

Locally Based River Basin Management Plan: An Integrated Modelling Framework for Ringkøbing Fjord

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Land Use and Water Quality Conference

Aarhus, Denmark, 3-6 June 2025

1 SEGES Innovation, 2 Longline Environment, 3 Marine Science & Consulting ApS,

4 Ringkøbing-Skjern Kommune

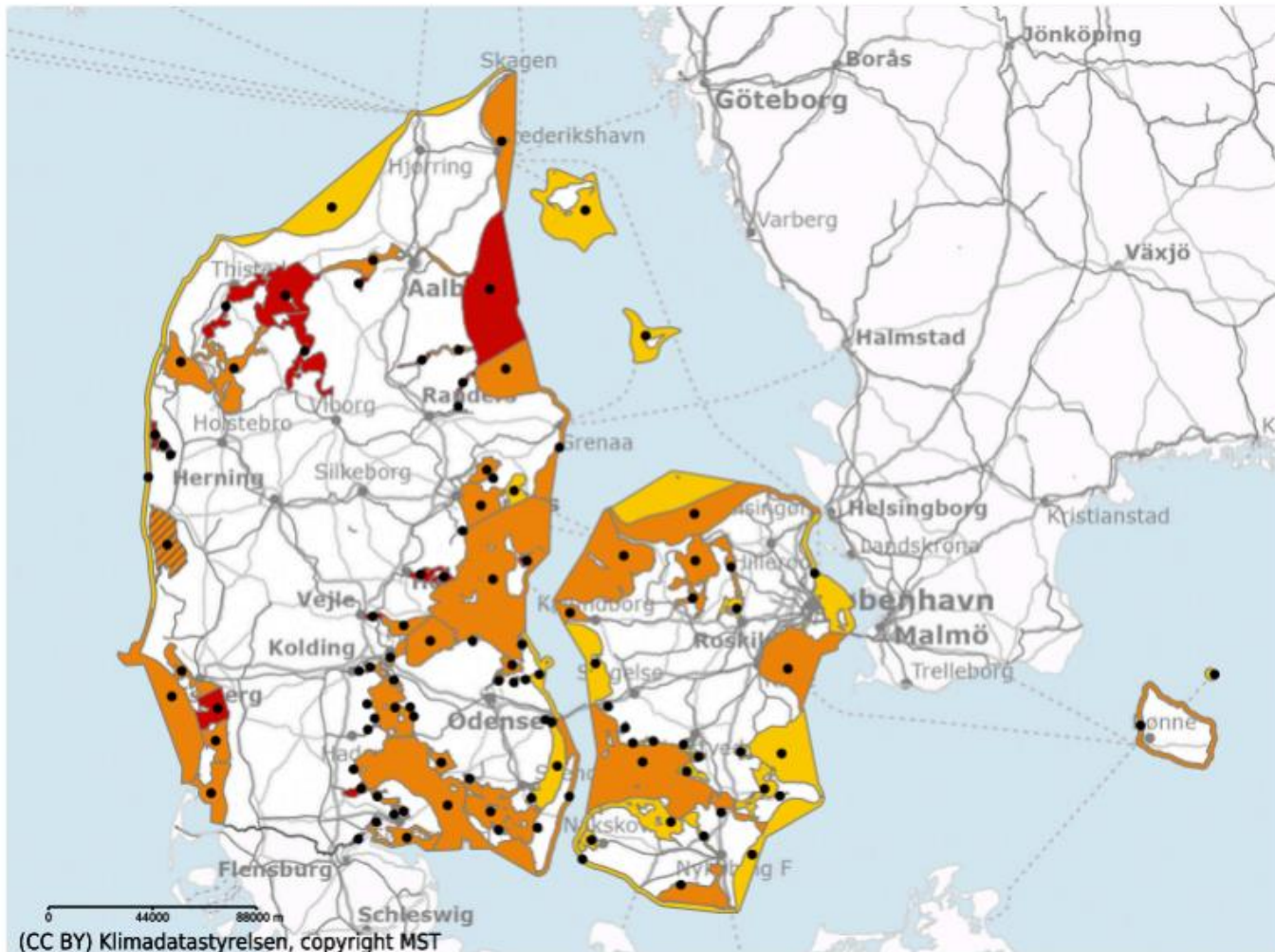
STØTTET AF
Promilleafgiftsfonden for landbrug

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Status in Danish Coastal Waters



Miljøministeriet



- Høj økologisk tilstand
- God økologisk tilstand
- Moderat økologisk tilstand
- Ring økologisk tilstand
- Dårlig økologisk tilstand
- Maksimalt økologisk potentiale
- Godt økologisk potentiale
- Moderat økologisk potentiale
- Ring økologisk potentiale
- Dårligt økologisk potentiale

