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Moa Edman, Iréne Wåhlström, Simon Pliscovaz, Daniel Carlsson

Reviewer: Elin Almroth-Rosell
Department: FoU

Summary

Several decades of remedial work have reduced the supply of nutrients from land to sea. Despite this, large-scale eutrophication remains a significant environmental problem along the Swedish coast and release of phosphorus from the sediments exacerbate the problem and reduces the effect of land load reductions. Thus, there is a need to identify where targeted remedial actions would have the most significance, and the highest likelihood to succeed. Additionally, there is a need to map the long-term relation between oxygen concentration and phosphate release from marine sediments in the Swedish coastal zone, which will support the aim to provide a scientific basis for prioritizing remedial targeted actions.

The results presented in this report indicate that there are more than 100 waterbodies along the Swedish coast with significant correlation between low oxygen concentrations and increased release of phosphorus from bottom sediments. However, oxygen concentrations below 1 ml L^{-1} is not the main driver for phosphorus release from Swedish coastal sediments and only three water bodies were found to actually have a net long-term internal source of phosphorus. The results also indicate that the number of years and autumns with an internal net release of phosphorus in the Swedish coastal zone seems to be decreasing, generally, and especially in late summer and autumn. An exception is the coastal zone bordering the northern Baltic Sea where, on an annual basis, the number of years and autumns with a net phosphorus outflux from the sediments seem to increase instead. Finally, it should be noted that locations with a significant correlation between low oxygen concentrations and increased release of phosphorus from bottom sediments do not necessarily overlap with areas with a generally high sediment phosphorus outflux. Thus, both types of areas need to be considered for targeted actions.

Colored Dissolved Organic Matter (CDOM), is the light absorbing fraction of the Dissolved Organic Matter (DOM) and is mainly of terrestrial origin. These substances are highly variable in the coastal zone and absorb and scatter light at different wavelengths and increase the light attenuation in the water column. As a consultation response from the latest Action Program for the Marine Environment an initial literature search of CDOM in Sweden's coastal waters and summary of the available literature and data was completed. It showed that the Swedish coastal observations of CDOM in the SHARKweb database are sparse and only locally occuring. However, the availiable litterature indicates that CDOM likely has a significant effect on the light attenuation in Swedish coastal waters. Future changes in light attenuation in the coastal zone are assumed to be driven largely by the changes in the terrestrial inputs. River discharge is expected to increase in a future climate, and thus also the supply of CDOM and nutrients to the coastal zone.

Sammanfattning

Flera decennier av åtgärdsarbete har minskat tillförseln av näringsämnen från land till våra hav. Trots detta kvarstår storskalig övergödning som ett betydande miljöproblem längs den svenska kusten och utsläpp av fosfor från bottensedimenten förvärrar problemet och minskar effekten av åtgärdsarbetet. Det finns därmed ett behov av att identifiera var riktade åtgärder kan ha störst betydelse och störst sannolikhet att vara framgångsrika. Dessutom finns det ett behov av att kartlägga sambandet mellan syrekoncentration och fosfatsläpp från sedimenten i kustzonen, vilket kommer att stödja arbetet med att tillhandahålla en vetenskaplig grund för att prioritera riktade åtgärder.

Resultaten från denna rapport indikerar att det finns mer än 100 vattenförekomster längs den svenska kusten som har signifikant korrelation mellan låga syrehalter och ökat utsläpp av fosfor från bottensediment. Syrekoncentrationer under 1 ml L^{-1} är dock inte den huvudsakliga orsaken till fosforutsläpp från sedimenten och endast tre vattenförekomster visade sig ha en långsiktig intern fosforkälla. Resultaten tyder också på att nettoutsläpp av fosfor från sedimenten i den svenska kustzonen generellt sker alltmer sällan, särskilt under sensommaren och hösten. Ett undantag är kustzonen som gränsar till Bottniska viken, där nettofosforutflöde från sedimenten på årsbasis istället tycks ske allt oftare. En slutsats är också att platser med en signifikant korrelation mellan låga syrekoncentrationer och utsläpp av fosfor från bottensediment inte nödvändigtvis överlappar med områden med generellt högt sedimentfosforutflöde. Båda typerna av områden måste därför övervägas som lämpliga för riktade åtgärder.

Colored Dissolved Organic Matter (CDOM) är en den ljusabsorberande delen av det lösta organiska material som finns i havs- och kustvatten och är huvudsakligen av terrestriskt ursprung. Dessa ämnen absorberar och sprider ljus vid olika våglängder och ökar ljusutsläckningen i vattenpelaren. Som ett remissvar från det senaste åtgärdsprogrammet för havsmiljön gjordes en första litteratursökning av CDOM i Sveriges kustvatten samt en sammanfattning av tillgänglig litteratur och data. Den visade att de svenska kustobservationerna av CDOM i SHARKweb-databasen är få och endast lokalt förekommande. Dock tyder litteraturen på att CDOM sannolikt har en betydande effekt på ljusutsläckningen i svenska kustvatten och framtida förändringar i ljusutsläckningen i kustvattnet antas till stor del bero av förändringarna i de lösta ämnen som når kusten med flodvattnet. Flodtillrinningen förväntas öka i ett framtida klimat och därmed väntas också tillförseln av CDOM och näringsämnen till kustzonen att öka.

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Background / Problem

Release of phosphorus from sediments in the Swedish coastal zone

This work has been commissioned by the Swedish Agency for Marine and Water Management and financed by contract 03432-2022.

Several decades of remedial work have reduced the supply of nutrients from land to sea. Despite this, large-scale eutrophication remains as a significant environmental problem in the Baltic Sea, not least along the Swedish coast. Long-term deficiency of oxygen cause phosphorus to remain in the cycle instead of being permanently retained in sediments. This exacerbates eutrophication and reduces the effect of land load reductions.

While only a few coastal water bodies suffer from long-term hypoxia, several of them show seasonal hypoxia. This occurs most often in late summer and is expected to cause a short-term, but significant, release of internally stored phosphorus that can quickly cause algal blooms and related damage. This release is mainly expected to have a direct local impact, but could affect nearby coastal water bodies and the open Baltic Sea (Almroth-Rosell, Edman, Eilola, Meier, & Sahlberg, 2016; M. Edman et al., 2018). Residence times and bathymetry within the coastal zone can also affect where the sedimentation of phosphorus-rich material takes place and what consequences it has. Thus, a holistic view of the biogeochemical dynamics in the coastal zone is necessary to locate places where phosphorus dynamics can be successfully affected by management actions.

Part of the remedial work by SWAM (the Swedish Agency for Marine and Water Management) is to identify "hotspots" for internal loading. These can be the subject of targeted remedial work, but the research needed to find these areas also increases our understanding of the processes around internal load and can thus lead to improved model capability.

Coloured dissolved organic matter in coastal waters

Colored Dissolved Organic Matter (CDOM), often called humic substances, is mainly of terrestrial origin and is a light absorbing fraction of the Dissolved Organic Matter (DOM). Other optical variables are phytoplankton, total suspended matter (TSM) and water molecules themselves. These substances are highly variable in the coastal zone and absorb and scatter light at different wavelength and by that, increase the light attenuation in the water column. Light attenuation is a measure of how fast the available light decreases from the surface and down through the water column and consequently, how much light there is available for photosynthesis. Light attenuation is strongly correlated with Secchi depth and the euphotic zone, in which there is enough light for photosynthesis. In addition to the light attenuation substances, the euphotic zone depth varies with the intensity of the incoming solar radiation, which is determined by the latitude and season.

In coastal waters the light attenuation is higher than the open ocean as the river discharge transports a lot of terrestrial organic matter from land to the coastal water. (Harvey et al., 2019). The freshwater with terrestrial CDOM is mixed with saltier water in the coastal zone. Therefore, CDOM is often seen as inversely related to salinity and as a proxy for light attenuation and thereby, Secchi depth (Dupont and Aksnes, 2013).

Aim

The main purpose of this report is to provide a scientific basis for prioritizing targeted action work to reduce the effects phosphorus release from marine sediments in the Swedish coastal zone.

The aim is to set the release of phosphorus from a water body's sediment in relation to local conditions, e.g.,

1. The organic matter production within water bodies
2. The external load from land and surrounding waters
3. Autumn situation

to identify where targeted remedial actions would have the most significance and the highest likelihood to be successful. The relation between oxygen concentration and phosphate release from sediments will also be investigated since it will support the main aim of providing a scientific basis for prioritizing remedial work.

Additionally, an initial literature search of coloured dissolved organic matter in Sweden's coastal waters and summary of the available literature will be presented. This task was added to the study since the consultation response from the latest Action Program for the Marine Environment identified this as a problem along large parts of Sweden's east coast.

Methodology

The analysis was based on results from the Swedish coastal zone model (SCM). The simulation was performed with model version 1.1.1, which is the same version as was delivered to the VattenWeb portal (https://vattenwebb.smhi.se/) in the autumn of 2021, with water bodies defined according to SVAR2016. The analysed period is set to 2011-2020, except when otherwise mentioned. However, the model simulation started two decades earlier to make sure that the sediment nutrient pools were spun up. SCM has previously been described and validated in, e.g., Almroth-Rosell et al. (2016), Moa Edman et al. (2018), Edman (2019).

The seasons were defined to capture different biogeochemical regimes, since that was assumed most valuable for evaluating sediment fluxes. Thus, spring and early summer were combined and set as Mars through June, autumn includes late summer and covers July-October and winter were set to November-February. Spring is then, in a generalized way, the beginning of the growing season with uptake of nutrient in surface waters and sinking of biomass into the coastal sediments, while autumn is the late growing season with remineralization and re-flux of nutrient from the sediments with increased potential for oxygen deficiencies and autumn blooms. Winter is the least biogeochemically active period of the year.

Relation of low oxygen concentrations and phosphorus release

Modelled oxygen concentrations ($[O_2]$) were given in ml L^{-1} with a daily temporal resolution and a vertical resolution of 0.5 to 1 m. The model's oxygen concentrations include "negative oxygen" equivalents to account for hydrogen sulphide 1 ml H_2S L^{-1} = -2 ml O_2 L^{-1} when oxygen is depleted (Fonselius, 1969). The negative concentrations can be seen as an oxygen "debt".

From the model output a subset of oxygen concentrations with values of, or below, 1 ml L^{-1} was defined. The time and depth associated with those values were then used to find the associated phosphorus outflux from the sediments (P_{flux_out}). Phosphorus flux values were converted to µg m^{-2} by dividing the flux with the discrete sediment areas at each depth (dA). No regard was taken to the type of bottom substrate as this is not implemented in the model. The dataset for this analysis thus contains paired values of $[O_2]$ and P_{flux_out} for different depths and times, within different coastal waterbodies. No regard was taken to if the data points were consecutive or not.

The pairs are used to search for situations with high likelihood of causality between the outflux of phosphorus from sediments and the oxygen situation in the water over the sediment. To find such situations the correlation coefficient (r) for subsets of the data is used. At least 10 data points are required for a correlation to be calculated. Large negative correlation coefficients identify location were mitigating low oxygen concentrations is likely to combat high internal phosphorus release.

Relative importance of internal phosphorus release

Different perspectives were used to evaluate the sediment phosphorus release. Each perspective highlighted a way in which the internal release could be problematic or significant. As each perspective was analysed, each water body were ranked from 1-10, where 10 means that the release in that water body is most likely to either be important, problematic, or at the highest risk to become problematic.

The rank is created by normalising with the worst value to come out of each analysis, e.g. the highest net flux or the largest fraction, and then multiplying with 10 and round to the nearest integer. The rounding is done to remove undue separation between water bodies, since the methods should not be seen to give that level of detail.

When no rank can be assigned, e.g. if a property is negative for a water body and only positive values are of interest, the rank is set to 0. A mean rank (MR) is then calculated and the highest scoring coastal water bodies are assumed to be most likely to benefit from targeted activities.

Relative to sedimentation of organic matter

This perspective evaluates if the sediment is acting as a long-term net source of inorganic phosphorus in the coastal zone. Thus, the phosphorus added to the sediment as part of the organic matter falling down to the seafloor (P_{in}) is subtracted from the phosphorus outflux, giving the net phosphorus flux (P_{flux_net}). This difference is then summarized over each year and normalized by the water body's area (A), i.e.

$$P_{flux\_net} = \frac{\sum_{day=1}^{365}(P_{flux\_out} - P_{in})_{day}}{A} \quad (1)$$

and then averaged over the analyse period.

Since this balance between input to, and outflux from, the sediment can shift from year to year, the number of years with a positive P_{flux_net}, i.e. years when the sediment is a net source (Y_{source}), will also be used separate from P_{flux_net} to rank water bodies.

An increased number of years with a net sediment outflux of phosphorus between the two ten-year periods (2011-2020 and 2001-2010) (dY_{source}) was defined as a risk factor for future problems with internal phosphorus release. Thus, also dY_{source} gives a rank separate from P_{flux_net} and Y_{source}.

Ranks assigned from P_{flux_net}, Y_{source} and dY_{source} calculations can be found in Table 2 and Table A1.

The same analysis was performed for the autumn period and ranks assigned from PA_{flux_net}, YA_{source} and dYA_{source} calculations can also be found in Table 2 and Table A1.

Relative to external phosphorus loads

The phosphorus release from the sediment was set in context of the external loads to evaluate if what is added internally is a significant contribution to total load, or not.

