Technical Report No. 2

Validation data set compiled from Baltic Environmental Database

Version 2 (January 26, 2011)

Bo G. Gustafsson
Miguel Rodriguez Medina

Baltic Nest Institute

The Baltic Nest Institute

The Baltic Nest Institute host the Nest model, a decision support system aimed at facilitating adaptive management of environmental concern in the Baltic Sea.

Nest can be used to calculate required actions needed to attain politically agreed targets for the Baltic Sea ecosystem. By modeling the entire drainage area, Nest is a novel tool for implementing the ecosystem approach in a large marine ecosystem. The main focus of the model is on eutrophication and the flows of nutrients from land to sea.

Reducing the nutrient input to the sea and thus decreasing the negative environmental impacts is a politically prioritized area of international cooperation. Baltic Nest Institute can contribute to this process by formulating policies that are fair, transparent and cost-efficient. The main target group for the Nest Decision Support System is HELCOM and regional water directors in the riparian countries.

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Authors: Bo G. Gustafsson, Miguel Rodriguez Medina
ISBN: 978-91-86655-01-3
Layout: Marmar Nekoro

Baltic Nest Institute
Stockholm Resilience Centre, Stockholm University
Address: Baltic Nest Institute, Stockholm University, SE-106 91 Stockholm, Sweden
www.balticnest.org

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Contents

1 Introduction

The evolution of coupled physical-biogeochemical models of the Baltic Sea has reach the point where the models are capable of rather accurate reproduction of the conditions in the Baltic Sea. With increased accuracy follows an increased demand for high-quality validation data sets. The Baltic Environmental Database (BED) at the Baltic Nest Institute contains probably the most complete collection of hydrographic and hydrochemical data from the Baltic Sea. The data base is built up from voluntary data contributions from a large number of institutes and individuals throughout the past two decades. Highly sophisticated graphical and statistical tools are available, and continuously developed, for accessing the data base through the Internet and retrieve various data products, i.e., the Nest and the DAS systems, both available from http://nest.su.se. However, there is a demand from modelers to get access to time-series that are closer to the raw data and still quality assured and relatively homogeneous. Therefore, we made an effort to produce a data set that is quality controlled and compiled in a consistent manner, yet keeping a high resolution vertically and temporally. Recently, direct access to the databases at Finnish Environmental Institute, Baltic Sea Research Institute, National Environmental Research Institute and Swedish Meteorological and Hydrological Institute has become available through the DAS system, which further increased the amount of data available.

The data set contains of monthly average time-series from 1970-2008, at some 16 selected monitoring stations around the Baltic Sea (see Table 1.1). Some statistics from each station are also computed and available in the data set.

Table 1.1: Station names and positions.
All stations within a bounding box around each station are selected. The sizes of the bounding boxes are: [1]+/- 5 nm, [2]+/- 10 nm, [3]+/- 8 nm, [4]+/- 2 nm and [5]+/- 3 nm

Station number	Station name	Latitude	Longitude
1	Anholt E[1]	5640	1207
2	Bornholm deep BY5[2]	5515	1559
3	Gotland deep BY15[2]	5720	2003
4	Gulf of Finland LL7[1]	5951	2450
5	Bothnian Sea SR5[2]	6103	1934
6	Bothnian Bay[2]	6444	2204
7	Arkona BY2[1]	5500	1405
8	Landsort Deep BY31[1]	5835	1814
9	Gulf of Finland F1[1]	6008	2620
10	Gulf of Riga[2]	5735	2335
11	Gdansk Deep[3]	5450	1919
12	Bothnian Sea US3[2]	6245	1912
13	Landskrona W[4]	5552	1245
14	Fehmarn Belt[5]	5434	1120
15	Great Belt[5]	5531	1052
16	SE Gotland basin[1]	5533	1824

Table 1.2: Parameters in the data set.

No.	Parameter	Unit
1	Temperature	degC
2	Salinity	
3	Total oxygen	ml/l
4	PO4-P	µmol/l
5	TP	µmol/l
6	SiO4-Si	µmol/l
7	NO3-N	µmol/l
8	NO2-N	µmol/l
9	NO2-N+NO3-N	µmol/l
10	NH4-N	µmol/l
11	TN	µmol/l
12	Chlorophyll-a	mg/m^3

2 Data treatment

2.1 Data preprocessing

Raw data were extracted for a quadratic area around the standard position of each station. The reason being that the position of sampling could vary somewhat, especially before common use of GPS. The positions and sizes of the quadratic regions are given in Table 1.1. Based on the sampling frequency, a number of standard depths are selected for each station (see Table 2.1, and data within a meter distance from that depth is used. Surface values (0 m depth) are selected if the observation depth of the uppermost measurement of the profile is less than or equal to 2 meters.