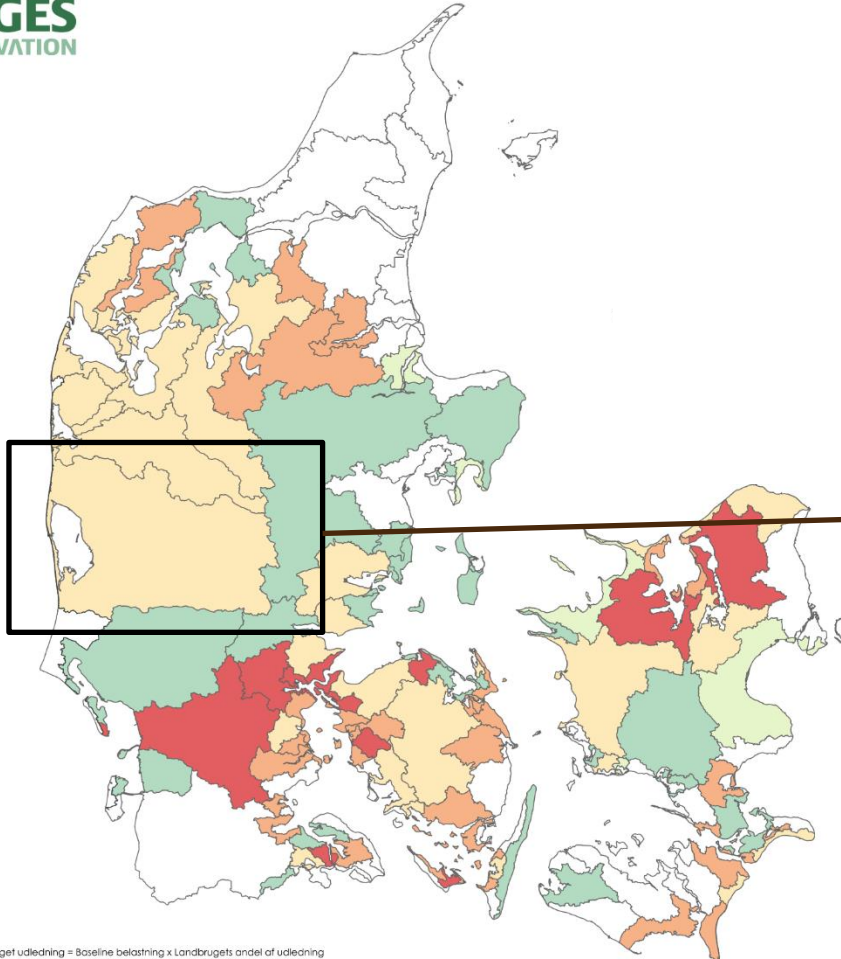
Miljøkvalitetskravet er overskredet for et
• flere nationalt specifikke miljøfarlige
forurenende stoffer

Current RBMP - Nitrogen reduction requirements for agriculture-related emissions

Nitrogen reduction requirements for agriculture-related emissions

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- Over 80 %
- 60 til 80 %
- 40 til 60 %
- 20 til 40 %
- 0 til 20 %
- Uændret



