



Water exchange in coastal waters affecting priorities of land-based measures

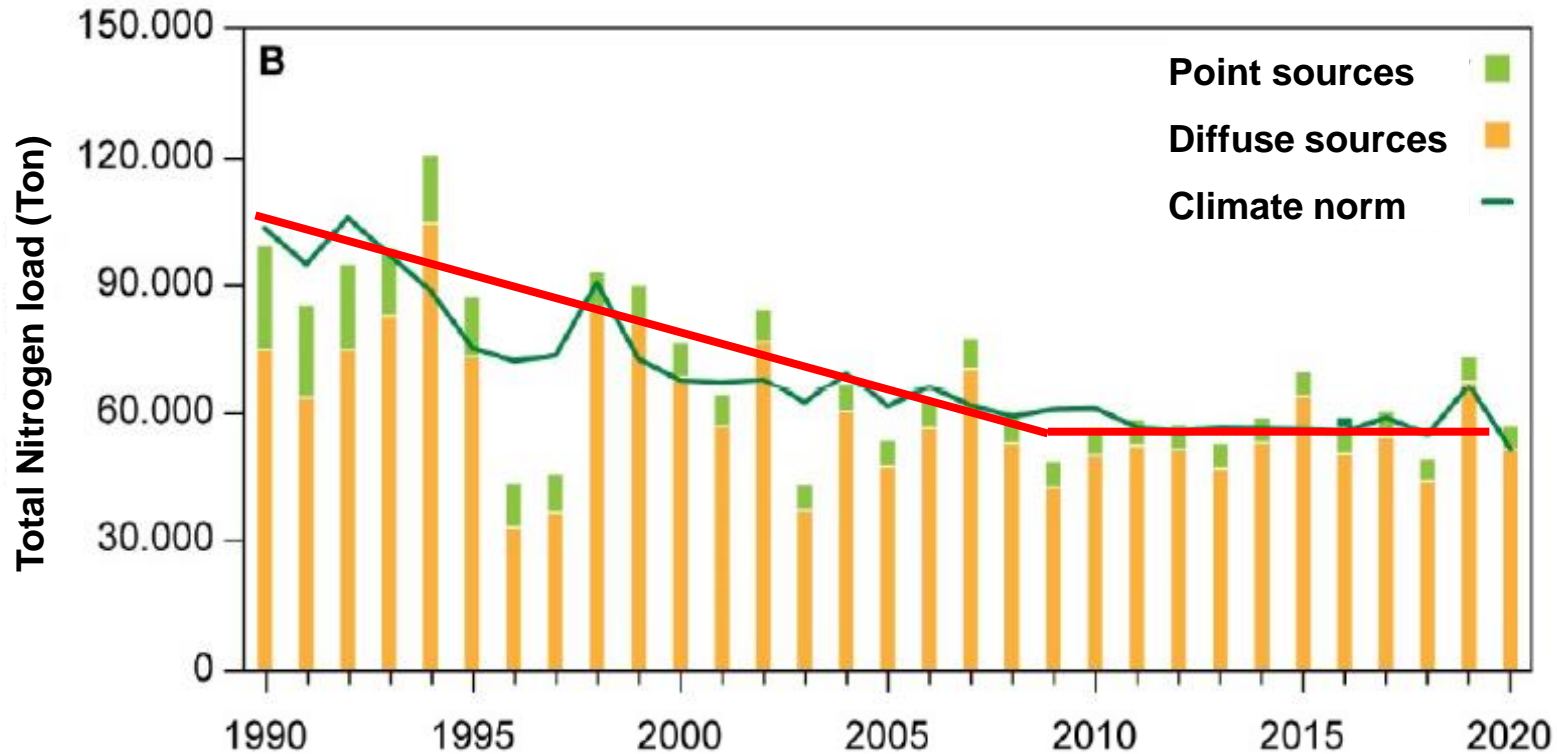
Flemming Gertz, Line Kolding Thostrup,
Line Bønnelycke Nørgaard

