Ecological Response of a Semi-enclosed Saline Bay to Damming and Sluice-management: Case of Lake Grevelingen in the Netherlands

MARIJN TANGELDER

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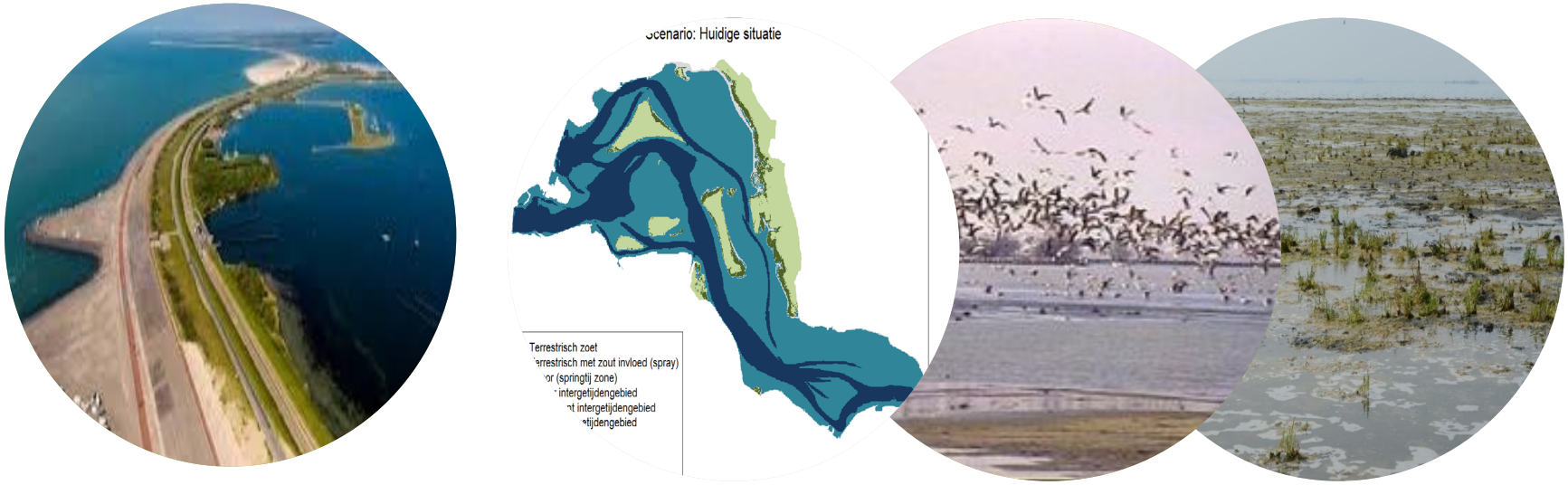
1=Wageningen Marine Research
2 = Wageningen Environmental Research
3 = Deltares



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Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Introduction

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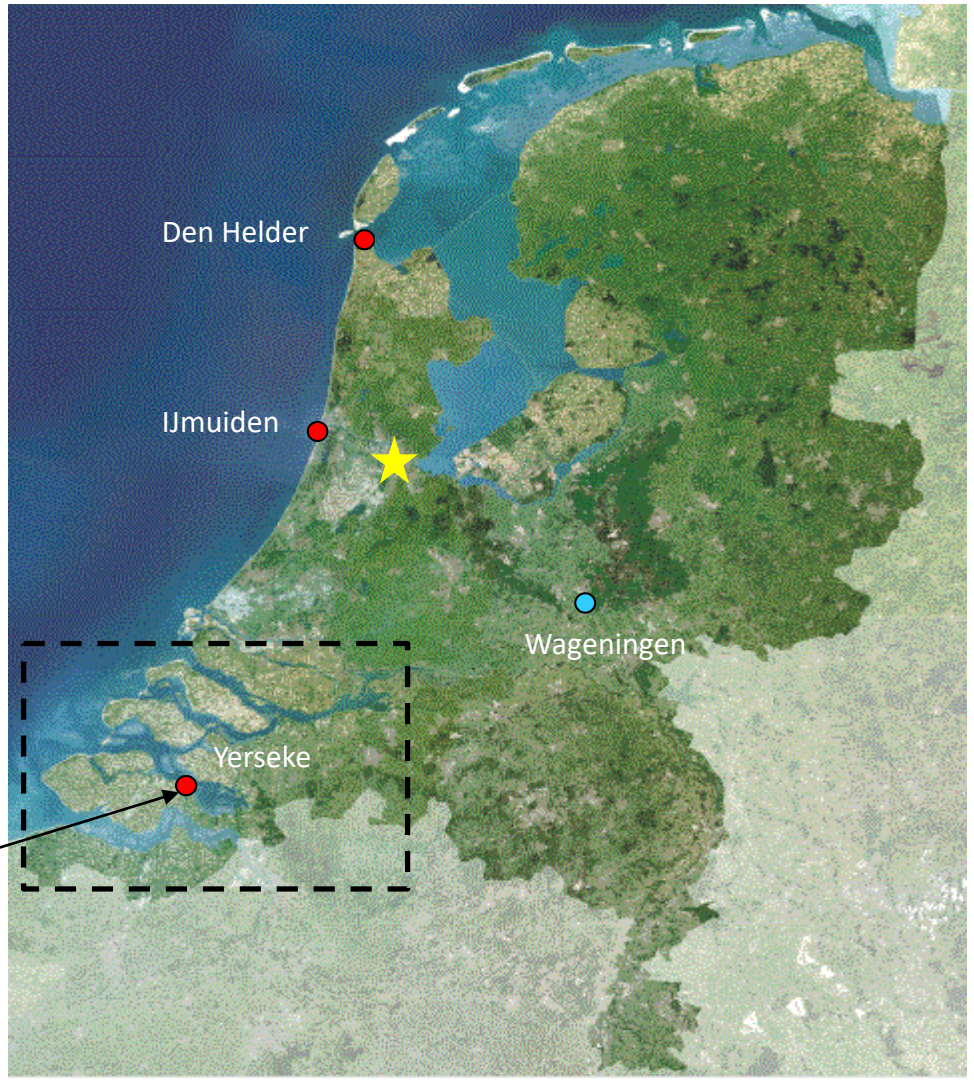
Research institute