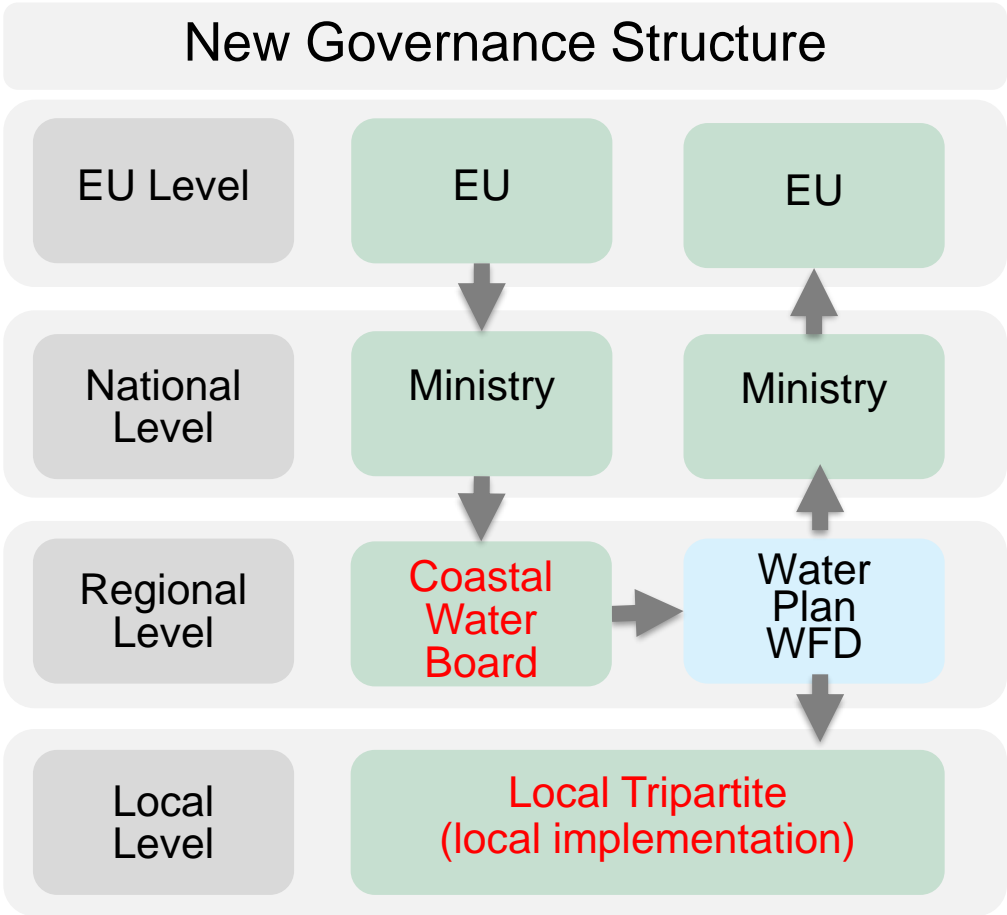
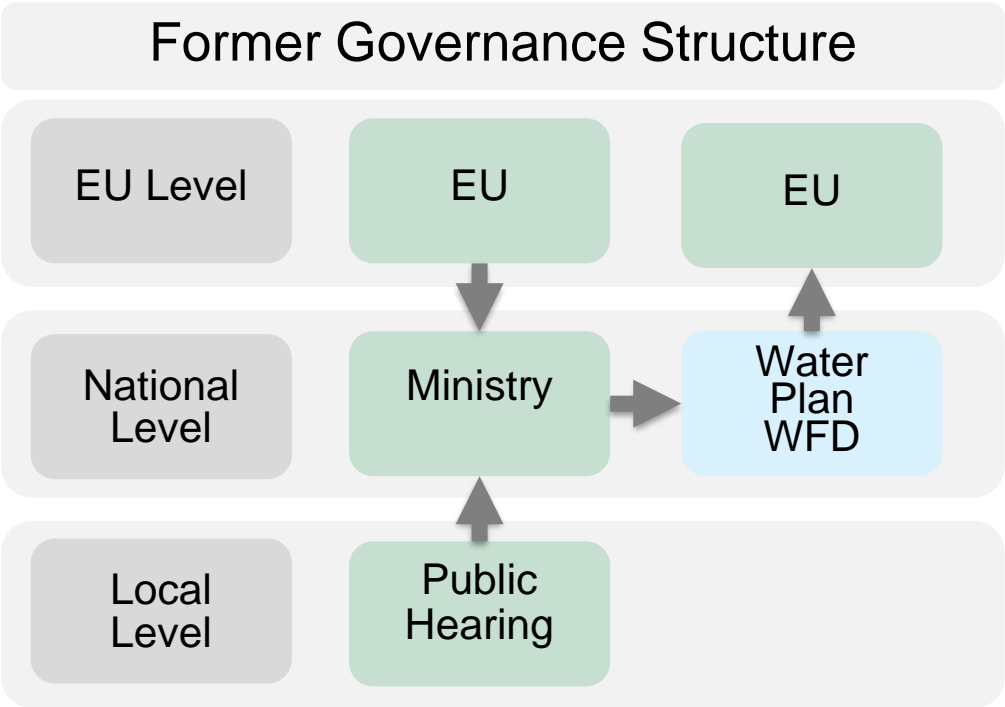
N-reduction based on models used in current RBMP
Based on a N-load to chlorophyll relation

0 50 km

New Parliament decision 2024 - Key Goals for Environment, Nature, and Climate in Denmark

- 400,000 ha farmland (15%) → nature (new forest, rewetting org. soils, wetlands)
- 20% of Denmark to be protected nature by 2030
- New Nitrogen regulation (Nitrogen emission cap)
- World's first CO₂e tax on agriculture
- A locally based approach to land management and coastal waters
- €5.8 billion land transition fund - Government
- €1.34 billion - Novo Nordisk Foundation (Wegovy/Ozempic producer)

