

# Extraction of nutrients from fish farms by mussel production in the Baltic in relation to WFD and MSFD

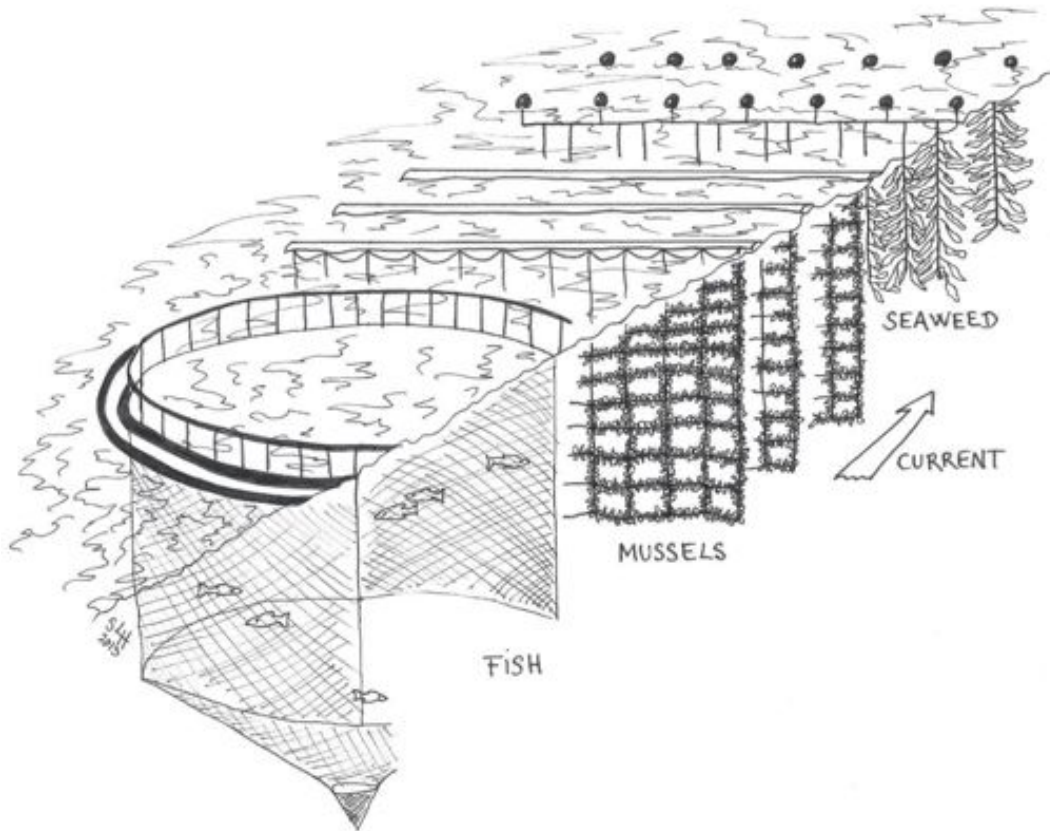


- Description of the IMTA facility
- Loss and extraction of nutrients
- Ecosystem impact – conflict and support management targets
- Management of offshore fishfarms

Per Dolmer, Orbicon  
pdol@orbicon.dk



# Integrated Multi-Trophic Aquaculture BUT only 12 % of the N is incorporated in particles



SL Holdt © Holdt and Edwards 2014



# Blue Mussels are filtrators



- 5-7 l water/h
- Particles > 2-5  $\mu\text{m}$
- Extract nutrients
- Filtration improve transparency of water
- Loss of organic matter to the sea bed



## WE ASSUME RESPONSIBILITY...

And focuses on sustainable production and keeps up-to-date with and develops new initiatives within aquaculture. We aim to achieve zero impact on the environment through own control and production.

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### LOCAL AREA

Endelave mariculture get an environmental...

The Ministry of Environment has responded to a request for compensation and will fund the operation of Endelave Aquaculture.

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### TV2 EAST JUTLAND ON SEAWEED

Hjarne Havbrug's marine biologists talk a...

Fang is already used in many products and it can be grown at the same Danish waters. See TV2 East Jutland's feature on...

