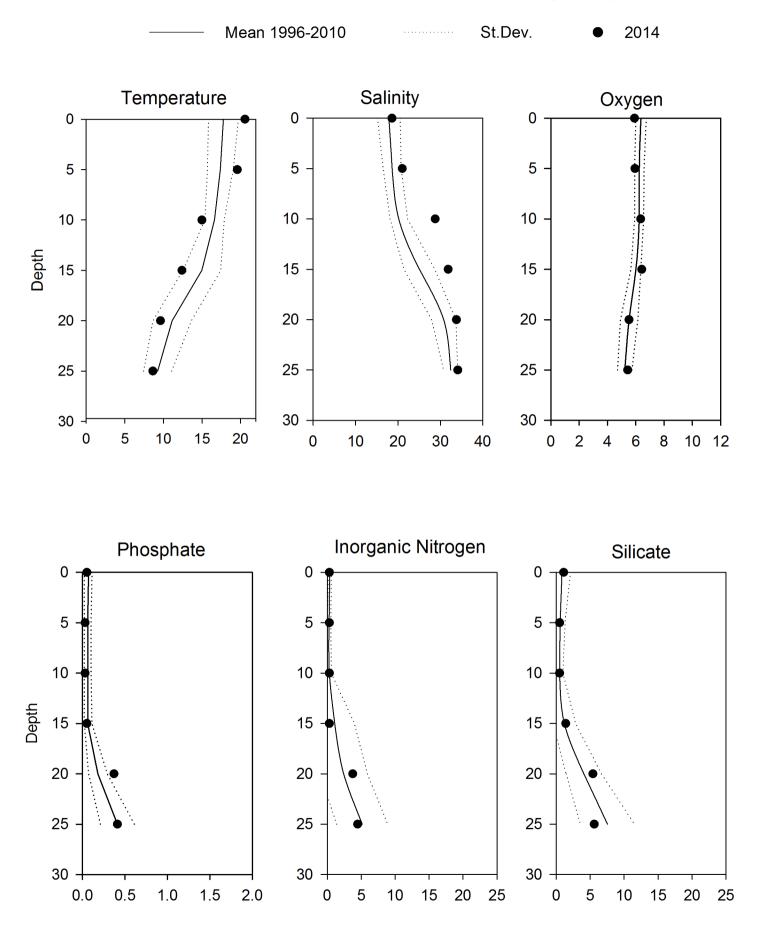
Vertical profiles Släggö July

STATION N14 Falkenberg SURFACE WATER

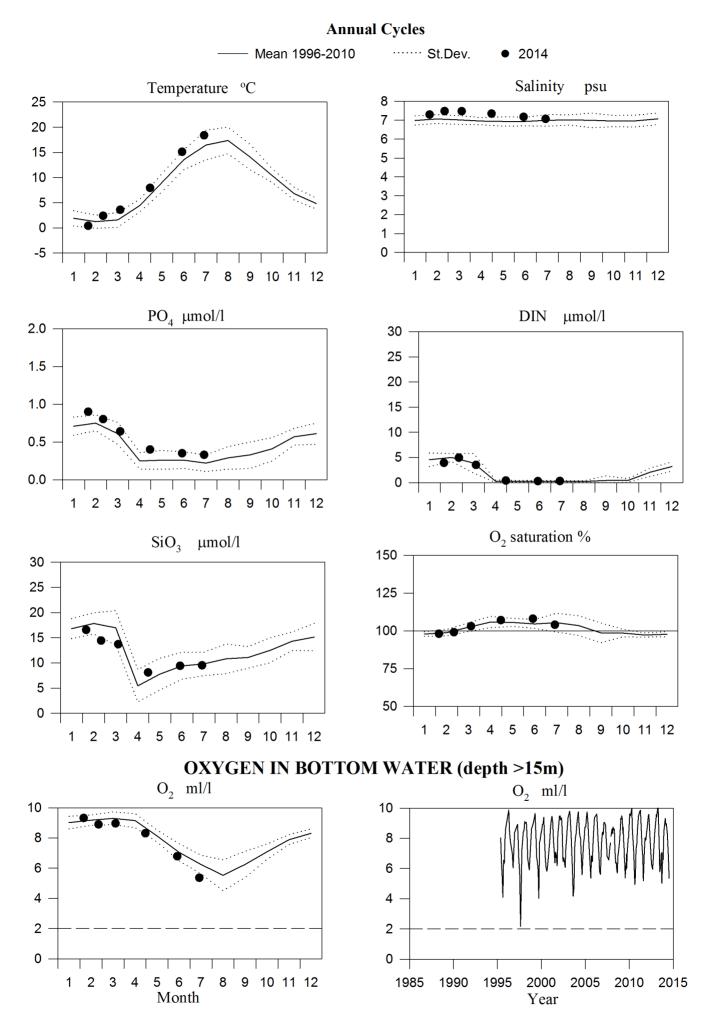


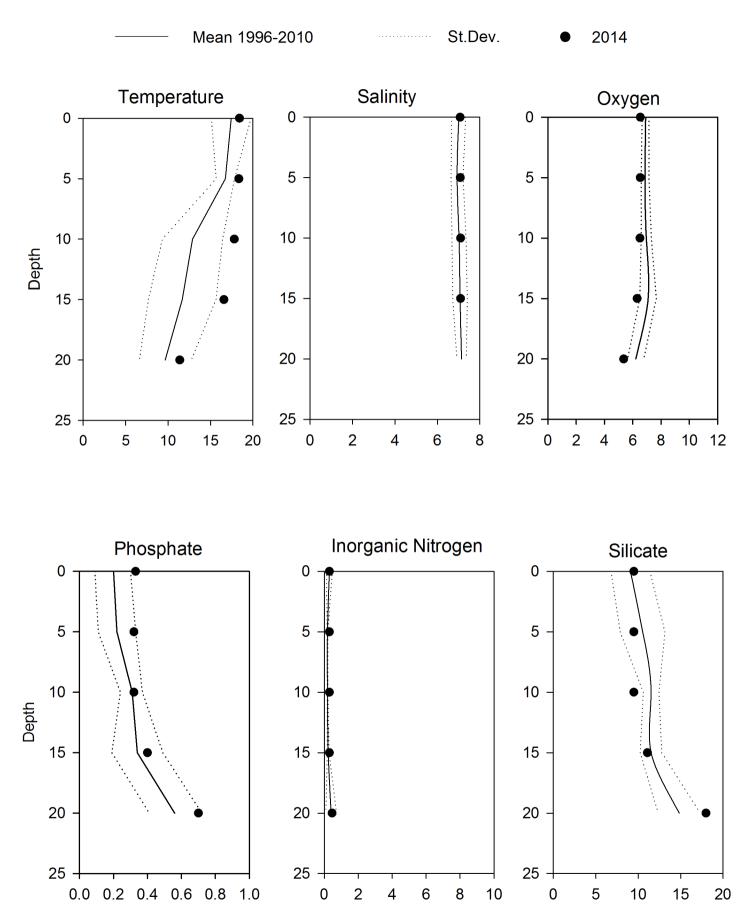
Annual Cycles

Vertical profiles N14 Falkenberg July



STATION REF M1V1 SURFACE WATER





Vertical profiles Ref M1V1 July