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**COMMISSION STAFF WORKING DOCUMENT**

*Accompanying the document*

**REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT**

**on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016–2019**

{COM(2021) 1000 final}

# Pressure from Agriculture

Sweden's utilized agricultural area amounts to 3 Mha, representing 7% of the total land area. The major outputs of the agricultural industry excluding services include in a decreasing order forage (17.9%), milk (17.3%) and cattle (10.5%).
Eurostat

## Major land use statistics for Sweden

Table 1.Utilized agricultural area (abbreviated as UAA)

| Sweden | 2005 | 2007 | 2010 | 2013 | 2016 |
|---|---|---|---|---|---|
| Utilised agricultural area UAA (1000 ha) | NA | 3121 | 3074 | 3036 | 3021 |
| arable land (1000 ha) | NA | 2631 | 2619 | 2589 | 2566 |
| permanent grass (1000 ha) | NA | 486 | 452 | 443 | 452 |
| permanent crops (1000 ha) | NA | 3 | 3 | 5 | 3 |
| kitchen gardens (1000 ha) | NA | NA | 0 | NA | 0 |

*Note:*
Eurostat (FSS)

Sweden's arable land has decreased by 2.5% since 2007. Permanent grassland increased by 2% from 2013.

## Animal distribution in Sweden

Sweden has seen a decrease in the number of pigs and a significant increase of poultry. The livestock density index (livestock unit per hectare of Utilized Agricultural Area) has remained stable and is below the EU average of 0.8.

Table 2. Livestock statistics

| Sweden | 2005 | 2007 | 2010 | 2013 | 2016 |
|---|---|---|---|---|---|
| Livestock index | 0.57 | 0.57 | 0.57 | 0.56 | 0.57 |
| dairy cows ($10^6$ heads) | 0.39 | 0.37 | 0.35 | 0.35 | 0.33 |
| live bovines ($10^6$ heads) | 1.53 | 1.52 | 1.47 | 1.44 | 1.44 |
| live pigs ($10^6$ heads) | 1.80 | 1.73 | 1.61 | 1.48 | 1.44 |
| live poultry ($10^6$ heads) | NA | NA | 14.29 | 16.59 | 18.78 |

*Note:*
Eurostat (FSS)

# Nitrogen and phosphorus fertilizers and surplus (kg/ha UAA)

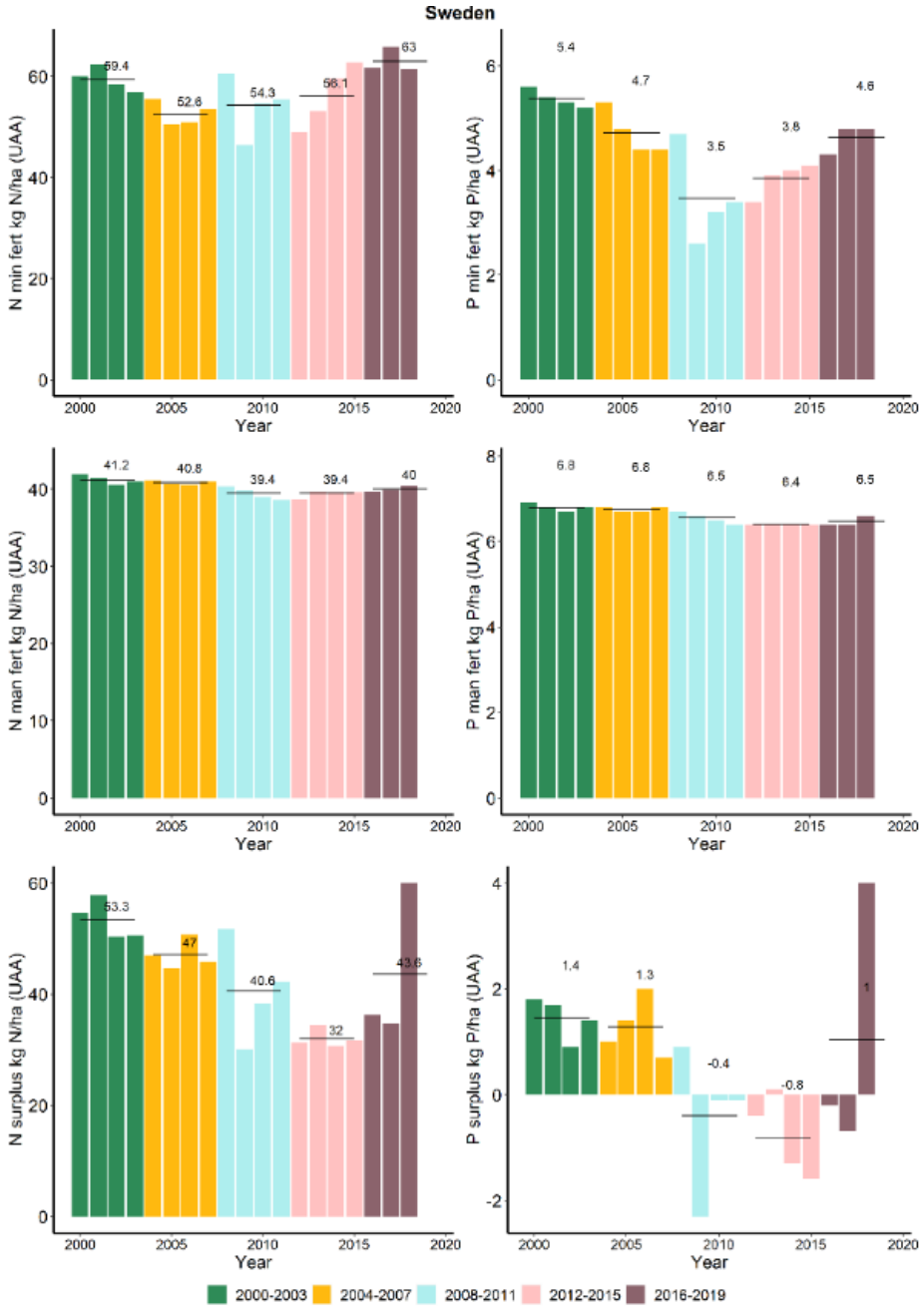



Figure 1. N and P fertilizers and gross surplus (kg/ha)

The gross nitrogen (N) and phosphorus (P) surpluses originate from EUROSTAT data for the years 2000-2018. The consumption of inorganic fertilizers during the last reporting period is higher than that of the previous reporting period. The usage of manure is similar to that of the previous reporting period. The N surplus is significantly higher than that of the previous reporting period with a value around 44 kg/ha UUA probably due to the predicted high surplus in 2018 because of a particularly dry year that resulted in low yields. The gross P surplus is also higher to that of the previous reporting period due to the large surplus in 2018.In the plots: N/P min and N/P man are respectively the N/P mineral fertilizers and N/P manure.