The evaluation uses average values for the analyse period. The external load is divided into a direct local load ($Load_{direct}$) and an indirect load from the inflow of nutrients over sounds from other water bodies in the coastal zone, or the open sea ($Load_{sounds}$). $Load_{direct}$ is the sum of the nutrient load from deposition on the sea surface, river discharge and point sources, e.g. industries and sewage treatment plants, which discharge directly into the water body. P_{flux_out} is compared with the external loads as

$$P_{flux\_frac} = \frac{P_{flux\_out}}{(P_{flux\_out} + Load_{direct} + Load_{sounds})} \quad (2)$$

where P_{flux_frac} is the importance of the internal phosphorus release expressed as a fraction of the total load. Ranks assigned from P_{flux_frac}, calculations can be found in Table 2 and Table A 1.

Literature survey and data extraction of CDOM in Swedish waters

A literature survey on CDOM were performed in the Web of Science with keywords such as coloured dissolved organic matter, yellow substances, humic substances and brownification. In addition, observations of CDOM where extracted from the Swedish National archive for oceanographic data, the SHARKweb database. The search for the CDOM data were restricted to be within 1 nm from the Swedish coast. The search resulted in total of 504 measurements from 0 to 84 m depth, but only 24 of these were deeper than 22 m and all those were in the Gaviksfjärden in the Gulf of Bothnia

Results

Relation of low oxygen concentrations and phosphorus release

Almost 33 000 occurences of low oxygen concentrations, distributed over 181 different water bodies, was found and used for the analys (see method section 3.1). An overview of where (water district, WD) and when (time of year) oxygen depletion occurs is shown in Fig. 1. Most occurences are during autumn with the maximun number of occurences in September (Fig.1).

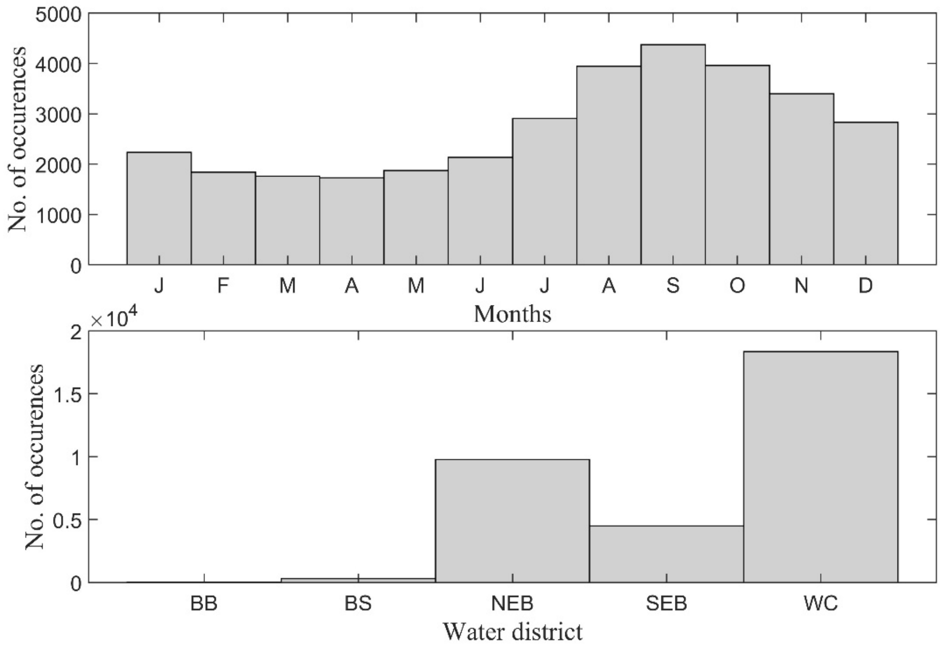

Figure 1. Histograms showing the distribution of low oxygen ($[O_2]$ <= 1 ml L^{-1}) occurrences according to time of year and water district (WC: West Coast, SEB: South-Eastern Baltic, NEB: North-Eastern Baltic, BS: Bothnian Sea, BB: Bothnian Bay).

Low oxygen occurs most frequently on the Swedish West Coast and in the coastal zone boardering the North-Easten Baltic Proper, probably due to these areas having archipelagos and fjords which tend to restrict water exchange and increase the risk of stagnant water prone to hypoxia.

Correlation coefficients for $[O_2]$ below 1 ml L^{-1} and P_{flux_out} were calculated for every unique water body in the dataset and for the 122 water bodies where the correlation was deemed significant ($P<=0.05$), values are shown in Fig. 2 and Table 1.

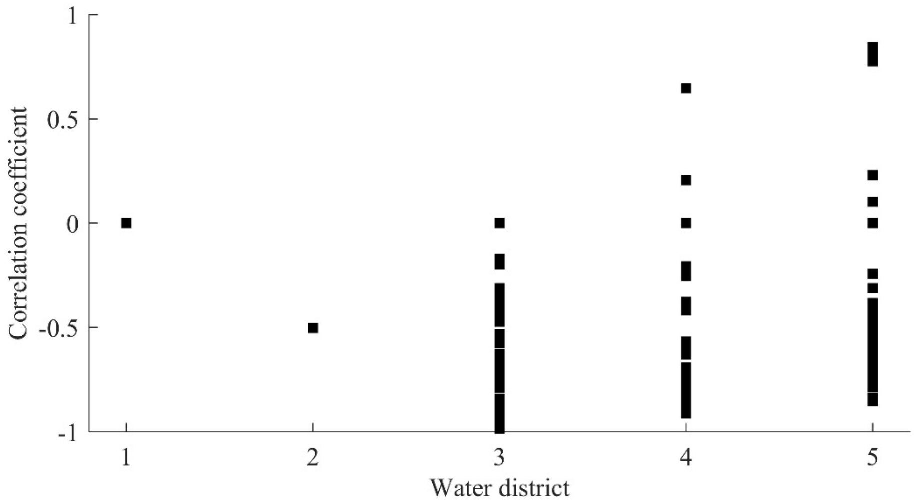

Figure 2. Correlation coefficients for the 122 water bodies with significant correlation ($P<=0.05$) between $[O_2]$ and P_{flux_out} shown according to water district (Bothnia Bay=WD 1, Bothnian Sea=WD 2, North-Eastern Baltic Proper=WD 3, South-Eastern Baltic=WD 4 and the West coast =WD 5).

In the Gulf of Bothnia (WD 1 and 2) only one significant correlation in each water district was found and the correlations are small (Fig. 2 and Fig. 3). The largest negative correlations (P_{flux_out} increase as oxygen concentrations decrease) were found in the North-Eastern Baltic Proper (WD 3), followed by the South-Eastern Baltic and the West coast (WD 4 and 5). Thus, in these water districts there are very likely water bodies with causality between $[O_2] < 1$ ml L^{-1} and increased release of phosphorus originating from the coastal sediments. Note that there are also a few water bodies were there are noticeably high positive correlation between $[O_2]$ and P_{flux_out}.

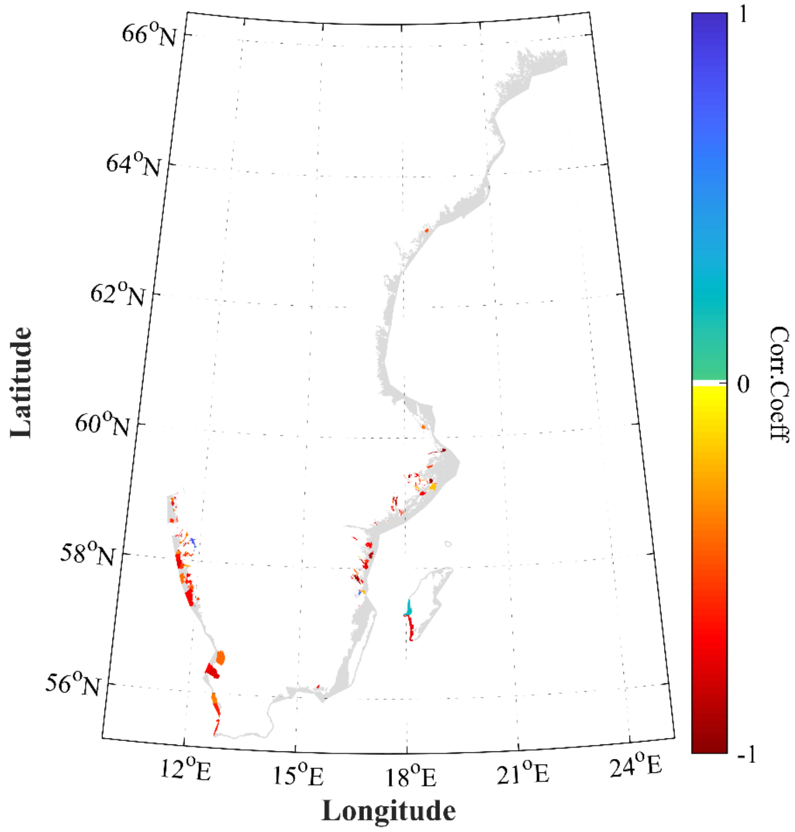

Figure 3. Map of all the correlation coefficients for the 122 water bodies with significant correlation (P<=0.05) between [O_2] and P_{flux_out} in the Swedish coastal zone.

The 40 waterbodies with the highest likelihood of phosphorus release from the sediment caused by oxygen deficiency are listed in Table 1. Out of these 40 water bodies, 8 have a correlation coefficient > 0.9; Ortalaviken, Lindalssundet, Vätösundet, Himmerfjärden, Inre Gamlebyviken, Svärdsfjärden, Igelstaviken and Tranaröfjärden.

Tabell 1. List of the 40 water bodies with the strongest negative correlation between oxygen concentrations and phosphorus release from the sediments. The water bodies are shown in order of the strongest negative correlation coefficient (Corr. Coeff.) first and then decreasing.

Order	Water District	Name	Corr. Coeff.
1	3	Ortalaviken	-0.98
2	3	Lindalssundet	-0.95
3	3	Vätösundet	-0.94
4	3	Himmerfjärden	-0.91
5	4	Inre Gamlebyviken	-0.91
6	3	Svärdsfjärden	-0.91
7	3	Igelstaviken	-0.90
8	3	Tranaröfjärden	-0.90
9	4	Gropviken	-0.89
10	4	Halsöfjärden	-0.89
11	3	Hallsfjärden	-0.88
12	3	Askrikefjärden	-0.87
13	3	Vissvassfjärden	-0.87
14	5	Råssö-Resöfjorden sek namn	-0.85
15	3	Fållnäsviken	-0.85
16	4	Marsviken	-0.84
17	3	Ingaröfjärden	-0.84
18	5	Ljungs kile	-0.84
19	5	Nordströmmarna	-0.84
20	4	Kaggebofjärden	-0.81
21	4	Grönvållsfjärden	-0.79
22	3	Dragfjärden sek namn	-0.79
23	5	Skäldervikens kustvatten	-0.78
24	4	Kärrfjärden	-0.78
25	3	Säbyvik	-0.78
26	5	Yttre Brofjorden	-0.78
27	3	Åvaviken	-0.77
28	4	Västra fjärden	-0.77
29	5	N Yttre Tjärnöarkipelage	-0.76
30	3	Stora Värtan	-0.75
31	4	Inre Valdemarsviken	-0.75
32	5	Askeröfjorden	-0.75
33	4	Pampusfjärden	-0.75
34	4	Merumsfjärden	-0.75
35	5	Käringöfjorden	-0.74
36	5	Dynekilen	-0.72
37	5	Halsviken	-0.72
38	5	Källö fjord	-0.72
39	3	Stadsfjärden	-0.72
40	3	Kalvfjärden	-0.72

Relative importance of internal phosphorus load

Period, and autumn, net flux of phosphorus from sediments

The averaged long-term net flux of phosphorus from the sediment to the water mass is negative, i.e. into the sediment, in almost all water bodies during the analysed period. The only exceptions are three water bodies in the Stockholm archipelago, Strömmen, Lilla Värtan and Stadsfjärden. Only these three waterbodies act as long-term net contributors of phosphorus and emit more phosphorus than they receive during the investigated period. Thus, these are good candidates for measures according to the model. However, for individual years, many water bodies can have a short-term net internal phosphorus source. This will be further explored in the next section. Assigned ranks are shown in Table 2 and Table A1.

The averaged long-term net flux of phosphorus from the sediment in the autumn (PA_{flux_net}) is predominately positive in the Baltic Proper and along the West Coast, while in the Gulf of Bothnia water districts there is a more even distribution between positive and negative fluxes.

Number of years with an internal net source of phosphorus

Even if the long-term analysis in the previous section could only identify three water bodies with net positive sediment release of phosphorus, and also assign a rank to only these three (Table 2 and A1), many more water bodies can have a positive net source on an annual basis (Fig. 4), i.e. these are the waterbodies that can have a net emission of phosphorus from the sediment for certain years, but which generally act as long-term P sinks.

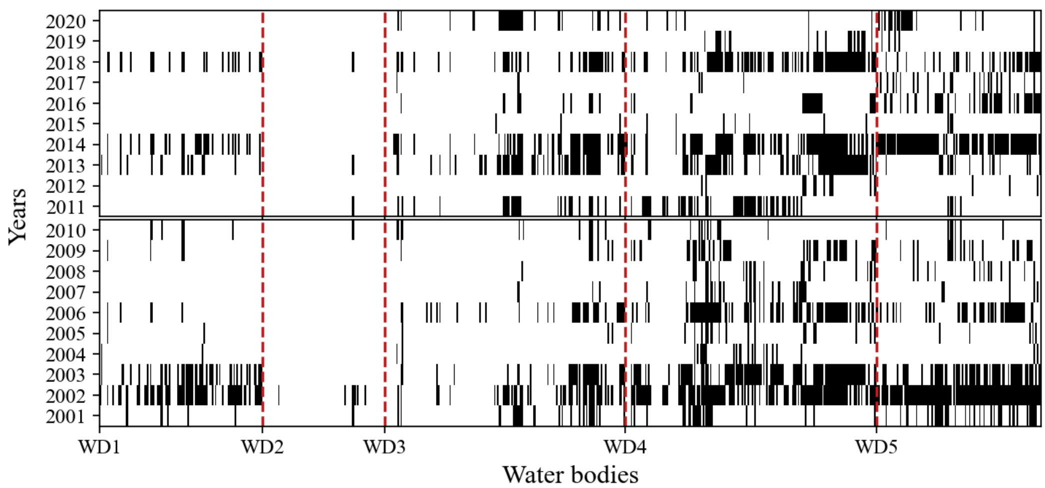

Figure 4. The years (y-axis) when a waterbody (x-axis) has positive net phosphorus flux from the sediment are marked with thin black lines. The water districts are separated with red vertical dashed lines. The analysis period and the previous 10 years are separated horizontally by a division into two boxes. Bothnia Bay=WD 1, Bothnian Sea=WD 2, North-Eastern Baltic Proper=WD 3, South-Eastern Baltic=WD 4 and the West coast =WD 5.