Initial quality control was done during inclusion of data into BED and at the four other databases. The assigned quality codes are listed in Table 2.2. Observations with quality codes 1, 3, 4, 5, 7 and 8 were used.

Still, after initial quality control, there are erroneous records in the data set. These can only be found if the values are in some respect unrealistic. Since the purpose of the data set is model validation and not data analysis as such, we can be less rigorous when eliminating questionable data because individual extreme events manifested by single observations of high/low values are most probably not caught by the models anyway. Vertical profile plots of the maximum and minimum values at each depth, together with average, median and quantiles; and time series plots for all depths and parameters were produced. By browsing these figures the most extreme values was found. The process was repeated until all values that could subjectively be considered extreme were eliminated. The whole profile for the questionable parameter was eliminated from the data set. Still, after this process there are questionable data, which the user of this data set should be aware of.

In the BED oxygen concentration and hydrogen sulfide is stored in the same variable, (hydrogen sulfide being converted into negative oxygen according to the demand of oxygen needed to oxidize hydrogen sulfide to sulfate). Occasionally, during sulfidic conditions hydrogen sulfide is not measured but zero oxygen is reported. Thus, time series of negative oxygen during anoxic conditions are interrupted by zero's. To eliminate these we disregard any records within the range $0 \leq [O2] < 0.01$ ml/l. In addition, we compute from raw data average O2 and H2S (in form of negative O2) concentrations since this may in some instances be valuable to have these separately.

The number of observations used for each parameter, depth and station are presented in Tables (B.1 - B.16) in the Appendix. Care has been taken to remove duplicates, but there is still a risk of duplication when multiple data bases are searched.

2.2 Construction of time series

The data are utterly unequally spaced in time, some periods may be frequently sampled with long gaps in-between. Therefore, we make make monthly averaged time-series. Not only the monthly average value of each parameter but also the average time of observations since they may be quite off centered from the mid of the month. Thus, the average of a property, say $\bar{c_m}$, at year y and month m is given by

$$\bar{c}_{y,m} = \frac{1}{N_{y,m}} \sum_{n=1}^{N_{y,m}} c_{n,y,m} \tag{2.1}$$

$$\overline{c^2}_{y,m} = \frac{1}{N_{y,m}} \sum_{n=1}^{N_{y,m}} c^2_{n,y,m} \tag{2.2}$$

where $N_{y,m}$ is the number of observations during year y and month m. Standard deviation time-series are calculated as

$$\sigma(c_{y,m}) = \sqrt{\overline{c^2}_{y,m} - \bar{c}^2_{y,m}} \tag{2.3}$$

The average annual cycle is computed with monthly resolution. Mean values of the parameters and time of observations are computed from the monthly averaged time-series, i.e.,

$$\overline{cm}_m = \frac{1}{Y_m} \sum_{y=Y_{min}}^{Y_{max}} \bar{c}_{y,m} \tag{2.4}$$

The annual cycle of standard deviation is computed as the sum of the variance from all individual measurements.

$$\sigma(cm_m) = \sqrt{\frac{1}{Y_m} \sum_{y=Y_{min}}^{Y_{max}} ((\bar{c}_{y,m} - \overline{cm}_m)^2 + \sigma(c_{y,m})^2)} = \sqrt{\frac{1}{Y_m} \sum_{y=Y_{min}}^{Y_{max}} \overline{c^2}_{y,m} - \overline{cm}^2_m} \tag{2.5}$$

Long-term mean values are computed from the annual cycle since this would lead to least bias.

$$\overline{ca} = \frac{1}{12}\sum_{m=1}^{12}\overline{cm}_m \tag{2.6}$$

and the overall standard deviation is computed from

$$\sigma(ca) = \sqrt{\frac{1}{12}\sum_{m=1} 12\left[\frac{1}{Y_m}\sum_{y=Y_{min}}^{Y_{max}}\overline{c^2}_{y,m}\right] - ca^2} \tag{2.7}$$

Table 2.1: Selected standard depths for the stations.

