Coastal Water Council - Stakeholder Board Meeting
Ringkøbing, September 15th, 2023

Modelling of Ringkøbing Fjord to support policy-makers
for compliance with the EU Water Framework Directive

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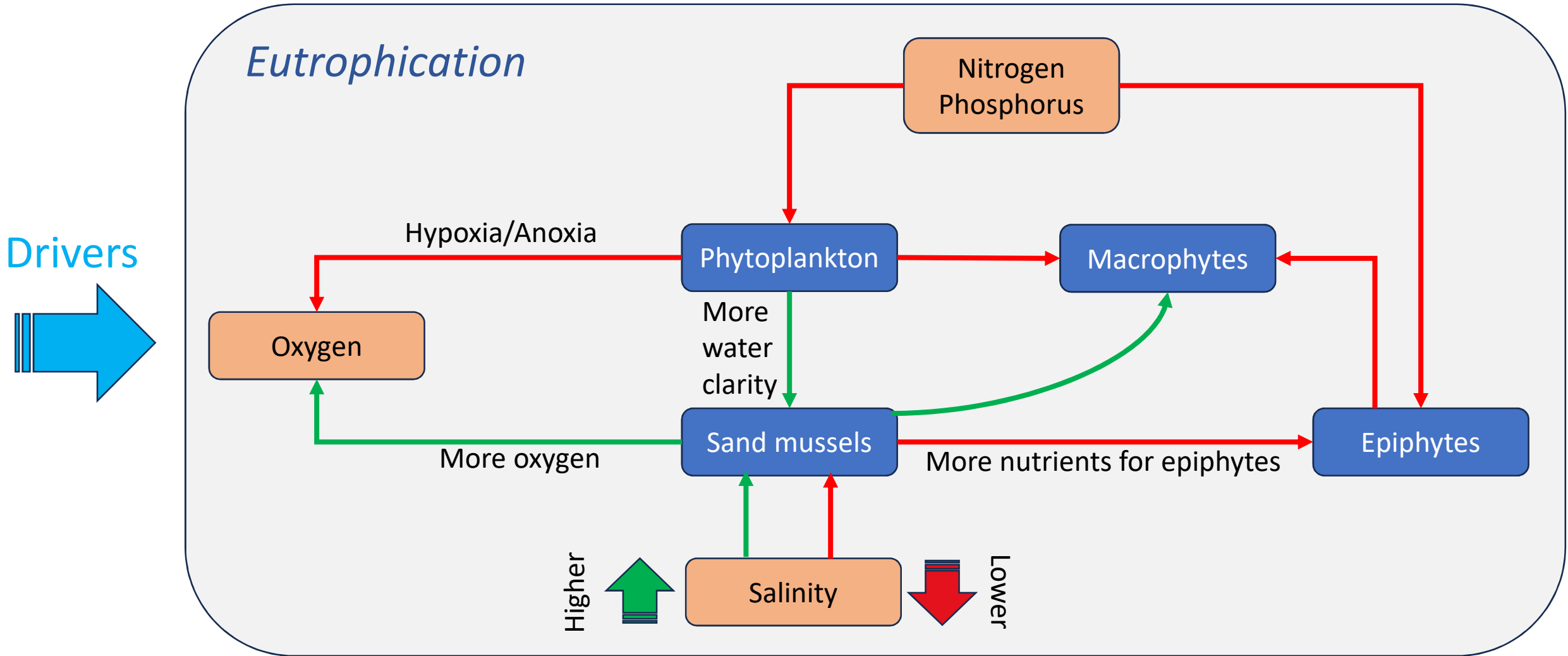Longline Environment Ltd., Ireland
http://longline.co.uk/rksk

Outline of talk

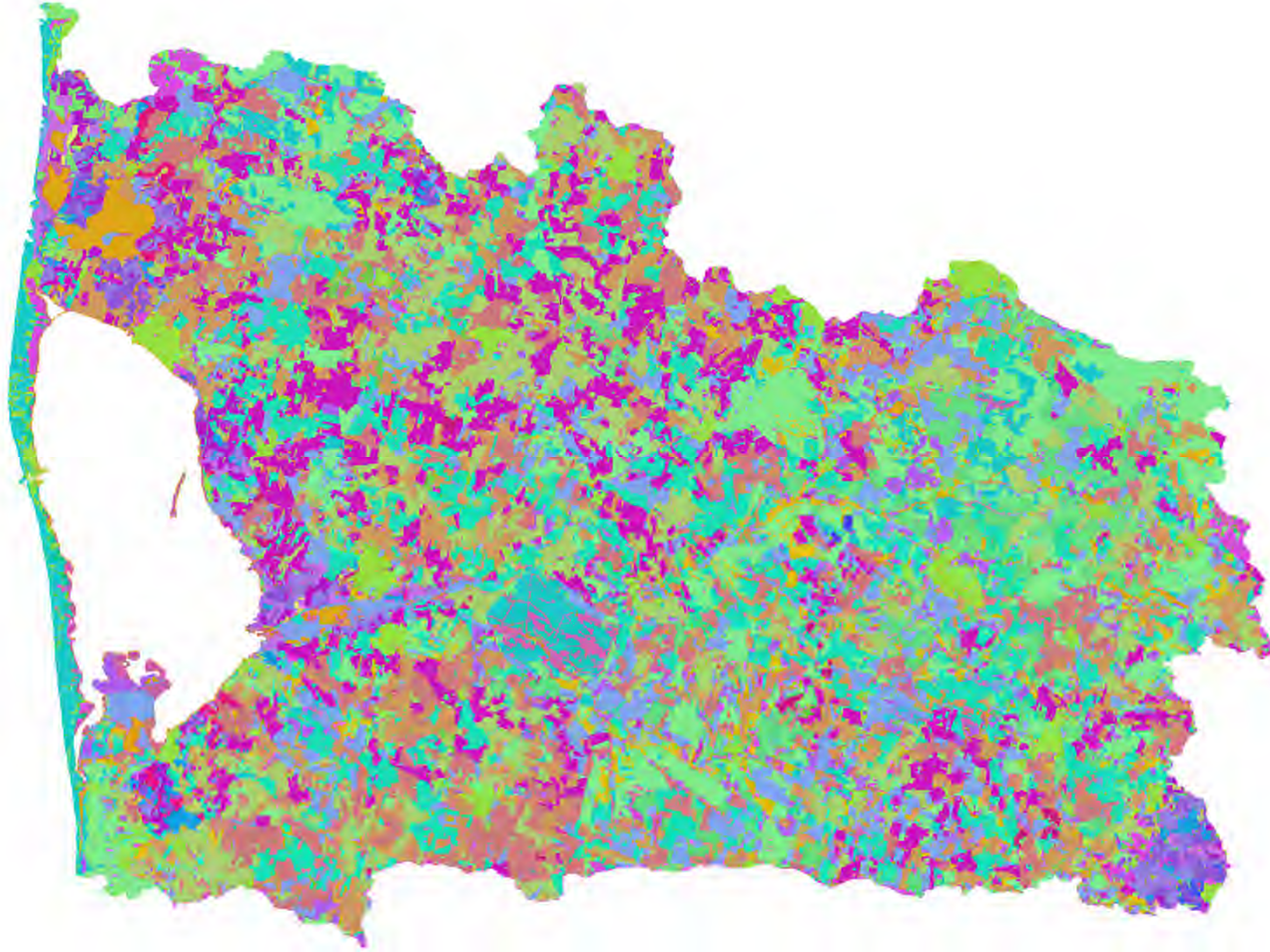Ringkøbing Fjord – a beautiful part of the world...