Fig. 4 shows that the years 2002, 2003, 2013, 2014 and 2018 are years where the coastal zone generally leans toward a net out flux of phosphorus from the sediments. In water district 2, i.e. at the Bothnian Sea coast, only a few water bodies experience years with positive P_{flux_net}. However, this could be a model artefact.

If only the autumn is considered, there are an increase in the number of years with positive P_{flux_net} (Fig. 5) relative to considering whole years. There is also a tendency for the number of autumns, or years, with net outflux from the sediment to increase from the Bothnian Bay towards the Swedish West Coast. At the West Coast, the majority of water bodies have a net autumn outflux for all, or almost all, years (Fig. 5).

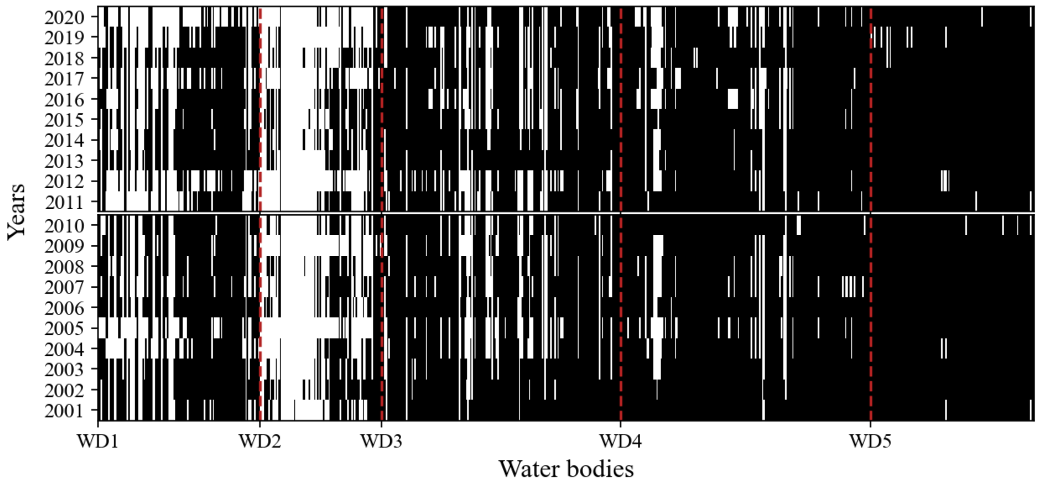

Figure 5. The years (y-axis) when a waterbody (x-axis) has positive net phosphorus flux from the sediment in the autumn period are marked with thin black lines. The water districts are separated with red vertical dashed lines. The analysis period and the previous 10 years are separated horizontally by a division into two boxes. Bothnia Bay=WD 1, Bothnian Sea=WD 2, North-Eastern Baltic Proper=WD 3, South-Eastern Baltic=WD 4 and the West coast =WD 5.

If only the autumn is considered, there are an increase in the number of years with positive P_{flux_net} (Fig. 5) relative to considering whole years. There is also a tendency for the number of autumns, or years, with net outflux from the sediment to increase from the Bothnian Bay towards the Swedish West Coast. At the West Coast, the majority of water bodies have a net autumn outflux for all, or almost all, years (Fig. 5).

However, there seem to be fewer years with a net phosphorus outflux $_{in}$ during the period 2011-2020 compared to the period 2001-2010 (Fig. 6a), especially in the Bothnian Bay and on the West Coast. In autumn the decrease in years is even more pronounced (Fig. 6b). However, in the northern Baltic Proper the number of years and autumns with a net outflux from the sediment seem to increase on an annual basis (Fig. 6a).

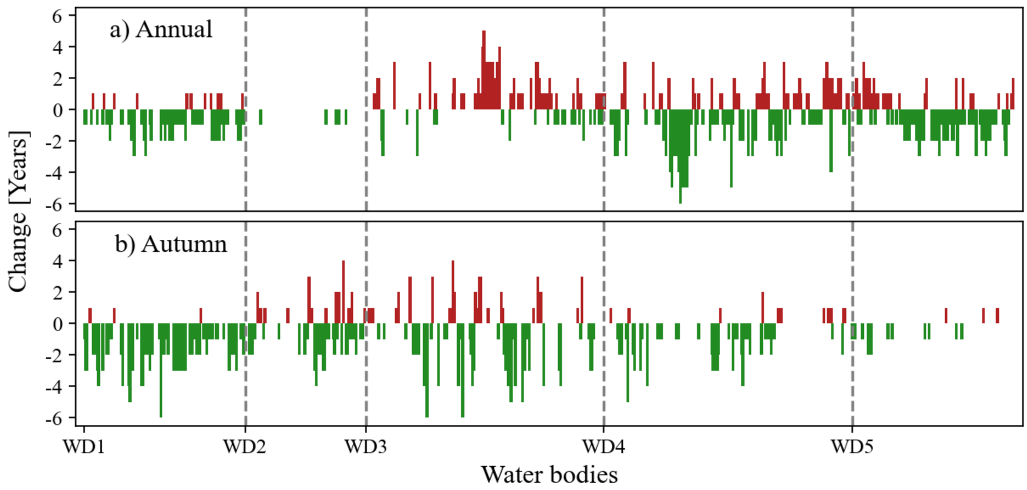

Figure 6. The change in the number of autumns/years with outflux of phosphorus from sediment (y-axis) for a waterbody (x-axis) is shown with red (increasing) or green (decreasing) bars between the two periods 2001-2010 and 2011-2020. *The water districts are separated with red vertical dashed lines. a) Annual averages and b) averaged over late summer and autumn months. Bothnia Bay=WD 1, Bothnian Sea=WD 2, North-Eastern Baltic Proper=WD 3, South-Eastern Baltic=WD 4 and the West coast =WD 5.*

Relative to external phosphorus loads

The fraction of the total phosphorus load that comes from sediments indicates the relative importance of the sediments as an internal phosphorus source. This fraction is variable both within a waterbody (over time) and between waterbodies (Fig. 7). Although there are definitely occasions and locations where the internal phosphorus load dominates, it does not seem to be consistent and the causes are not easy to interpret without further analysis.

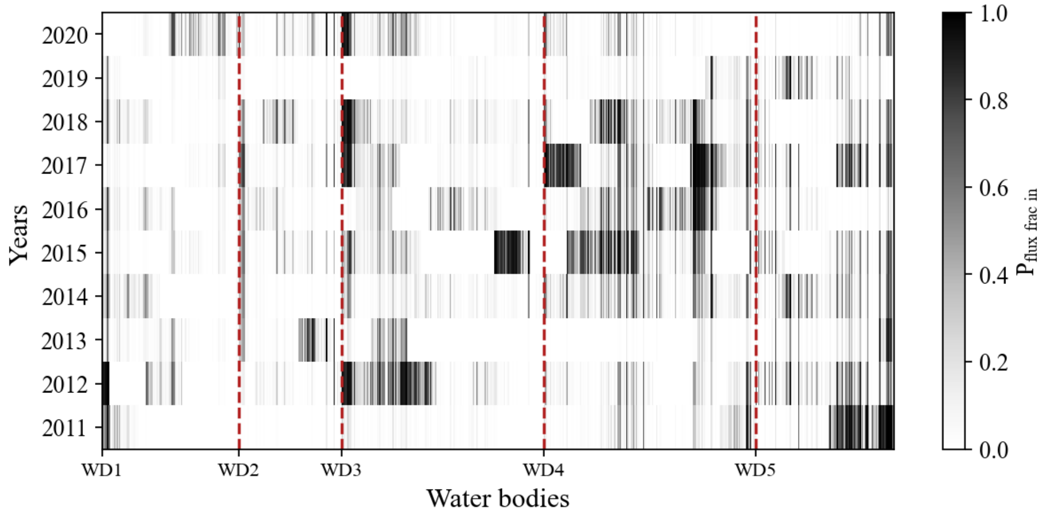

Figure 7. The fraction of the total phosphorus load that is made up of an internal phosphorus load is shown in grey-scale (white=0% and black=100%) shown over years (y-axis) and waterbodies and water districts (x-axis). The water districts are separated with red vertical dashed lines. Bothnia Bay=WD 1, Bothnian Sea=WD 2, North-Eastern Baltic Proper=WD 3, South-Eastern Baltic=WD 4 and the West coast =WD 5.

Prioritizing water bodies for remedial actions

The mean (MR) and individual ranks for the 23 highest scoring water bodies are a listed in Table 2 and shown in a map (Fig. 8), while all waterbody are listed in Table A1 in the appendix. The 23 water bodies in Table 2 are the most likely to benefit from targeted remedial actions.

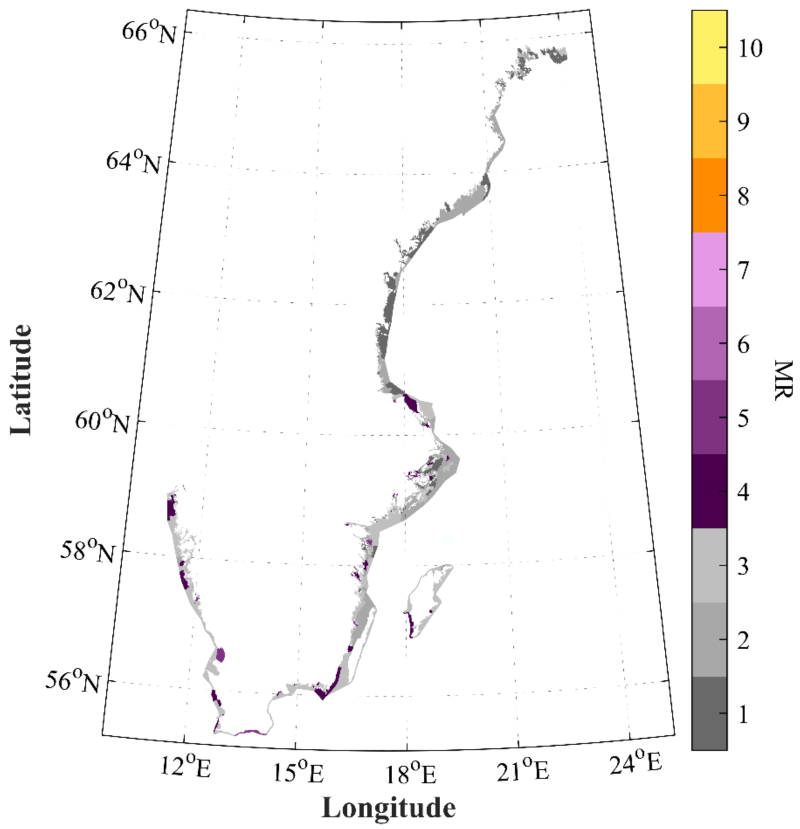

Figure 8. Map of the Swedish coastal zone with the mean rank calculated to identify where targeted remedial actions against internal phosphorus release would have the most significance and the highest likelihood to be successful.

The top five water bodies are; 1) Strömmen, 2) Stadsfjärden, 3) Södra Vaxholmsfjärden, 4) Lilla Värtan and 5) Onsala kustvatten. Notable are that three of these are the three water bodies with a positive mean flux of phosphorus from the sediment on a long-term basis (section 4.2.1), that four of the five are located in North-Eastern Baltic water district, specifically three in the inner Stockholm archipelago, and that one of the five is bordering the open sea (i.e. a boundary water body on the Swedish west coast). The boundary water bodies that are included in Table 2 seem to score high, or relatively high, due to their high fraction of phosphorus from internal sediment release relative to the external sources, and their tendency for outflux of phosphorus from the sediment during autumn.