LUWQ - Maastricht, the Netherlands,
12-15 September 2022

STØTTET AF
Promilleafgiftsfonden for landbrug

SEGES
INNOVATION

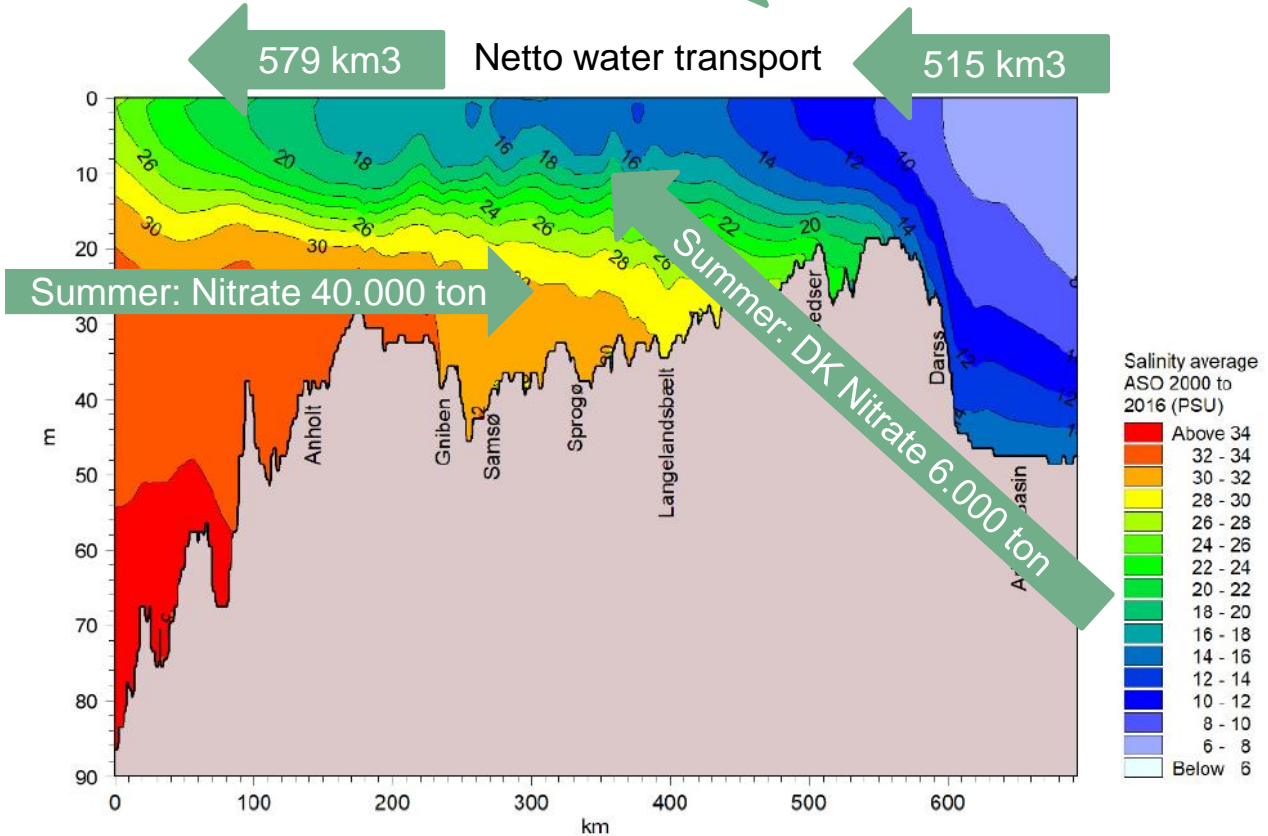
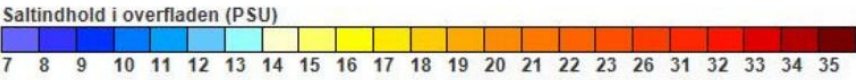
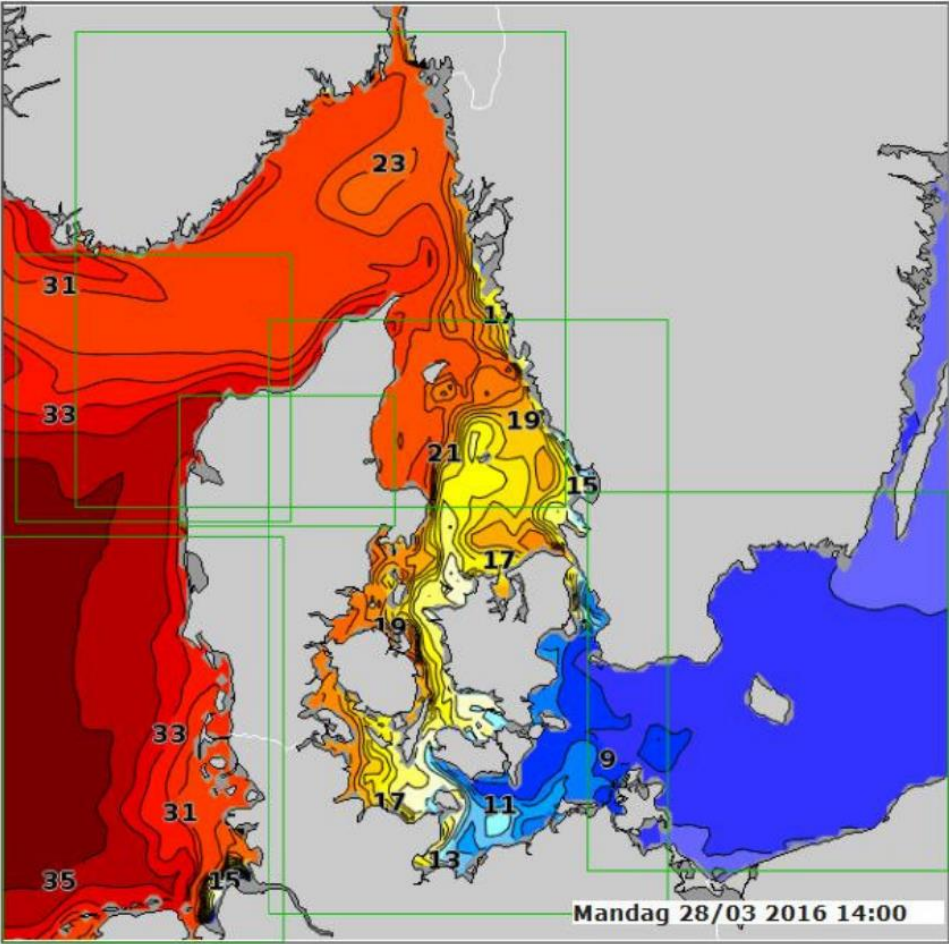
Yearly nitrogen loads to Danish coastal waters