Ringkøbing Fjord – a complex management problem

Ringkøbing Fjord er et turistmål, et ål- og skrubberfiskeri, vadefuglebestande, smukt landbrugsland, og det er et HMWB...
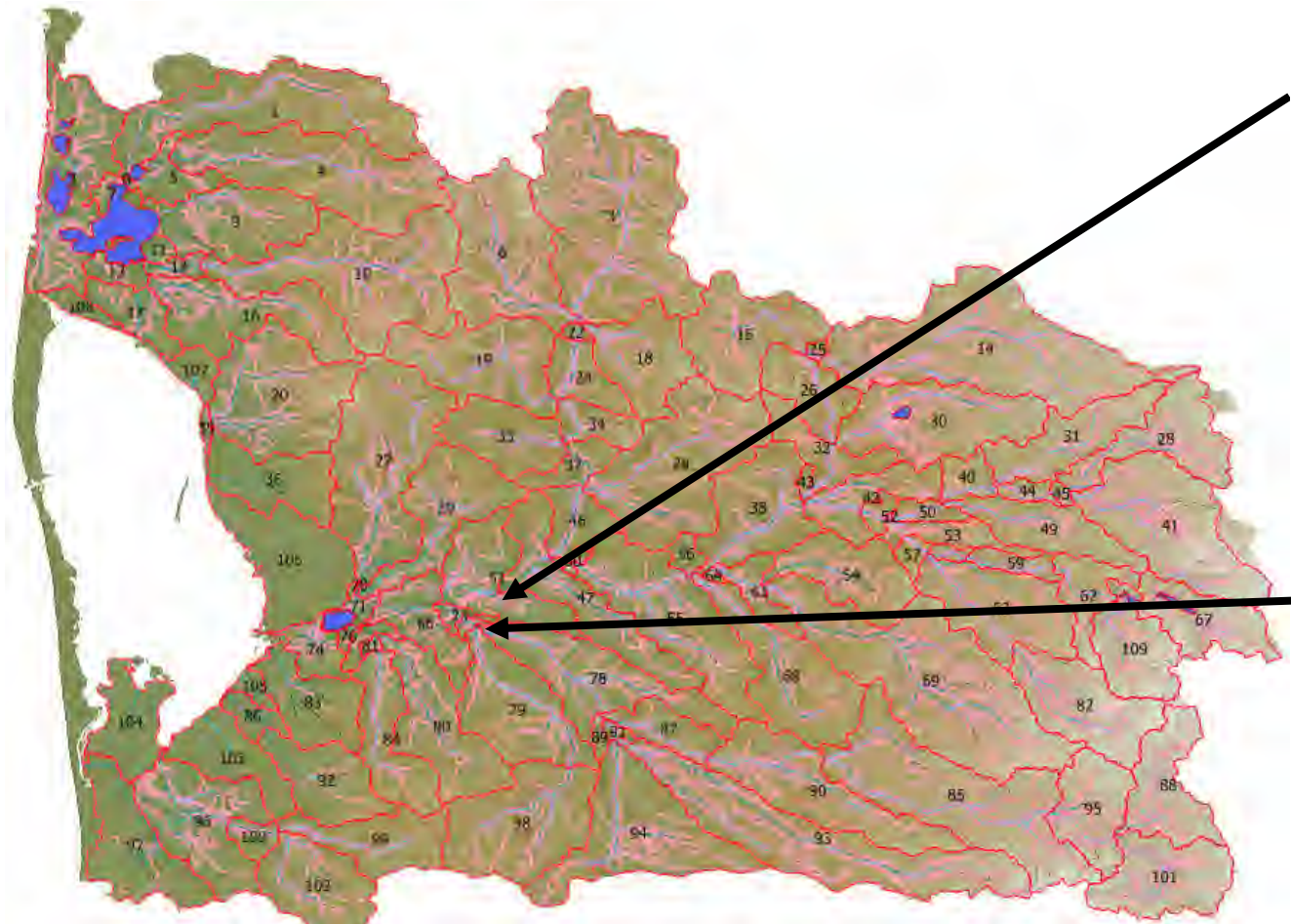
Catchment model setup: land use

The model simulates **20 crop rotations** representative of the practices in the catchment.

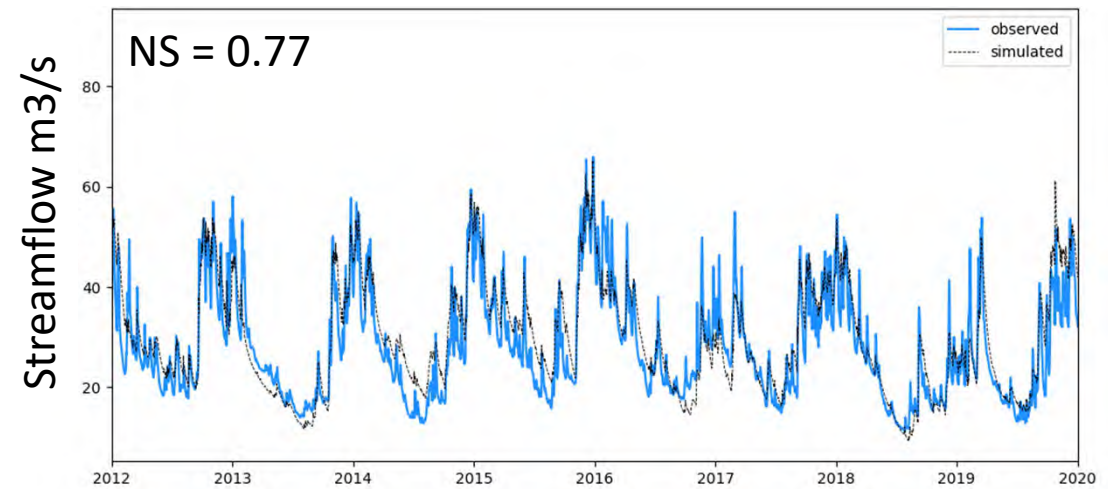| Crop rotation 1	Main crop	Catch crop	Animal manure (kg N/ha)	Mineral fertiliser (kg N/ha)
Crop 1	Spring barley		76	59
Crop 2	Winter barley		113	87
Crop 3	Winter rape		125	96
Crop 4	Winter wheat		103	80
Crop 5	Spring barley	Oil radish	76	59
Crop 6	Spring barley	Oil radish	76	59