Table 2. Individual and combined ranking of the 23 waterbodies (23 to avoid breaking the table between water bodies with the same rounded of MR) that are evaluated as most suitability for remedial actions. MR is the mean of the seven individual ranks. P_{flux_net} is the averaged 2011-2020 net outflux of phosphorus from the sediment, Y_{source} is the number of years with a net outflux of phosphorus from the sediment and dY_{source} is how the number of years with a net outflux of phosphorus from the sediment has changed. P_{flux_frac} is the fraction of the total phosphorus load which comes from the net phosphorus flux. PA_{flux_net} is the averaged 2011-2020 autumn net outflux of phosphorus from the sediment, YA_{source} is the number of years with a net autumn outflux of phosphorus from the sediment and dYA_{source} is the how the number of years with a net autumn outflux of phosphorus from the sediment has changed

Order	Water District	Name	MR	P_{flux_net}	Y_{source}	dY_{source}	P_{flux_frac}	PA_{flux_net}	YA_{source}	dYA_{source}
1	3	Strömmen	**5.71**	10	10	4	1	6	9	0
2	3	Stadsfjärden	**4.71**	3	9	0	1	10	10	0
3	3	Södra Vaxholmsfjärden	**4.57**	0	9	10	1	2	10	0
4	3	Lilla Värtan	**4.43**	2	9	6	1	3	10	0
5	5	Onsala kustvatten	**4.43**	0	6	0	10	2	10	3
6	5	N m Hallands kustvatten	**4.29**	0	5	0	10	2	10	3
7	5	Laholmsbuktens kustvatten	**4.29**	0	9	2	4	5	10	0
8	3	Edsviken	**4.14**	0	9	8	1	1	10	0
9	4	Inre Slätbaken	**4.14**	0	9	6	1	3	10	0
10	4	V sydkustens kustvatten	**4.14**	0	9	6	1	3	10	0
11	3	Rindösundet	**4.00**	0	8	8	1	1	10	0
12	3	Kaggfjärden	**4.00**	0	6	6	1	1	6	8
13	4	N n Kalmarsunds utsjövatten	**4.00**	0	3	2	9	1	10	3
14	3	Överbyfjärden	**3.86**	0	6	6	1	1	10	3
15	3	Brunnsviken	**3.86**	0	8	4	1	1	10	3
16	3	Kodjupet	**3.71**	0	8	6	1	1	10	0
17	4	S Kalmarsunds utsjövatten	**3.71**	0	5	0	10	2	9	0
18	4	Yttre Gamlebyviken	**3.71**	0	5	4	1	1	10	5
19	3	Solöfjärden	**3.57**	0	3	2	1	1	10	8
20	3	Trosafjärden	**3.57**	0	8	4	1	2	10	0
21	4	Pampusfjärden	**3.57**	0	8	4	1	2	10	0
22	4	Ö Gotlands s kustvatten	**3.57**	0	6	4	3	2	10	0
23	4	Helsingborgsområdet	**3.57**	0	5	0	4	3	10	3

Literature survey of CDOM in Swedish waters

Swedish coastal waters

The Swedish coastal observations of CDOM in the SHARKweb database are sparse (Fig. 9). The longest timeserie (2017-2021) is from the inner coastal water of the Bay of Bothnia and the Gulf of Bothnia. The highest values of CDOM has been observed in the inner coastal water of the Bay of Bothnia in spring 2018. The CDOM is also relatively high in the central coastal water of Östergötland and Stockholm archipelago with a value of 3.45 m^{-1} in Sjösafjärden in August 2021. In the inner coastal waters of the Northern Baltic Sea, especially in Östhammarsfjärden, Karlholsmfjärden, Berghamraviken and Edeboviken, the CDOM is also relativly high. In the outer coastal water CDOM measurements are even fewer than in the inner and central costal water, but CDOM seem to be lower.

Figure 9. CDOM data available from the SHARKweb database at SMHI within 1 nm from the coast

Harvey et al. (2019) collected samples of Chl-a, suspended particulate inorganic matter (SPIM) and CDOM in coastal waters in three areas around the Swedish coast from 2010-2014, and investigated how much each of them contributes to the Secchi depth. In the northern Baltic Sea (the Bothnian Sea) they found that CDOM absorption is very high and in the Baltic Proper (BP) there is high CDOM absorption and also high suspended particular matter (SPM) near the coast, while in the Skagerrak the CDOM absorption is lower (Harvey et al., 2019). The highest CDOM absorption was found in spring in the Öre estuary in the Bothnian Sea and in one of the sub-areas in the Baltic Proper; Nyköping Bay (BP.4). The lowest CDOM absorption where observed in the Skagerrak area (Fig. 10). For further figures of Secchi depth, Chl-a, SPM, SPIM and total SPM, see Harvey et al. (2019).

In another study in the Öre estuary, they revealed that riverine DOC had a strong negative influence on coastal phytoplankton production, likely due to light attenuation. However, it positively influenced the bacterial production as the supplied DOC was a food source for bacteria. With climate-induced increase in river discharge, the bacteria will probably be favored and thus, the pelagic food web structure and overall productivity will be changed (Andersson et al., 2018).

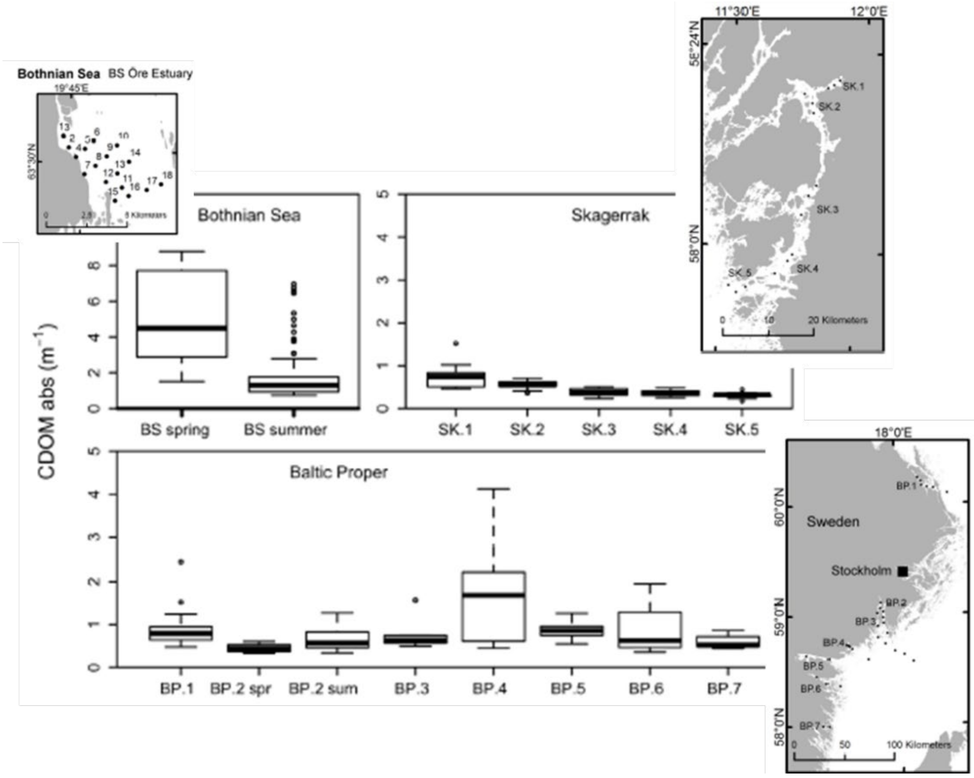

Figure 10. Boxplots of CDOM absorption (m^{-1}) for each region and sub-area. For the Bothnian Sea (BS) and Himmerfjärden (BP.2) in the Baltic Proper (BP), the data is separated for spring and summer. Note, the y-axis differs between regions. Horizontal lines in the boxplots show the median values, horizontal edges of the boxes the 25th and 75th percentiles, the whiskers the minimum and maximum observations within 10th and 90th percentiles, open circles represent outliers. The figure is modified from Harvey et al. (2019)

In the coastal water of Skagerrak, CDOM explained most of the variance in Secchi depth (~70%). In the Bothnian Sea, ~46% was explained by the CDOM alone and 42% by the interaction of CDOM and SPIM. In Baltic Proper the largest contribution was from the interaction of all three variables (53%) with the highest unique contribution from SPIM (17%) (Harvey et al., 2019).
Harvey et al. (2019) also pointed out the importance of taking optical variables, such as CDOM and SPM, into account when setting reference and target levels for Secchi depth for water quality assessment as a eutrophication indicator. Therefore, suggesting enhanced observations of the optical variables, either by measurements or satellite remote sensing.

Coastal waters in Norway

In a review report about the Norwegian coastal waters, they concluded that fjords are sensitive to increased freshwater supply with high content of CDOM and TSM as they are highly stratified (Frigstad et al., 2020, and references therein). They further concluded that the Skagerrak/Southern North Sea have relatively high input of terrestrial DOM and that this will increase with future increased precipitation in boreal regions. They also found that CDOM contributed 71 % to the Secchi depth, indicating that CDOM is the main driver for the light attenuation in this area. Also, future climate-induced glacier melts, as well as permafrost thaw and less land-fast ice, leads to increased coastal erosion that will increase the supply of terrestrial matter to the waters. This could be expected to be most pronounced in northern Sweden. Globally, including the Baltic Sea, they found that the effects of reduced light availability, and its drivers, are comparable around different global coastal systems with negative effects on light demanding organism and positive effects on bacterial and filter feeders.

Future effects

In a future climate, river discharge is expected to increase as climate projections indicate an increase in precipitation. The increase in the river discharge increases the supply of DOM, CDOM, TSM and nutrients to the coastal zone. This means that the light attenuation increases and less light is available for primary production. However, more nutrients also stimulate primary production, which could further increase the light attenuation as the phytoplankton also absorb/scatter light. Ultimately, the changes in light attenuation in the coastal zone are assumed to be driven largely by the changes in the terrestrial inputs.

SMHI’s climate indicator for Sweden shows that the running average annual precipitation has increased since the mid 1970s from around 600 mm to 700 mm (Fig. 11).

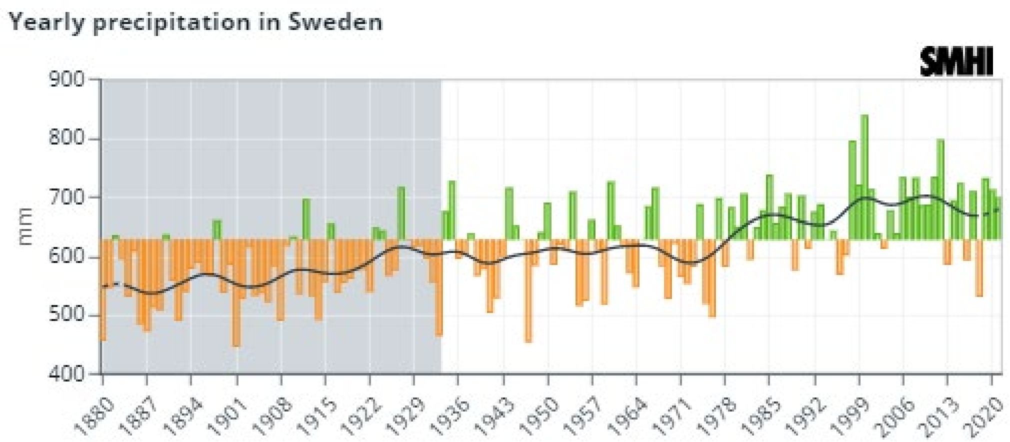

Figure 11. The total precipitation per year. Green bars show higher and orange show lower precipitation than the average for the normal period 1961-1990. The grey line shows a running mean calculated over about ten years. Observations before 1933 are considered to have lower reliability than later observations. This is marked with a grey shadow in the diagram. Caution should be exercised in any climatological conclusions based on this time period. The figure is from the homepage Climate indicators - Precipitation at the Swedish Meteorological and Hydrological Institutes.

Increased precipitation will affect the river runoff and by that the supply of e.g. CDOM. In climate projections (RCP4.5) of changes (%) in annual average river discharge between the period of 2011-2041 and 1971-2000, an increase in the river discharge along the Swedish coastline of the Baltic Sea is observed. de Wit et al. (2016) estimated that an increase of 10% in precipitation will increase the mobilization of organic carbon from soils to freshwaters by at least 30%. They did the estimation from investigating the organic carbon in 474 streams, lakes, and rivers in boreal and subarctic ecosystems in Norway, Sweden, and Finland between 1990 and 2013. Consequently, the input of organic matter that scatter and absorb light increases with increasing precipitation.

Modelling light attenuation in the SCM

In SCM the light attenuation is modelled by a light attenuation coefficient k_d, which considers both scatter and absorption from the water itself, phyto- and zooplankton, detrital matter and CDOM. However, the CDOM component is parameterized from dissolved organic nitrogen (DON), which is currently inert in the SCM and only contributed to by the fraction of river organic matter that is not in Redfield balance (Redfield, 1963).

Discussion

There is surprisingly little overlap between the water bodies listed in Table 1 and 2, which suggests that the causality between oxygen deficiency and phosphorus release is only one possible cause for an internal phosphorus load. If phosphorus has been stored in sediments during periods of high external loads, it's realistic to assume that this would cause a continuously high phosphorus release from sediments for some time afterwards, even after the external loads have abated. The results in this report shows that this residual phosphorus release from previous external loads do not necessarily coincide with phosphorus release during events of oxygen deficiency. To cover both issues when implementing remedial action water bodies from both Table 1 and Table 2 needs to be considered and the ultimate decision on which water bodies to focus resources on will also depend on what mitigation methods are considered.

The positive correlations between phosphorus release and oxygen concentrations could be due to several different things, e.g. the main share of organic matter being mineralised in sediments which do not stay deoxygenated for long, e.g. at shallower regions within a water body, while a smaller fraction of the mineralisation takes place where the water tends to be more stagnant and a larger oxygen debt can build up. However, causation cannot be derived from this correlation and more thorough analyse would be needed, which is outside the scope of this report.

Although a numerical model, like the SCM, is a necessary tool for this type of analyse, it is important to remember that a model is always flawed due to knowledge gaps and lack of observational data to force the simulations and to evaluate the results. However, most of the basins that place high in Table 1 and Table 2 are located in monitored areas and the model skill is overall acceptable. The model skill of the latest set-up of SCM is available at the Vattenwebb portal (vattenwebb.smhi.se) and an extensive evaluation is included in Edman (2019).