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# Nutrient Extraction at Hjarnø Havbrug



- 2105 t rainbow trout
- 7500 t blue mussels
  - Nutrient extraction decoupled
  - Located in same WFD water body





# AQUACULTURE: Production of mussels



# Smartfarm produce 20-25 t of mussels per unit



Musselfarm area= 18 ha

100 smartfarm units

20-25 tons mussels per unit

1,37 % N for small mussels

1,18 % N for large mussels

2000-2500 tons of mussels per farm

## **Small mussels - May to Oct**

No problems with ice or eider

27-34 tons N per musselfarm

1.5-1.9 tons N/ha (x2 for longlines)

## **Large mussels – May to May**

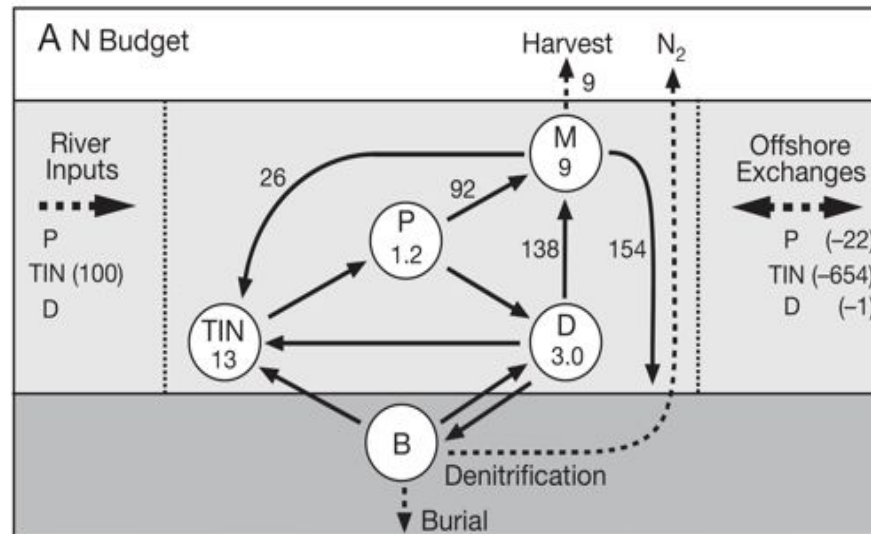
Mussels for human consumption

*24-29 tons N per musselfarm*

1.3-1.6 tons N/ha



# Impact on the ecosystem - sedimentation



**Cranford et al (2007). Flow of N in Canadian Bay. The mussels (M) annually extract 92 t of N as plankton (P) and 138 t as detritus (D). 9 tons are harvested and 154 is lost to the sea bed.**