The catchment model reproduces agricultural practices at detailed spatial scale.
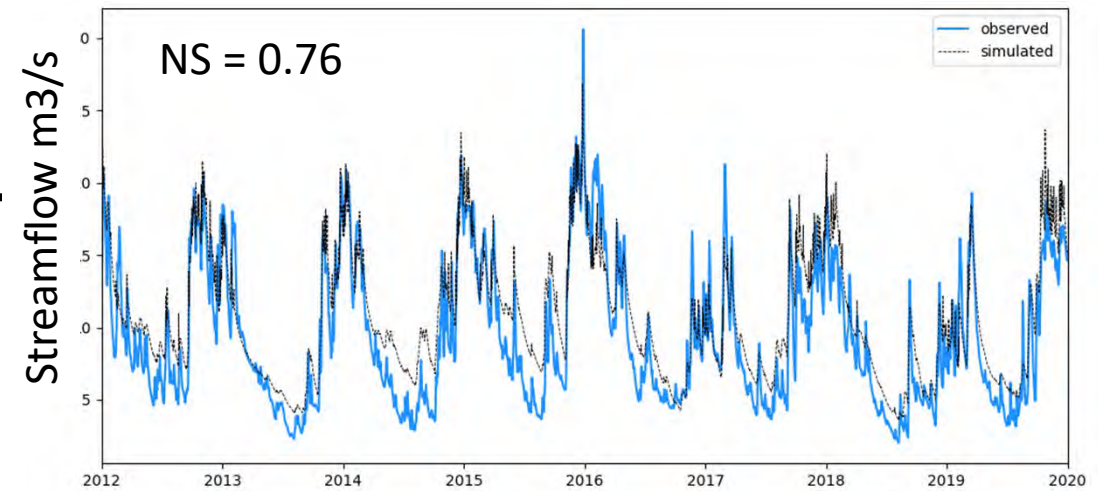**Oplandsmodellen gengiver landbrugspraksis på detaljeret rumlig skala.**

Results: streamflow simulation
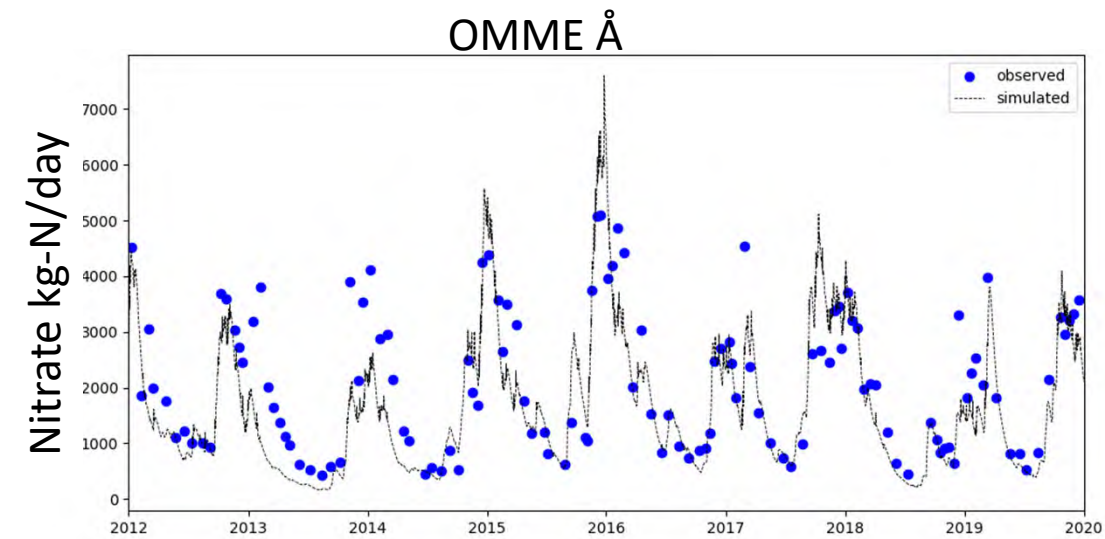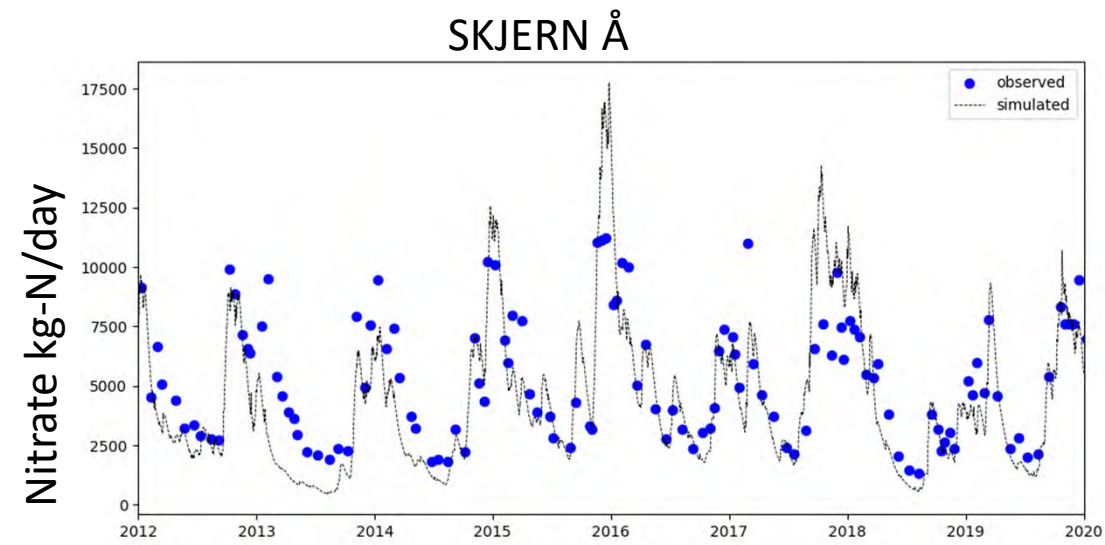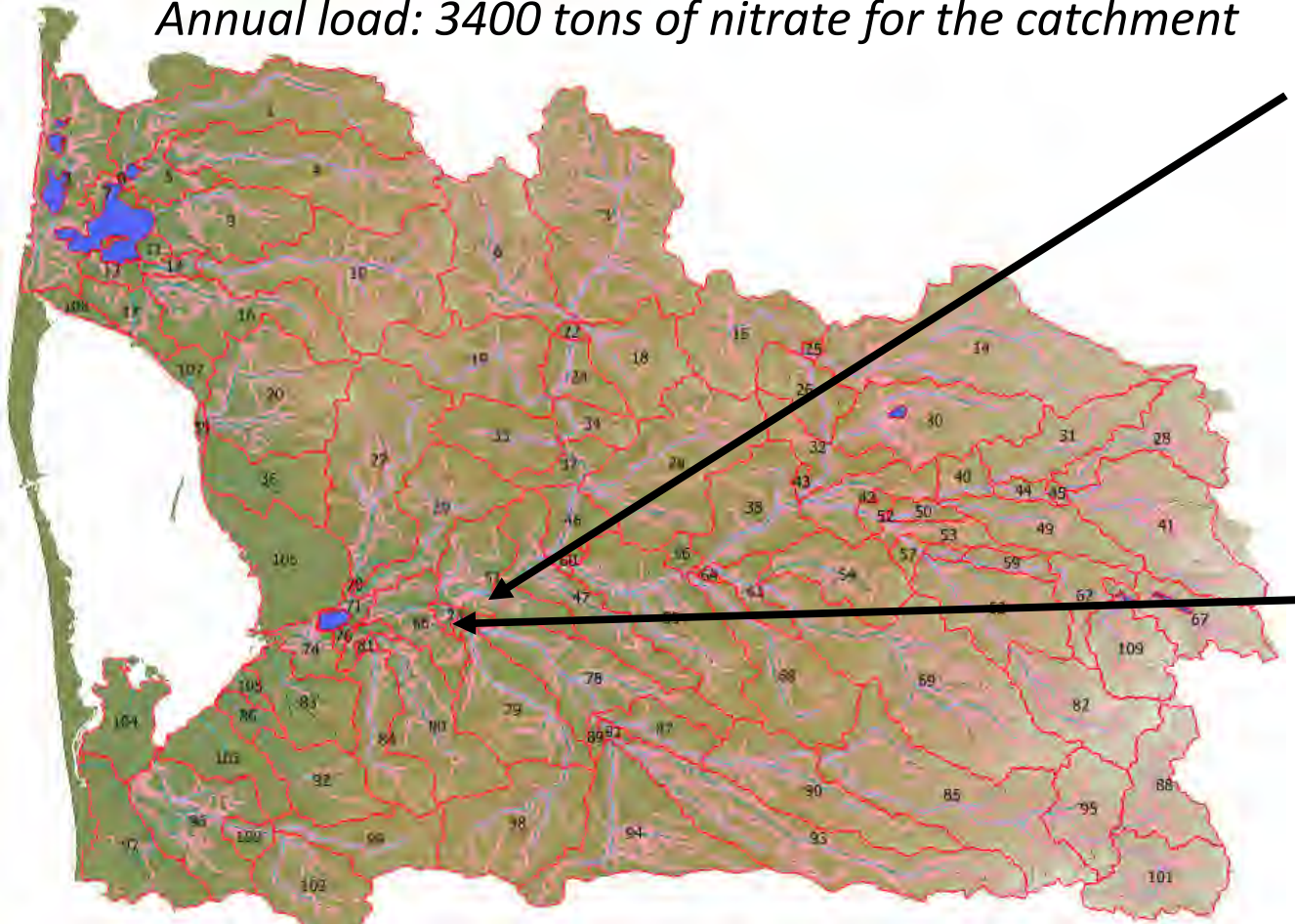