Wageningen
Marine Research

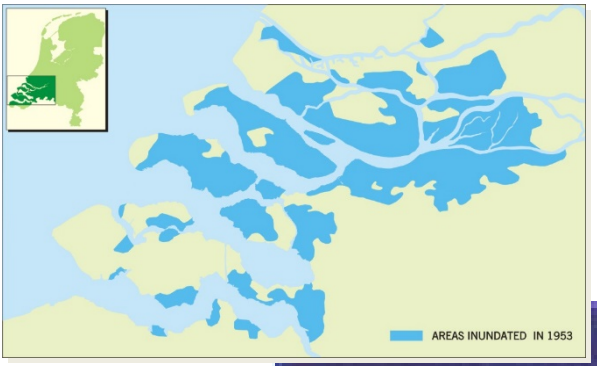
Research focus: acquiring knowledge and offering advice on the sustainable management and use of marine and coastal areas.

Delta ecology & shellfish research



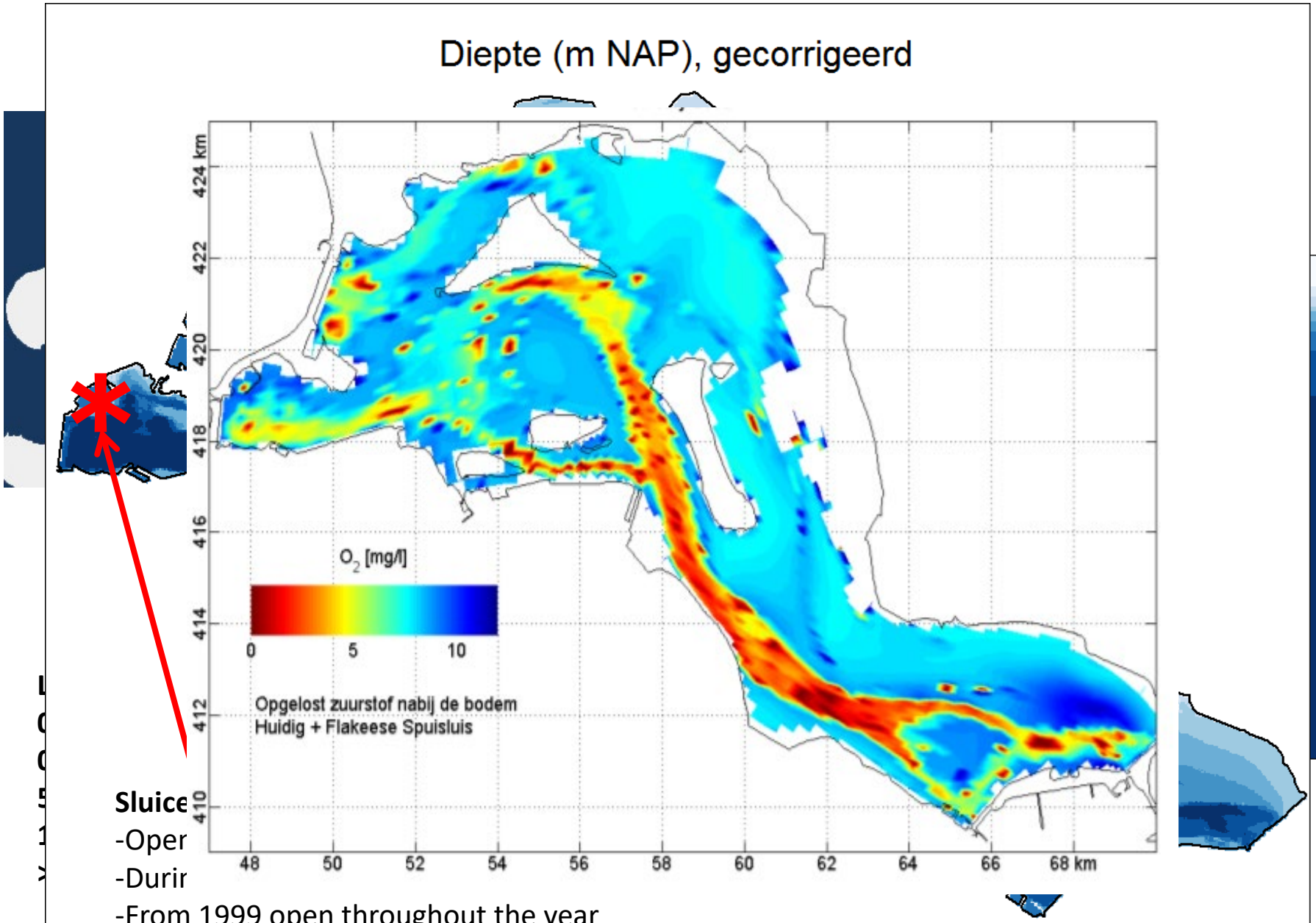
What's my talk about?