Governance structure



More about Governance at Poster #9

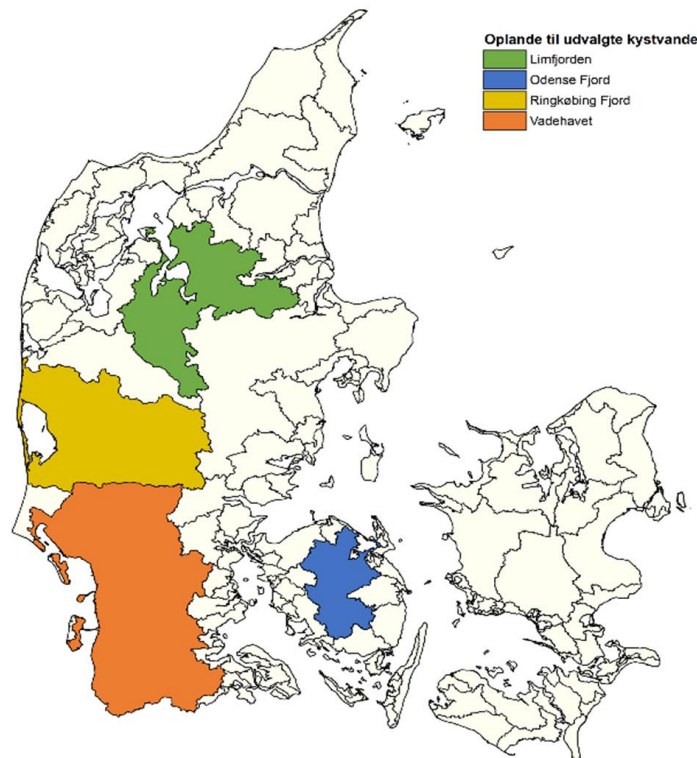
Coastal Water Board / Local Water Plans

Test in 2023

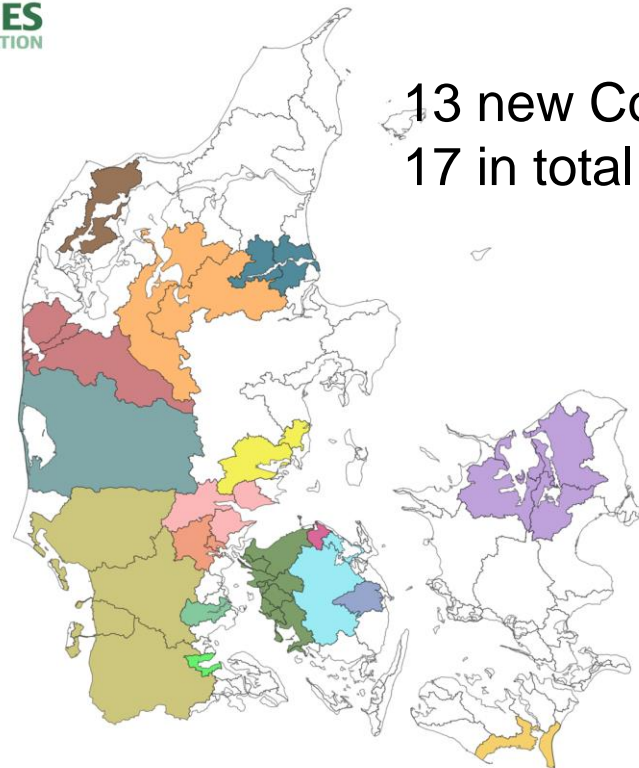
Task: Local plan for achieving good ecological status

4 test sites (8 applications)

Budget 2.1 million euro / 9 month



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13 new Coastal Water Boards 2025-2027
17 in total

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Coastal Water Board Ringkøbing Fjord

- 13 organizations represented and 4 municipalities involved
- Environmental organizations, agriculture, fisheries, and water utilities
- Coordination group, technical group, and fisheries group
- 8 Coastal Water Council meetings held from March to December 2023
- All professional reports, meeting minutes, evaluations etc. available on the municipality's website:(Google: “Kystvandråd 2023 Ringkøbing-Skjern Kommune”) Final report available in English.

Technical Work – Fjord and Catchment Analyses/Models

- System understanding – statistical analyses (SEGES Innovation)
- Sluice and fjord model (Marine Science & Consulting ApS)
- Hydrodynamic and ecological model of the fjord (Longline Environment)
- SWAT catchment model (Longline Environment)
- Phosphorus model – risk mapping in the catchment area (Aarhus University)