SKJERN Å

NS = 0.77

OMME Å

NS = 0.76

Modellen gengiver korrekt den observerede strømning, hvilket betyder, at vandbalancen i afvandingsområdet er simuleret korrekt.
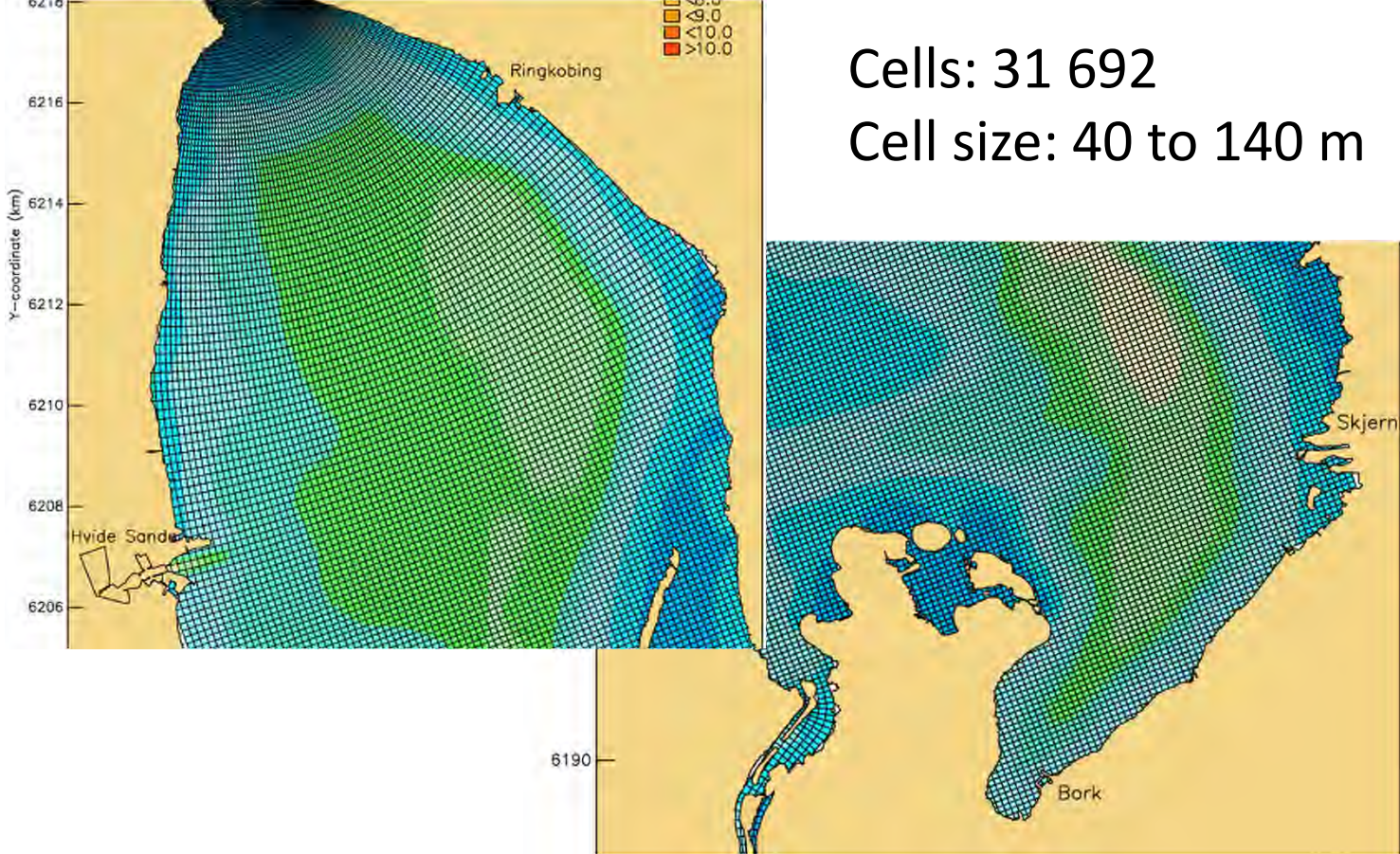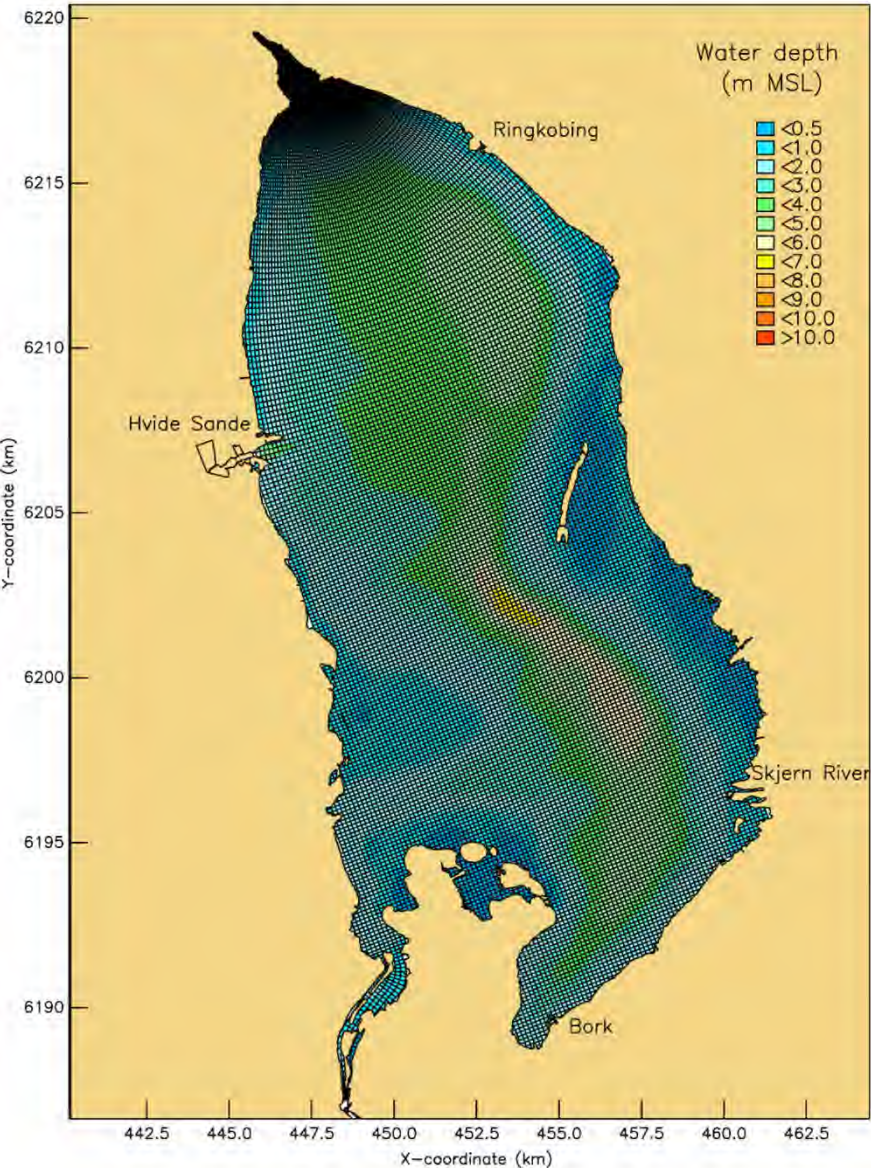
Results: nitrate loads simulation