# Nitrogen in the sediment below musselfarms at Hjarnø Havbrug

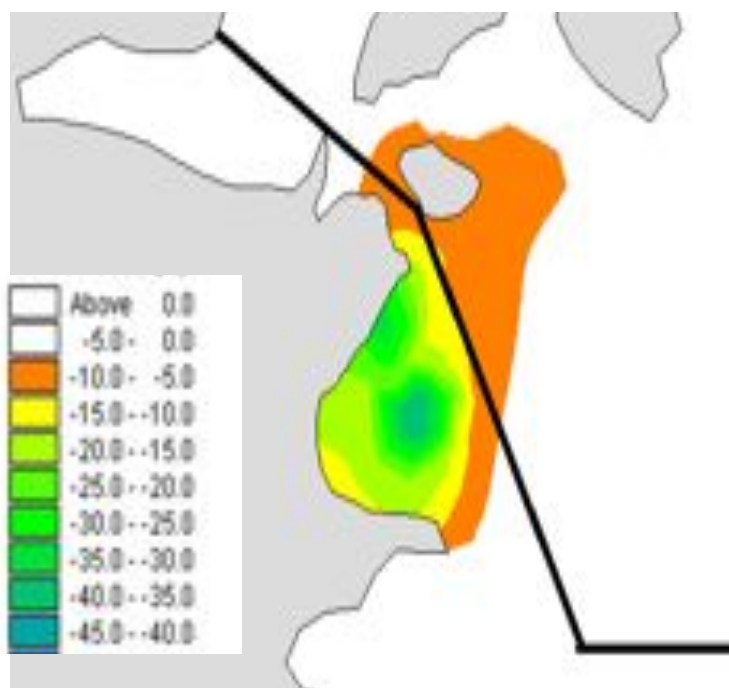


**At seabeds at sites with stronger currents no impact of the sedimentation.**

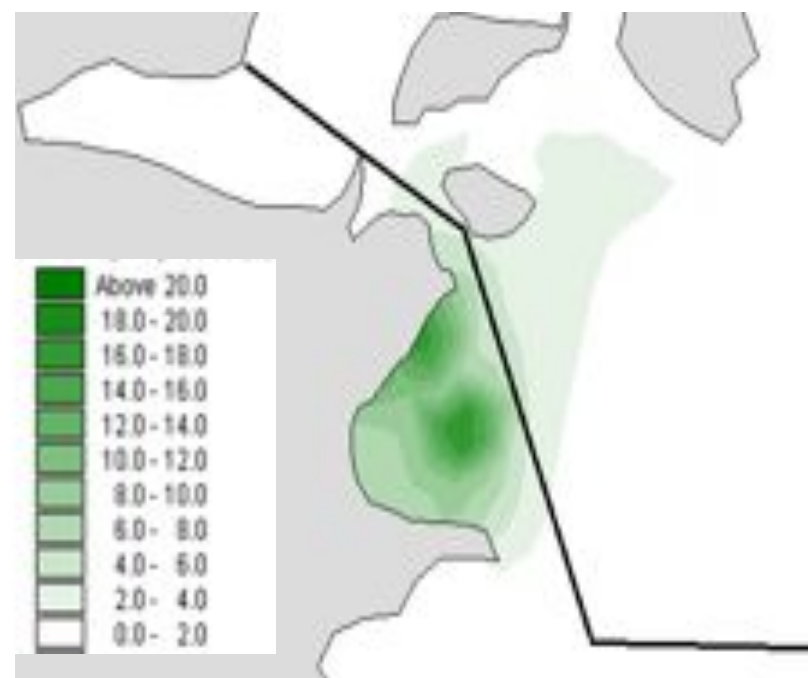


# Goods and services – waterquality

Chl a



Transparency



# Good and services



## Reef effects



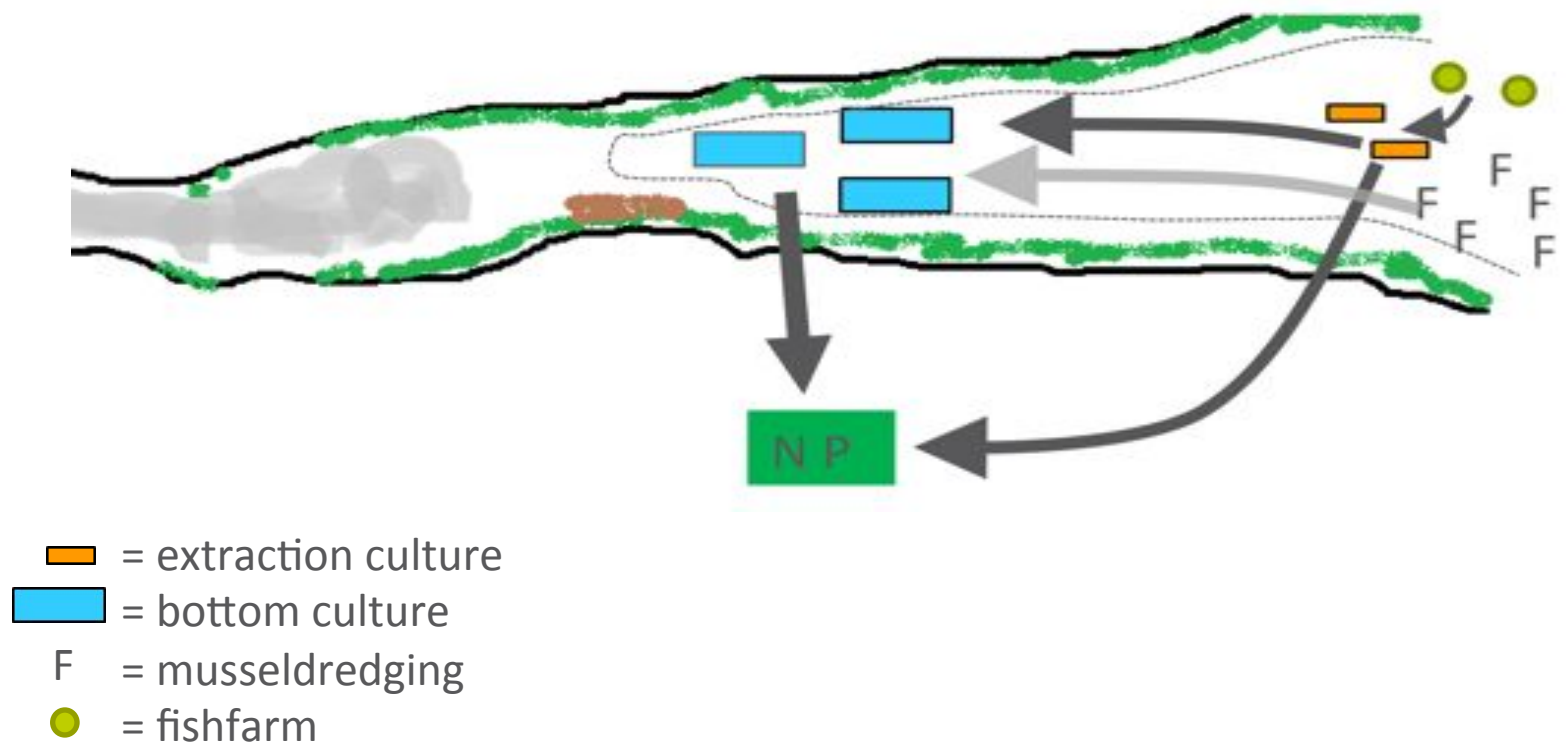