- Better use of manure
- Reduced use of mineral fertilizer
- Catch crops
- Green fields
- Wetlands

Kilde: N.B., Blicher-Mathiesen, G. & Kjeldgaard, A. 2021. Vandløb 2020. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 82 s. - Videnskabelig rapport nr. 473

Danish coastal waters – a big estuary

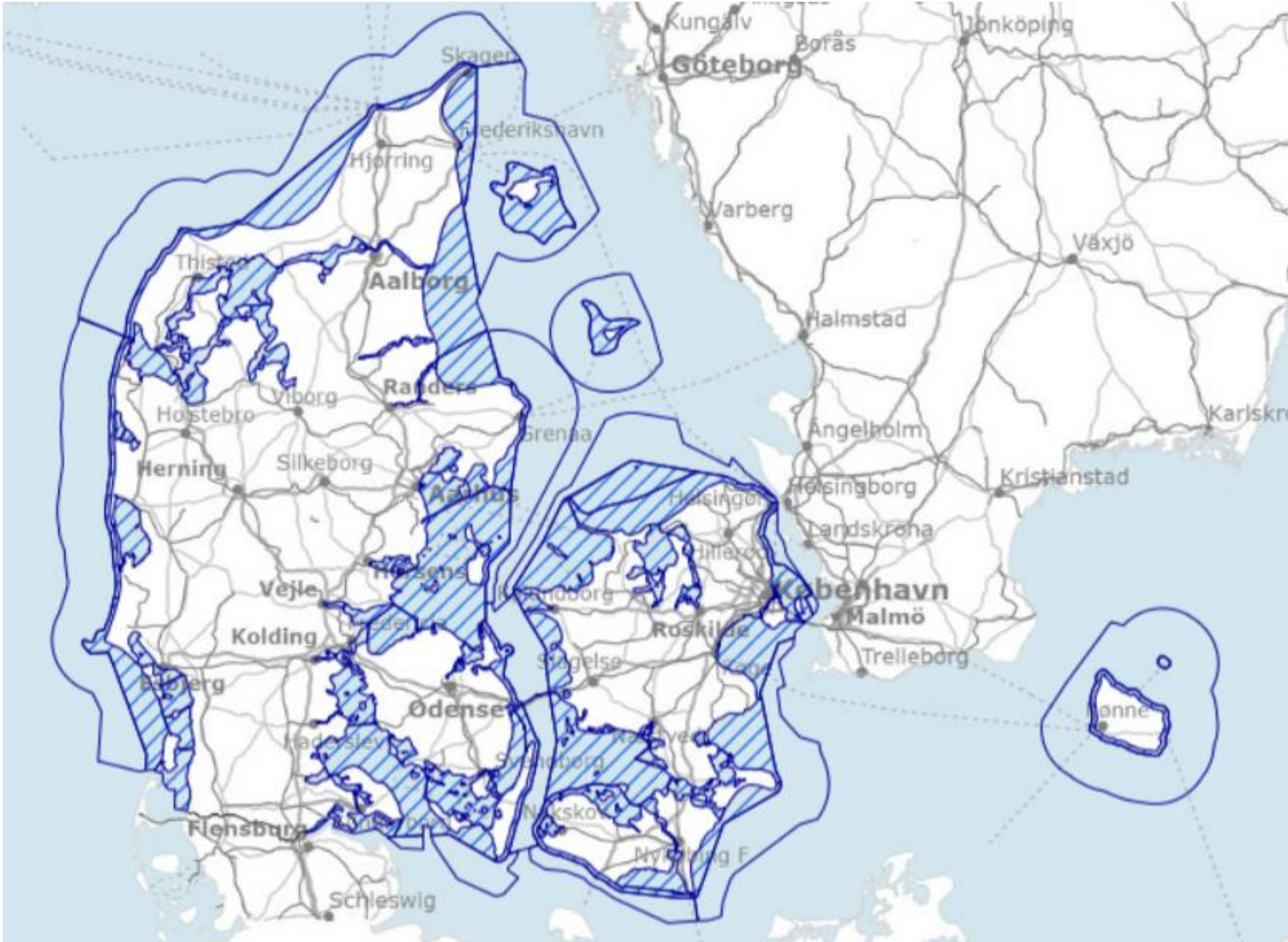


Source: Hansen J.W. & Høglund S. (red.) 2021. Marine områder 2020. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 192 s. - Videnskabelig rapport fra DCE nr. 475. <http://dce2.au.dk/pub/SR475.pdf>