## Livestock unit - LSU /ha

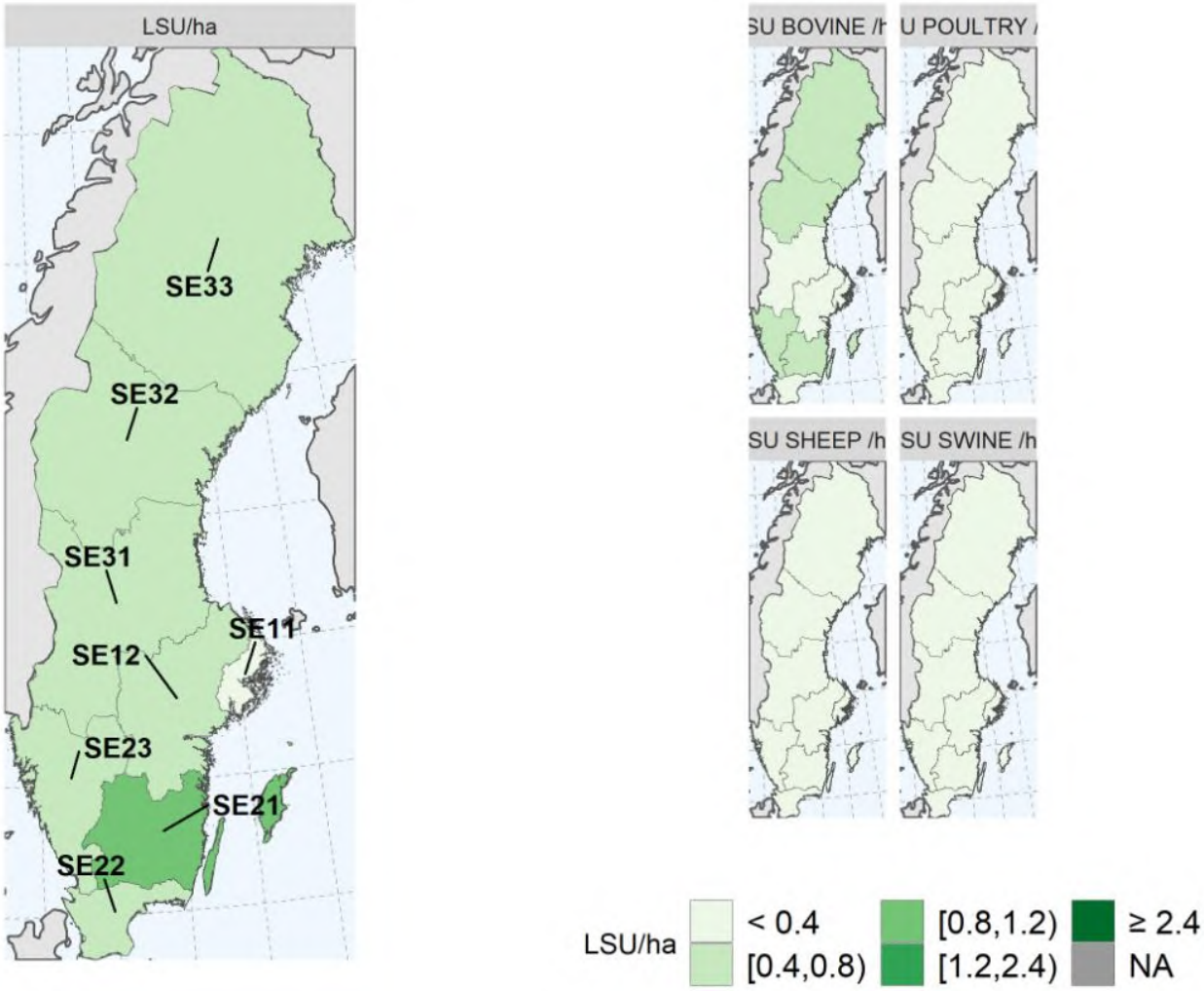



Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is concentrated in the south western part of the Sweden (total LSU and LSU by animal type were retrieved individually from EUROSTAT).
In this document, the NUTS-2013 version is used.
(https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/nuts)

# Water Quality Monitoring

Swedish water quality is monitored by means of national environmental monitoring programmes coordinated by the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency. Sweden does not have a specific environmental monitoring programme for the Nitrates Directive. Data is stored by various data hosts and is available to the general public. The Swedish University of Agricultural Sciences is the data host for fresh water (lakes and watercourses), the Geological Survey of Sweden is the data host for groundwater, while SMHI (Swedish Meteorological and Hydrological Institute) is the data host for coastal and marine waters. The period of the current assessment covers the years 2016-2018.

Investigations of lake water quality in Sweden have been carried out every autumn as part of the national environmental monitoring programme involving cyclical sampling of lakes, where sixth of them are sampled every year. The watercourses have been sampled at least 12 times a year, while groundwaters are sampled several times per year.

For groundwater measurements, some stations have same coordinates because their location is classified/secret. In this case, the average values cover different measurements in time, but also location. In maps providing the spatial distribution of monitoring points, it is not possible to distinguish stations with the same coordinates: for NO3 concentration, the average value is shown; for trends and trophic status the worst case was considered.

It is noteworthy that in some cases in the bar charts the total value can differ from 100% due to rounding errors.

