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Swedish Environmental Quality Criteria

Nutrients in Lakes and Watercourses

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Present criteria



- Only for Phosphorus concentrations (Total P)
 - P is the main regulatory element for primary production
 - Classification on 3 years sampling

- Nitrogen standards are under development
 - Total nitrogen and DIN/TP ratio

History

- SEPA – General Guidelines 1990
 - Only total N and total P concentrations
- SEPA – Environmental Quality Criteria 1999
 - Total N and P concentrations and area-specific losses
 - Deviation from reference values
- SEPA/SwAM – Environmental Quality Criteria 2008
 - Only total P concentrations compared to references (EQR)

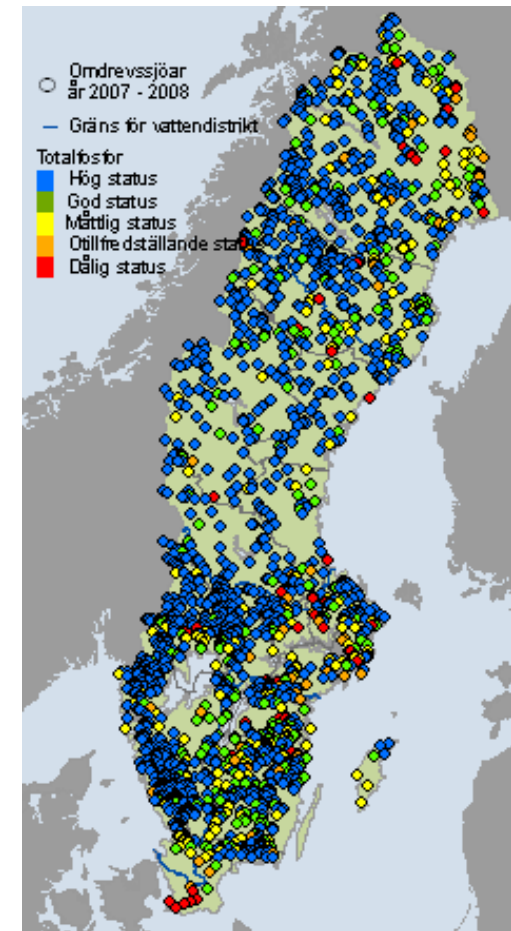


Phosphorus criteria

- Reference values based on “unpolluted waters”
- P content highly influenced by humic matter
- Site-specific references:
 - Water colour (humic substances)
 - Altitude (weathering)
 - Ca+Mg (weathering, watercourses only)
 - Lake mean depth (retention)
 - (Alkalinity removed due to low impact)

Correction for watercourses with > 10% Arable land

Soil type, P in subsoil, and soil inclination



Site-specific references

(based on reference objects <10% arable land, no obvious point sources etc.)

■ Lakes

- $\text{Log}(\text{Ref-P}) = 1.63 + 0.25 \cdot \text{logABS} - 0.14 \cdot \text{Altitude} - 0.20 \cdot \text{Mean depth}$
- $\text{Log}(\text{Ref-P}) = 1.56 + 0.30 \cdot \text{logABS} - 0.15 \cdot \text{Altitude}$

■ Watercourses

- $\text{Log}(\text{Ref-P}) = 1.53 + 0.24 \cdot \text{CaMg} + 0.30 \cdot \text{logABS} - 0.012 \cdot (\text{Altitude})^{0.5}$
- $\text{Log}(\text{Ref-P}) = 1.38 + 0.24 \cdot \text{logABS} - 0.014 \cdot (\text{Altitude})^{0.5}$

>0.7

0.5-0.7

0.3-0.5

0.2-0.3

<0.2

Boundaries and verification

- “Expert judgement” notable deviation from undisturbed conditions at about 2 • reference value
- Lakes
 - Boundaries verified with phytoplankton and chlorophyll (old criteria)
- Watercourses
 - No verification due to low correlation between P and production



Challenges

- About 10% of the surface is water
- More than 300 000 lakes
- More than 100 000 lakes $> 0.04 \text{ km}^2$
- More than 4 000 lakes $> 1 \text{ km}^2$
- More than ? km of watercourses
- Oblong country in North – South direction