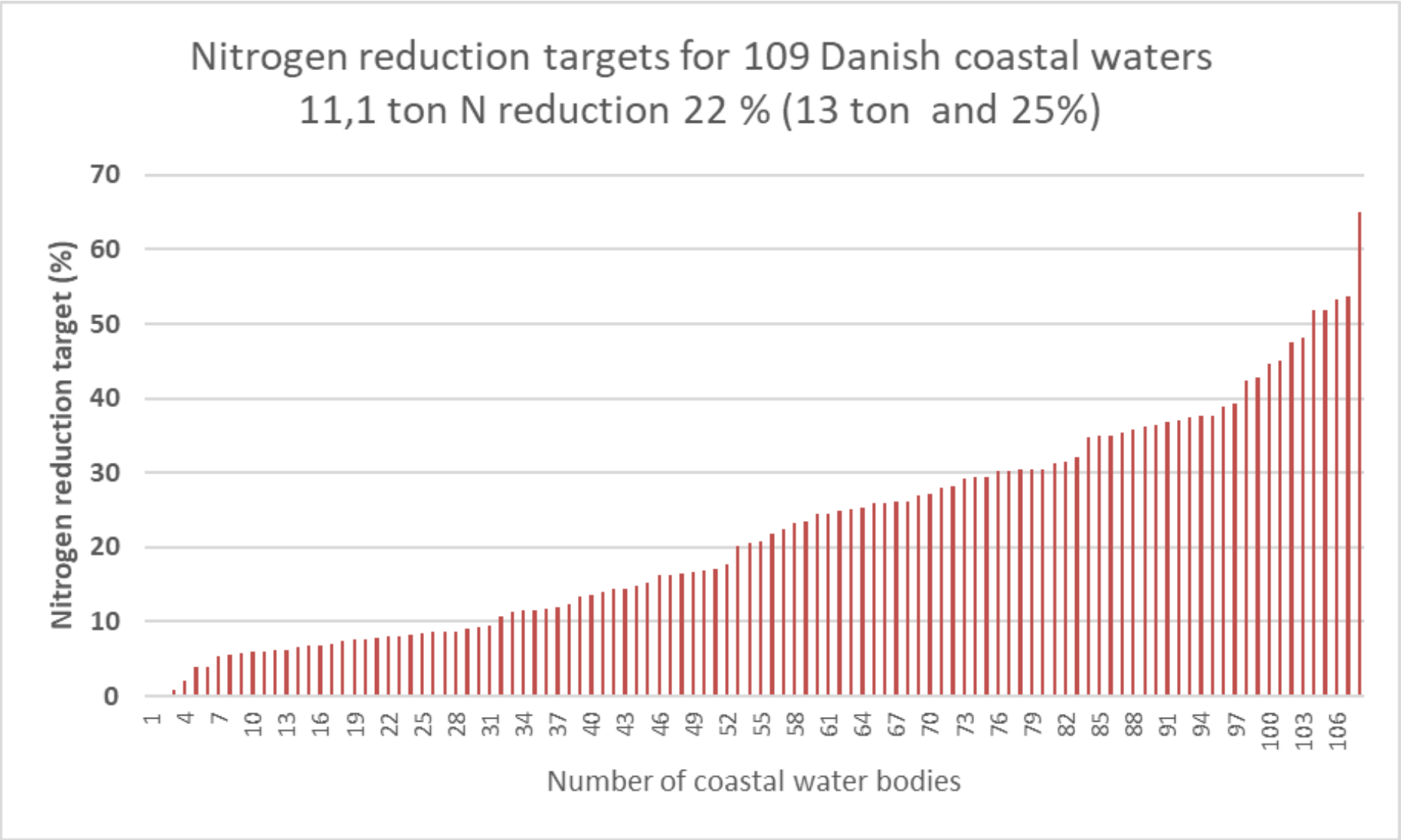
Source : Jørgen S. Steinfeld, 2016



Coastal water bodies and catchments

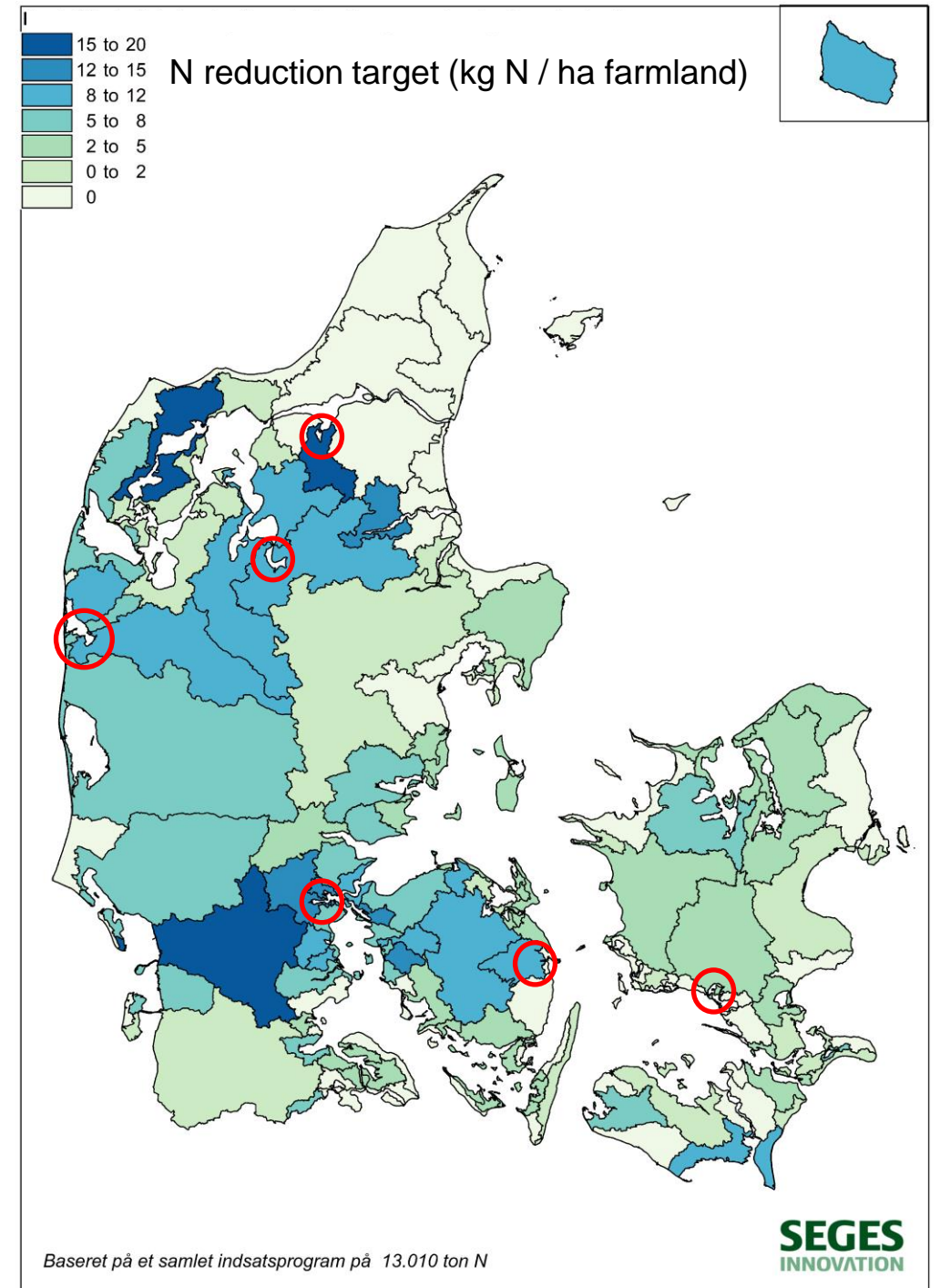


Nitrogen reductions in Danish WFD III plans to coastal waters



N –yearly reduction targets

Halkær Bredning: 29 %
Hjarbæk Fjord 36 %
Nissum Fjord, mellem fjord: 35 %
Kolding Fjord: 65 %
Holckenhavn Fjord: 54 %