## Groundwater quality monitoring network

Table 3. Number of GW stations with measurements and trends per type

| | | Number of stations with measurements | | | Number of stations with Trends | | |
|---|---|---|---|---|---|---|---|
| Station Type | Description | 2008-2011 | 2012-2015 | 2016-2019 | 2008-2011 | 2012-2015 | 2016-2019 |
| 0 | Phreatic groundwater (shallow): 0-5 m | 301 | 298 | 316 | 0 | 70 | 80 |
| 1a | Phreatic groundwater (deep) 5-15 m | 8 | 11 | 41 | 0 | 7 | 6 |
| 1b | Phreatic groundwater (deep) 15-30 m | 8 | 8 | 15 | 0 | 8 | 7 |
| 1c | Phreatic groundwater (deep) >30 m | 7 | 6 | 5 | 0 | 6 | 4 |
| 2 | Captive groundwater | 2 | 2 | 17 | 0 | 2 | 7 |
| 3 | Karstic groundwater | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Not specified | 0 | 111 | 139 | 0 | 6 | 5 |
| | **Total** | **326** | **436** | **533** | **0** | **99** | **109** |

## Surface water quality monitoring network

Table 4. Number of SW stations with measurements, trends and trophic status per type

| | | Number of stations with measurements | | | Number of stations with Trends | | | Number of stations with Trophic status | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station Type | Description | 2008-2011 | 2012-2015 | 2016-2019 | 2008-2011 | 2012-2015 | 2016-2019 | 2008-2011 | 2012-2015 | 2016-2019 |
| 4 | River water | 187 | 222 | 197 | 0 | 45 | 33 | 186 | 221 | 197 |
| 5 | Lake/reservoir water | 0 | 2570 | 2085 | 0 | 0 | 0 | 2269 | 2570 | 2085 |
| 6 | Transitional water | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Coastal water | 134 | 97 | 120 | 0 | 0 | 0 | 0 | 0 | 120 |
| 8 | Marine water | 97 | 75 | 70 | 0 | 0 | 0 | 0 | 0 | 70 |
| 9 | Not specified | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | **420** | **2976** | **2472** | **0** | **45** | **33** | **2455** | **2791** | **2472** |

# Groundwater Quality

## Groundwater average annual nitrate concentration

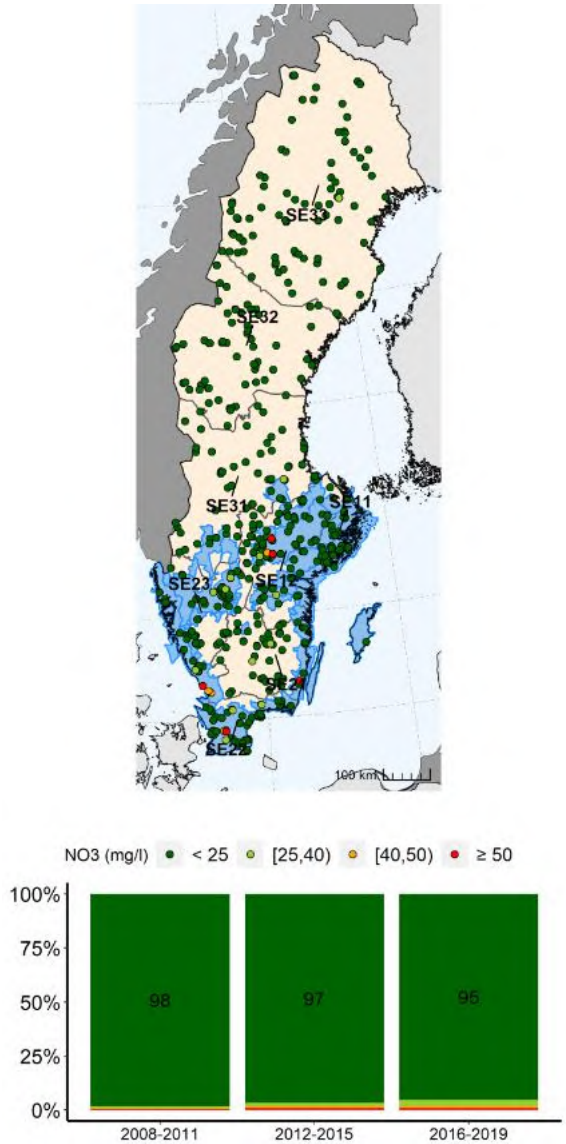



Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

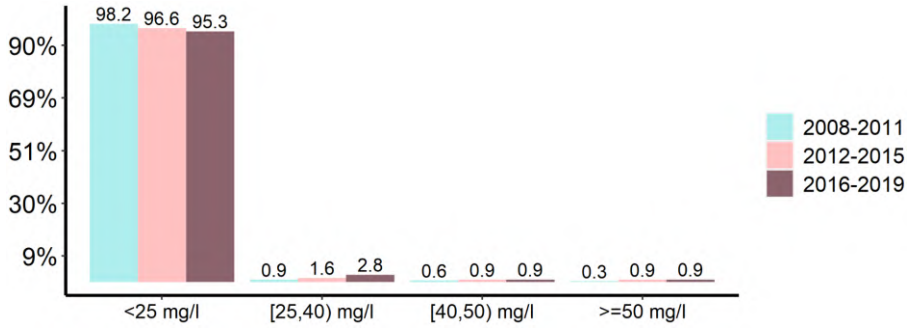



Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis).

## Groundwater average annual nitrate concentration trend

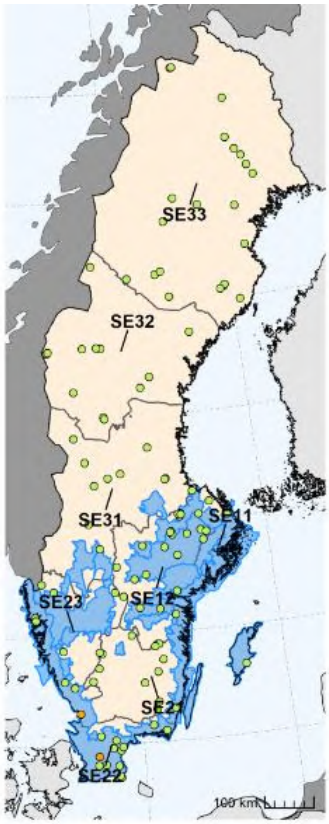



Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

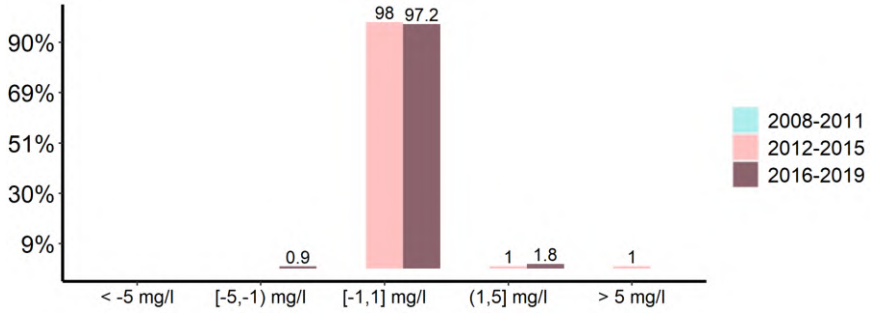



Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis).