- Damming of SW Netherlands
- Saline lake Grevelingen
- Understanding ecological changes:
  - Macrobenthos
  - Fish
  - Birds
- Lessons learned
- Implications for management and research



1953 Flooding

DELTA PLAN



Sluice

-Oper

-Durir

-From 1999 open throughout the year

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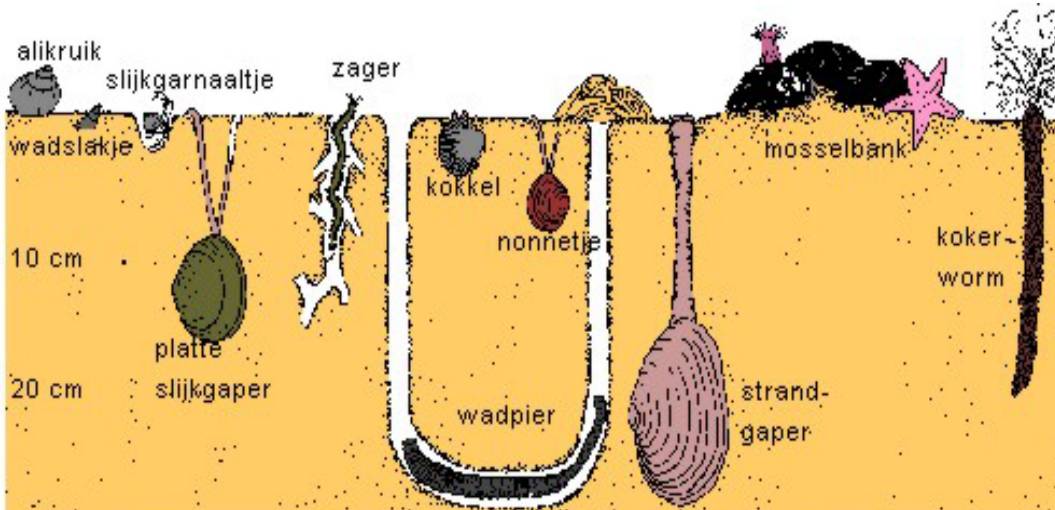
Ecological development after damming (1) - macrobenthos

Simplified food web ("homemade")

Sneak preview, macrobenthos development reflects:
-Transition from estuary to lake
-Sluice management



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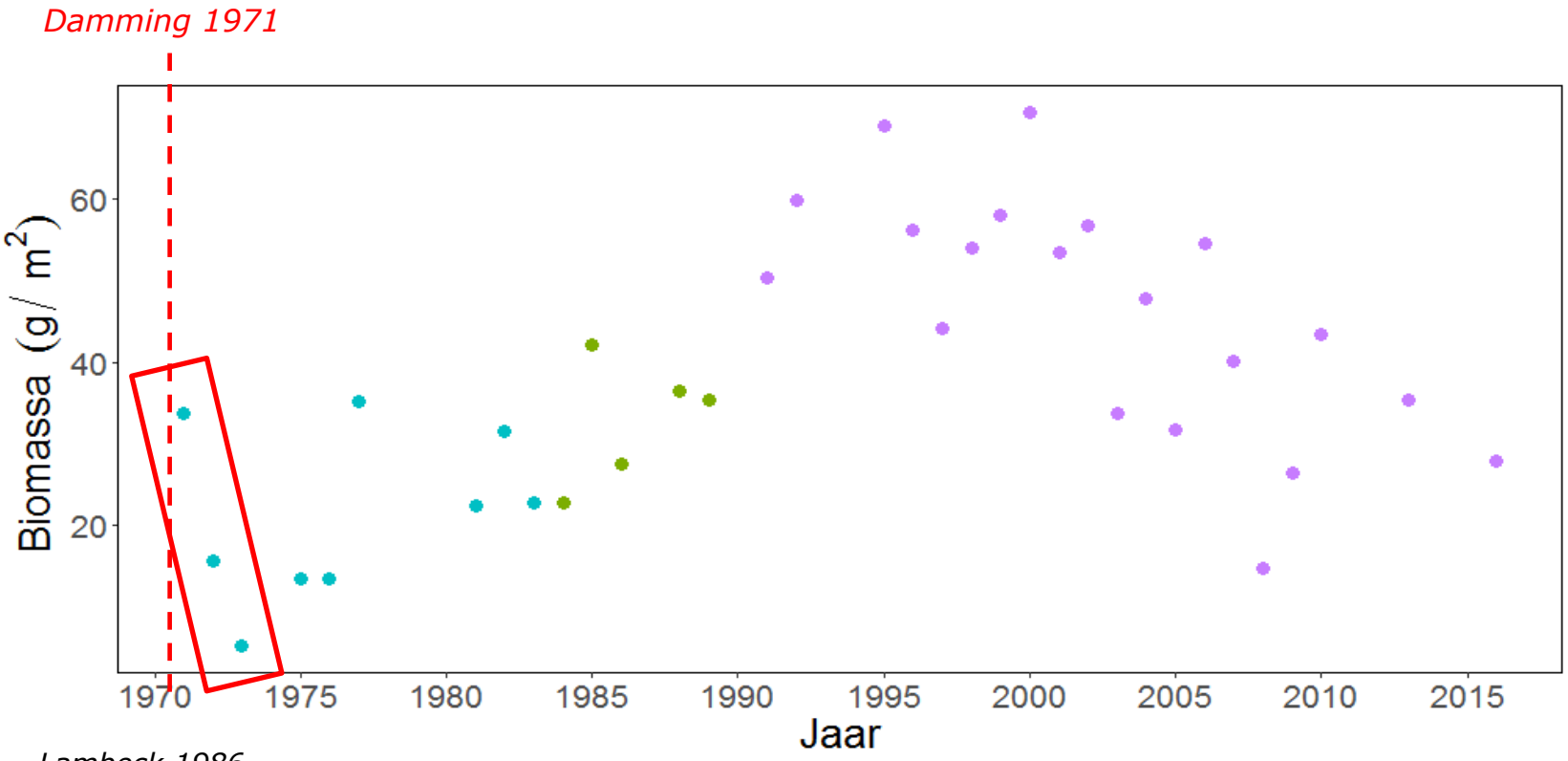
Macrobenthos 1964-1974