Karrebæk Fjord: 16 %



Seasonal Effects from Nitrogen Reductions

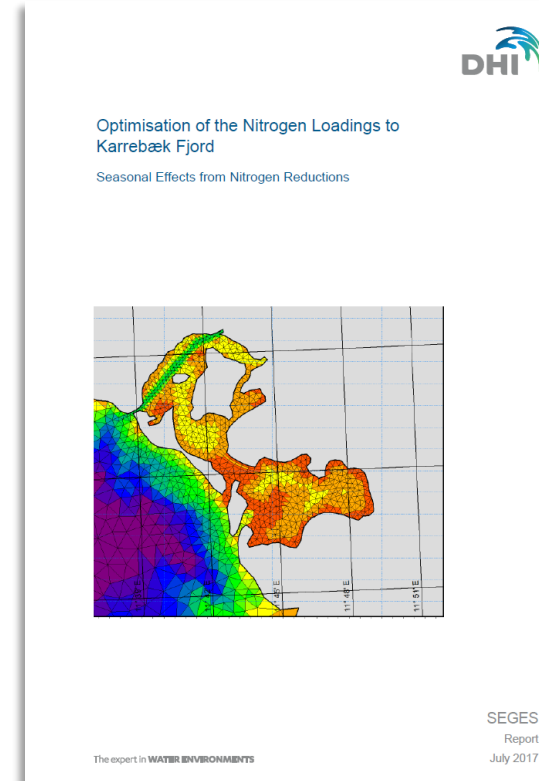
Station	Time for 50% water exchange (days)		Time for 90% water exchange (days)	
	Summer	Winter	Summer	Winter
1	3	1.5	32	10
5	15.5	2.5	41	16.5
6	11.5	2.5	39	10.5
7	5	3	38.5	10.5

Conclusion: very little effect on summer chlorophyll-a by reducing nitrate in winter time