## Groundwater hotspot


NO3 (mg/l) [40,50) incr. trend InNVZ [40,50) incr. trend OutNVZ ≥ 50 InNVZ ≥ 50 OutNVZ

| | | >=40 and < 50 mg/l incr.trend | | >=50 mg/l | |
|---|---|---|---|---|---|
| NUTS ID | NUTS NAME | InNVZ | OutNVZ | InNVZ | OutNVZ |
| SE12 | Östra Mellansverige | 0 | 0 | 2 | 0 |
| SE21 | Småland med öarna | 0 | 0 | 1 | 0 |
| SE22 | Sydsverige | 0 | 0 | 1 | 0 |
| SE23 | Västsverige | 1 | 0 | 1 | 0 |
| | **Total** | **1** | **0** | **5** | **0** |

Figure 7. GW hotspot analysis map (top graph) and distribution by NUTS2 (lower graph) of average NO3 annual concentration greater than 40 mg/l. In the map in blue the NVZ.

The hotspot analysis identifies all the GW monitoring stations that have NO3 concentration in the range of 40-50 mg/l with increasing trends and above 50 mg/l. The map shows the spatial distribution of these points, and the table reports the number of stations by NUTS inside and outside NVZ.
Only the NUTS of interest are reported.

# Surface Water Quality

## Surface water average annual nitrate concentration

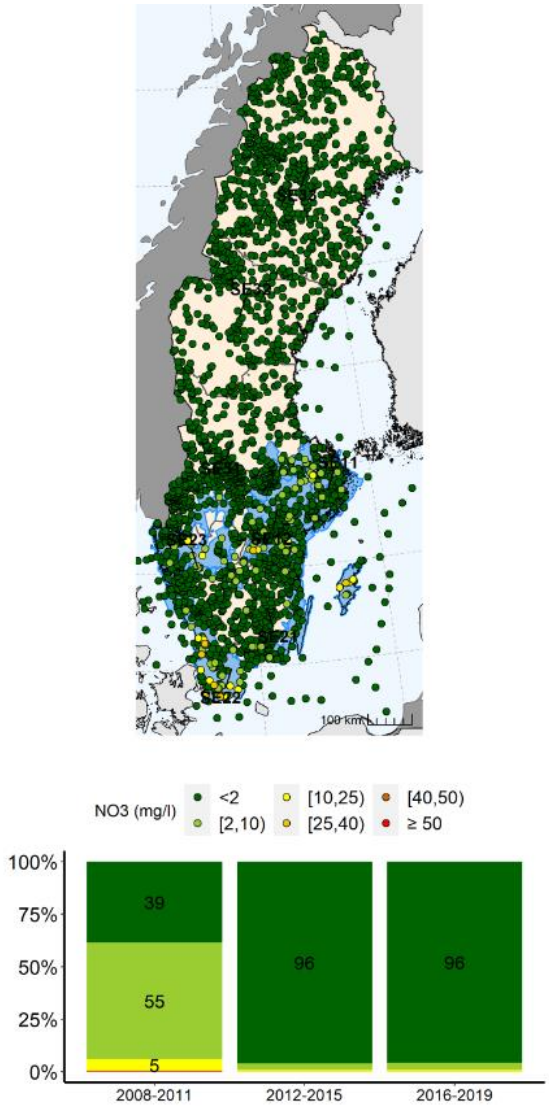



Figure 8. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

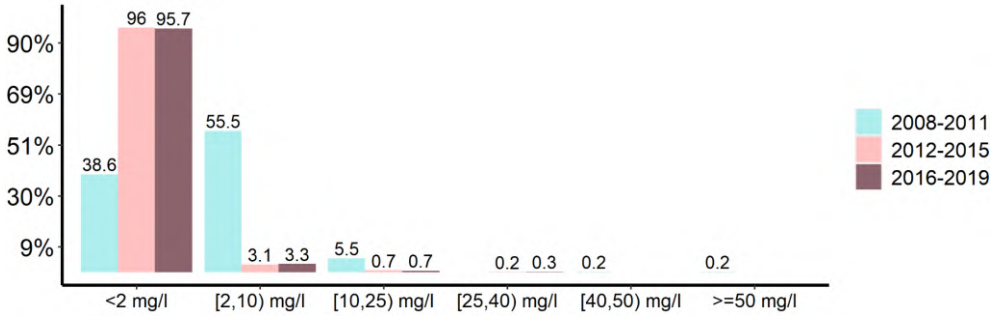



Figure 9. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis) .