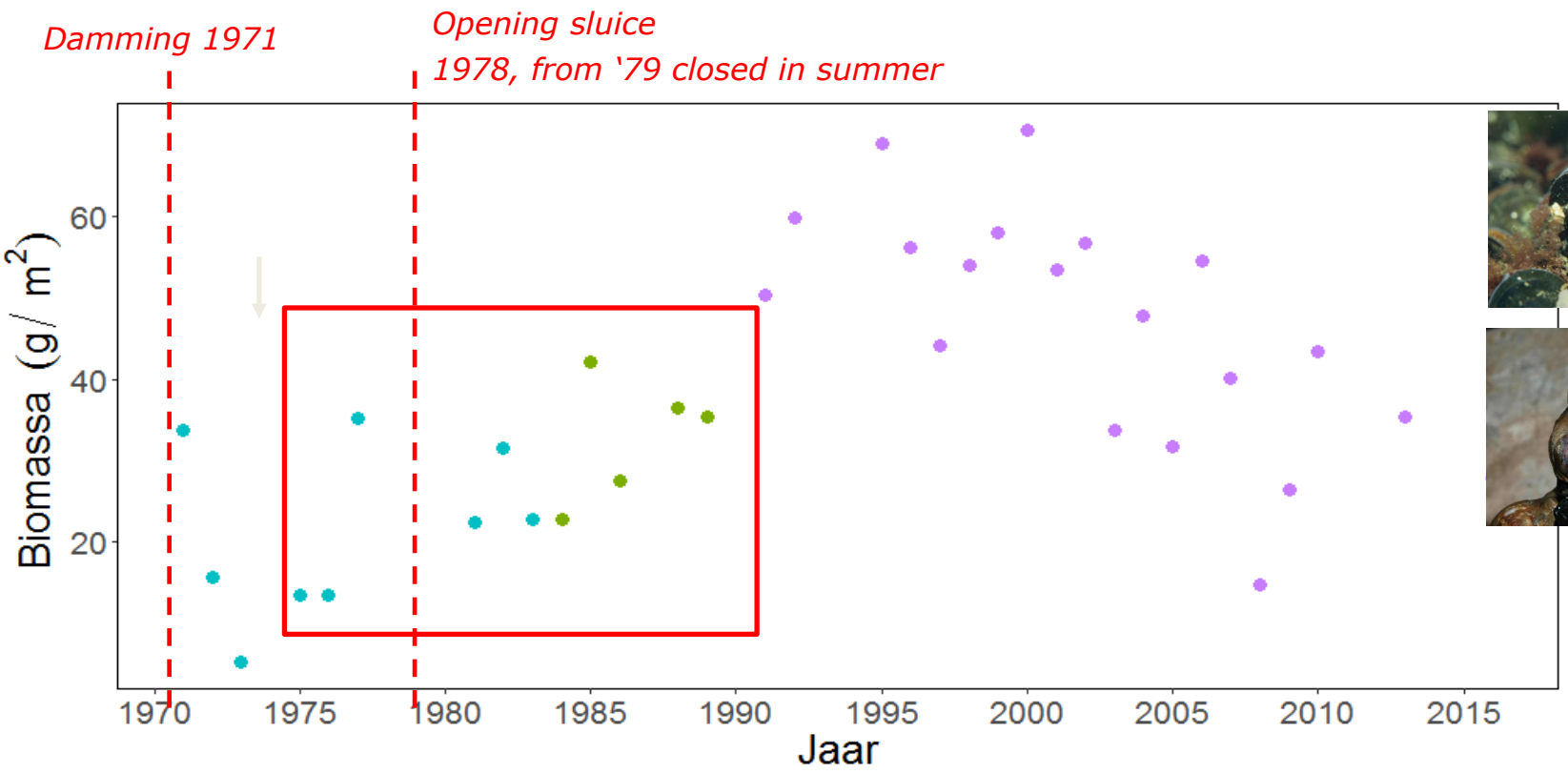


Lambeck 1986

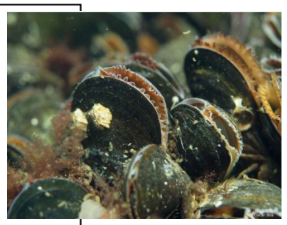
- Mass mortality after damming
- Tide and currents disappeared