Annual load: 3400 tons of nitrate for the catchment

Modellen gengiver korrekt de observerede nitratbelastninger, hvilket betyder, at kvælstofprocesserne er godt simuleret i afvandingsområdet.
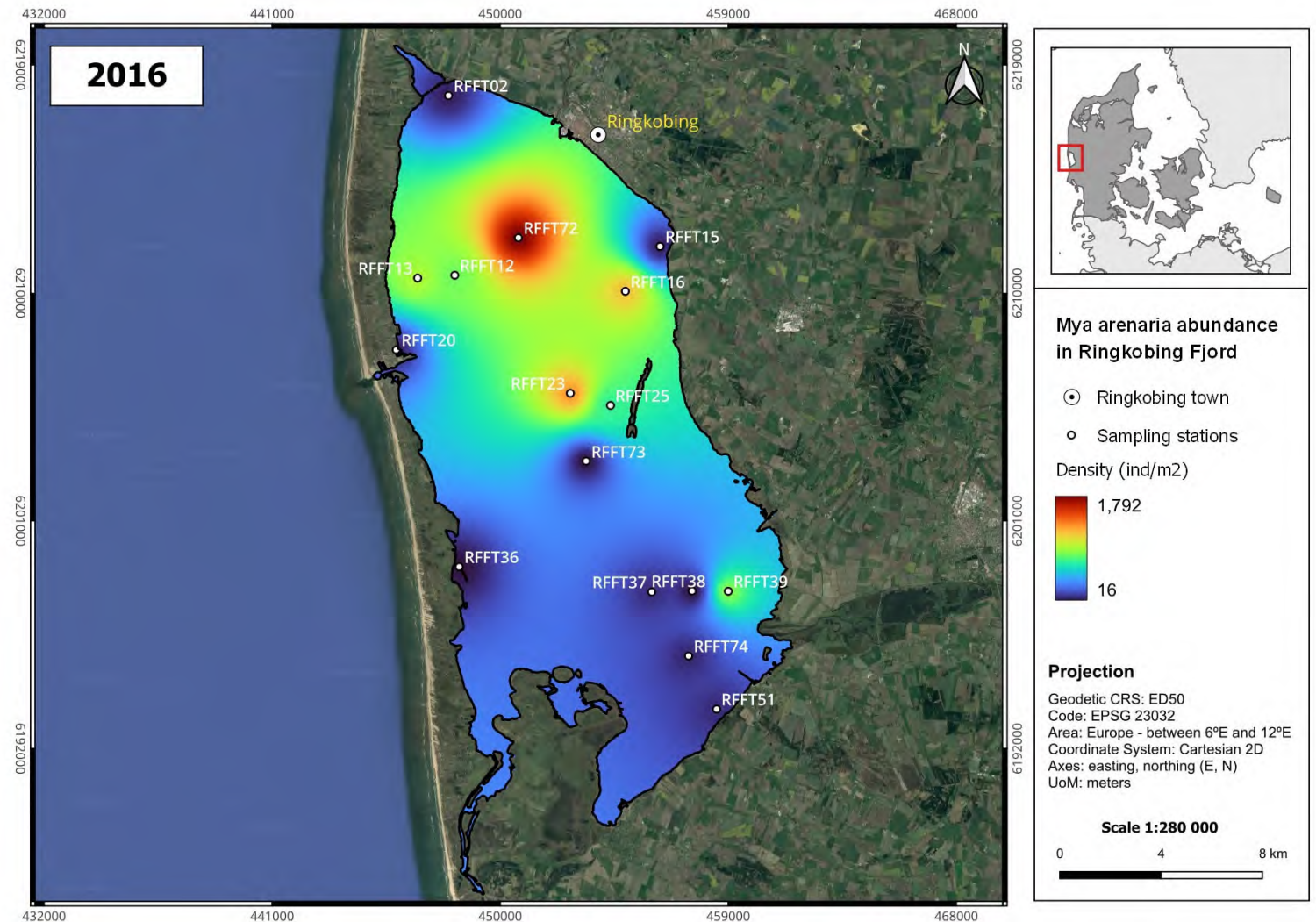
Water circulation model