Depth	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
15	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x
20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
25	x	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-
30	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x
33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-
40	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x
50	x	x	x	x	x	x	-	x	x	x	x	x	x	-	-	x
60	-	x	x	x	x	x	-	x	x	-	x	x	-	-	-	x
70	-	x	x	x	x	x	-	x	-	-	x	x	-	-	-	x
80	-	x	x	-	x	x	-	x	-	-	x	x	-	-	-	x
85	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	-	-	x	-	x	x	-	x	-	-	x	x	-	-	-	-
100	-	-	x	-	x	x	-	x	-	-	x	x	-	-	-	-
110	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
125	-	-	x	-	-	-	-	x	-	-	-	x	-	-	-	-
150	-	-	x	-	-	-	-	x	-	-	-	x	-	-	-	-
175	-	-	x	-	-	-	-	x	-	-	-	x	-	-	-	-
200	-	-	x	-	-	-	-	x	-	-	-	-	-	-	-	-
225	-	-	x	-	-	-	-	x	-	-	-	-	-	-	-	-
240	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
400	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
440	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-

Table 2.2: Quality codes in the BED data base.

Quality code	explanation
0	missing
1	ok
2	will be changed
3	modified
4	manually interpolated
5	traces
6	$>$
7	$<$
8	NO2-N+NO3-N is calculated from the sum of measurements of NO2-N and NO3-N
9	questionable
40	ship 40, sweden ,bad chemdata

3 Data files

All data is stored in simple ASCII files.

3.1 Monthly time-series

One file for each station, parameter and depth. The filenames are constructed as, for example: GotlanddeepBY15SALINmonth000.dat which contain salinity data from 0 m depth at BY15. The columns in the files are, Day no, Year, Month, Day, Average value, Standard deviation, Minimal value, Maximal value and Number of observations. A header line gives information of the columns. Day numbers are julian days since 1850-01-01.

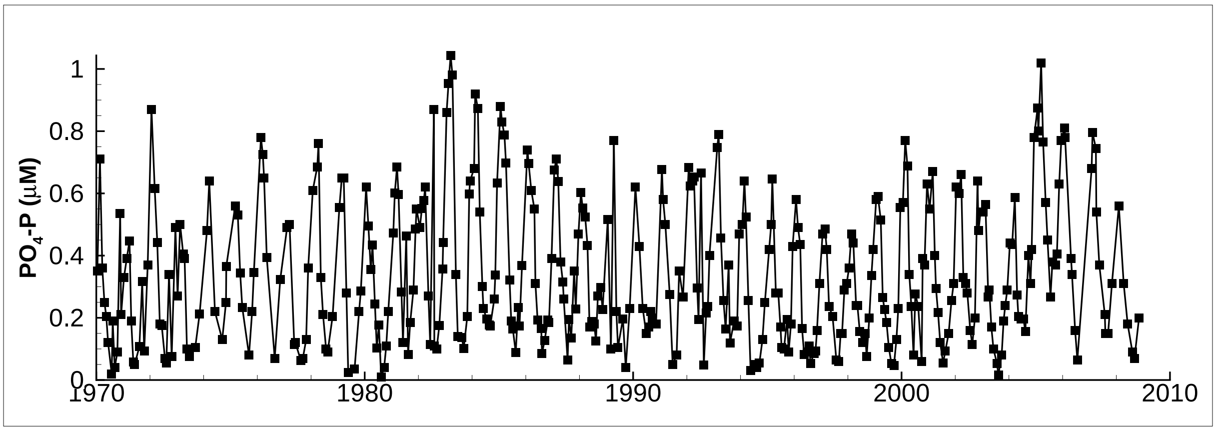

Figure 3.1: Example of monthly time-series of PO4-P from 0 m depth at BY5 (Bornholm basin)

3.2 Seasonal cycles

One file for each station and month. Filenames are constructed as for example: GotlanddeepBY15SeasonM01.dat for profiles in January. The columns are: Depth, Temp, Temp standard deviation, Salinity, Salinity standard deviation, etc... A header line gives the information of the columns.

3.3 Average profiles

One file for each station, format the same as for seasonal cycles.