## Surface water average annual nitrate concentration trend

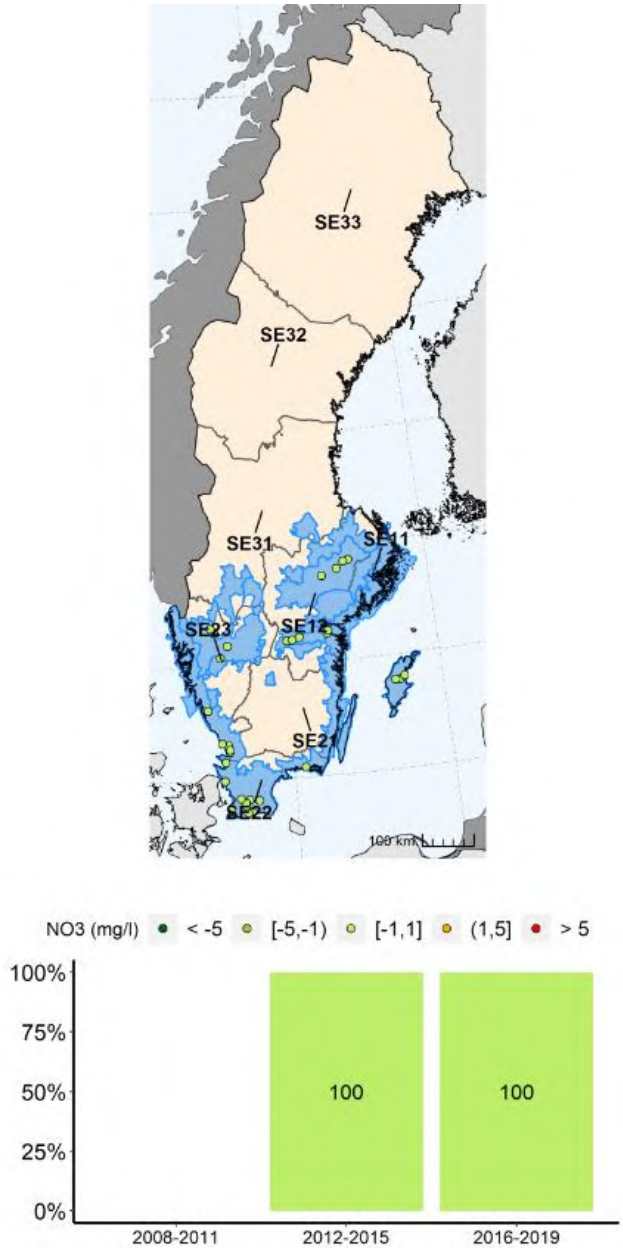



Figure 10. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

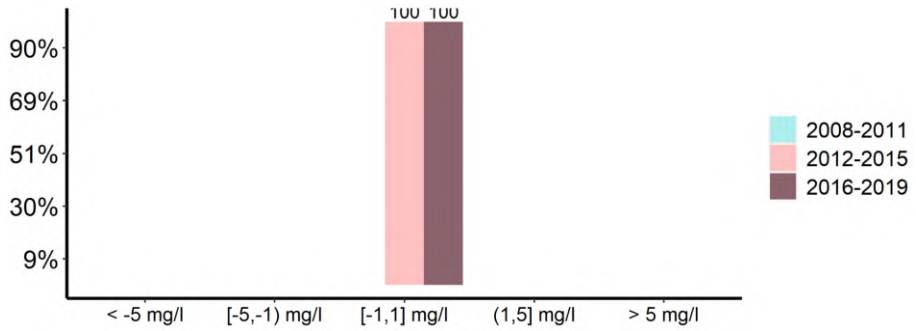
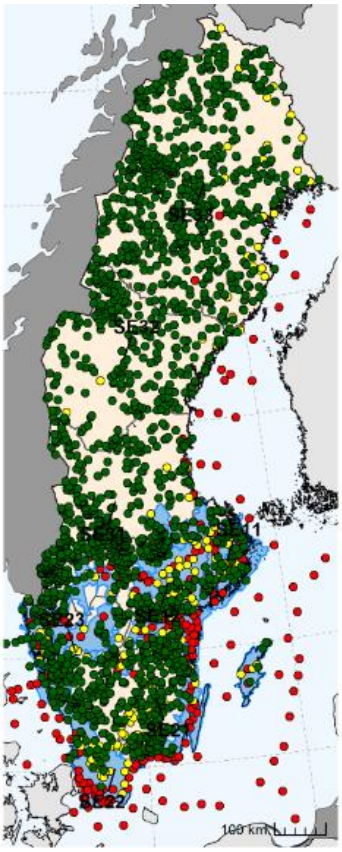



Figure 11. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis).

# Surface Water Eutrophication



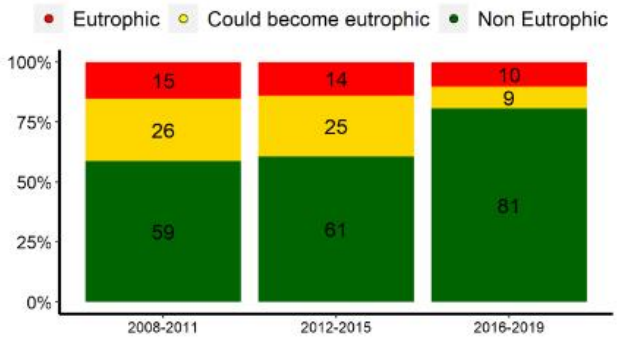




Figure 12. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). In the map in blue the NVZ.

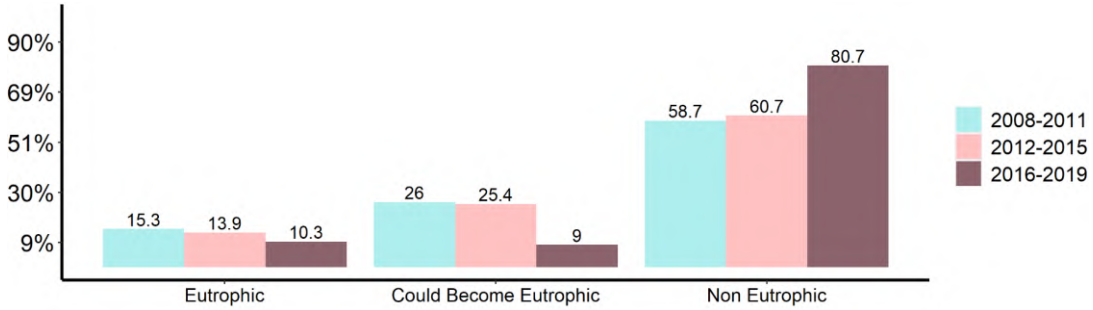
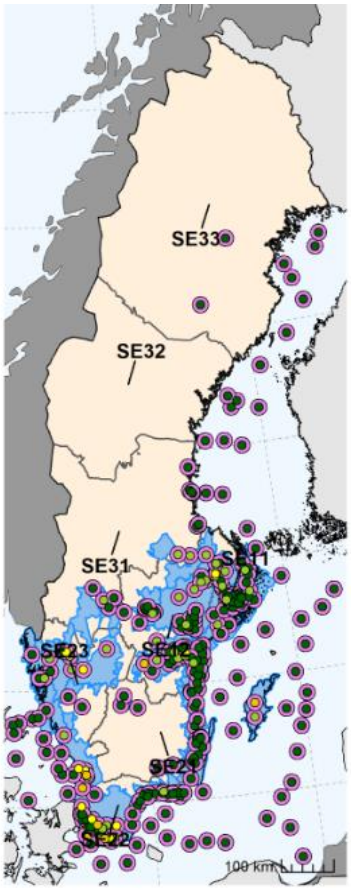



Figure 13. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis).

In the context the Marine strategy framework directive, Swedish authorities use the evaluation by HELCOM in their assessment of status for the Baltic Sea. HELCOM integrated eutrophication assessment (published in 2018) assesses the status of eutrophication in the Baltic Sea during the years 2011-2016.
Some of the marine stations located west of Sweden are part of the OSPAR network and were evaluated to be part of a “non-problem area”.