Cells: 31 692
Cell size: 40 to 140 m

Vandcirkulationen i fjorden er beregnet på en meget detaljeret skala for at sikre, at nøgleprocesser som lagdeling er godt gengivet af modellen.
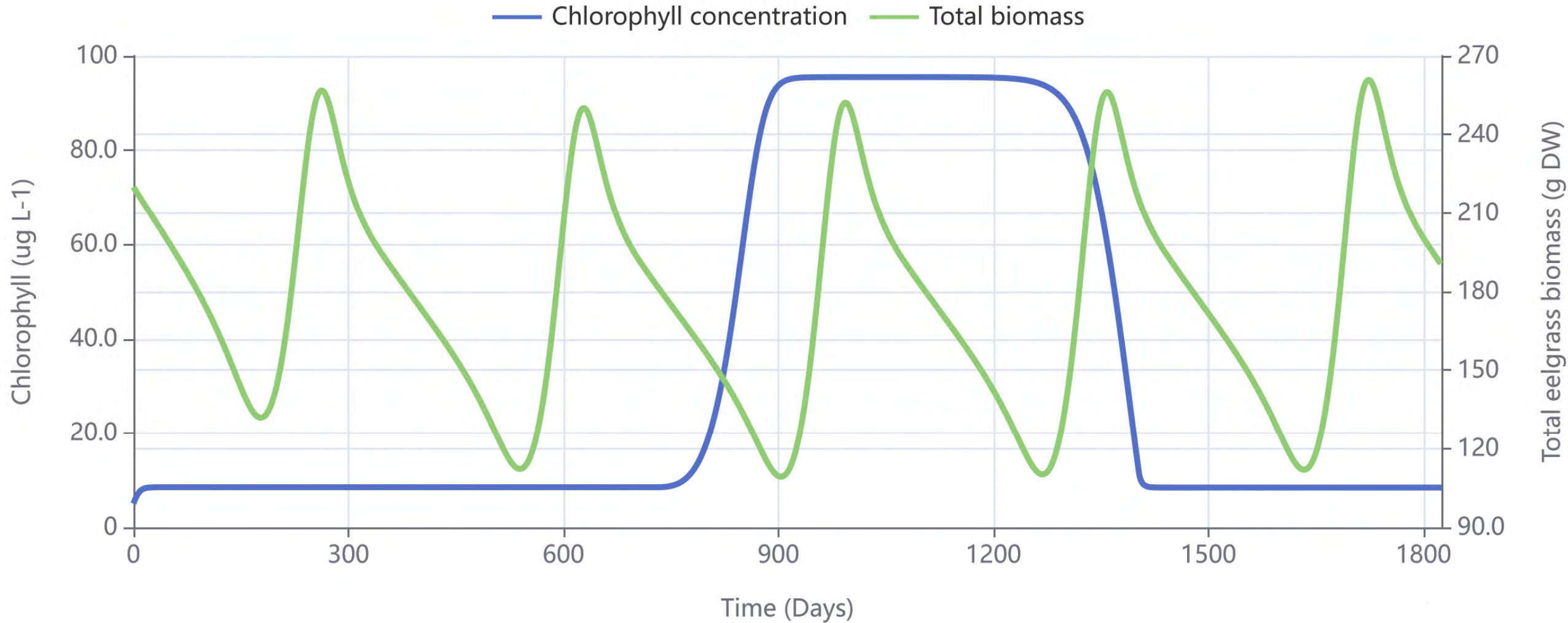
Sand mussel

The distribution of sand mussels in the fjord is estimated using the best available data to ensure that their role is properly taken into account in the model.

Udbredelsen af sandmuslinger i fjorden er estimeret ved hjælp af de bedste tilgængelige data for at sikre, at deres rolle er korrekt taget i betragtning i modellen.

Ringkøbing Fjord - Zostera and Phytoplankton (ZAP) model

Chlorophyll in dry/wet years (sand mussel top-down control), and eelgrass biomass (decoupled)
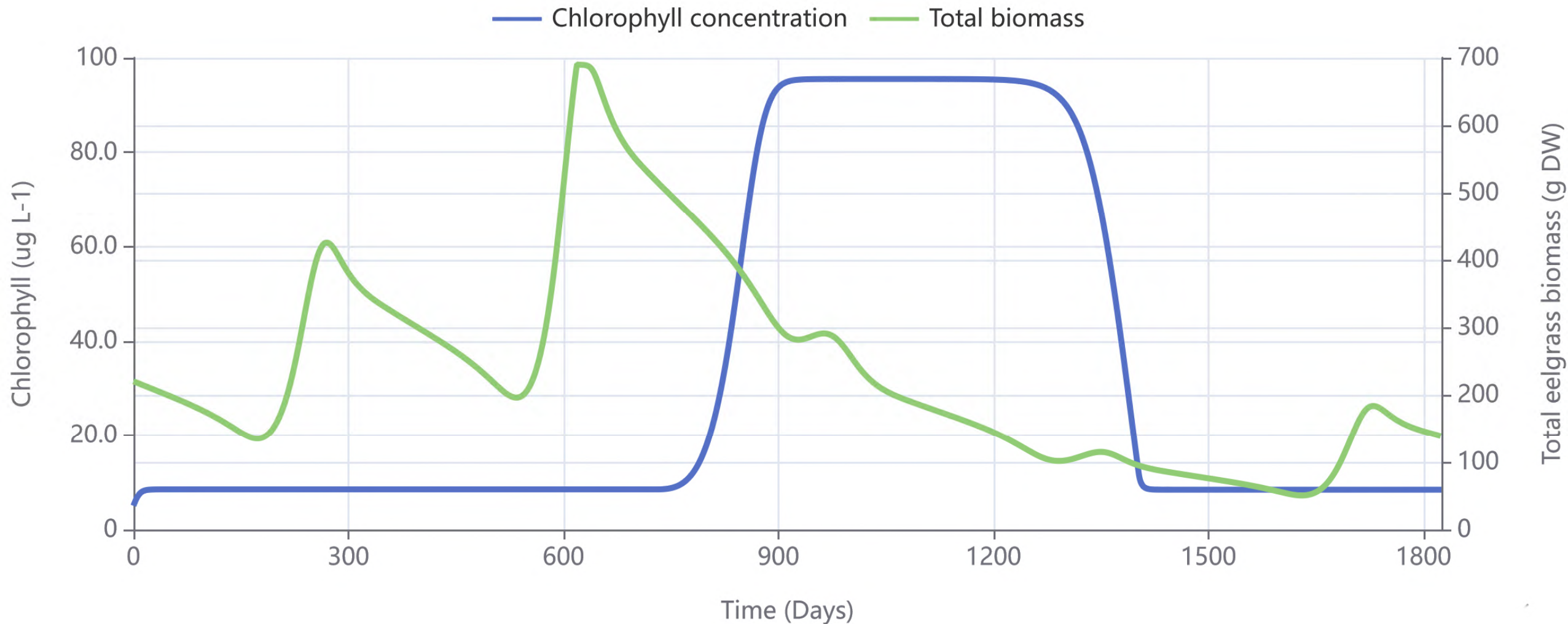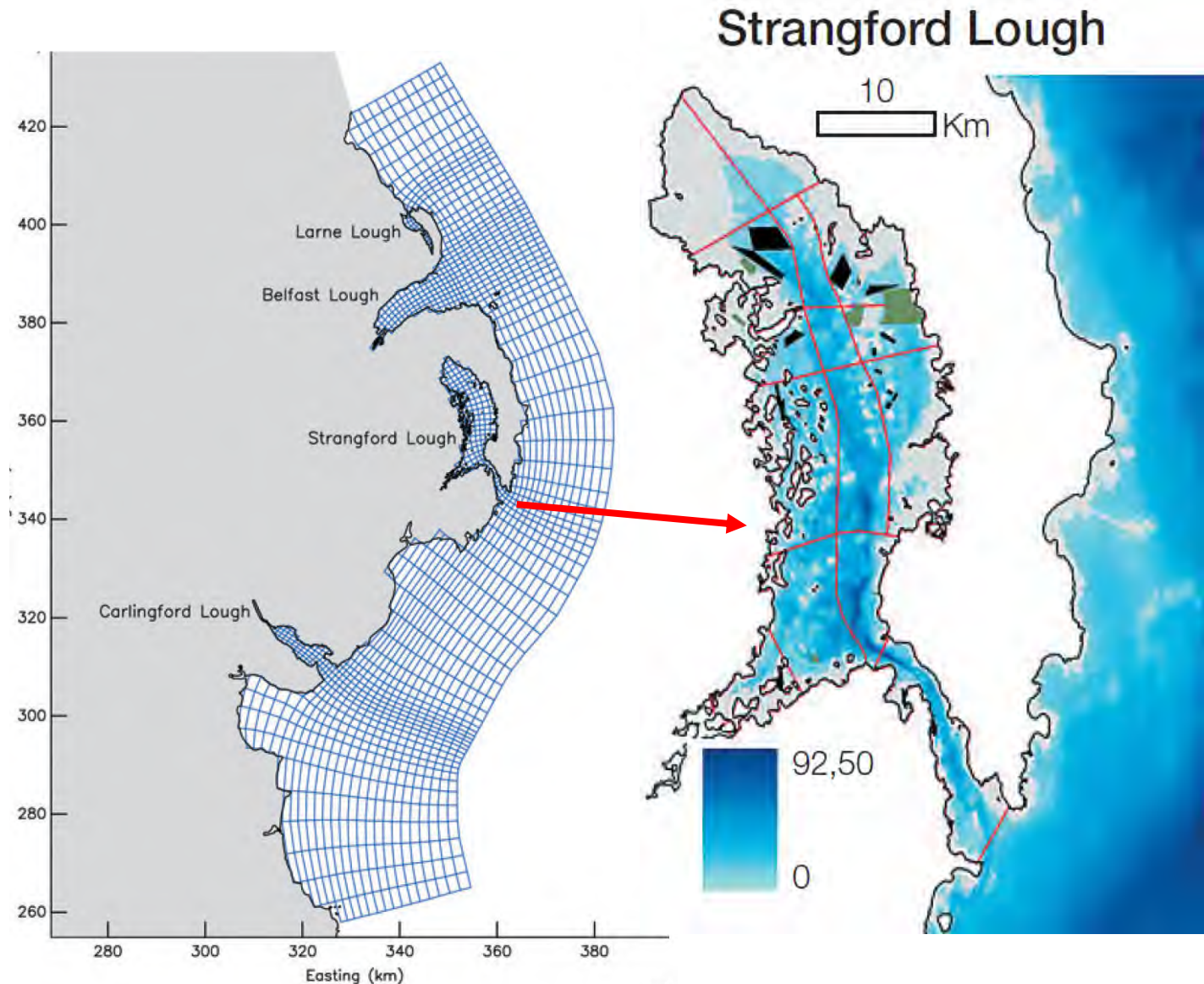**Klorofyl i tørre/våde år (top-down kontrol med sandmuslinger) og ålegræsbiomasse (afkoblet)**