Not part of the DK - WFD plan III

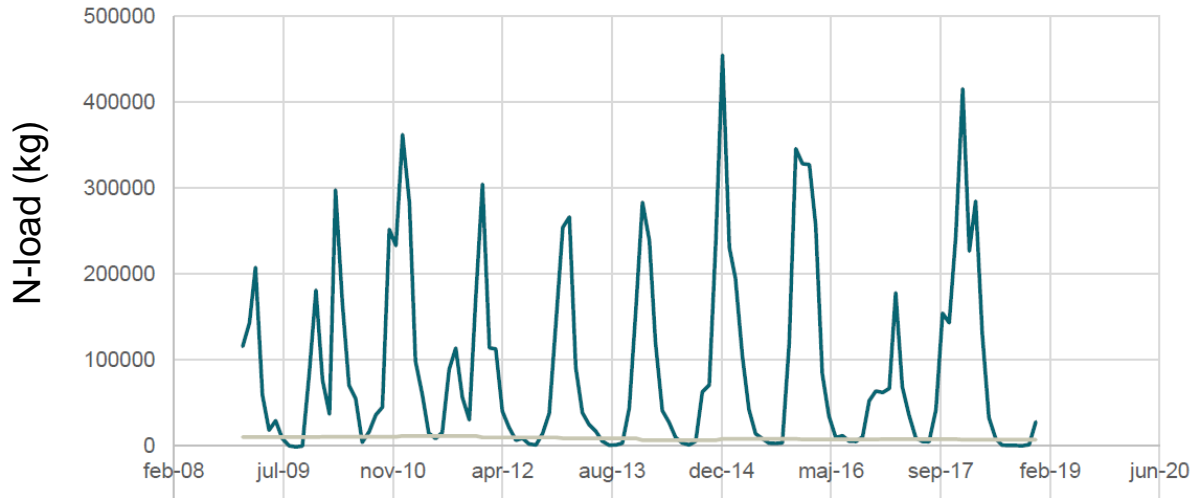
Josefson et al 2000. doi:10.1006/ecss.1999.0562

Fenchel et al 2006. "Naturen i Danmark - Havet"