Relationship to other elements

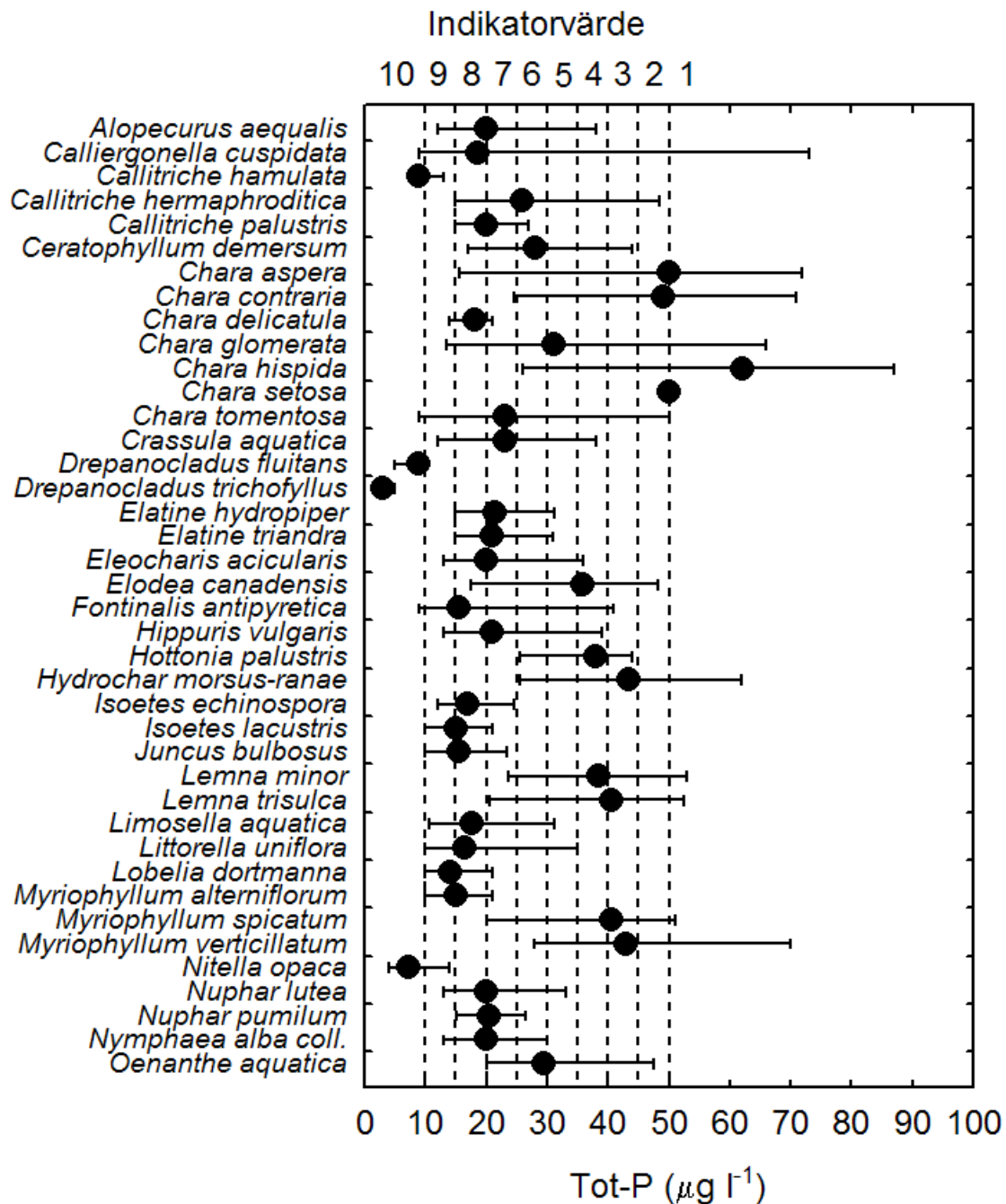
Classification according to Total Phosphorus

			1 <1%	2 1%
	1 <1%	8 4%	3 1%	16 7%
	3 1%	2 1%	4 2%	9 4%
21 10%	11 5%	4 2%	4 2%	6 3%
67 30%	34 15%	18 8%	5 2%	5 2%