Ringkøbing Fjord - Zostera and Phytoplankton (ZAP) model

Chlorophyll in dry/wet years (sand mussel top-down control), and eelgrass biomass (coupled)
Klorofyl i tørre/våde år (top-down kontrol med sandmuslinger) og ålegræsbiomasse (koblet)

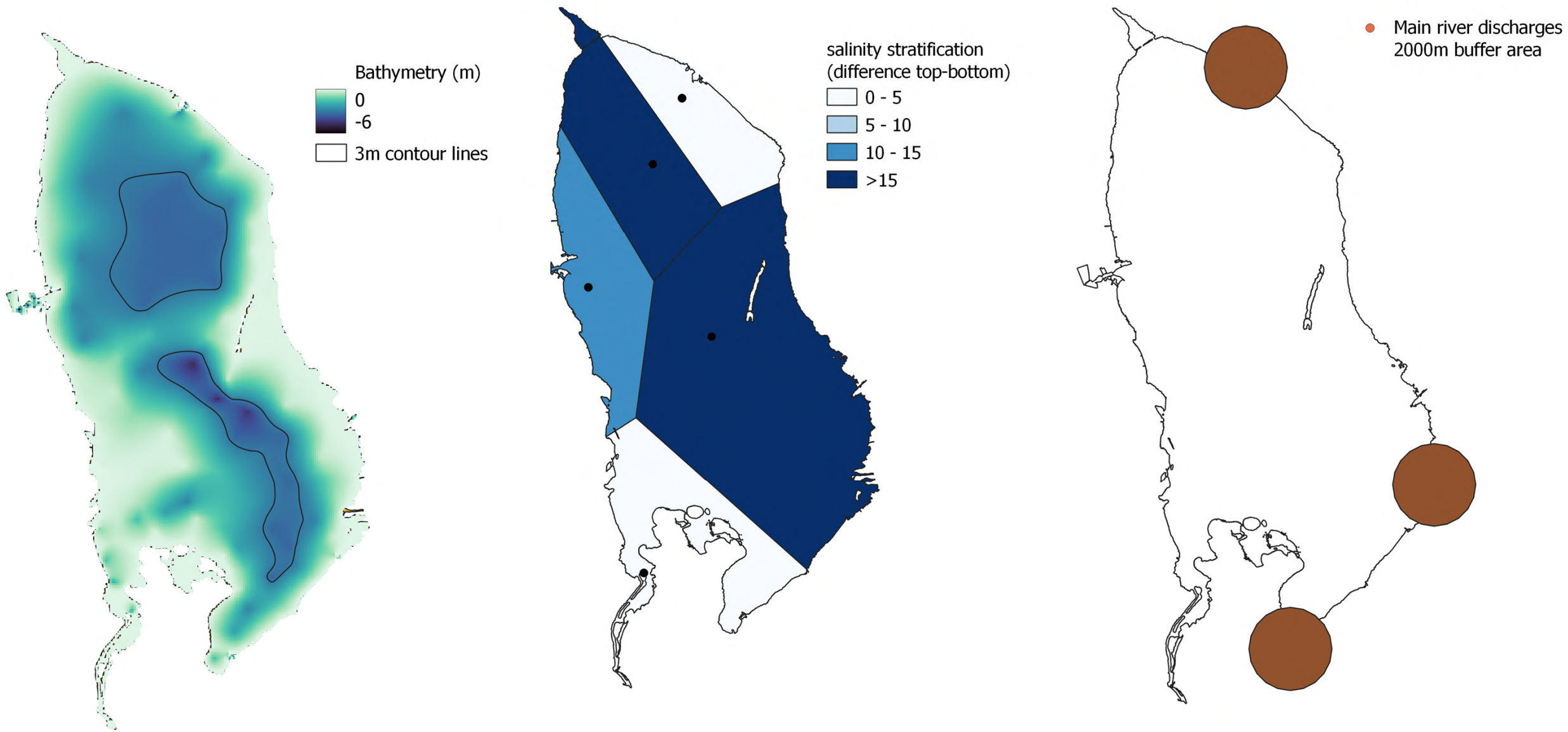# EcoWin model boxes for Ringkøbing fjord