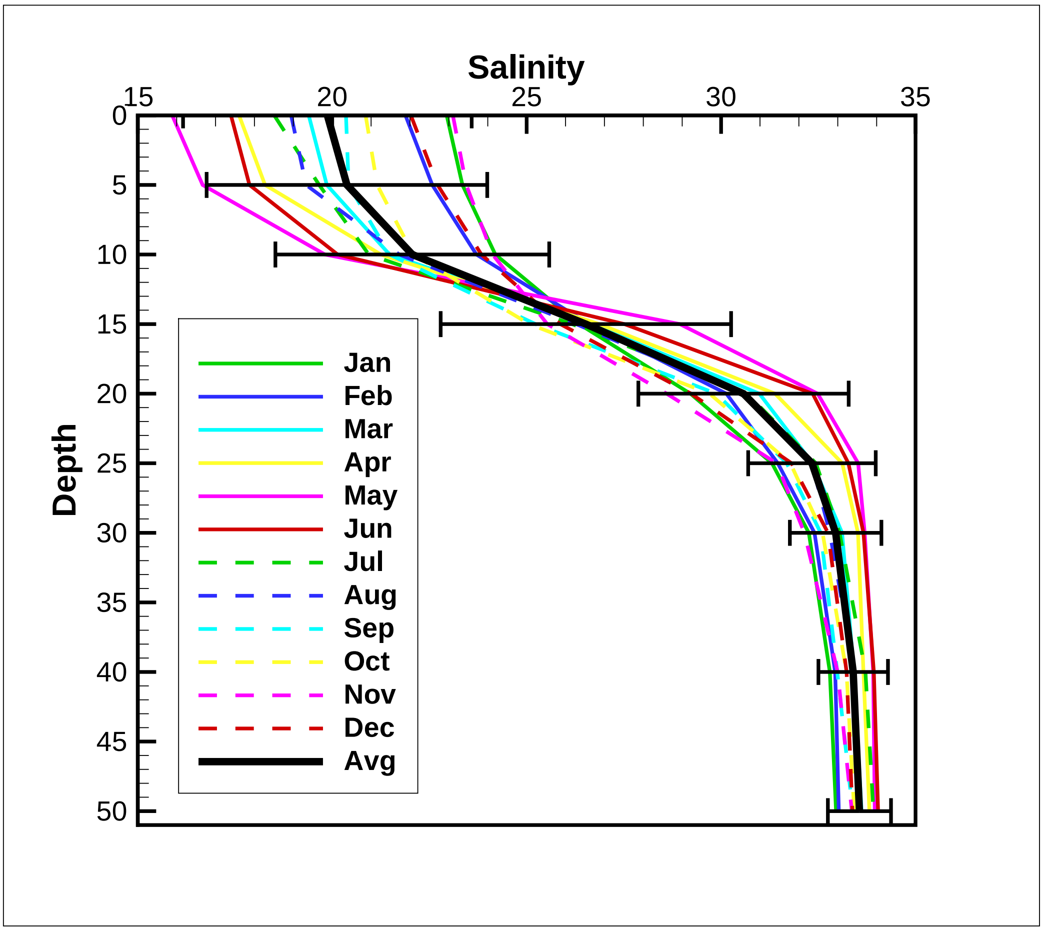

Figure 3.2: Example of monthly and long-term average profiles of salinity from Anholt E. Errorbars indicate the standard deviation around the long-term average.

Acknowledgements This compilation is done as a part of the EU-BONUS project ECOSUPPORT. Maintenance of the Baltic Environmental Database is a part of the core activities of the Baltic Nest Institute funded by the Swedish Ministry of Environment through the Swedish Environmental Protection Agency.

A Data contributers

The following institutes have contributed to the BED with marine data. We give the complete list and not only the contributors to the data used for this compilation.

A.1 Denmark

National Environmental Research Institute

Fyns Amt Teknik og Miljøforvaltning

International Council for the Exploration of the Sea, ICES

Marine Biological Laboratory Helsingr. Univ. Copenhagen

A.2 Estonia

Estonian Marine Institute, Tallinn

Estonian Meteorological and Hydrological Institute

A.3 Finland

Finnish Environment Institute, Helsinki (coastal water and river loads data)

The Finnish Environment Institute also provided data from the City of Helsinki, Environment Centre; Lapland

Regional Environment Centre, Finland; Middle Ostrobothnia Regional Environment Centre, Finland; North Ostrobothnia Regional Environment Centre, Finland; Southwest Finland Regional Environment Centre, Finland; Southeast Finland Regional Environment Centre, Finland; University of Turku, Finland; Uusimaa Regional Environment Centre; Finland; West Finland Regional Environment Centre, Finland.

