

Skive Fjord and Eutrophication

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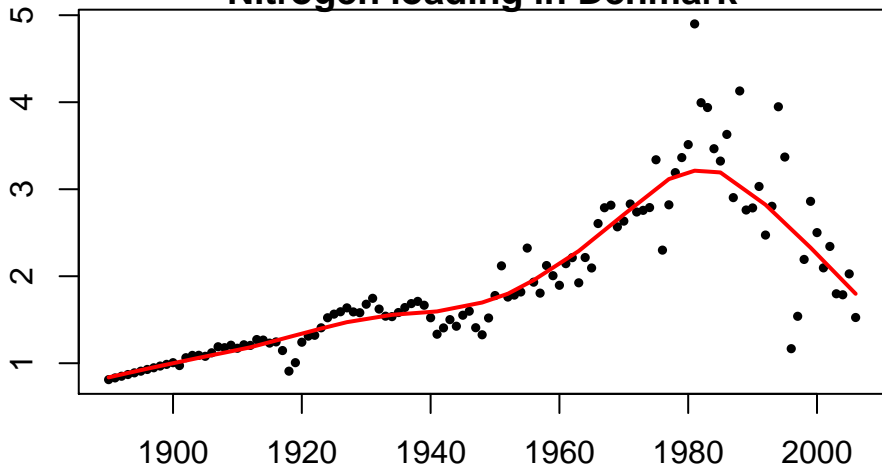
Water Management

Before: The solution to pollution is dilution

Now: To maintain good ecological status we need to limit the pollution pressure on the ocean.

Regulation: “Vandmiljøplaner” (1987, 1998, and 2003), EU: water frame-work directive.

Nitrogen loading in Denmark

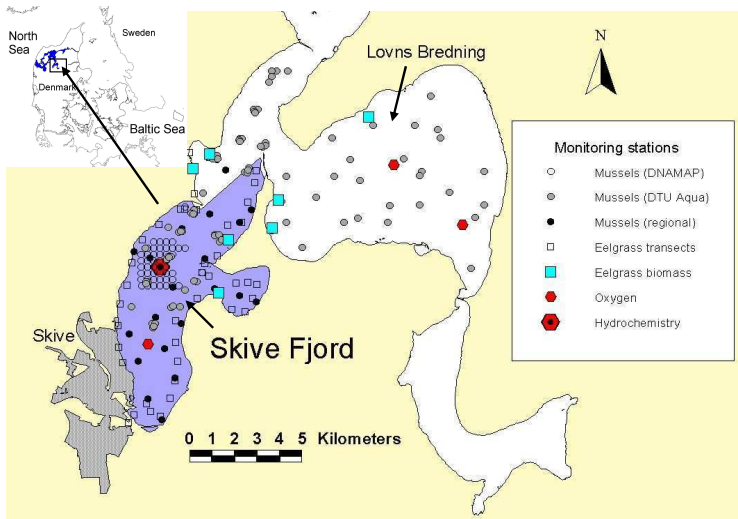


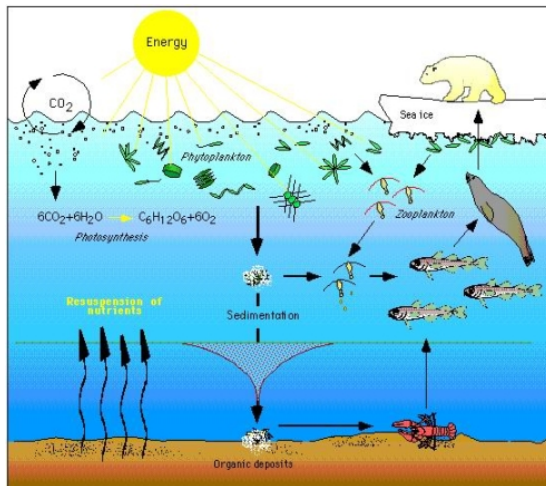
Eutrophication - consequences

Nutrient enrichment can have severe consequences, including:

- High levels of phytoplankton
- Oxygen depletion (death of stationary animals)
- Depletion of seabed vegetation (eelgrass)

In order to measure effects of the legislation the marine monitoring program was also launch.





Drawn by Christopher Krembs

Picture: Christopher Krembs, NOAA, US Department of Commerce

Ecological modelling

We can basically take two approaches in modelling of ecosystems:

- **Mechanistic modelling:** All components of the ecosystem and their interaction are modelled with a detailed (deterministic) model.
- **Statistical modelling:** Only key interactions and effects are included and other effects are lumped into a probabilistic model.

Key questions

- Did we manage to bring down loading?
- Have the reduced loading reduced phytoplankton levels?
- Have the reduced loading reduced risk of oxygen-depletion?
- Existence of alternative stable states
- Tipping points, are there any? Have we crossed it?
- Can we return to “good ecological” status (Return to Neverland¹)?

¹Duarte et al. 2008. Return to *Neverland*: Shifting Baselines Affect Eutrophication Restoration Targets. *Estuaries and Coasts*