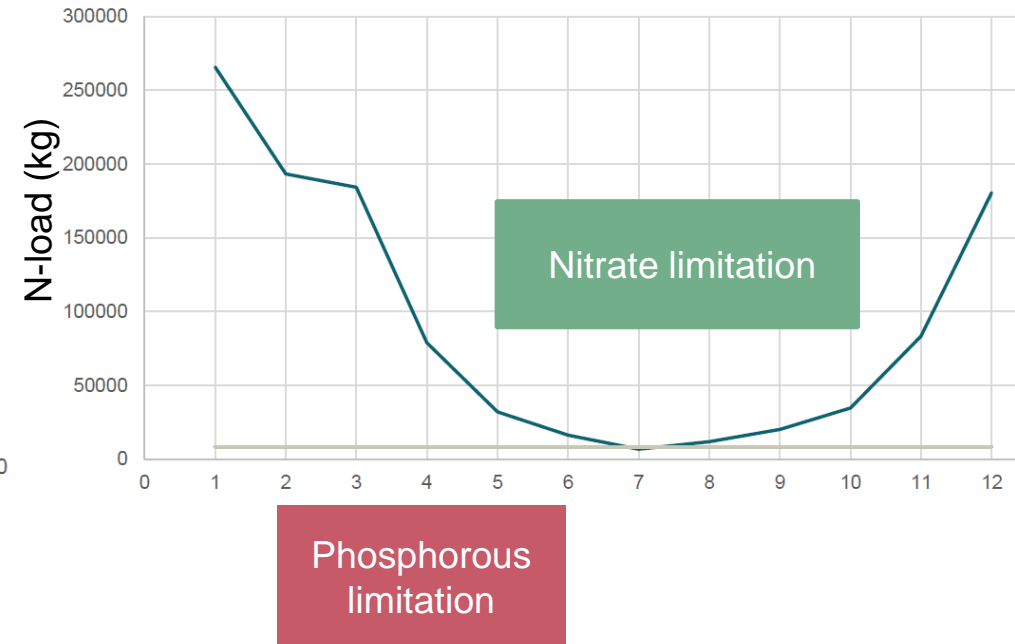


N-load to Karrebæk Fjord

N-Load to Karrebæk Fjord 2008 to 2020



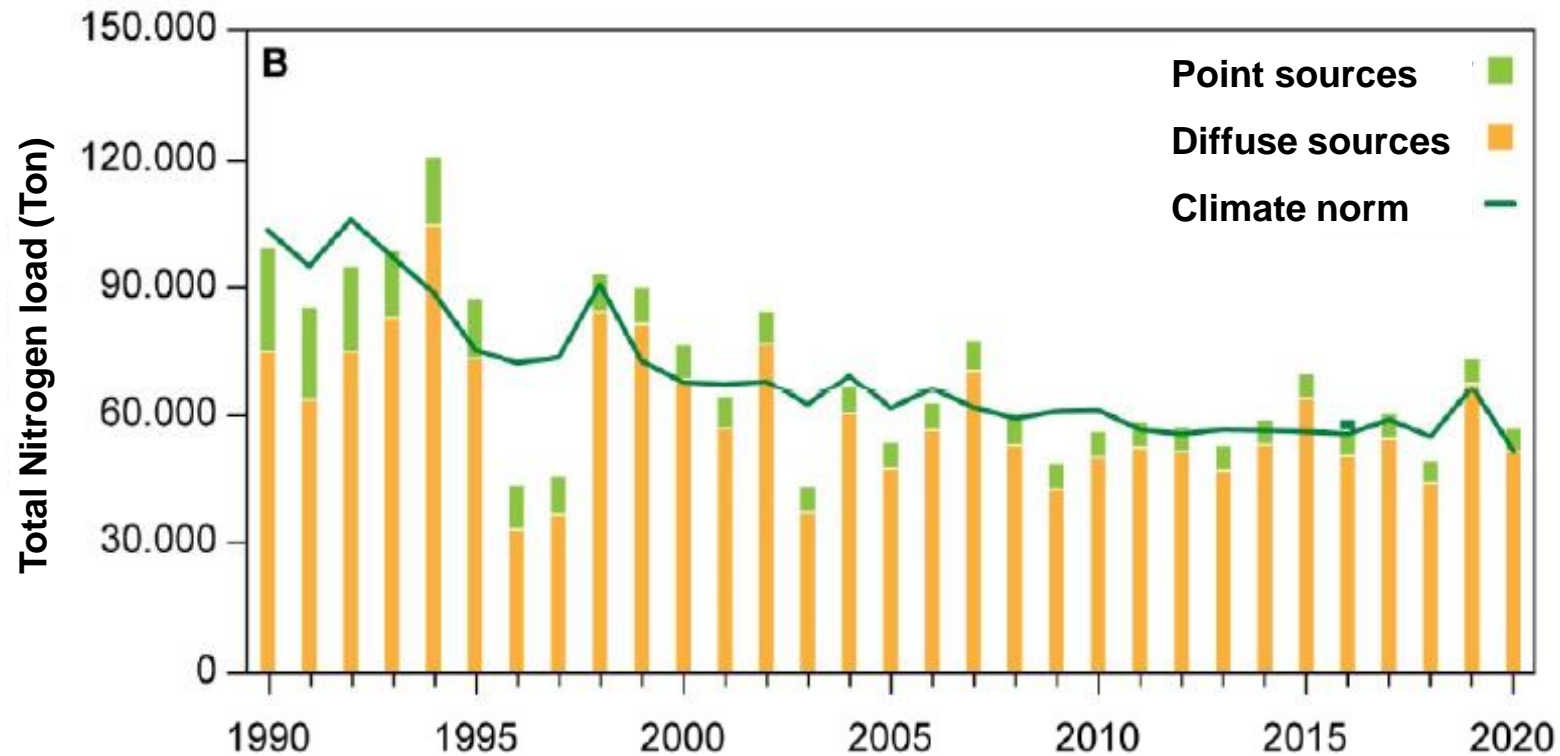
Yearly N-Load to Karrebæk Fjord average 2009-2018



Field measures and seasonal timing

- Catch crops versus winter wheat
- Early spreading of manure in the spring (risk if lots of rain)
- Gradually and/or precision fertilizing in spring
- Drain filter solutions – (constructed wetlands, Integrated buffer zones etc.)