Finnish Institute of Marine Research, Helsinki

Helsinki Commission, Helcom

Husö biologiska station. Åbo Akademi

A.4 Germany

Baltic Sea Research Institute, Warnemuende

Federal Maritime and Hydrographic Agency

German Oceanographic Data Center, Hamburg

Institut für Meereskunde der Universität Hamburg, Hamburg

Institut für Mereeskunde, Kiel

Landesamt für Natur und Umwelt des Landes Schleswig-Holstein

Landesamt für Umwelt, Naturschutz und Geologie. Mecklenburg-Vorpommern

A.5 Latvia

Balt. Fish. Res. Inst. Riga, Latvia

Hydromet in Latvia

Latvian Institute of Aquatic Ecology, Riga

A.6 Lithuania

Klaipeda Hydrometeorological Observatory (In 1992, this observatory became an institution that was first called Lithuanian Laboratory of Marine Research. After the reorganisation of the Environmental Protection Department to Ministry in Lithuania, it was renamed as Centre of Marine Research.)

Coastal Research and Planning Institute, Klaipeda University

A.7 Poland

Gdansk University

Institute of Meteorology and Water Management, Gdynia

Morski Instytut Rybacki / Sea Fisheries Institute

A.8 Russia

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography, AtlantNIRO

Arctic and Antarctic Research Institute in St. Petersburg

Institute of Oceanology of the Russian Academy of Science, Atlantic Branch

North-Western Board of the Hydrometeorological Service of Russia

Russian State Hydrometeorological University, St. Petersburg.

St.-Petersburg branch of State Oceanographic Institute

A.9 Sweden

Department of Systems Ecology and Stockholm Marine Research Centre, University of Stockholm
Gothenburg Marine Sciences Centre
HavsFiskeLaboratoriet (Fiskeriverket)*
Kristinebergs Marina Forskningsstation*
KustLaboratoriet (Fiskeriverket)*
Ljusnan-Voxnans Vattenvårdsförbund in Sandarne
Lunds Universitet
Länstyrelse i Gävleborg
Länstyrelse i Norrbotten
Länstyrelse i Västernorrlands län *
Miljölaboratoriet i Gävle
Nordvöstskånes Kustvattenkommitte's kustkontrollprogram i Skälderviken och södra Laholmsbukten
Oceanografiska Institutionen, Göteborgs Universitet
SMHI, Gothenburg *
Stockholm Water
former Svelab AB
Swedish CoastGuard *
Tjärnö Marine Biological Laboratory*
Toxicon AB *
UmeåMarine Sciences Centre, UmeåUniversity *
VBB Consult i Malmö (refer Öresunds Vattenförbund)
Öresunds Vattenförbund*

* These data were provided via the SMHI which is the national data host for hydrophysical/chemical marine data from the Swedish national monitoring programmes.

The coastal control programs that collaborated with data to this database via SMHI are:

Bohuskusten, Gullmarn, Halland, Öresund, Sydkusten, Västra Hanöbukten, Blekingekusten, Kalmar, Gavikfjärden, Råneåfjärden.

B Number of measurements

Table B.1: Number of observations from Anholt E

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	1393	1253	954	1143	1093	1048	1003	1082	421	1020	939	854
5	1827	1764	1111	1007	967	969	873	1000	404	945	858	837
10	1960	1927	1237	1160	1099	1057	1013	1092	430	1039	942	830
15	1903	1864	1165	1078	1032	1032	944	1071	423	1009	879	808
20	1998	1943	1260	1102	1029	1057	971	1087	440	1032	888	694
25	1591	1551	900	798	727	794	689	811	288	770	624	213
30	1985	1940	1261	1116	1029	1047	1009	1080	441	1008	936	204
40	1931	1899	1231	1011	911	1002	923	1038	415	983	853	200
50	1664	1634	1020	802	727	765	743	800	303	751	694	38

Table B.2: Number of observations from Arkona BY2

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	1904	1928	1709	1300	844	622	864	881	552	755	662	571
5	2181	2189	1868	777	597	626	654	738	421	695	513	558
10	2952	2989	2522	1334	843	687	906	913	592	822	703	558
15	2448	2454	1922	845	594	621	647	728	409	689	508	443
20	2916	2959	2547	1277	757	683	838	933	610	824	598	550
30	2917	2948	2499	1322	770	674	904	903	582	807	640	229
40	2929	2961	2516	1272	711	674	851	929	625	811	566	113
43	1676	1663	1249	394	76	42	103	112	99	66	30	5