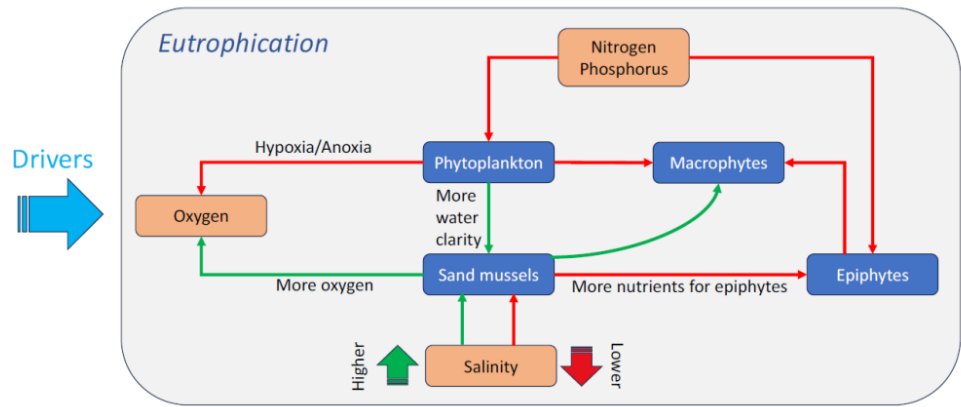
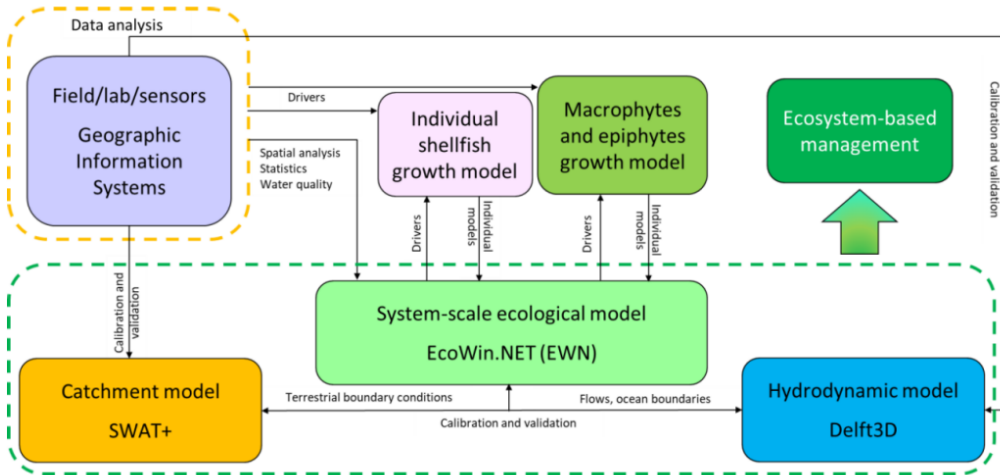
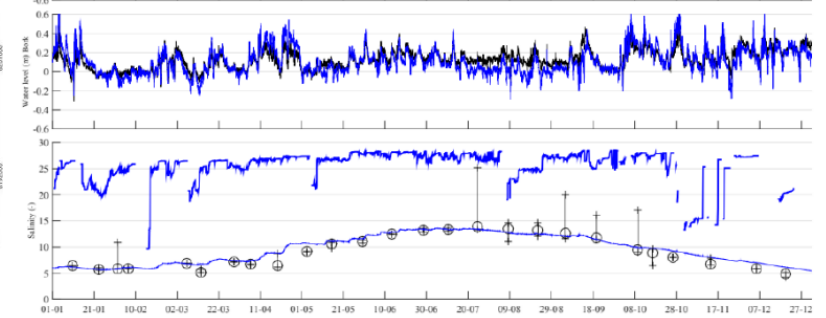
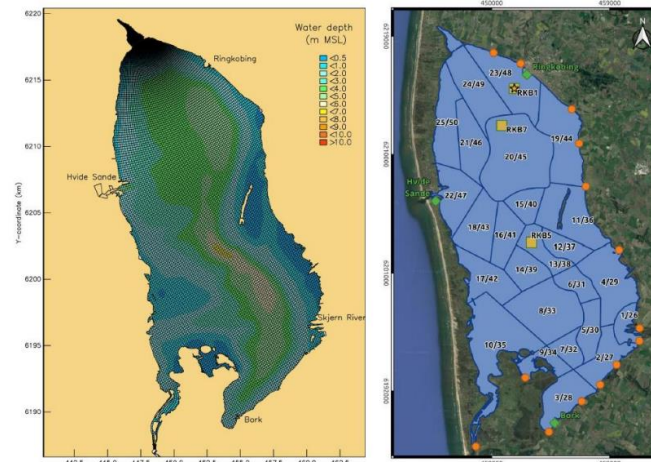
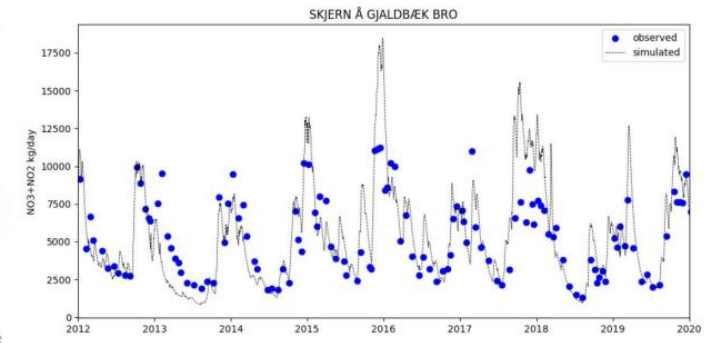
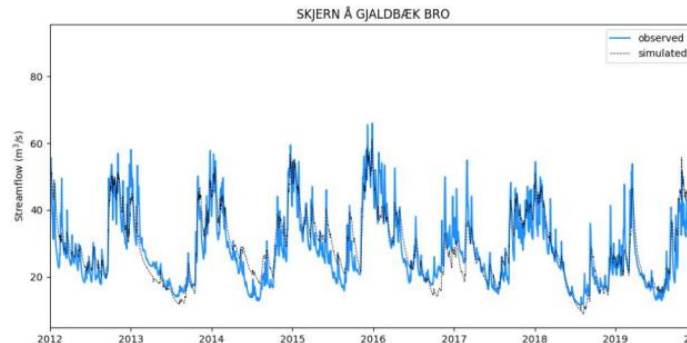
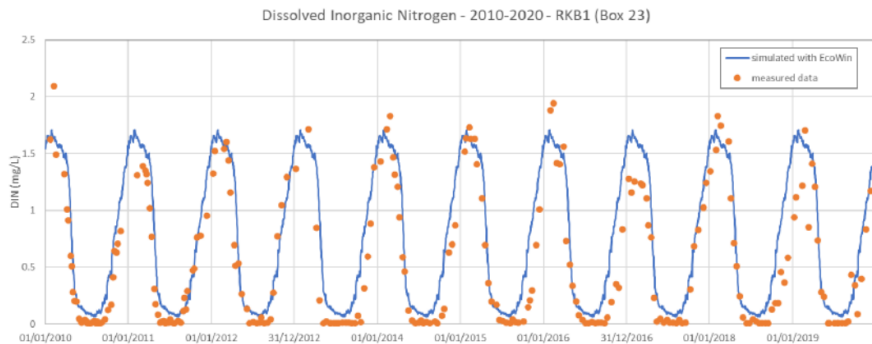
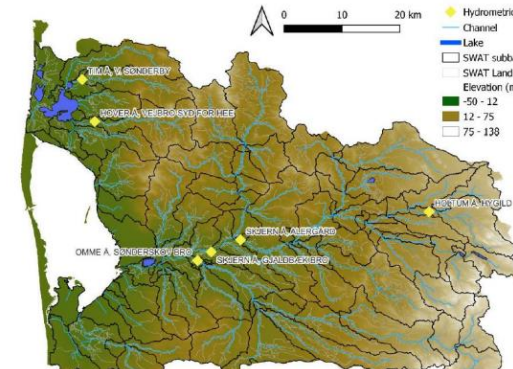
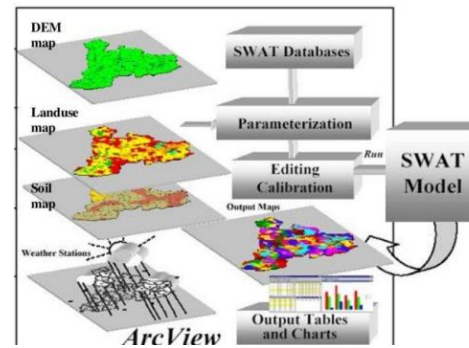