Jaar	1964-1970	1972
Aantal soorten	338	258

Macrobenthos 1975-1990



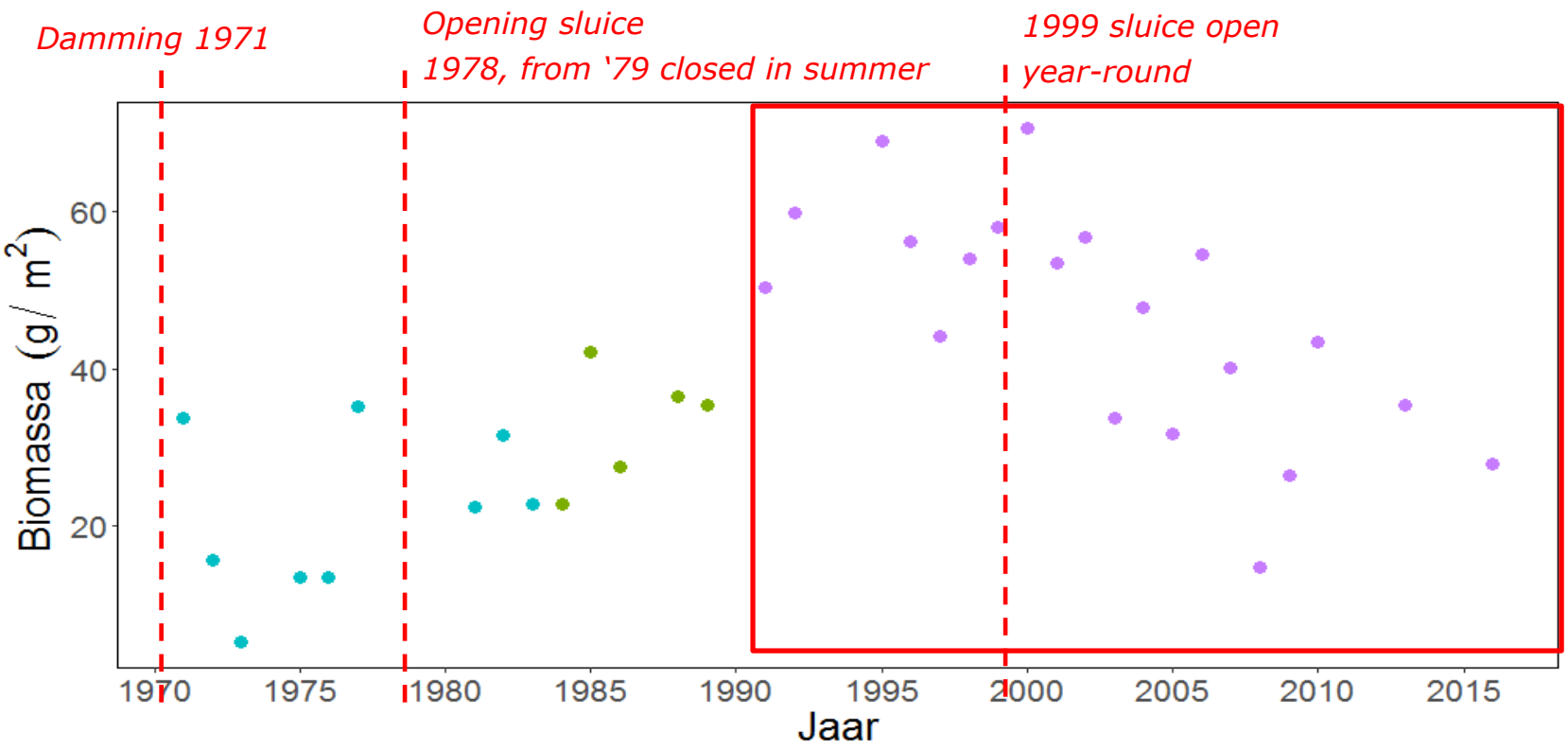
Mytilus edulis



Crepidula fornicata

- **Biomass doubles** in 1976 due to expansion of mussel *Mytilus edulis*
- Opening Brouwerssluice in 1978 lead to **mortality** below 8 m depth
- Accumulation **organic matter**
- After closure of the sluice in summer **biomass increased** with *Crepidula fornicate* as dominant species