Yearly nitrogen loads to Danish coastal waters

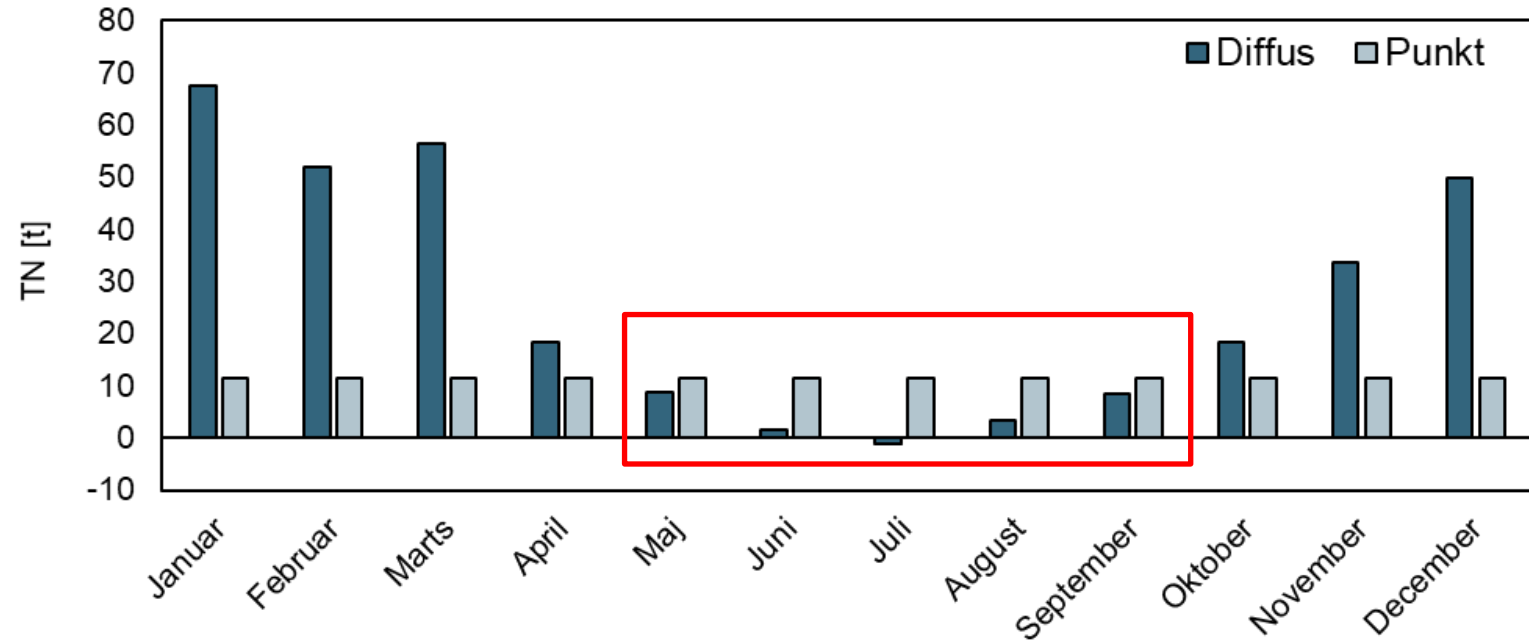


Kilde: N.B., Blicher-Mathiesen, G. & Kjeldgaard, A. 2021. Vandløb 2020. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 82 s. - Videnskabelig rapport nr. 473

Point sources and diffuse sources – seasonal distribution

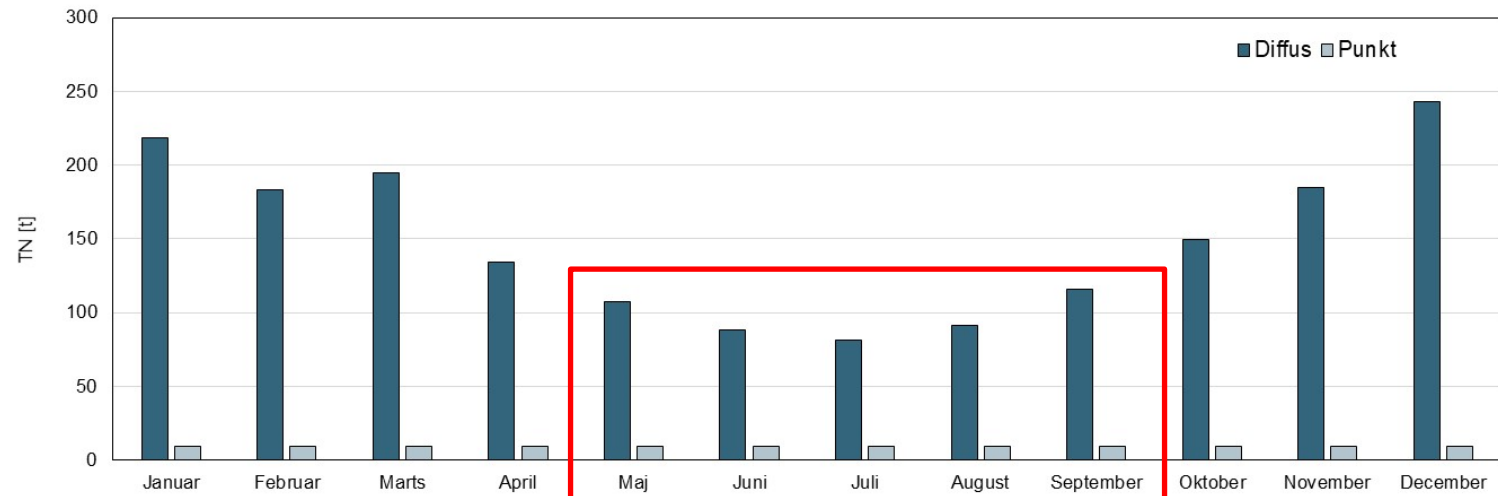
Catchment in DK east

- Clay
- Drains
- Dense population



Catchment in DK west

- Sandy
- High ground water load to stream
- Less dense population



New Danish pilot program for Local based water plans

- Local partnerships can apply for money for making local plans for achieving good ecological status in the local coastal water fjord
- Deadline for the plans are August 2023
- Possible to include more details in the plans and including water exchange and timing of N-loads

Conclusions

- Better understanding of the connection between recipient and catchment is necessary to achieve good ecological status in coastal waters
- Introduce a new dimension in the N-loads reduction targets: timing
- More work must be done to understanding the effect of different measure during a year (not only yearly loads)
- Point sources are more important than we believed
- Local based Water Plans could be a way to include necessary details including “timing”