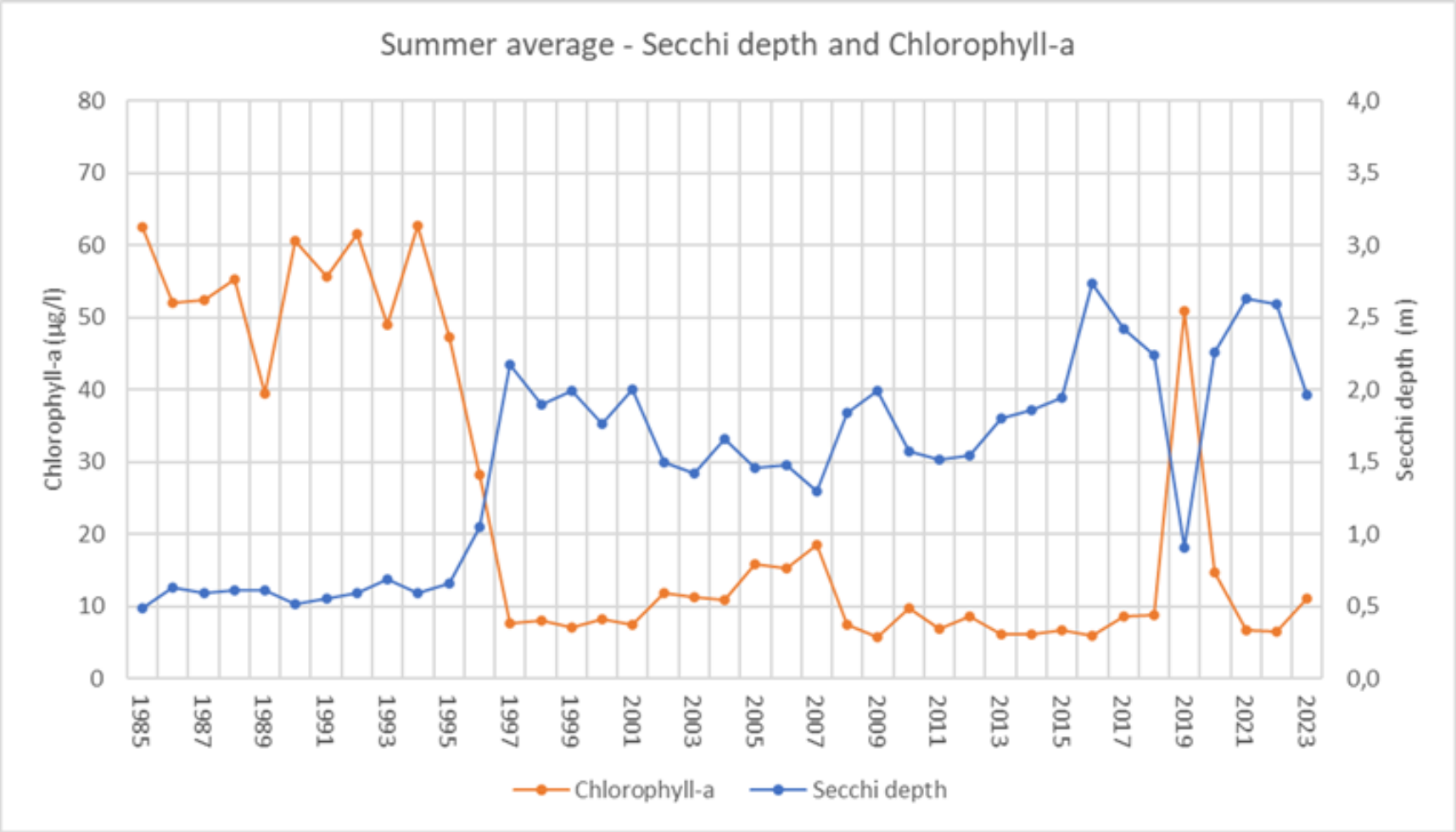
Fig. 1. Conceptual diagram illustrating interactions of key ecosystem components in Ringkøbing Fjord