Macrobenthos 1990-2016



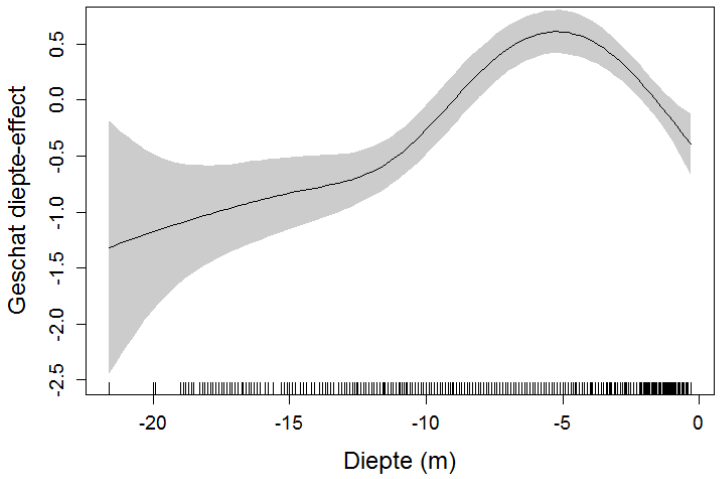
Mulder et al., 2019

- 1990-2000 biomass stable level
- Relative decrease of molluscs (*Crepidula fornicata*)