There are several boundary basins that got a high mean rank in the evaluation shown in Table 2. One general reason for their high MR is that their external net phosphorus load is not as influenced by high phosphorus loads from land, instead the internal load is mainly compared to the load from the open sea. This can cause internal phosphorus load to be of high relative importance. However, they all also rank as high as possible for their frequency of autumn net release of phosphorus. These types of boundary water bodies also tend to have high water exchange and be highly connected to other water bodies, which arguably means that they can be good candidates due to the high likelihood than a successful abatement of the sediment release can spread to nearby waters. However, this should be investigated more since the effect can also be lost to the open sea, which, while this can of course be beneficial to the environmental state of the Baltic Sea, is not very effective to improve the coastal zone environment.

Note that the rank calculations presented in this report are based on annual and autumnal averages and thus effects from the timing of sediment release, e.g. in relation to the spring bloom or if the autumn release drives additional primary production., is not part of this evaluation.

To further improve the analyse it would be beneficial to also do model simulations with only natural background nutrient loads, i.e. excluding the current anthropogenically induced load, to investigate to which degree the internal load of phosphorus is a result of human activities and to what degree it might be a natural part of how the coastal zone functions. This would further highlight where there are anthropogenic issues that need targeted actions.

Conclusions

The highest-ranking waterbodies from both the analysis of the correlation between oxygen concentrations and phosphorus release from the sediments (Table 1) and from the ranking due to the relation of sediment phosphorus release and local conditions (Table 2) are likely to benefit from targeted remedial actions.

The main conclusions from this report are that:

1. More than 100 waterbodies along the Swedish coast have significant correlation between low oxygen concentrations and increased release of phosphorus from bottom sediments.
2. The correlation between low oxygen concentrations and an increased release of phosphorus from bottom sediments mainly occur in the coastal zone of the Baltic Proper and on the West Coast (WD 3, 4 and 5).
3. Oxygen concentrations below 1 ml L^{-1} is not the main driver for phosphorus release from Swedish coastal sediments.
4. Three water bodies were found to have a net long-term internal source of phosphorus.
5. The number of years with an internal net release of phosphorus in the Swedish coastal zone seem to be decreasing, generally, and especially in late summer and autumn.
6. However, on an annual basis the number of years and autumns with a net phosphorus outflux from the sediment seems to increase in the coastal zone bordering the northern Baltic Sea.
7. Locations with a significant correlation between low oxygen concentrations and increased release of phosphorus from bottom sediments do not necessarily overlap with areas with a generally high sediment phosphorus outflux. Thus, both types of areas need to be considered for targeted remedial actions.
8. The Swedish coastal observations of CDOM in the SHARKweb database are sparse and localized.
9. CDOM likely has a significant effect on the light attenuation in Swedish coastal waters and future changes in light attenuation in the coastal zone are assumed to be driven largely by the changes in the terrestrial inputs.
10. In a future climate the river discharge is expected to increase and, consequently, also the supply of DOM, CDOM, TSM and nutrients to the coastal zone.

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Appendix

Table A1. Individual and combined ranking of Sweden's coastal water bodies.

WD	Name	**MR**	P_{flux_net}	Y_{source}	dY_{source}	P_{flux_frac}	PA_{flux_net}	YA_{source}	dYA_{source}
1	Norrbottens skärgårds kustvatten	**1.43**	0	0	0	1	1	8	0
1	N m Bottenvikens kustvatten	**1.29**	0	2	0	1	0	6	0
1	S Bottenvikens kustvatten	**0.29**	0	0	0	1	0	1	0
1	N n Kvarkens kustvatten	**1.43**	0	0	0	1	1	8	0
1	S n Kvarkens kustvatten	**2.14**	0	0	0	2	1	9	3
1	Haparandafjärden sek namn	**2.57**	0	5	0	1	3	9	0
1	Skomakarfjärden	**1.86**	0	2	2	1	1	7	0
1	Katajafjärden	**0.14**	0	0	0	1	0	0	0
1	Hamnskärsfjärden	**0.86**	0	0	0	1	0	5	0
1	Knivskärsfjärden	**0.86**	0	0	0	1	0	5	0
1	Enskärsfjärden	**0.57**	0	0	0	1	0	3	0
1	Seskaröfjärden	**0.14**	0	0	0	1	0	0	0
1	S. Seskaröfjärden sek namn	**0.14**	0	0	0	1	0	0	0
1	Bodöfjärden	**0.86**	0	0	0	1	0	5	0
1	Repskärsfjärden	**2.57**	0	5	2	1	1	9	0
1	Törefjärden	**1.71**	0	2	0	1	1	8	0
1	Siknäsfjärden	**0.71**	0	0	0	1	0	4	0
1	Rånöfjärden	**0.14**	0	0	0	1	0	0	0
1	Storöfjärden	**1.43**	0	0	0	1	1	8	0
1	Båtöfjärden	**1.71**	0	2	0	1	1	8	0
1	Bergöfjärden	**0.14**	0	0	0	1	0	0	0
1	Rånefjärden	**2.71**	0	3	2	1	1	9	3
1	Gussöfjärden	**0.29**	0	0	0	1	0	1	0
1	N. Sigfridsöfjärden	**0.14**	0	0	0	1	0	0	0
1	Tistersöfjärden	**0.14**	0	0	0	1	0	0	0
1	S. Sigfridsöfjärden	**0.14**	0	0	0	1	0	0	0
1	Fjuksöfjärden	**1.14**	0	0	0	1	0	7	0
1	Bergnäsfjärden	**1.29**	0	2	0	1	1	5	0
1	Björköfjärden	**0.14**	0	0	0	1	0	0	0
1	Hamnöfjärden	**0.14**	0	0	0	1	0	0	0
1	Hindersöfjärden	**0.14**	0	0	0	1	0	0	0
1	Degeröfjärden	**0.29**	0	0	0	1	0	1	0
1	Saxskärsfjärden	**0.29**	0	0	0	1	0	1	0
1	Bastaskärsfjärden	**1.29**	0	0	0	1	1	7	0

1	Sörbrändöfjärden	**0.57**	0	0	0	1	0	3	0
1	Inre Lulefjärden	**2.43**	0	3	0	1	3	10	0
1	Yttre Lulefjärden	**2.57**	0	5	0	1	2	10	0
1	Sandöfjärden	**2.14**	0	3	2	1	1	8	0
1	Germandöfjärden	**0.14**	0	0	0	1	0	0	0
1	Västantillfjärden	**0.14**	0	0	0	1	0	0	0
1	Sandgrönnfjärden	**0.71**	0	0	0	1	0	4	0
1	Börstskärsfjärden	**0.57**	0	0	0	1	0	3	0
1	Mannöfjärden	**1.71**	0	2	0	1	1	8	0
1	Holfjärden	**1.71**	0	2	0	1	1	8	0
1	Bastafjärden	**0.14**	0	0	0	1	0	0	0
1	Brändöfjärden	**1.43**	0	2	0	1	1	6	0
1	Harrbäcksfjärden	**1.57**	0	2	0	1	1	7	0
1	Storfjärden	**1.43**	0	0	0	1	1	8	0
1	Håkansöfjärden	**1.57**	0	3	0	1	1	6	0
1	Bärtnäsfjärden	**0.14**	0	0	0	1	0	0	0
1	Rävahavet	**0.14**	0	0	0	1	0	0	0
1	Nördfjärden	**0.14**	0	0	0	1	0	0	0
1	Davids stenar	**0.14**	0	0	0	1	0	0	0
1	Haraholmsfjärden	**0.57**	0	0	0	1	0	3	0
1	Mjoöfjärden sek namn	**0.57**	0	0	0	1	0	3	0
1	Baggholmsdraget	**1.14**	0	0	0	1	0	7	0
1	Vargödraget	**1.29**	0	0	0	1	1	7	0
1	Inrefjärden	**2.71**	0	5	0	1	4	9	0
1	Yttrefjärden	**2.29**	0	5	0	1	2	8	0
1	Bondöfjärden	**0.86**	0	0	0	1	0	5	0
1	Jävrefjärden	**1.57**	0	0	0	1	1	9	0
1	Bursfjärden	**1.86**	0	2	0	1	1	9	0
1	Kinnbäcksfjärden	**1.14**	0	0	0	1	1	6	0
1	Åbyfjärden	**1.57**	0	2	0	1	1	7	0
1	Tåmfjärden	**1.57**	0	2	0	1	1	7	0
1	Byskefjärden	**1.29**	0	0	0	1	1	7	0
1	Rösnäsfjärden	**1.57**	0	2	0	1	1	7	0
1	Bredviksfjärden	**1.57**	0	2	0	1	1	7	0
1	Inre Kågefjärden	**1.71**	0	2	0	1	1	8	0
1	Kågefjärden	**1.57**	0	2	0	1	1	7	0
1	Boviksfjärden	**1.71**	0	2	0	1	1	8	0
1	Hålfjärden	**1.57**	0	2	0	1	1	7	0
1	Ursviksfjärden	**3.14**	0	5	2	1	4	10	0
1	Sörfjärden	**2.00**	0	2	0	1	1	10	0
1	Ytterviksfjärden	**1.71**	0	3	0	1	1	7	0
1	Simpan	**2.29**	0	2	2	1	1	10	0
1	Skelleftehamnsfjärden	**1.43**	0	0	0	1	1	8	0
1	Burefjärden	**1.57**	0	0	0	1	1	9	0
1	Storsladan	**1.86**	0	2	0	1	1	9	0
1	Skelleftebukten	**0.71**	0	0	0	1	0	4	0
1	Bäckfjärden	**1.57**	0	0	0	1	1	9	0
1	Bjuröfjärden	**0.86**	0	0	0	1	0	5	0

1	Blackefjärden	**2.00**	0	0	0	1	1	9	3
1	Kallviken	**1.57**	0	0	0	1	1	9	0
1	Lövselefjärden	**1.43**	0	0	0	1	1	8	0
1	Gumbodafjärden	**2.43**	0	3	2	1	1	10	0
1	Vändskärsfjärden	**1.29**	0	0	0	1	1	7	0
1	Sikeåfjärden	**1.57**	0	0	0	1	1	9	0
1	Ricklefjärden	**1.57**	0	0	0	1	1	9	0
1	Bygdefjärden	**2.29**	0	3	2	1	1	9	0
1	Ostnäsfjärden	**1.57**	0	0	0	1	1	9	0
1	Ytterbodafjärden	**1.71**	0	0	0	1	1	10	0
1	Lillfjärden	**2.29**	0	3	0	1	2	10	0
1	Täftefjärden	**1.43**	0	0	0	1	1	8	0
1	Tavlefjärden	**2.71**	0	5	2	1	2	9	0
1	Yttre Täftefjärden	**1.71**	0	0	0	1	1	10	0
1	Österfjärden	**2.57**	0	3	2	1	2	10	0
1	Fjärdgrundsområdet sek namn	**1.71**	0	0	0	1	1	10	0
1	Västerfjärden	**1.57**	0	0	0	1	1	9	0
1	Mjölefjärden	**1.71**	0	0	0	1	1	10	0
1	Hörnefors området sek namn	**1.71**	0	0	0	1	1	10	0
1	Örefjärden	**1.43**	0	0	0	1	1	8	0
1	Mulöviken	**1.29**	0	2	0	1	1	5	0
1	Granöfjärden	**0.14**	0	0	0	1	0	0	0
1	Möröfjärden	**1.86**	0	3	0	1	1	8	0
1	Ersnäsfjärden	**0.29**	0	0	0	1	0	1	0
1	M?ttsundsfjärden	**0.43**	0	0	0	1	0	2	0
1	Sandvikssundet	**1.29**	0	0	0	1	1	7	0
1	Raggavaviken	**1.71**	0	0	0	1	1	10	0
1	Österlångslädan	**1.14**	0	0	0	1	1	6	0
1	Megrundsområdet	**1.43**	0	0	0	1	1	8	0
1	Kroksfjärden	**2.86**	0	5	2	1	2	10	0
1	Slumpfjärden	**1.57**	0	2	0	1	1	7	0
2	N Bottenhavets kustvatten	**0.14**	0	0	0	1	0	0	0
2	N Höga kustens kustvatten	**0.14**	0	0	0	1	0	0	0
2	N M Bottenhavets kustvatten	**0.14**	0	0	0	1	0	0	0
2	N S M Bottenhavets kustvatten	**0.43**	0	0	0	2	0	1	0
2	Gävlebuktens utsjövatten	**0.43**	0	0	0	2	0	1	0
2	Yttre Nordmalingfjärden	**0.86**	0	0	0	1	1	4	0
2	Nordmalingsfjärden	**1.14**	0	0	0	1	1	6	0
2	Degerfjärden	**0.14**	0	0	0	1	0	0	0
2	Husumsbukten	**0.71**	0	0	0	1	0	4	0