Soil and Water Assessment Tool

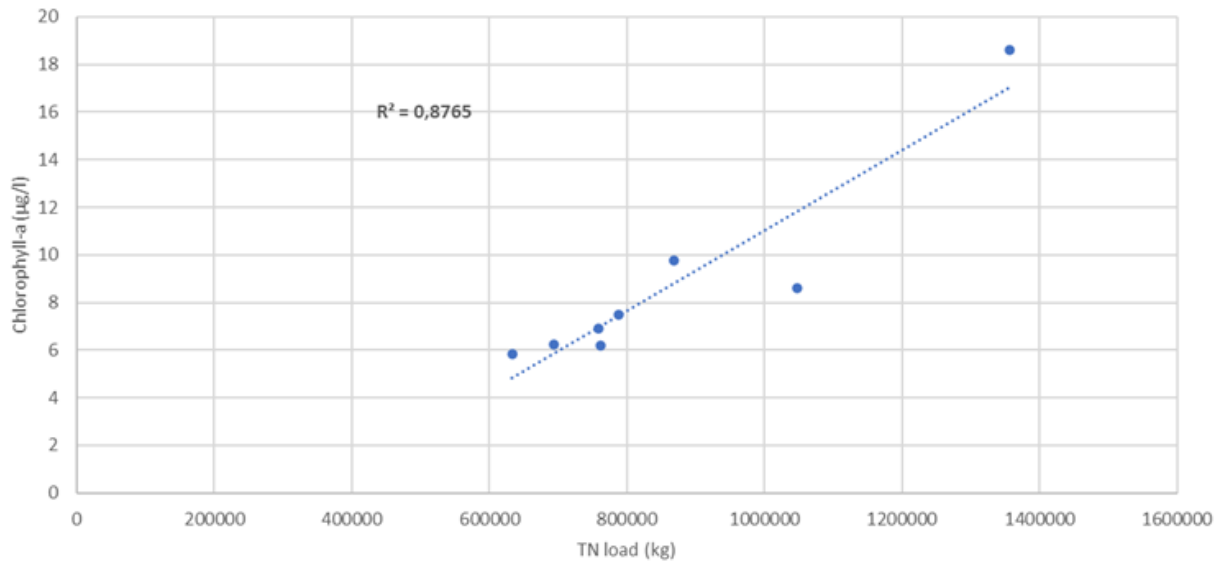


Ecosystem function

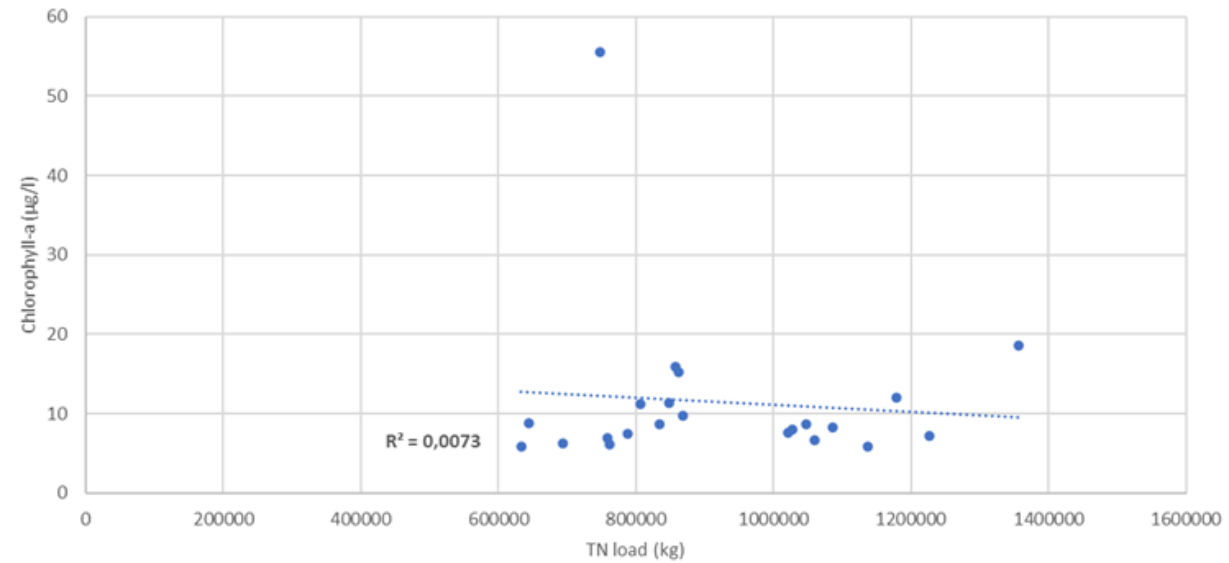


Correlation between N-load and chlorophyll-a

Correlation TN load (May-Aug) to Chlorophyll (May-Sep)
Data 2007-2014



Correlation TN load (May-Aug) to Chlorophyll (May-Sep)
Data 1998-2019



Correlation TN-load to Chlorophyll-a			
	TN load (May-Aug) Chlorophyll (May-Sep)	TN load (June-Aug) Chlorophyll (June-Aug)	TN load (Jan-Aug) Chlorophyll (May-Sep)
Years	R ²	R ²	R ²
1998-2019	0,01	0,002	0,01
1998-2018	0,09	0,13	0,02
1998-2014	0,18	0,18	0,05
2002-2014	0,48	0,35	0,17
2007-2014	0,88	0,81	0,68
2008-2018	0,001	0,02	0,09
2008-2019	0,02	0,003	0,05

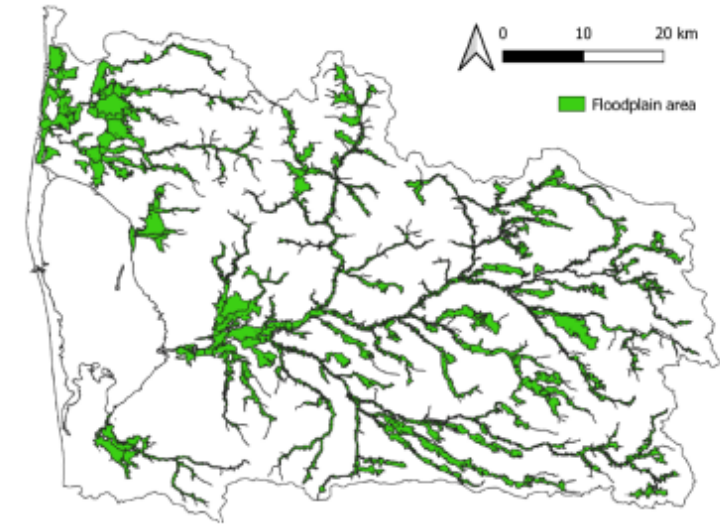
Table 1. Correlations result R² for correlation TN-load to Chlorophyll-a for different combinations of years and different combination of month.

Conclusions from Fjord modelling

- The model results indicate that chlorophyll concentrations are below the threshold for good ecological potential, set to 8.4 $\mu\text{g}\cdot\text{L}^{-1}$ in the current River Basin Management (RBMP), in 48 out of the 50 model boxes
- The collapse of the fjord's mussel population in 2019 could have been avoided by changes in the sluice operation, despite increased runoff from the catchment area.
- Reducing the N-load indicates a reduction in the risk for epiphytes

Conclusions from the SWAT catchment model