- Many models simply use a geometric approach

- This ignores key characteristics of a system

- We focus on morphology, circulation, water quality, uses, and policy

- We ask stakeholders to analyse our proposal and come to a final decision

Strangford Lough

Vi har brug for din hjælp til at bestemme den mest fornuftige opdeling af fjorden i kasser.
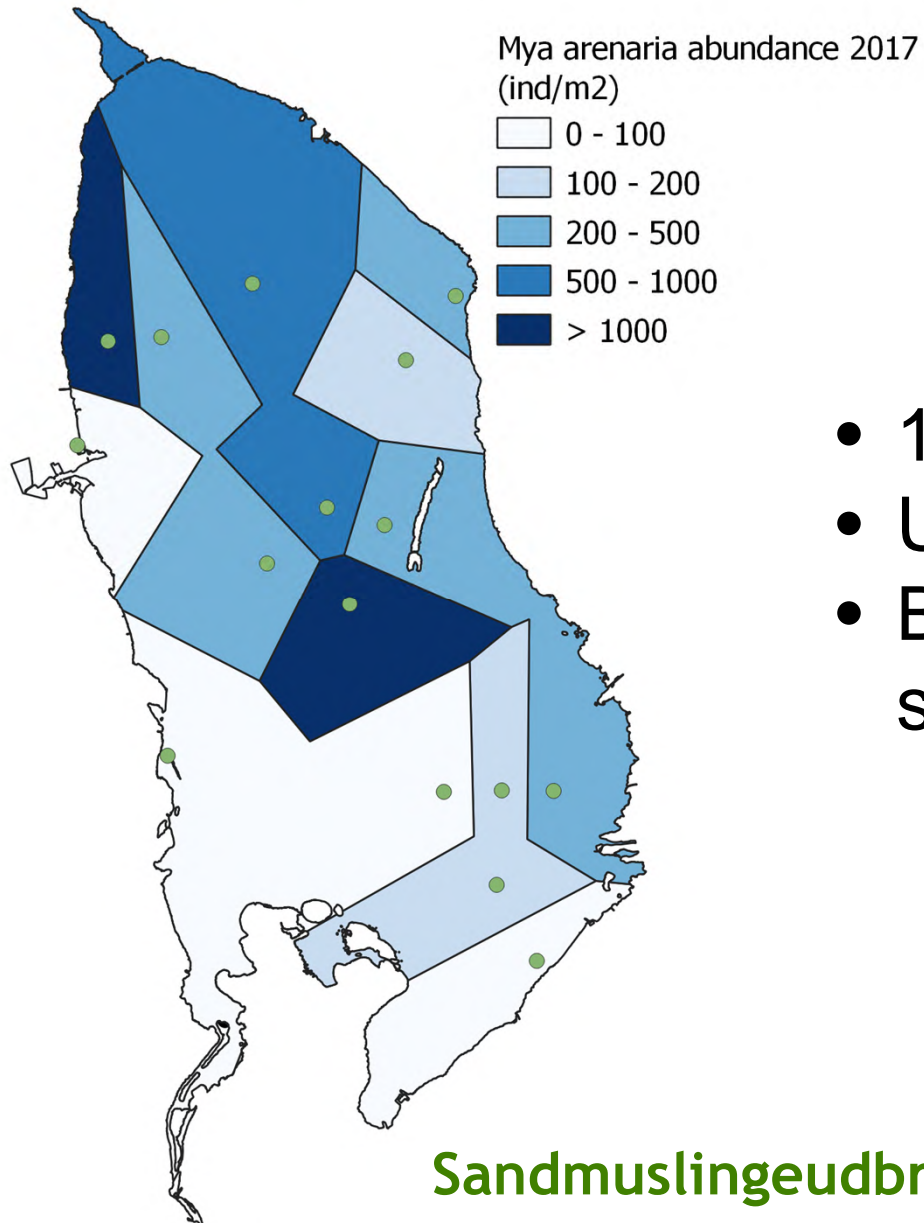
Criteria for deciding on box divisions for the fjord

Batymetri, saltholdighed og hovedfloder.

Sand mussel abundance

Mya arenaria abundance 2017 (ind/m2)

- 0 - 100
- 100 - 200
- 200 - 500
- 500 - 1000
- > 1000

- 16 sampling points
- Use zone of influence for each sampling point
- Based on 2017 data used to parameterise shellfish abundance

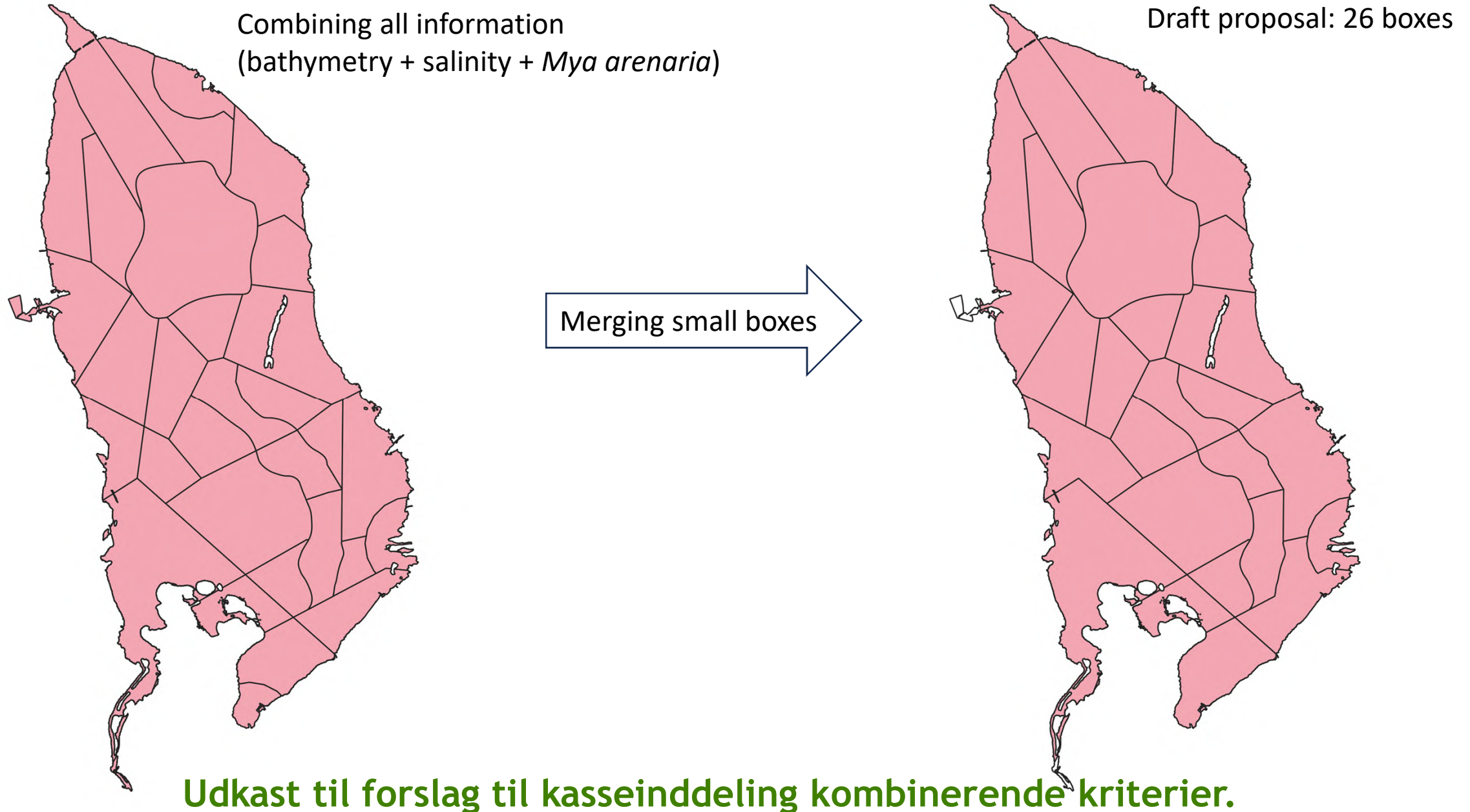**Sandmuslingeudbredelse er et eksempel på parametre, der kan indgå.**

EcoWin boxes and circulation model

52 boxes
2 layers

The circulation model is integrated into the ecological model at a scale that can be used for management purposes.

Cirkulationsmodellen er integreret i den økologiske model på en skala, der kan bruges til forvaltningsformål.

Draft proposal for box division combining criteria

Combining all information
(bathymetry + salinity + *Mya arenaria*)

Draft proposal: 26 boxes

Merging small boxes

Udkast til forslag til kasseinddeling kombinerende kriterier.

Thank-you for your attention