2	Risöfjärden	**1.43**	0	0	0	1	0	4	5
2	Havsfjärden sek namn	**0.14**	0	0	0	1	0	0	0
2	Idbyfjärden	**1.57**	0	0	0	1	1	6	3
2	Nötbolandsfjärden	**0.14**	0	0	0	1	0	0	0
2	Dekarsöfjärden	**1.00**	0	0	0	1	1	5	0
2	Örnsköldsviksfjärden	**2.29**	0	0	0	1	2	10	3
2	Gullviksfjärden sek namn	**0.14**	0	0	0	1	0	0	0
2	Bäckfjärden	**0.14**	0	0	0	1	0	0	0
2	Nätrafjärden	**0.14**	0	0	0	1	0	0	0
2	Mjältöfjärden sek namn	**0.14**	0	0	0	1	0	0	0
2	Näskefjärden	**0.14**	0	0	0	1	0	0	0
2	Ullångersfjärden	**0.14**	0	0	0	1	0	0	0
2	Norrfjärden	**0.14**	0	0	0	1	0	0	0
2	Dockstafjärden	**0.14**	0	0	0	1	0	0	0
2	Omnefjärden	**0.14**	0	0	0	1	0	0	0
2	Edsätterfjärden	**0.14**	0	0	0	1	0	0	0
2	Gaviksfjärden	**0.14**	0	0	0	1	0	0	0
2	Grönsviksfjärden	**0.14**	0	0	0	1	0	0	0
2	Norafjärden	**0.14**	0	0	0	1	0	0	0
2	Storfjärden	**0.14**	0	0	0	1	0	0	0
2	Hemsösundet sek namn	**0.14**	0	0	0	1	0	0	0
2	Ramöfjärden sek namn	**0.86**	0	0	0	1	0	2	3
2	Kramforsfjärden sek namn	**0.57**	0	0	0	2	0	2	0
2	Bollstafjärden	**0.14**	0	0	0	1	0	0	0
2	Norra sundet	**0.14**	0	0	0	1	0	0	0
2	Södra Sundet	**0.29**	0	0	0	1	0	1	0
2	Älandsfjärden	**0.14**	0	0	0	1	0	0	0
2	Åvikebukten	**0.14**	0	0	0	1	0	0	0
2	Sundsvallsbukten	**0.14**	0	0	0	1	0	0	0
2	Klingerfjärden	**0.57**	0	0	0	1	0	3	0
2	Alnösundet	**0.14**	0	0	0	1	0	0	0
2	Sundsvallsfjärden	**1.29**	0	0	0	1	1	7	0
2	Draget	**0.14**	0	0	0	1	0	0	0
2	Svartviksfjärden	**1.00**	0	0	0	1	1	5	0
2	Björköfjärden	**0.14**	0	0	0	1	0	0	0
2	Agöfjärden sek namn	**0.14**	0	0	0	1	0	0	0
2	Hudiksvallsfjärden	**1.86**	0	0	0	1	0	4	8
2	Gårdsfjärden	**1.71**	0	0	0	1	1	7	3
2	Njutångersfjärden	**1.14**	0	0	0	1	0	4	3
2	Siviksfjärden	**0.14**	0	0	0	1	0	0	0
2	Hålsängesfjärden	**0.86**	0	0	0	1	0	5	0
2	Enångersfjärden	**0.71**	0	0	0	1	0	4	0
2	Långvindsfjärden	**1.29**	0	0	0	1	1	7	0

2	Skärsåfjärden sek namn	**1.14**	0	0	0	1	1	6	0
2	Midsommarfjärden	**1.29**	0	0	0	1	1	7	0
2	Sandarnesfjärden sek namn	**1.14**	0	0	0	1	1	6	0
2	Söderhamnsfjärden	**1.29**	0	0	0	1	1	7	0
2	Vallviksfjärden sek namn	**0.14**	0	0	0	1	0	0	0
2	Ljusnefjärden	**2.14**	0	0	0	1	1	10	3
2	Kusöfjärden sek namn	**1.29**	0	0	0	1	1	7	0
2	Axmarfjärden	**1.43**	0	0	0	1	1	8	0
2	Skutskärsfjärden sek namn	**1.00**	0	0	0	2	0	5	0
2	Yttre Fjärden	**0.57**	0	0	0	1	0	3	0
2	Inre Fjärden	**2.57**	0	5	0	1	3	9	0
2	Avan	**2.43**	0	5	0	1	3	8	0
2	Avafjärden	**1.29**	0	0	0	1	0	3	5
2	Sannafjärden	**0.71**	0	0	0	1	0	4	0
2	Ulträfjärden	**1.71**	0	0	0	1	0	6	5
2	Ällöviken	**0.71**	0	0	0	1	0	4	0
2	Tennviken	**0.14**	0	0	0	1	0	0	0
2	Åvikfjärden	**2.29**	0	0	0	1	0	5	10
2	Yttre Gaviksfjärden	**0.14**	0	0	0	1	0	0	0
2	Sörleviken	**1.00**	0	0	0	1	1	5	0
2	S Höga kustens kustvatten	**0.43**	0	0	0	2	0	1	0
2	Inre Tynderösundet	**1.14**	0	0	0	1	0	4	3
2	Juniskär-Bergsfjärden	**0.57**	0	0	0	1	0	3	0
2	Salen	**1.86**	0	0	0	1	0	7	5
2	Yttre Björköfjärden	**1.14**	0	0	0	1	1	6	0
2	Lubban	**1.14**	0	0	0	1	0	7	0
2	S S M Bottenhavets kustvatten	**0.29**	0	0	0	2	0	0	0
2	Norrsundet	**1.71**	0	0	0	1	1	10	0
2	Fårholmen	**1.71**	0	0	0	1	1	10	0
2	Hamnskär	**1.43**	0	0	0	1	1	8	0
2	Iggösundet	**1.71**	0	0	0	1	1	10	0
2	Hilleviksfjärden	**1.57**	0	0	0	1	1	9	0
2	Harkskärsfjärden	**2.14**	0	0	0	1	1	10	3
3	Öregrunds kustvatten	**1.86**	0	0	0	2	1	10	0
3	Östhammars kustvatten	**1.71**	0	0	0	1	1	10	0
3	Stockholms skärgårds n n	**1.14**	0	0	0	1	0	4	3
3	Stockholms skärgårds s n	**1.43**	0	0	0	1	1	5	3
3	Stockholms skärgårds m kustvatten	**1.86**	0	0	0	2	1	10	0

3	Stockholms skärgårds s kustvatten	**2.14**	0	0	0	2	1	9	3
3	Krabbfjärden	**2.43**	0	2	2	2	1	10	0
3	Kränkfjärden sek namn	**2.29**	0	2	2	1	1	10	0
3	Lövstabukten	**3.14**	0	6	4	1	1	10	0
3	Karlholmsfjärden	**3.43**	0	8	4	1	2	9	0
3	Öregrundsgrepen	**1.71**	0	0	0	1	1	10	0
3	Kallriga Fjärden	**2.71**	0	6	0	1	2	10	0
3	Gällfjärden	**2.14**	0	3	0	1	1	10	0
3	Ängsfjärden sek namn	**1.57**	0	0	0	1	1	9	0
3	Kasfjärden sek namn	**1.71**	0	0	0	1	1	10	0
3	Norrfjärden	**1.71**	0	0	0	1	1	10	0
3	Raggaröfjärden	**1.71**	0	0	0	1	1	10	0
3	Östhammarfjärden sek namn	**0.43**	0	0	0	1	0	2	0
3	Galtfjärden	**1.71**	0	0	0	1	1	10	0
3	Hargsviken	**1.71**	0	0	0	1	1	10	0
3	Edeboviken	**3.29**	0	5	6	1	1	10	0
3	Singöfjärden	**2.00**	0	0	0	1	1	9	3
3	Ortalaviken	**1.71**	0	0	0	1	1	10	0
3	Havssvalget	**2.29**	0	0	0	1	1	9	5
3	N Lidöfjärden sek namn	**1.71**	0	0	0	1	1	10	0
3	Björköfjärden	**1.71**	0	0	0	1	1	10	0
3	Vätösundet	**1.71**	0	0	0	1	1	10	0
3	Norrtäljeviken	**1.71**	0	0	0	1	1	10	0
3	Tjocköfjärden	**1.57**	0	0	0	1	1	9	0
3	Söderarms skärgård	**1.71**	0	0	0	1	1	10	0
3	Granhamnsfjärden	**1.71**	0	0	0	1	1	10	0
3	Uddjupet	**3.14**	0	0	0	5	1	8	8
3	Nåtfjärden	**2.00**	0	2	0	1	1	10	0
3	Vidingefjärden	**1.57**	0	0	0	2	1	8	0
3	Gräsköfjärden	**1.57**	0	0	0	2	1	8	0
3	Ålandsfjärden sek namn	**1.57**	0	0	0	2	1	8	0
3	Långfjärden	**1.71**	0	0	0	1	1	10	0
3	Åkeröfjärden	**1.57**	0	2	0	1	1	7	0
3	Stenfjärden	**2.71**	0	3	2	3	1	10	0
3	Lökharfjärden	**1.86**	0	0	0	2	1	10	0
3	Nö Kobbfjärden sek namn	**1.86**	0	0	0	2	1	10	0
3	Kobbfjärden	**0.57**	0	0	0	2	0	2	0
3	Svartlögafjärden	**1.57**	0	0	0	2	1	8	0
3	Blidösund	**0.86**	0	0	0	1	1	4	0
3	Yxlaområdet	**1.71**	0	0	0	1	1	10	0
3	Bergshamraviken	**3.43**	0	6	6	1	1	10	0
3	Skatfjärden	**1.57**	0	0	0	1	1	9	0
3	Norrfjärden sek namn	**2.71**	0	0	0	1	1	9	8
3	Gälnan	**1.71**	0	0	0	1	1	10	0

3	Högfjärden	**2.29**	0	2	2	1	1	10	0
3	Ormskärsfjärden sek namn	**1.71**	0	0	0	1	1	10	0
3	Kallskärsfjärden	**1.14**	0	0	0	1	1	6	0
3	Gillögafjärden	**1.71**	0	0	0	1	1	10	0
3	Björkskärsfjärden	**1.71**	0	0	0	1	1	10	0
3	Möja västerfjärd	**0.14**	0	0	0	1	0	0	0
3	Möja söderfjärd	**0.57**	0	0	0	1	0	3	0
3	Träsköfjärden	**1.57**	0	0	0	1	1	9	0
3	Skagsfjärden	**1.43**	0	0	0	1	1	8	0
3	Sollenkrokafjärden	**1.14**	0	0	0	1	1	6	0
3	Sandöfjärden	**1.14**	0	0	0	1	0	4	3
3	Östra Saxarfjärden	**0.14**	0	0	0	1	0	0	0
3	Västra Saxarfjärden	**3.00**	0	2	2	1	0	6	10
3	Lindalssundet	**3.43**	0	3	4	1	1	10	5
3	Kanholmsfjärden	**0.29**	0	0	0	1	0	1	0
3	Rödkobbsfjärden	**1.71**	0	0	0	1	1	10	0
3	Eknösundet	**0.43**	0	0	0	1	0	2	0
3	Getholmsfjärden sek namn	**2.00**	0	2	0	1	1	10	0
3	Breviken	**2.14**	0	2	2	1	1	9	0
3	Älgöfjärden	**0.86**	0	0	0	1	1	4	0
3	Brandfjärden	**2.29**	0	2	2	1	1	10	0
3	Bulleröfjärden	**2.00**	0	2	0	1	1	10	0
3	Norrfjärden	**1.71**	0	0	0	1	1	10	0
3	Kalkkobbsfjärden	**1.71**	0	0	0	1	1	10	0
3	Nämdöfjärden	**0.57**	0	0	0	1	0	3	0
3	Tranaröfjärden	**0.29**	0	0	0	1	0	1	0
3	Våmfjärden	**0.29**	0	0	0	1	0	1	0
3	Lagnöström	**1.29**	0	2	0	1	1	5	0
3	Grisslingen	**2.29**	0	2	2	1	1	5	5
3	Kolström	**2.00**	0	2	0	1	1	10	0
3	Torsbyfjärden	**3.43**	0	5	4	1	1	10	3
3	Solöfjärden	**3.57**	0	3	2	1	1	10	8
3	Trälhavet	**3.00**	0	2	2	1	1	7	8
3	Rindösundet	**4.00**	0	8	8	1	1	10	0
3	Södra Vaxholmsfjärden	**4.57**	0	9	10	1	2	10	0
3	Norra Vaxholmsfjärden	**3.43**	0	6	6	1	1	10	0
3	Kodjupet	**3.71**	0	8	6	1	1	10	0
3	Överbyfjärden	**3.86**	0	6	6	1	1	10	3
3	Säbyvik	**2.71**	0	3	4	1	1	10	0
3	Tallaröfjärden	**3.43**	0	6	6	1	1	10	0
3	Askrikefjärden	**3.43**	0	6	6	1	1	10	0
3	Stora Värtan	**3.29**	0	6	4	1	2	10	0
3	Kyrkfjärden	**3.14**	0	6	4	1	1	10	0
3	Lilla Värtan	**4.43**	2	9	6	1	3	10	0
3	Strömmen	**5.71**	10	10	4	1	6	9	0
3	Edsviken	**4.14**	0	9	8	1	1	10	0