Table B.3: Number of observations from Bornholm Deep BY5

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	4873	4398	3290	2281	1621	933	1755	1893	1057	1052	824	717
5	4746	4198	2994	1088	732	880	1011	1042	365	907	682	638
10	7529	7022	4708	2225	1505	1091	1778	1907	1078	1157	855	691
15	6727	6179	3332	1412	1006	875	1253	1334	610	910	655	519
20	7446	6944	5095	2310	1505	1090	1856	1972	1152	1151	839	673
30	7432	6919	4501	2031	1274	1036	1703	1794	1004	1114	768	248
40	7419	6937	4759	2160	1370	1074	1799	1901	1120	1136	852	139
50	7411	6922	4993	2286	1470	1030	1784	1920	1097	1100	762	138
60	7508	7015	5016	2285	1455	1068	1860	1975	1169	1139	790	18
70	6610	6085	4545	1864	1063	991	1490	1589	816	1054	741	15
80	6854	6336	4660	2222	1392	1029	1790	1930	1138	1070	783	10
85	4663	4418	3125	1026	823	178	696	793	575	171	144	4

Table B.4: Number of observations from Bothnian Bay F9

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	784	794	231	426	533	373	397	367	167	364	527	46
5	647	661	101	513	612	508	499	506	220	496	614	44
10	597	609	231	419	507	365	389	358	165	357	493	31
15	348	355	97	303	317	300	289	297	138	290	315	34
20	461	466	226	327	333	322	304	320	150	312	321	20
30	304	303	101	260	256	258	246	258	116	251	257	0
40	623	623	233	385	483	367	350	362	164	359	475	19
50	307	308	108	267	259	262	248	262	117	255	260	0
60	607	609	239	417	502	364	387	356	153	357	498	12
70	349	348	104	312	299	306	297	302	132	297	300	0
80	607	609	239	374	463	367	344	355	156	359	455	12
90	291	292	101	268	257	261	252	257	110	250	257	0
100	495	497	262	371	367	325	351	321	146	317	368	12
110	338	344	331	230	232	230	226	222	90	225	227	12

Table B.5: Number of observations from Bothnian Sea SR5

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	396	396	314	344	334	324	126	307	313	310	332	12
5	402	402	250	263	255	254	113	248	235	247	253	11
10	427	444	335	337	326	316	124	296	301	305	317	11
15	363	363	236	209	207	205	80	200	195	199	206	10
20	433	436	336	320	310	304	118	293	290	292	305	12
30	391	397	260	219	208	212	89	212	201	204	206	1
40	426	433	334	330	318	314	121	299	304	306	313	0
50	393	403	289	227	217	219	90	215	206	209	212	0
60	425	427	356	328	320	312	125	304	301	301	312	0
70	389	393	261	219	208	215	94	211	206	203	206	0
80	422	427	360	333	316	321	117	308	316	313	311	0
90	319	322	201	163	154	156	84	154	146	152	148	0
100	388	397	343	309	306	299	115	292	294	285	298	0

Table B.6: Number of observations from Bothnian Sea US3

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	587	582	355	350	454	275	210	257	213	258	432	27
5	445	444	140	184	288	177	126	176	119	172	271	26
10	606	609	366	333	413	263	203	244	201	253	416	14
15	322	321	141	116	136	108	59	113	102	102	115	14
20	467	463	360	212	203	200	87	197	188	191	205	3
30	329	323	196	177	164	171	79	171	161	165	166	0
40	611	607	371	272	363	264	141	249	214	256	341	15
50	330	329	225	175	163	171	80	172	170	166	169	0
60	596	594	383	318	409	251	202	245	201	242	389	12
70	324	321	218	169	157	162	77	158	158	159	158	0
80	599	597	385	258	344	253	136	247	210	248	324	12
90	270	267	153	128	119	124	76	125	120	119	121	0
100	531	528	381	204	198	197	88	191	190	186	203	12
125	302	305	247	194	181	182	84	183	184	176	186	0
150	520	529	364	290	376	222	200	222	178	211	355	12
175	176	182	180	125	123	123	62	124	121	121	122	0