Classification according to Chlorophyll a

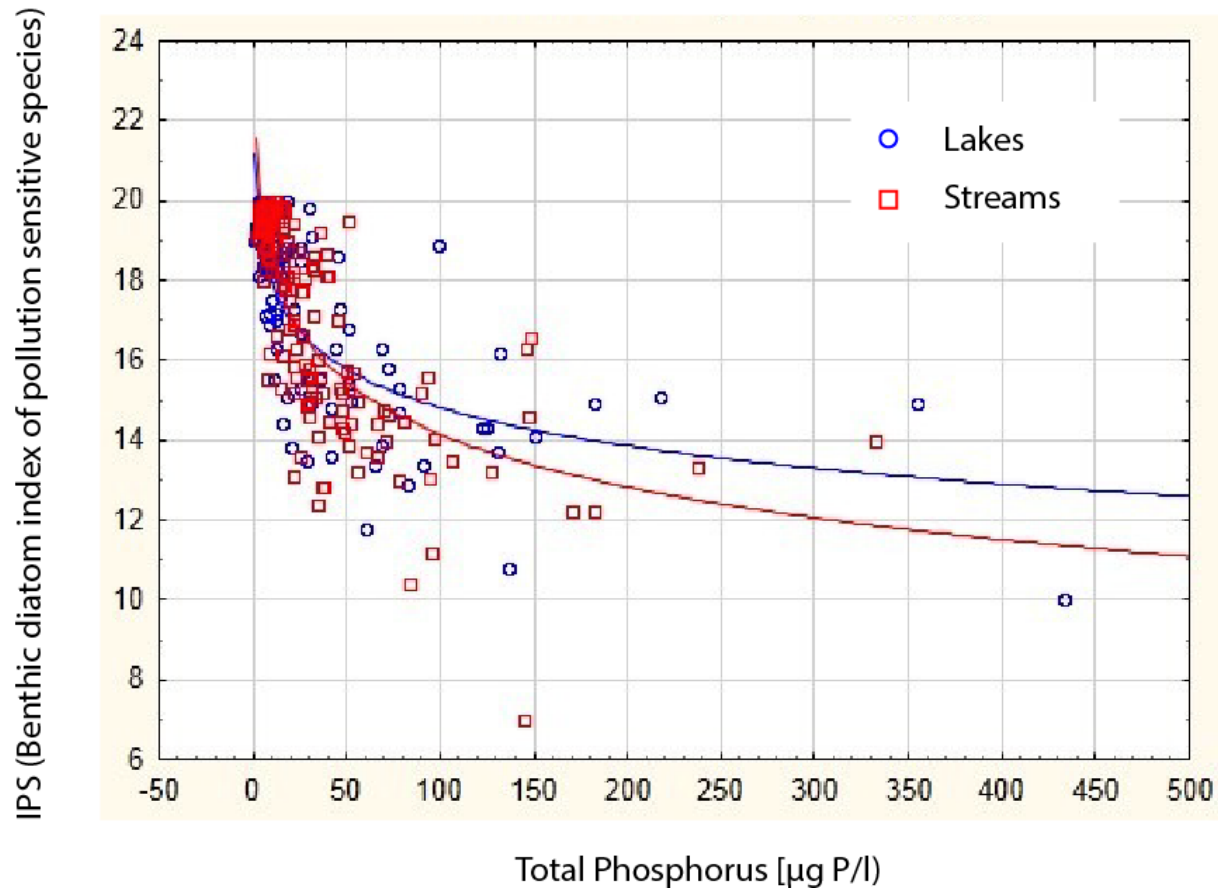
Relationship to other elements

Total P and Macrophytes
(lakes only)



Relationship to other elements

Total P vs. IPS (Benthic diatoms)



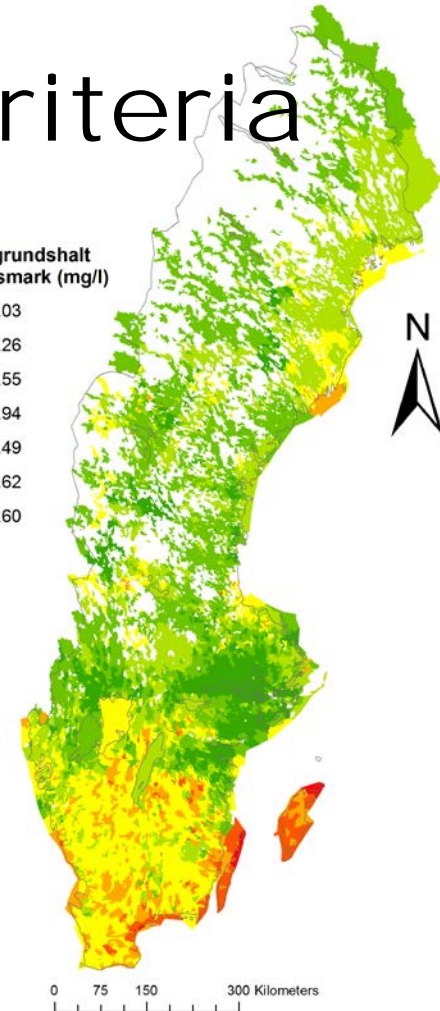
Suggested new Nitrogen criteria

- Total nitrogen, and DIN/TP (N limitation)
- Highly influenced by organic matter
- Site-specific references:
 - TOC (organic matter)
 - Nitrogen deposition

Correction for watercourses with > 10% Arable land

Soil type, percolation

Viktad N-bakgrundshalt från jordbruksmark (mg/l)



>0.7

0.5-0.7

0.3-0.5

0.2-0.3

<0.2

Future

- Biological Quality Elements are under revision
 - 5 year research project Waters (<http://www.waters.gu.se/english/>)
- New Hydromorphological Quality Criteria
- At the present, no organised revision on Physico-chemical Elements
 - Need to develop estimates of uncertainty in classifications
 - In future, area-specific losses might be used again