3	Skurusundet	**2.86**	0	5	0	1	1	8	5
3	Baggensfjärden	**0.86**	0	0	0	1	0	2	3
3	Erstaviken	**0.29**	0	0	0	1	0	1	0
3	Ingaröfjärden	**0.43**	0	0	0	1	0	2	0
3	Björnöfjärden	**2.00**	0	2	0	1	1	10	0
3	Gränöfjärden	**1.14**	0	0	0	1	1	6	0
3	Åvaviken	**1.71**	0	0	0	1	1	10	0
3	Vissvassfjärden	**1.14**	0	2	2	1	0	3	0
3	Ällmorafjärden	**0.57**	0	2	0	1	0	1	0
3	Kalvfjärden	**2.57**	0	5	4	1	1	7	0
3	Jungfrufjärden	**0.43**	0	0	0	1	0	2	0
3	Biskopsfjärden	**2.00**	0	2	0	1	1	10	0
3	Norstensfjärden	**2.29**	0	2	2	1	1	10	0
3	Hanstensfjärden	**2.29**	0	2	2	1	1	10	0
3	Fåglaröfjärden sek namn	**1.71**	0	0	0	1	1	10	0
3	Sandemars fjärd sek namn	**1.57**	0	2	2	1	1	5	0
3	Mysingen	**1.43**	0	0	0	1	1	8	0
3	Horsfjärden	**0.29**	0	0	0	1	0	1	0
3	Gårdsfjärden	**2.14**	0	3	0	1	1	10	0
3	Nynäsviken	**0.14**	0	0	0	1	0	0	0
3	Dragfjärden sek namn	**0.29**	0	0	0	1	0	1	0
3	Konabbsfjärden	**2.71**	0	3	4	1	1	10	0
3	S Konabbsfjärden sek namn	**2.14**	0	3	0	1	1	10	0
3	Svärdsfjärden	**1.86**	0	0	0	1	1	8	3
3	Fållnäsviken	**1.71**	0	0	0	1	1	10	0
3	Himmerfjärden	**3.29**	0	5	6	1	1	10	0
3	Kaggfjärden	**4.00**	0	6	6	1	1	6	8
3	Hallsfjärden	**3.00**	0	5	4	1	1	10	0
3	Näslandsfjärden	**2.71**	0	3	2	1	1	7	5
3	Stavbofjärden	**2.00**	0	2	0	1	1	10	0
3	Gälöfjärden	**1.71**	0	3	2	1	1	5	0
3	Fifångsdjupet	**2.14**	0	2	2	1	1	9	0
3	Asköfjärden	**2.29**	0	2	2	1	1	10	0
3	Fågelöfjärden	**2.00**	0	2	0	1	1	10	0
3	Trosafjärden	**3.57**	0	8	4	1	2	10	0
3	Gillsviken	**2.86**	0	6	2	1	1	10	0
3	Hållsviken	**2.14**	0	3	0	1	1	10	0
3	Skettnefjärden	**2.14**	0	3	0	1	1	10	0
3	Gunnarbofjärden	**2.14**	0	3	0	1	1	10	0
3	Gupafjärden	**2.43**	0	3	2	1	1	10	0
3	Bergöområdet	**2.57**	0	6	0	1	1	10	0
3	Ringsöfjärden sek namn	**1.29**	0	0	0	1	1	7	0
3	Tvären	**0.29**	0	0	0	1	0	1	0
3	Dragviksfjärden	**2.43**	0	5	0	1	1	10	0

3	Kråkfjärden	**2.14**	0	3	0	1	1	10	0
3	Risöområdet sek namn	**2.43**	0	5	0	1	1	10	0
3	Örsbaken	**2.14**	0	3	0	1	1	10	0
3	Sjösafjärden	**3.00**	0	8	0	1	2	10	0
3	Mellanfjärden	**3.29**	0	8	0	1	4	10	0
3	Stadsfjärden	**4.71**	3	9	0	1	10	10	0
3	Aspafjärden	**2.43**	0	5	0	1	1	10	0
3	Ålöfjärden	**2.71**	0	5	2	1	1	10	0
3	Hasselöområdet	**2.43**	0	5	0	1	1	10	0
3	Edsviken	**3.00**	0	8	0	1	2	10	0
3	Brunnsviken	**3.86**	0	8	4	1	1	10	3
3	Prästmaren	**2.00**	0	2	0	1	1	10	0
3	Neglingeviken	**2.14**	0	2	2	1	1	9	0
3	Vårgärdssjön	**2.00**	0	0	0	1	0	5	8
3	Grisslehamn	**2.14**	0	3	0	1	1	10	0
3	Väddö kustvatten	**1.29**	0	0	0	1	1	7	0
3	Järsjöviken	**2.43**	0	5	0	1	1	10	0
3	Norra Hargsviken	**1.71**	0	0	0	1	1	10	0
3	Mjölkfjärden	**1.86**	0	2	0	1	1	9	0
3	Dragsfjärden	**1.71**	0	3	0	1	1	7	0
3	Sandikafjärden	**1.00**	0	0	0	1	0	6	0
3	Kapellskärsområdet	**0.43**	0	0	0	1	0	2	0
3	Kapellskärs hamnområde	**1.71**	0	0	0	1	1	10	0
3	Nynäshamn	**2.43**	0	3	2	1	1	10	0
3	Igelstaviken	**3.00**	0	6	2	1	2	10	0
3	Inre Ålöfjärden	**2.14**	0	3	0	1	1	10	0
3	Ljungskärsflagen	**2.71**	0	5	2	1	1	10	0
3	Oxelösunds hamnområde	**2.43**	0	5	0	1	1	10	0
4	Bråvikens kustvatten	**2.57**	0	2	2	3	1	10	0
4	St Anna skärgårds kustvatten	**2.43**	0	2	2	2	1	10	0
4	Yttre Bråviken	**1.71**	0	0	0	1	1	10	0
4	Mellersta Bråviken	**1.71**	0	0	0	1	1	10	0
4	Ållonöfjärden	**2.86**	0	8	0	1	1	10	0
4	Inre Bråviken	**2.43**	0	2	0	1	1	10	3
4	Svensksundsviken	**2.43**	0	5	0	1	1	10	0
4	Arköfjärden sek namn	**1.71**	0	0	0	1	1	10	0
4	Bosöfjärden sek namn	**1.71**	0	0	0	1	1	10	0
4	Arkösund	**1.71**	0	0	0	1	1	10	0
4	Aspöfjärden	**1.57**	0	0	0	1	1	9	0
4	Lönshuvudfjärden	**1.43**	0	0	0	1	1	8	0
4	Rimmöfjärden sek namn	**1.71**	0	2	0	1	1	8	0
4	Trännöfjärden	**2.00**	0	3	2	1	1	7	0
4	Merumsfjärden	**2.86**	0	6	2	1	1	10	0
4	Inre Slätbaken	**4.14**	0	9	6	1	3	10	0

4	Kärrfjärden	**1.86**	0	2	0	1	1	9	0
4	Hålfjärden	**0.57**	0	2	0	1	0	1	0
4	Gryts skärgårds kustvatten	**2.14**	0	0	0	1	1	10	3
4	Valdemarsviks kustvatten	**1.86**	0	0	0	3	1	9	0
4	Turmulefjärden	**1.71**	0	0	0	1	1	10	0
4	Kullskärsdjupet	**1.29**	0	0	0	1	1	7	0
4	Håsköfjärden sek namn	**1.14**	0	0	0	1	1	6	0
4	Finnfjärden	**0.57**	0	0	0	1	0	3	0
4	Orren	**0.57**	0	0	0	1	0	3	0
4	Korsfjärden	**0.43**	0	0	0	1	0	2	0
4	Lagnöströmmen	**0.57**	0	2	0	1	0	1	0
4	Lindensfjärden	**0.86**	0	2	0	1	0	3	0
4	Sandfjärden	**1.29**	0	2	0	1	1	5	0
4	Gropviken	**2.14**	0	3	2	1	1	8	0
4	Ytteröområdet	**1.71**	0	0	0	1	1	10	0
4	Hesselöfjärden	**1.00**	0	0	0	1	1	5	0
4	Flisdjupet	**1.71**	0	0	0	1	1	10	0
4	Halsöfjärden	**1.71**	0	0	0	1	1	10	0
4	Yttre Valdemarsviken	**1.71**	0	0	0	1	1	10	0
4	Inre Valdemarsviken	**3.00**	0	5	6	1	1	8	0
4	Kvädöfjärden	**1.71**	0	0	0	1	1	10	0
4	Licknevarpefjärden	**2.00**	0	2	0	1	1	10	0
4	Lindödjupet	**1.00**	0	0	0	1	1	5	0
4	Kaggebofjärden	**1.86**	0	2	0	1	1	9	0
4	Gisslöfjärden sek namn	**2.71**	0	6	2	1	1	9	0
4	Edsviken	**3.00**	0	8	2	1	1	9	0
4	Erskärområdet sek namn	**2.00**	0	2	0	1	1	10	0
4	Sillöfjärden	**2.00**	0	2	0	1	1	10	0
4	Marsviken	**2.00**	0	2	0	1	1	10	0
4	Motala Ström	**3.29**	0	8	0	1	4	10	0
4	Pampusfjärden	**3.57**	0	8	4	1	2	10	0
4	V Gotlands s kustvatten	**2.00**	0	2	0	1	1	10	0
4	Burgsviken	**2.57**	0	6	0	1	1	10	0
4	V Gotlands m kustvatten	**2.00**	0	2	0	1	1	10	0
4	Klintehamnsviken sek namn	**2.57**	0	6	0	1	1	10	0
4	Gotlands nv kustvatten	**2.00**	0	3	0	1	1	9	0
4	Irevik	**2.00**	0	2	0	1	1	10	0
4	Gotlands n kustvatten	**2.43**	0	5	0	2	1	9	0
4	Kappelshamnsviken	**1.71**	0	0	0	1	1	10	0
4	Fårö n kustvatten	**2.00**	0	2	0	1	1	10	0
4	Ajkesvik	**2.43**	0	5	0	1	1	10	0
4	Fårösund	**2.43**	0	5	0	1	1	10	0
4	Fårö sö kustvatten	**2.29**	0	3	0	1	2	10	0

4	Sudersandsviken	**2.43**	0	5	0	1	1	10	0
4	Kyrkviken	**2.14**	0	3	0	1	1	10	0
4	Ö Gotlands n kustvatten	**2.43**	0	3	0	2	2	10	0
4	Ö Gotlands m kustvatten	**2.43**	0	3	0	2	2	10	0
4	Ö Gotlands s kustvatten	**3.57**	0	6	4	3	2	10	0
4	Lausvik	**2.86**	0	6	2	1	1	10	0
4	Gansviken	**2.57**	0	6	0	1	1	10	0
4	Slesviken	**2.57**	0	6	0	1	1	10	0
4	Bogevik	**2.29**	0	3	2	1	1	9	0
4	S Kalmarsunds utsjövatten	**3.71**	0	5	0	10	2	9	0
4	M v s Kalmarsunds kustvatten	**2.71**	0	6	0	2	1	10	0
4	Hossmoviken	**2.43**	0	5	0	1	1	10	0
4	Västra sjön	**2.14**	0	3	0	1	1	10	0
4	N v s Kalmarsunds kustvatten	**2.71**	0	6	0	2	1	10	0
4	Ö s Kalmarsunds kustvatten	**2.71**	0	5	0	3	1	10	0
4	S Ålands kustvatten	**3.00**	0	5	0	4	2	10	0
4	S n Kalmarsund	**1.71**	0	2	0	1	1	8	0
4	M n Kalmarsunds utsjövatten	**2.57**	0	3	4	3	1	7	0
4	Bockskärs skärgård	**1.57**	0	2	0	1	1	7	0
4	Pataholmsviken	**1.86**	0	3	0	1	1	8	0
4	Lövöområdet sek namn	**1.29**	0	2	0	1	1	5	0
4	Mönsteråsområdet sek namn	**1.57**	0	2	0	1	1	7	0
4	Ödänglaområdet sek namn	**1.86**	0	3	0	1	1	8	0
4	N n Kalmarsunds utsjövatten	**4.00**	0	3	2	9	1	10	3
4	Emområdet sek namn	**2.86**	0	6	2	1	1	10	0
4	Taktöområdet sek namn	**2.57**	0	6	0	1	1	10	0
4	Påskallavikområdet	**2.43**	0	5	0	1	1	10	0
4	Oskarshamnsområdet	**2.43**	0	5	0	1	1	10	0
4	Figeholmsområdets kustvatten	**2.43**	0	5	0	1	1	10	0
4	Fågelöfjärden	**2.29**	0	5	0	1	1	9	0
4	Simpevarpsområdet	**2.14**	0	3	0	1	1	10	0
4	Ärnöområdet sek namn	**2.43**	0	5	0	1	1	10	0
4	Granholmsfjärden	**0.57**	0	0	0	1	0	3	0
4	Borholmsfjärden	**2.86**	0	5	4	1	1	9	0
4	N Ölands kustvatten	**2.71**	0	6	0	1	2	10	0

4	Grankullaviken	**1.43**	0	3	2	1	0	4	0
4	Misterhults skärgårds kustvatten	**2.29**	0	2	2	1	1	10	0
4	Misterhults skärgårds inre kustvatten	**2.43**	0	5	0	1	1	10	0
4	Gåsfjärden	**0.43**	0	0	0	1	0	2	0
4	Vistingsdjupet	**1.43**	0	2	0	1	1	6	0
4	Skälöfjärden	**0.57**	0	2	0	1	0	1	0
4	Grönvållsfjärden	**0.57**	0	2	0	1	0	1	0
4	Västrumsfjärden	**2.29**	0	5	0	1	1	9	0
4	Lökholmsdjupet	**2.14**	0	3	0	1	1	10	0
4	Verkebäcksviken	**1.86**	0	3	0	1	1	8	0
4	Stora Hökhallen	**2.00**	0	2	0	1	1	10	0
4	Uvöfjärden	**2.00**	0	2	0	1	1	10	0
4	Björkskärsdjupet	**2.14**	0	3	0	1	1	10	0
4	Idöfjärden	**2.00**	0	2	0	1	1	10	0
4	Västerviks kustvatten	**2.43**	0	3	2	1	1	10	0
4	Asken	**2.71**	0	5	2	1	1	10	0
4	Lusärnafjärden	**2.00**	0	2	0	1	1	10	0
4	Skeppsbrofjärden sek namn	**1.86**	0	3	2	1	1	6	0
4	Yttre Gamlebyviken	**3.71**	0	5	4	1	1	10	5
4	Inre Gamlebyviken	**3.43**	0	6	6	1	1	10	0
4	Gudingen	**1.00**	0	2	2	1	0	2	0
4	Bergholmsfjärden	**0.14**	0	0	0	1	0	0	0
4	Syrsan	**2.29**	0	3	2	1	1	9	0
4	Torröfjärden sek namn	**2.14**	0	3	0	1	1	10	0
4	Smågöfjärden	**1.43**	0	2	0	1	1	6	0
4	Rågödjupet	**2.14**	0	3	0	1	1	10	0
4	Vivassen	**1.43**	0	3	0	1	1	5	0
4	Kåröområdet	**2.00**	0	2	0	1	1	10	0
4	Inre Oskarshamnsområdet	**2.43**	0	5	0	1	1	10	0
4	N Öresunds kustvatten	**3.29**	0	5	0	2	3	10	3
4	N m Öresunds kustvatten	**2.86**	0	5	0	2	4	9	0
4	S m Öresunds kustvatten	**3.14**	0	3	0	2	4	10	3
4	S Öresunds kustvatten	**2.57**	0	5	0	1	2	10	0
4	V sydkustens kustvatten	**4.14**	0	9	6	1	3	10	0
4	Ö sydkustens kustvatten	**2.57**	0	3	0	2	3	10	0
4	Sandhammaren-Simrishamn	**2.57**	0	3	2	1	2	10	0
4	V Hanöbuktens kustvatten	**3.14**	0	5	2	2	3	10	0
4	Lundåkrabukten	**2.71**	0	6	0	1	2	10	0