## The Eutrophic status vs average NO3 annual concentration




High trophic status · <2 · [2,10) · [10,25) · [25,40) · [40,50) · ≥ 50 mg/l · Unclassified

| | | | Number of stations by classes of concentration | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NUTS ID | NUTS NAME | High trophic status | <2 mg/l | [2,10) mg/l | [10,25) mg/l | [25,40) mg/l | [40,50) mg/l | >=50 mg/l | Unclassified |
| NO_NUTS | SALINE | 147 | 147 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE11 | Stockholm | 13 | 8 | 5 | 0 | 0 | 0 | 0 | 0 |
| SE12 | Östra Mellansverige | 45 | 24 | 18 | 2 | 1 | 0 | 0 | 0 |
| SE21 | Småland med öarna | 7 | 5 | 1 | 0 | 1 | 0 | 0 | 0 |
| SE22 | Sydsverige | 18 | 3 | 7 | 4 | 4 | 0 | 0 | 0 |
| SE23 | Västsverige | 18 | 6 | 6 | 5 | 1 | 0 | 0 | 0 |
| SE31 | Norra Mellansverige | 5 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| SE33 | Övre Norrland | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | **255** | **198** | **39** | **11** | **7** | **0** | **0** | **0** |

Figure 14. The SW monitoring stations with eutrophic status versus the average NO3 annual concentration. In the map in blue the NVZ.

The analysis shows all the SW monitoring stations with the higher trophic status and the corresponding value of NO3 concentration. The map shows the spatial distribution of these points, and the table reports the number of stations with measurements with highest trophic status and the corresponding stations by classes of NO3 concentration. Only the NUTS of interest are reported.

The assessment of trophic state of lakes is based on phosphorus criteria established by the Environmental Protection Agency. Lakes and water courses with a concentration of total phosphorus between 0.025 and 005 mg/l TotP are considered slightly eutrophic, and lakes and water courses with concentration between 0.05 and 0.1 mg/l Tot P strongly eutrophic, and those with concentrations above 0.1 are hypertrophic. About 22% of water courses are classified as eutrophic while only 3% of the lakes fall in that category.

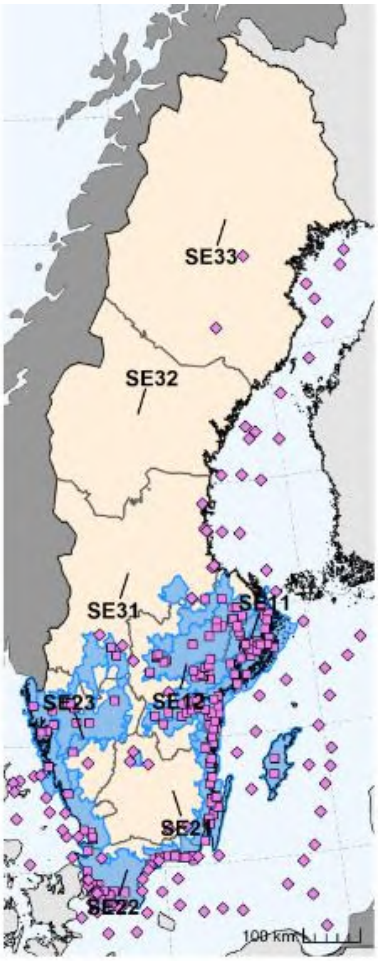
Assessments of the trophic status of the seas are carried out both nationally and internationally. Nationally, the water authorities carry out status classifications of coastal waters according to the Water Framework Directive. In the Swedish report, the classification of status is assessed on the basis of nutrients, where the classification is based on winter values for dissolved organic phosphorus, dissolved inorganic nitrogen, total phosphorus and total nitrogen, as well as summer concentrations of total phosphorus and total nitrogen.

In the overall assessment of eutrophication, in Skagerrak/Kattegat, only Skagerrak's deep-sea waters, and in the Baltic Sea, only the coastal waters in the northern part of the Bothnian Sea and the northern part of the Gulf of Bothnia were not considered to be eutrophic. However, in Skagerrak/Kattegat, the assessment results for other areas are often close to the limit for good status, while in coastal waters, it is usually bottom fauna and harmful algal blooms which lower the status. All deep-sea areas in the Baltic Sea are considered to be eutrophic. The situation in the Bothnian Sea appears to have worsened slightly, partly as a result of the input of nutrients from the Baltic Proper, but also because of climate impacts. Based on the reported data all marine stations are eutrophic and the large majority of coastal waters are eutrophic

Table 5. Summary of SW stations by classes of trophic status and type.

| | | Number of stations with Trophic status | | |
|---|---|---|---|---|
| Station Type | Description | Eutrophic | Could become eutrophic | Non Eutrophic |
| 4 | River water | 44 | 40 | 113 |
| 5 | Lake/reservoir water | 64 | 172 | 1849 |
| 6 | Transitional water | 0 | 0 | 0 |
| 7 | Coastal water | 81 | 11 | 28 |
| 8 | Marine water | 66 | 0 | 4 |
| 9 | Not specified | 0 | 0 | 0 |
| | **Total** | **255** | **223** | **1994** |

## Surface Water quality hotspot




| | | High trophic status | | >=40 and < 50 mg/l incr.trend | | >=50 mg/l | |
|---|---|---|---|---|---|---|---|
| NUTS ID | NUTS NAME | InNVZ | OutNVZ | InNVZ | OutNVZ | InNVZ | OutNVZ |
| NO_NUTS | SALINE | 62 | 85 | 0 | 0 | 0 | 0 |
| SE11 | Stockholm | 13 | 0 | 0 | 0 | 0 | 0 |
| SE12 | Östra Mellansverige | 43 | 2 | 0 | 0 | 0 | 0 |
| SE21 | Småland med öarna | 2 | 5 | 0 | 0 | 0 | 0 |
| SE22 | Sydsverige | 17 | 1 | 0 | 0 | 0 | 0 |
| SE23 | Västsverige | 17 | 1 | 0 | 0 | 0 | 0 |
| SE31 | Norra Mellansverige | 2 | 3 | 0 | 0 | 0 | 0 |
| SE33 | Övre Norrland | 0 | 2 | 0 | 0 | 0 | 0 |
| | **Total** | **156** | **99** | **0** | **0** | **0** | **0** |

Figure 15. SW hotspot analysis map (top graph) and distribution by NUTS2 (lower graph of average NO3 annual concentration greater than 40 mg/l and trophic status. In the map in blue the NVZ.