Table B.7: Number of observations from Fehmarn Belt

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	838	719	439	579	364	397	574	570	441	444	221	253
5	1601	1562	886	501	282	351	495	499	377	335	159	234
10	1683	1667	1069	610	365	430	608	611	486	440	198	234
15	1639	1633	1019	576	342	417	576	577	455	410	181	171
20	1656	1651	1032	593	347	415	593	596	474	427	188	121
26	1603	1578	1020	735	454	557	736	747	557	525	244	30

Table B.8: Number of observations from Gdansk Deep

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	1570	1558	1208	732	233	339	480	498	464	379	225	247
5	1113	1106	683	346	200	278	284	303	270	241	192	116
10	1794	1789	1303	691	239	346	492	509	477	395	227	216
15	1101	1094	680	304	182	254	253	271	238	213	173	43
20	1807	1809	1322	695	240	348	492	510	479	393	228	173
30	1790	1791	1308	661	196	315	457	472	444	369	186	85
40	1747	1749	1251	683	231	345	485	504	480	393	227	4
50	1780	1779	1283	662	193	312	455	467	446	363	190	10
60	1769	1763	1286	700	213	340	467	487	467	380	206	2
70	1762	1754	1282	667	188	306	448	458	443	354	181	3
80	1777	1761	1292	697	231	338	459	475	457	371	216	9
90	1690	1682	1197	641	172	292	408	436	407	330	170	0
100	1590	1577	1100	650	206	322	413	456	419	348	197	1

Table B.9: Number of observations from Gotland Deep BY15

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	1563	1557	1450	1165	814	777	801	950	637	841	705	560
5	1848	1848	1638	782	552	667	586	745	450	694	518	517
10	2457	2478	2242	1168	831	801	809	939	633	842	723	513
15	2019	2015	1745	822	547	663	606	740	449	698	512	417
20	2407	2424	2214	1094	770	794	776	979	678	876	647	506
30	2192	2200	1973	988	623	702	679	847	552	785	564	210
40	2383	2398	2164	1073	751	791	764	972	678	882	636	105
50	2163	2177	1955	1023	653	720	700	881	587	804	580	107
60	2280	2298	2081	1157	748	832	851	996	711	910	658	0
70	1887	1900	1742	914	576	684	661	812	532	749	547	1
80	2214	2217	2028	1051	724	825	775	968	685	882	644	1
90	1753	1751	1569	793	508	643	636	750	475	712	487	0
100	2247	2245	2089	1132	729	879	801	1019	713	907	647	1
125	1954	1955	1755	1045	641	853	759	958	605	835	630	0
150	2150	2147	1749	1160	688	938	821	1035	665	914	639	0
175	1663	1670	1263	899	571	741	651	816	514	771	578	0
200	1948	1956	1487	1102	708	899	764	992	619	868	656	0
225	1599	1616	1210	925	619	739	684	796	480	731	621	0
240	678	678	624	589	379	526	456	548	242	479	415	0

Table B.10: Number of observations from Great Belt

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	4290	4266	3795	1787	1776	730	12	14	1761	1782	1773	1760
5	7956	7936	6873	557	551	502	9	11	538	556	555	547
10	7285	7283	6500	569	559	507	14	16	551	567	565	584
15	7304	7301	6517	559	553	505	11	13	541	557	554	664
20	7352	7350	6588	561	556	504	12	14	543	559	556	553
33	5039	5036	4495	1175	1182	443	1	1	1180	1204	1194	4

Table B.11: Number of observations from Gulf of Finland LL7

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	945	945	659	651	521	536	216	525	552	579	513	80
5	802	796	504	359	286	315	148	326	343	331	278	62
10	931	957	722	575	449	474	219	508	538	516	439	63
15	811	791	446	270	216	237	108	260	254	246	212	8
20	920	941	668	506	386	416	182	469	473	442	376	50
30	873	890	593	394	290	317	147	371	370	343	286	46
40	903	913	666	504	396	430	175	465	469	448	386	3
50	847	860	612	378	282	316	139	360	358	337	272	3
60	788	790	626	435	362	388	134	406	407	389	355	3
70	597	603	484	320	253	281	94	290	297	283	251	3