4	Lommabukten	**2.71**	0	6	0	1	2	10	0
4	Höllviken	**2.57**	0	6	0	1	1	10	0
4	Landöbukten sek namn	**3.00**	0	6	2	1	2	10	0
4	Tostebergabukten	**3.00**	0	6	2	1	2	10	0
4	Valjeviken	**2.86**	0	6	2	1	1	10	0
4	Sölvesborgsviken	**2.71**	0	5	2	1	1	10	0
4	Västra Blekinge skärgårds kustvatten	**3.43**	0	6	4	4	2	8	0
4	S v s Kalmarsunds kustvatten	**2.86**	0	6	2	1	1	10	0
4	Inre Pukaviksbukten	**2.57**	0	5	0	1	2	10	0
4	Mellersta Pukaviksbukten	**2.57**	0	5	0	1	2	10	0
4	Yttre Pukaviksbukten	**2.71**	0	6	0	1	2	10	0
4	Karlshamnsfjärden	**3.00**	0	6	2	1	2	10	0
4	Sandviksfjärden	**3.00**	0	6	2	1	2	10	0
4	Matviksfjärden	**2.57**	0	5	0	1	2	10	0
4	Tärnöfjärden sek namn	**2.57**	0	5	0	1	2	10	0
4	Boköfjärden	**2.57**	0	5	0	1	2	10	0
4	Tjäröfjärden	**2.43**	0	5	0	1	1	10	0
4	Järnavikafjärden sek namn	**2.43**	0	5	0	1	1	10	0
4	Östre fjorden	**2.57**	0	5	0	1	2	10	0
4	Vierydfjorden	**2.57**	0	5	0	1	2	10	0
4	Spjälköområdet	**2.57**	0	5	0	1	2	10	0
4	Ronnebyfjärden	**2.57**	0	5	0	1	2	10	0
4	Arpöfjärden sek namn	**2.57**	0	5	0	1	2	10	0
4	Kålfjärden	**3.43**	0	5	4	1	1	10	3
4	Hästholmsfjärden	**2.86**	0	6	2	1	1	10	0
4	Västra fjärden	**3.14**	0	6	6	1	1	8	0
4	Danmarksfjärden	**2.86**	0	3	2	1	1	10	3
4	Yttre redden	**3.14**	0	6	4	1	1	10	0
4	Lyckebyfjärden	**2.71**	0	3	0	1	2	10	3
4	Östra fjärden	**2.43**	0	5	4	1	1	6	0
4	Gåsefjärden	**2.86**	0	6	2	1	1	10	0
4	Hallarumsviken	**2.29**	0	3	2	1	1	9	0
4	Kållafjärden	**2.86**	0	6	2	1	1	10	0
4	Djupfjärden sek namn	**3.14**	0	6	4	1	1	10	0
4	Torhamnsfjärden	**2.71**	0	5	2	1	1	10	0
4	Mellersta Blekinge skärgårds kustvatten	**3.14**	0	5	4	1	2	10	0
4	Östra Blekinge skärgårds kustvatten	**2.00**	0	3	0	1	2	8	0
4	Bredasund	**2.43**	0	2	0	1	1	10	3
4	Helsingborgsområdet	**3.57**	0	5	0	4	3	10	3
4	Trelleborgs hamnområde	**3.29**	0	8	2	1	2	10	0
4	Ystads hamnområde	**3.00**	0	6	2	1	2	10	0

4	Malmö hamnområde	**2.57**	0	5	0	1	2	10	0
4	Stärnö Sandvik	**2.71**	0	6	0	1	2	10	0
5	N n Bohusläns skärgårds kustvatten_no	**2.71**	0	3	0	6	1	9	0
5	Skjebergkilen_no	**2.43**	0	3	2	1	1	10	0
5	Singlefjorden	**2.43**	0	3	2	2	1	9	0
5	Inre Singlefjorden	**3.00**	0	5	4	1	1	10	0
5	Idefjorden	**2.00**	0	2	0	1	1	10	0
5	Halden_no	**2.86**	0	5	2	1	2	10	0
5	Inre Idefjorden	**2.57**	0	5	0	1	2	10	0
5	N n Bohusläns skärgårds kustvatten	**2.43**	0	3	0	3	2	9	0
5	Yttre Dynekilen	**3.29**	0	5	6	1	1	10	0
5	Dynekilen	**3.00**	0	5	4	1	1	10	0
5	Strömstadsfjorden	**3.00**	0	5	4	1	1	10	0
5	N Kosterfjorden	**1.86**	0	3	0	1	1	8	0
5	N Yttre Tjärnöarkipelage	**3.00**	0	5	4	1	1	10	0
5	S Kosterfjorden	**1.71**	0	2	0	1	1	8	0
5	Inre Tjärnöarkipelagen	**2.71**	0	5	2	1	1	10	0
5	Flo	**3.00**	0	5	4	1	1	10	0
5	M n Bohusläns skärgårds kustvatten	**3.00**	0	5	0	4	2	10	0
5	Råssö-Resöfjorden sek namn	**2.43**	0	3	2	1	1	10	0
5	Stridsfjorden	**2.43**	0	3	2	1	1	10	0
5	Lindöfjorden sek namn	**2.14**	0	3	0	1	1	10	0
5	Tanumskilen	**2.43**	0	5	0	1	1	10	0
5	Sannäsfjorden sek namn	**2.43**	0	5	0	1	1	10	0
5	n Långebyområdet	**2.43**	0	3	2	1	1	10	0
5	s Långebyområdet	**2.43**	0	3	2	1	1	10	0
5	Grebbestad inre skärgård	**2.43**	0	3	2	1	1	10	0
5	Väderöfjorden	**2.14**	0	3	0	1	2	9	0
5	Fjällbacka yttre skärgård	**2.57**	0	3	2	1	2	10	0
5	Fjällbacka inre skärgård	**2.71**	0	5	2	1	1	10	0
5	Sotefjorden	**2.29**	0	3	0	2	2	9	0
5	Hamburgsundsområdet	**2.00**	0	2	0	1	1	10	0
5	Heestrand området	**2.00**	0	2	0	1	1	10	0
5	Bottnefjorden	**2.00**	0	2	0	1	1	10	0
5	Hunnebostrand skärgård	**2.00**	0	2	0	1	1	10	0
5	Haby bukt	**2.43**	0	3	2	1	1	10	0
5	Kungshamn n skärgård	**2.00**	0	2	0	1	1	10	0

5	M Bohusläns skärgårds kustvatten	**2.71**	0	5	0	2	2	10	0
5	Kungshamn s skärgård	**2.00**	0	2	0	1	1	10	0
5	Hovenäset området	**2.00**	0	2	0	1	1	10	0
5	Åbyfjorden	**2.00**	0	2	0	1	1	10	0
5	Slaholmen området	**2.14**	0	3	0	1	1	10	0
5	Yttre Brofjorden	**2.29**	0	3	0	1	2	10	0
5	Brofjorden	**2.14**	0	3	0	1	1	10	0
5	Saltö fjord	**2.29**	0	3	0	1	2	10	0
5	Trälebergskile	**2.43**	0	5	0	1	1	10	0
5	Färlevfjorden	**2.14**	0	3	0	1	1	10	0
5	Saltkällefjorden	**2.29**	0	3	0	1	2	10	0
5	Gullmarn centralbassäng	**2.14**	0	3	0	1	1	10	0
5	Getevikssund	**1.71**	0	0	0	1	1	10	0
5	Grundsundsområdet	**2.00**	0	2	0	1	1	10	0
5	Byfjorden	**2.43**	0	6	0	1	1	9	0
5	Havstensfjorden	**1.71**	0	0	0	1	1	10	0
5	Kalvöfjord	**2.71**	0	6	2	1	1	9	0
5	Borgilefjorden	**2.86**	0	6	4	1	1	8	0
5	Nordströmmarna	**2.14**	0	3	0	1	1	10	0
5	Koljö fjord	**2.29**	0	5	0	1	1	9	0
5	Snäckedjupet	**2.14**	0	3	0	1	1	10	0
5	Malö Strömmar	**2.00**	0	2	0	1	1	10	0
5	Ellösefjorden	**2.00**	0	2	0	1	1	10	0
5	Ljungs kile	**2.43**	0	5	0	1	1	10	0
5	n Käringöfjorden inre skärgård	**2.00**	0	2	0	1	1	10	0
5	s Käringöfjorden inre skärgård	**2.00**	0	2	0	1	1	10	0
5	Käringöfjorden	**2.00**	0	2	0	1	1	10	0
5	Boxvike kile	**2.14**	0	3	0	1	1	10	0
5	Lyresund	**2.00**	0	2	0	1	1	10	0
5	Kalvöfjorden	**2.43**	0	5	0	1	1	10	0
5	Halsefjorden	**1.71**	0	0	0	1	1	10	0
5	Tången området	**2.57**	0	3	0	1	1	10	3
5	Mollöfjorden	**2.71**	0	5	0	2	2	10	0
5	Kråke fjord	**2.14**	0	3	0	1	1	10	0
5	Stigfjorden	**2.00**	0	2	0	1	1	10	0
5	Askeröfjorden	**1.71**	0	0	0	1	1	10	0
5	Hjärteröfjorden	**2.86**	0	5	0	3	2	10	0
5	Skärhamnområdet	**2.00**	0	2	0	1	1	10	0
5	Klädesholmenområdet	**3.29**	0	8	4	1	1	9	0
5	Marstrandsfjorden	**2.29**	0	3	0	1	2	10	0
5	Hake fjord	**2.00**	0	2	0	1	1	10	0
5	Älgöfjorden	**2.00**	0	2	0	1	1	10	0
5	Göteborgs n n skärgårds kustvatten	**2.29**	0	3	0	2	2	9	0

5	Sälö fjord	**3.14**	0	6	4	1	1	10	0
5	Göteborgs n skärgårds kustvatten	**2.86**	0	5	0	3	2	10	0
5	Källö fjord	**2.57**	0	5	0	1	2	10	0
5	Nordre Älvs fjord	**2.57**	0	5	0	1	2	10	0
5	Stora Kalvsund	**2.29**	0	3	0	1	2	10	0
5	Björköfjorden	**2.86**	0	5	2	1	2	10	0
5	Dana fjord	**2.29**	0	3	0	1	2	10	0
5	Rivö fjord	**3.00**	0	6	2	1	2	10	0
5	Göteborgs s skärgårds kustvatten	**2.86**	0	5	0	3	2	10	0
5	Brännö- Styrsöområdet	**2.00**	0	2	0	1	1	10	0
5	Asperöfjorden sek namn	**2.14**	0	3	0	1	1	10	0
5	Halsviken	**2.14**	0	3	0	1	1	10	0
5	Styrsö- Vrångöområdet	**2.00**	0	2	0	1	1	10	0
5	Askims fjord	**2.14**	0	2	0	2	1	10	0
5	Onsala kustvatten	**4.43**	0	6	0	10	2	10	3
5	Kräklingeområdet	**2.00**	0	2	0	1	1	10	0
5	Maleviken	**2.14**	0	3	0	1	1	10	0
5	Skörvallaviken	**2.43**	0	5	0	1	1	10	0
5	Risö-Säröarkipelagen	**2.00**	0	2	0	1	1	10	0
5	Stallviken	**2.43**	0	5	0	1	1	10	0
5	Låddholmsviken	**2.43**	0	5	0	1	1	10	0
5	Öckerösund	**2.14**	0	3	0	1	1	10	0
5	Kyrkefjälls sund	**2.14**	0	3	0	1	1	10	0
5	Varren	**2.00**	0	2	0	1	1	10	0
5	N m Hallands kustvatten	**4.29**	0	5	0	10	2	10	3
5	Yttre Kungsbackafjorden	**2.71**	0	5	2	1	1	10	0
5	Inre Kungsbackafjorden	**2.57**	0	6	0	1	1	10	0
5	Vändelsöarkipelagen	**2.14**	0	3	0	1	1	10	0
5	Klosterfjorden	**2.71**	0	6	0	1	2	10	0
5	Balgöarkipelagen	**2.43**	0	5	0	1	1	10	0
5	S m Hallands kustvatten	**2.43**	0	3	0	1	3	10	0
5	Laholmsbuktens kustvatten	**4.29**	0	9	2	4	5	10	0
5	Laholmsbukten	**2.71**	0	5	0	2	2	10	0
5	Skäldervikens kustvatten	**2.43**	0	5	0	2	2	8	0
5	Skälderviken	**2.71**	0	5	2	1	1	10	0
5	Rivö fjord syd	**3.14**	0	6	4	1	1	10	0

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SMHI
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SE 601 76 NORRKÖPING
Phone +46 11-495 80 00 Telefax +46 11-495 80 01

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