The hotspot analysis identifies all the SW monitoring stations that have high eutrophic status, NO3 concentration in the range of 40-50 mg/l with increasing trends and above 50 mg/l. The map shows the spatial distribution of these points, and the table reports the number of stations by NUTS inside and outside NVZ.
Only the NUTS of interest are reported.

# Measures in the Action Programme

In Sweden the Code of Good Agricultural practices (CGAP) is primarily represented by regulations and is not voluntary but includes general advices for areas outside the NVZ.

The Swedish Action Programme (AP) has been collated in a document governed by the Swedish Board of Agriculture's regulations and general advice (SJVFS 2004:62) on environmental concerns in agriculture which entered into force in 1999. Last amendments to the regulation were carried out in the period 2012-2015, mainly related to adjustments in order to clarify the text and changes to the areas to be included in the nitrate vulnerable zones. No changes were made to the regulations during the period 2016-2019.

The AP regulates not only agricultural activities in the nitrate vulnerable zones, but also the rest of the country in certain respects. The details of AP are reported in the following table. No cost effectiveness was reported.

Table 6. Details of the Action Programme

| Measure | General details in Action Programme (*) |
|---|---|
| Period of prohibition of fertiliser application | Inside NVZ: |
| | • The restrictions on the application of fertilisers vary by region, type of crop and type of fertiliser used. Details are listed in Sections 23a, 25, 26-26a, 28a-28b of SJVFS 2004:62 |
| | Outside NVZ: |
| | • 1 December to 28 February: livestock manure or other organic fertiliser that is applied must be ploughed in within twelve hours |
| Restrictions for application on sloped soils | • Never when slope >10%, within NVZ |
| Restrictions for application on soaked, frozen, or snow-covered soils | • Not on water-saturated, snow-covered and frozen soils, within NVZ |
| Restrictions for application near watercourses (buffer strips) | • 2 m within NVZ |
| Effluent storage works | • The rules vary by the units and types of livestock. Storage capacity requirements also apply to holdings outside nitrate vulnerable zones. The rules are described in Sections 6–7 of Ordinance 1998:915 and 4–4b, 5a–5d, 6–7 SJVFS 2004:62 |
| Capacity of manure storage | • The rules vary by the units and types of livestock. The rules are described in Sections 6–7 of Ordinance 1998:915 and 4–4b, 5a–5d, 6–7 SJVFS 2004:62 |
| Rational fertilisation (e.g., splitting fertilisation, limitations) | • Within NVZ, maximum N-total applied on different crops (Section 20 SJVFS 2004:62) |
| | • Maximum application of 170 kg of nitrogen from livestock manure per hectare in the NVZ |
| | • Restrictions with regard to the provision relating to phosphorus (Sections 8, 10, 13-14, 17-19 b (section 12 repealed in 2012) SJVFS 2004:62) |
| | • Restriction on the quantity of readily available nitrogen applied prior to autumn sowing in the NVZ (Sections 8, 10, 13-14, 17-19 b (section 12 repealed in 2012) SJVFS 2004:62) |
| | • Rules relating to the procedure for land application of mineral fertilisers and livestock manure in the NVZ subject to certain restrictions (Sections 1, 23–23 c, 26 c, 27 (replaced by 23 b 2012), 28 (replaced by 23 c 2012), 28 d SJVFS 2004:62) |
| Crop rotation, permanent crop enhancement | • Not specified |
| Vegetation cover in rainy periods, winter | • In some parts of Sweden including the NVZ, certain proportion of arable land must be planted with an autumn or winter cover crop (Sections 29–34 SJVFS 2004:62 and section 11 of Ordinance 1998:915) |
| Fertilisation plans, spreading records | • Not specified |
| Other measures | • A Rural Development Programme covers the period 2014-2020 and includes environmental investments, environmental payments and enterprise aid |
| Date for application limit of 170 kg N/ha/year: | • Not specified |

(*) Decree on environmental considerations in agriculture (SFS 1998:915)

Regulations on Environmental Concerns in Agriculture with Regard to Plant Nutrients (SJVFS 2004:62)

# Controls

The correct implementation of the Action Programme is indirectly controlled through cross-compliances checks, even though the results do not, however, provide a comprehensive picture of the situation in the country because they are not sufficiently representative. The number of annual controls was around 403. The highest numbers of non-conformity concerned the application of manure (9% of non-compliance). Manure storage non-conformity concerned about 2.4% of the controls.

# Designation of NVZ

Sweden has made no adjustment to the nitrate vulnerable zones designated in the previous report. As a consequence, Sweden designated 94,742 $km^2$ as NVZ, which represents 23% of the national territory. NVZs were first designated in 1995, and the last revision took place on 1 April 2016 (2,484 $km^2$).

# Forecast of Water Quality

According to the national report of Sweden, if additional pollution reduction measures are not taken, nitrate concentrations in surface water bodies are not expected to diminish.