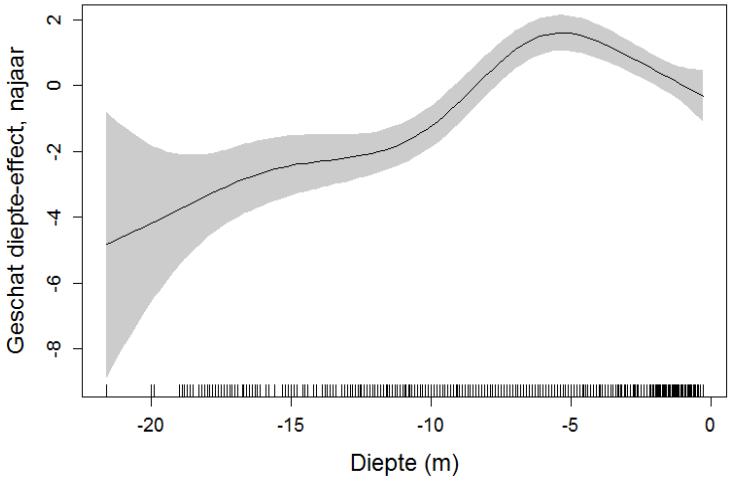
Mulder et al., 2018

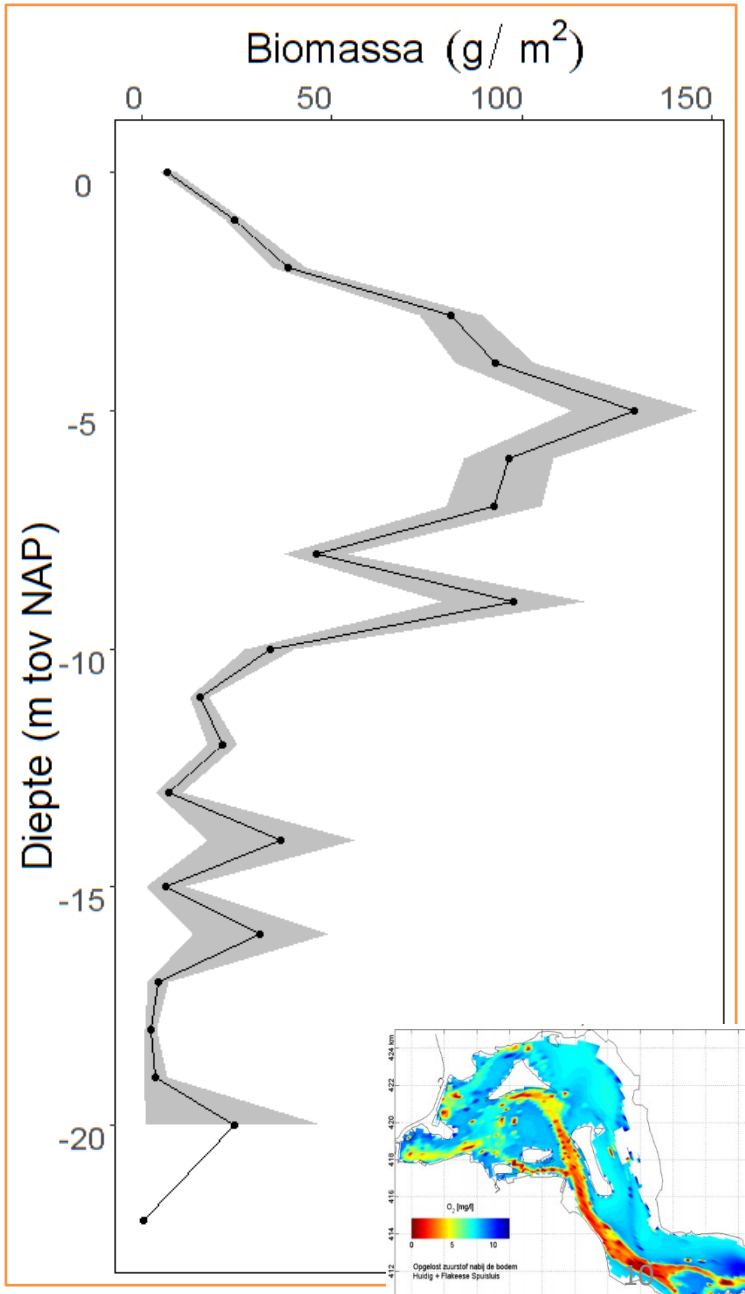
Depth

Biomass

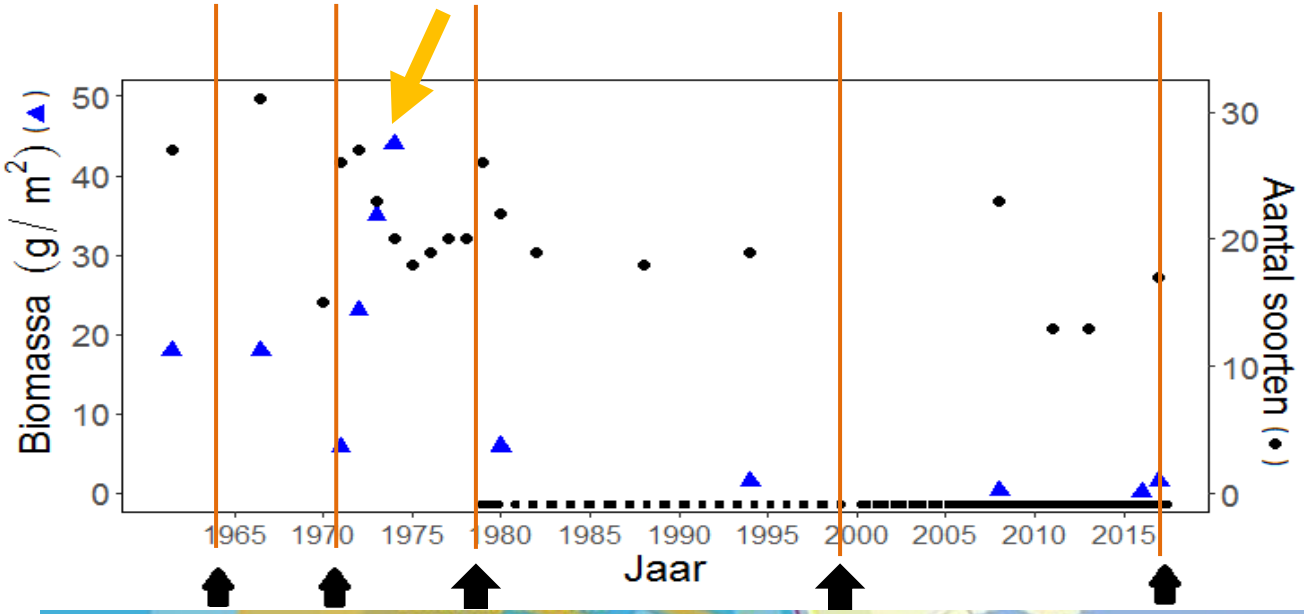


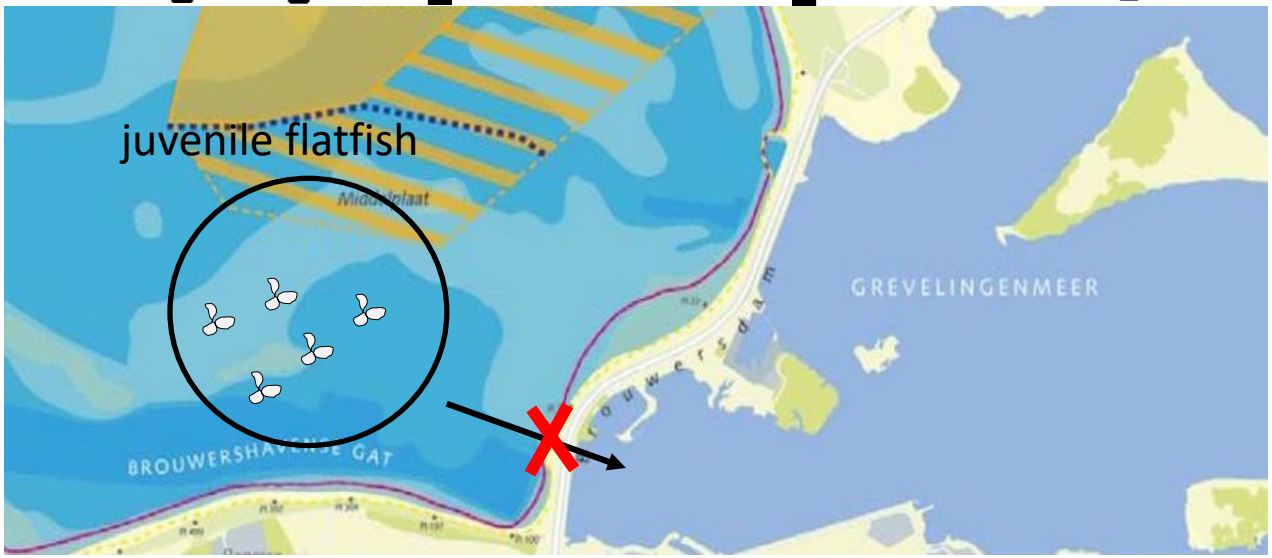
Density

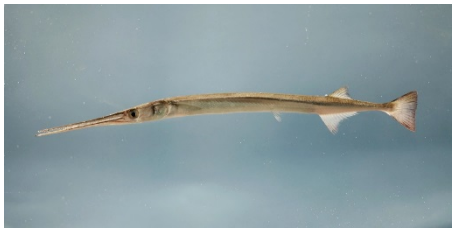




Ecological development (2) – fish

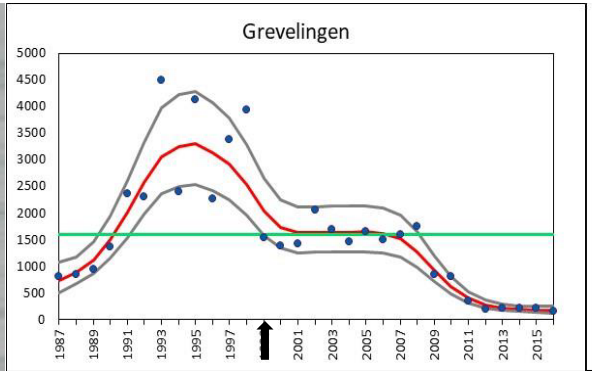


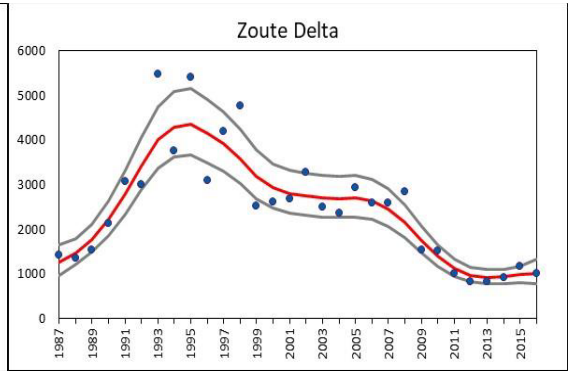




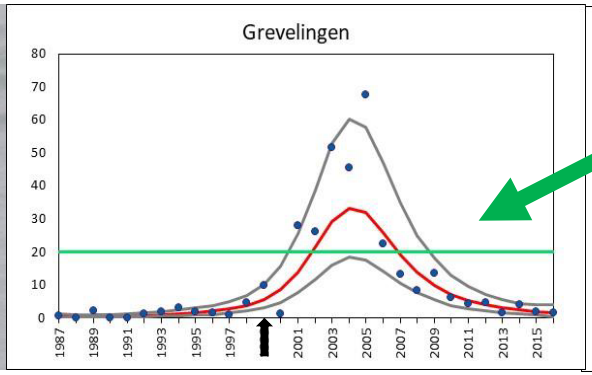
Ecological development (3) birds

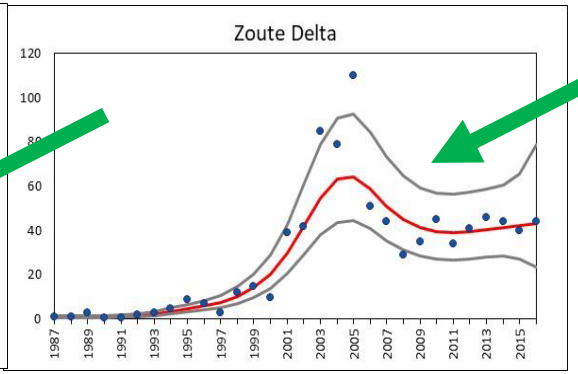
Great crested grebe - *Podiceps cristatus*





Horned grebe - *Podiceps auritus*





Arts et al., 2019

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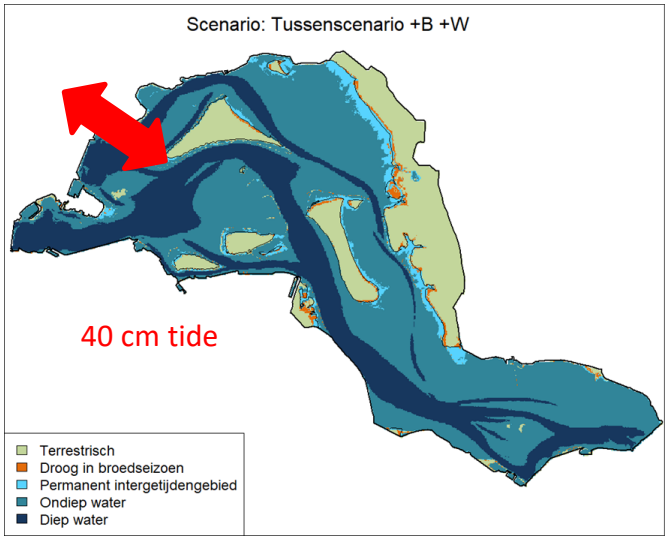
DPM
Delta Project Management

Lessons learned ecological response to damming/sluice management

- Macrobenthos:
  - Macrobenthos biomass and species composition underwent large changes over time and is still in development nearly 50 years after closure.
  - Effect of damming on development species composition: estuary to lake
  - Sluice opening lead to:
    - Stratification and mortality of fauna below 8 m
    - Settlement of organic matter and oxygen depletion affected shellfish settlement
    - More food and marine species
- Fish diversity declined and was largely affected by sluice management: migration and exchange of larvae
- Birds numbers (piscivores/benthivores) strongly fluctuate and food availability seems to play a role

Implications for future management

- Sluice opening (1978) had adverse effects on benthos: important to understand system functioning
- Especially with respect to plans to introduce micro-tide
- Suggestion for future research:
  - -”intensive monitoring year”
  - -> because measuring more at the same
  - time increases the value of every single
  - measurement and holistic approach



Thank you for your attention!

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