Scenario	Fertiliser inputs	Exports to Ringkøbing Fjord	Exports reduction compared to baseline (%)	Wetlands area (ha)
0 – Baseline	45 485	4 518		4 031
1 – No farming	0	2 248	50%	4 031
2 – Full wetland	37 836	1 191	74%	53 937
3 – 60% wetlands	41 005	2 425	46%	32 029
4 – 50% wetlands	41 781	2 797	38%	26 966
5 – 40% wetlands	42 557	3 158	30%	21 903



Recommendations from the Coastal Water Board

- Higher salinity levels in winter/spring of 7–8 ‰ (currently 6 ‰) to support clam (*Mya arenaria*) population
- Reduce nutrient input from the catchment area to limit epiphyte growth and thus create optimal growing conditions for seagrasses. Two scenarios:
 - Nitrogen reduction as proposed in RBMP (1,647 tons N) using wetlands as a mitigation measure
 - Half of the reduction in scenario 1, also using wetlands as a mitigation measure

Recommendations from the Coastal Water Board

- Monitoring epiphyte growth on vegetation in Ringkøbing Fjord ✓
- Increased monitoring of seagrasses in terms of both coverage and depth distribution to establish a better data basis.
- Enhanced monitoring of the clams (*Mya arenaria*)
- Planting of eelgrass/seagrasses at selected locations in the fjord

Evaluation by Morten Graversgaard Aarhus University

- Overall, the results indicate that the council has been effective in involving various stakeholders and producing durable solutions for the fjord, based on local conditions and interests

Thank you for
your attention



Photo: Danmarks Center for Vildlaks