# Summary

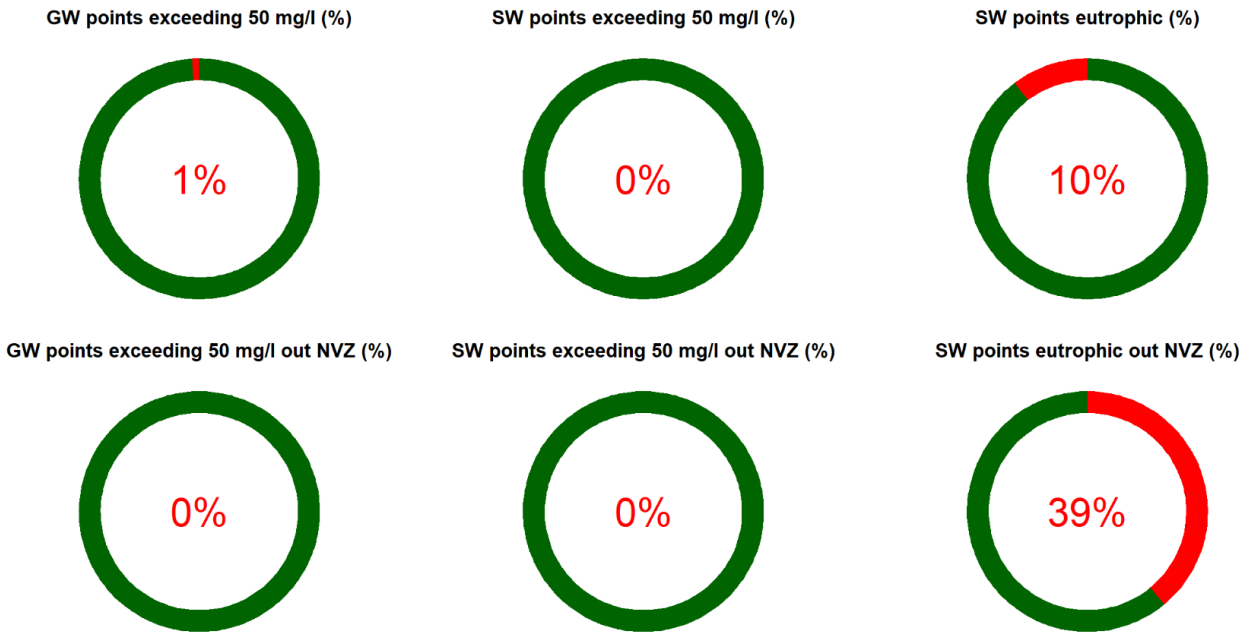



Figure 16. The summary plot for the period 2016-2019

This plot provides in the first row the percentage of stations exceeding 50 mg/l with respect to the total stations with measures and the percentage of eutrophic SW stations with respect to the total for which the trophic status is reported. In the second row, the percentage of stations exceeding 50 mg/l that are outside NVZ with respect to the total of stations exceeding 50 mg/, and the percentage of SW eutrophic stations that are outside NVZ with respect to the total that are eutrophic.

# Long term analysis

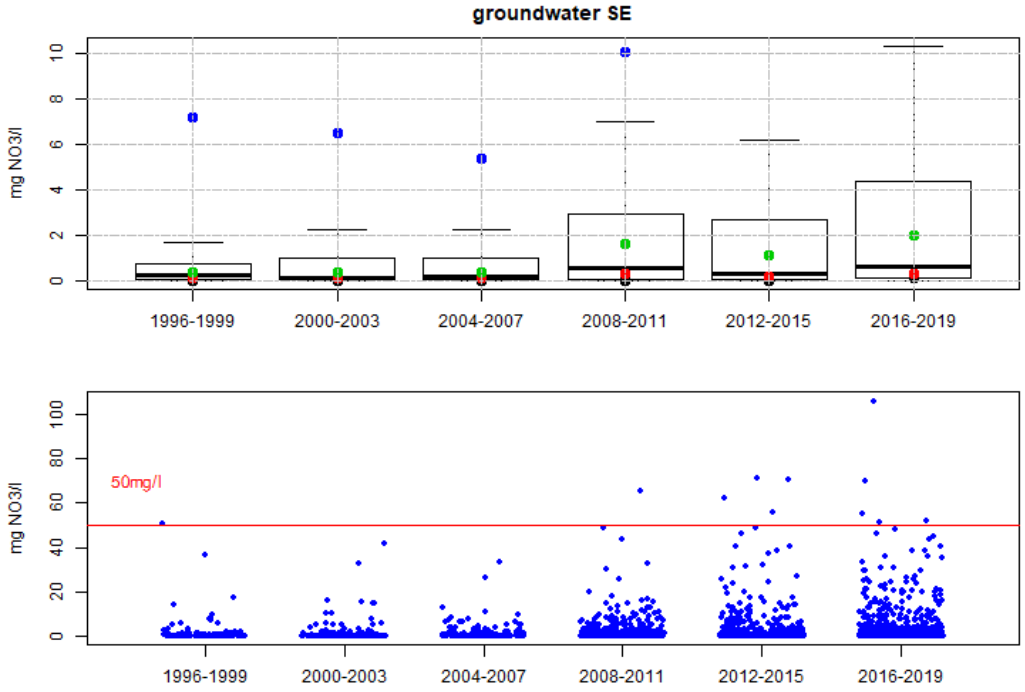



Figure 17. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

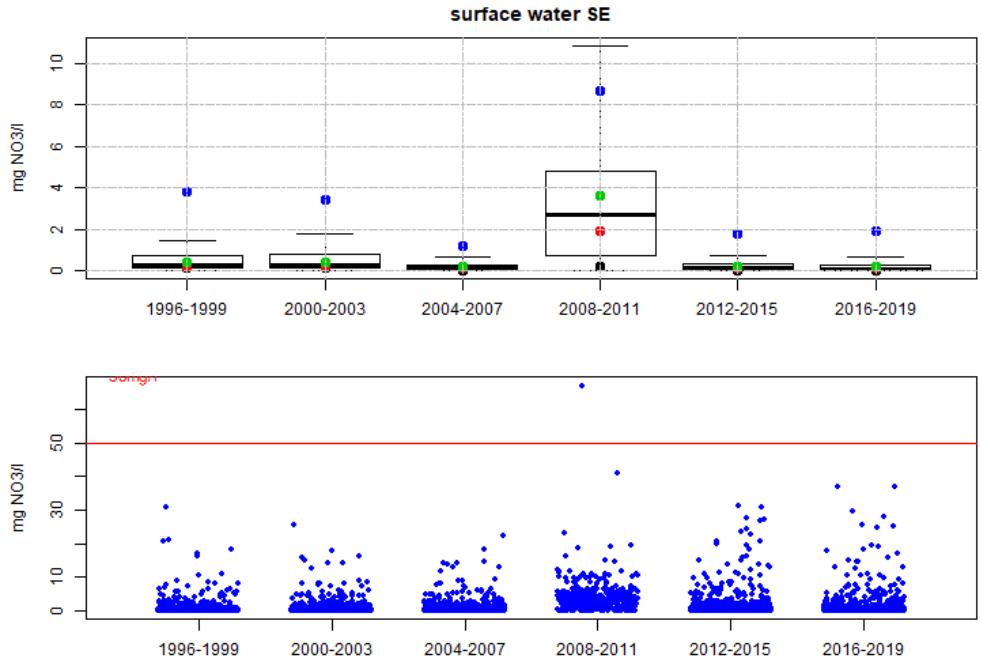



Figure 18. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

# Conclusions and recommendations

Sweden has a low livestock density, a low surplus of nitrogen and phosphorus.

There is a well-elaborated network of monitoring stations. The groundwater quality is generally very good, but there a number of monitoring stations showing eutrophication. Eutrophication affects inland waters inside NVZ and coastal waters.

The action programme was revised in 2015.

The Commission recommends Sweden to reinforce its action programme to better address eutrophication issues for inland waters and marine waters.