Table B.12: Number of observations from Gulf of Finland F1

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	340	353	338	319	298	299	81	293	302	304	292	2
5	298	309	236	206	189	190	56	198	195	194	185	2
10	354	377	343	320	287	300	80	294	302	304	281	2
15	276	279	214	165	161	162	44	159	155	156	161	2
20	341	354	313	290	271	275	77	274	276	272	268	2
30	311	324	265	210	181	202	33	198	198	202	180	0
40	336	347	319	289	271	276	79	264	272	270	268	0
50	313	323	281	193	178	190	41	188	186	191	177	0
60	263	271	259	216	208	209	53	203	204	200	206	0

Table B.13: Number of observations from Gulf of Riga

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	435	434	401	403	395	230	242	347	370	360	216	39
5	265	239	178	216	201	171	127	195	198	201	148	41
10	439	433	407	400	391	224	244	341	365	363	210	45
20	435	430	398	384	370	211	234	333	353	341	197	9
30	423	418	392	370	362	200	228	323	332	337	186	5
40	413	407	396	374	362	203	230	327	345	338	192	3
50	282	279	272	253	251	142	162	221	236	222	139	6

Table B.14: Number of observations from Landskrona W

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	3320	3132	2616	1800	1732	1475	1072	1120	1073	1671	1478	1361
5	7793	7650	6623	1508	1474	1237	856	910	893	1414	1291	1240
10	7829	7681	6753	1729	1670	1463	1062	1104	1047	1630	1417	1266
15	7957	7837	6868	1676	1567	1401	1052	1095	1014	1572	1363	1201
20	7980	7866	6930	1750	1652	1483	1090	1127	1092	1640	1428	1100
25	7552	7441	6507	1299	1222	1103	709	772	865	1241	1046	160
30	7910	7792	6835	1570	1482	1312	1052	1084	935	1470	1258	142
40	7593	7489	6543	1524	1449	1292	876	918	977	1446	1268	134
50	5894	5849	5353	486	480	419	281	278	296	463	386	10

Table B.15: Number of observations from Landsort Deep BY31

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	1361	1371	1251	1099	1022	990	819	657	488	985	996	724
5	1555	1493	837	993	896	958	745	614	456	952	863	716
10	1640	1639	1086	1129	1038	1022	848	682	518	1025	1001	718
15	1390	1378	813	984	893	954	736	604	445	952	870	678
20	1598	1611	1559	1078	986	1001	798	688	525	1024	948	716
30	1427	1436	891	1055	919	982	784	670	506	1007	889	552
40	1590	1605	1548	1070	986	993	796	683	524	1017	941	433
50	1379	1392	841	1063	939	989	794	672	518	1015	900	426
60	1501	1519	1474	1067	929	998	798	680	522	1022	904	469
70	1312	1326	950	1040	909	984	785	666	504	1007	890	0
80	1476	1490	1438	1114	986	1017	842	679	516	1010	957	469
90	904	902	825	611	566	587	449	338	265	588	552	0
100	1468	1478	1396	1049	976	988	780	675	504	1008	950	0
125	988	986	898	727	616	686	535	452	372	704	601	0
150	1274	1288	1140	1023	909	980	756	647	484	984	891	0
175	876	875	727	632	521	597	452	371	342	619	530	0
200	1411	1423	1235	1009	947	969	747	637	481	980	930	0
225	528	522	382	277	257	267	206	274	145	262	259	0
250	1076	1084	904	838	809	830	590	478	375	824	815	0
300	1397	1408	1197	997	915	962	741	634	475	967	895	0
400	1335	1330	1149	1040	942	984	789	625	465	965	927	0
440	889	913	812	827	811	825	634	477	337	813	807	0

Table B.16: Number of observations from SE Gotland basin

Depth	T	S	O_2	PO_4	TP	SiO_4	NO_3	NO_2	NO_x	NH_4	TN	Chl
0	992	985	834	766	600	633	625	733	448	656	570	533
5	1273	1276	1121	768	565	661	671	763	483	691	558	496
10	1365	1363	1214	827	652	698	696	799	518	717	628	531
15	1278	1281	1120	759	559	653	665	756	479	692	553	422
20	1357	1360	1218	830	622	702	701	803	522	728	590	495
30	1341	1346	1198	821	584	690	697	795	520	721	564	191
40	1362	1365	1203	826	647	692	686	797	528	724	618	111
50	1350	1348	1204	812	591	685	682	785	517	706	568	111
60	1352	1354	1219	820	578	684	687	787	529	716	563	1
70	1304	1299	1161	757	550	653	647	739	483	673	554	0
80	1325	1317	1181	786	570	677	669	762	512	685	563	2