## Food for Eider







# Integrated management of mussel production in Danish waters

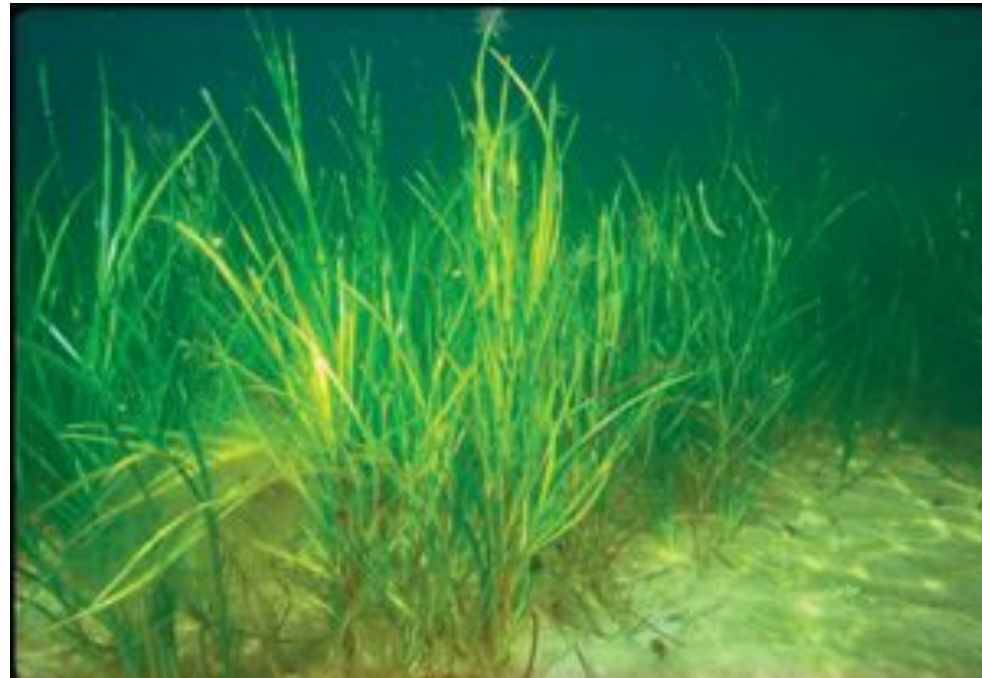


# Aquaculture strategy

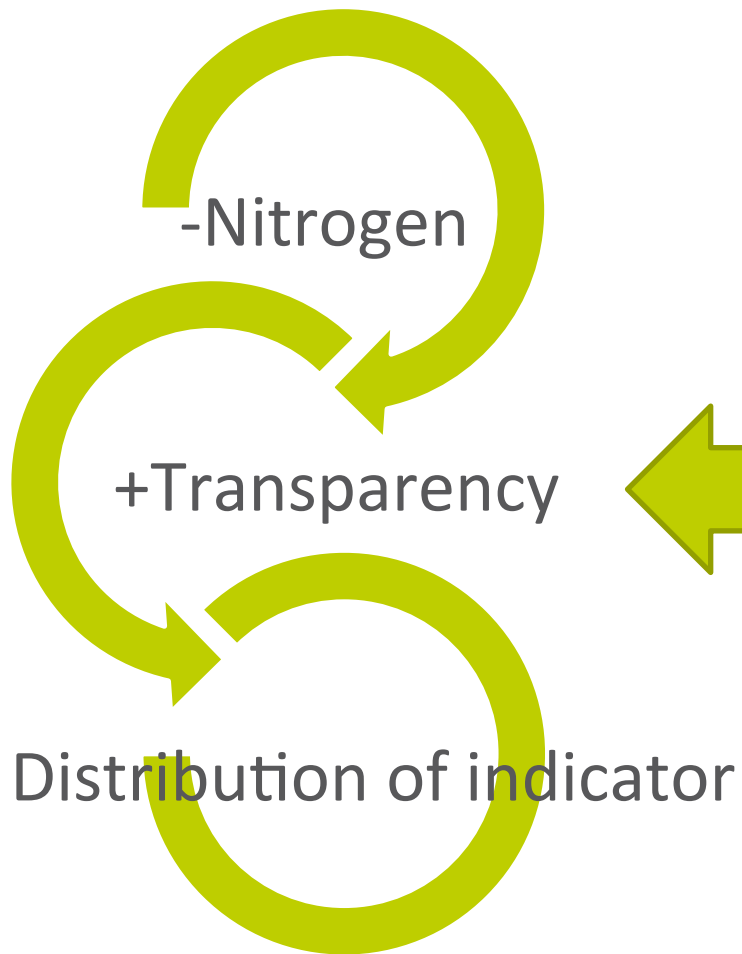
## 50% growth – reduced impact



- 12 new projects outside WFD-areas
  - Nutrients extraction???
  - Management areas???



# WFD: Zostera indicator for GES

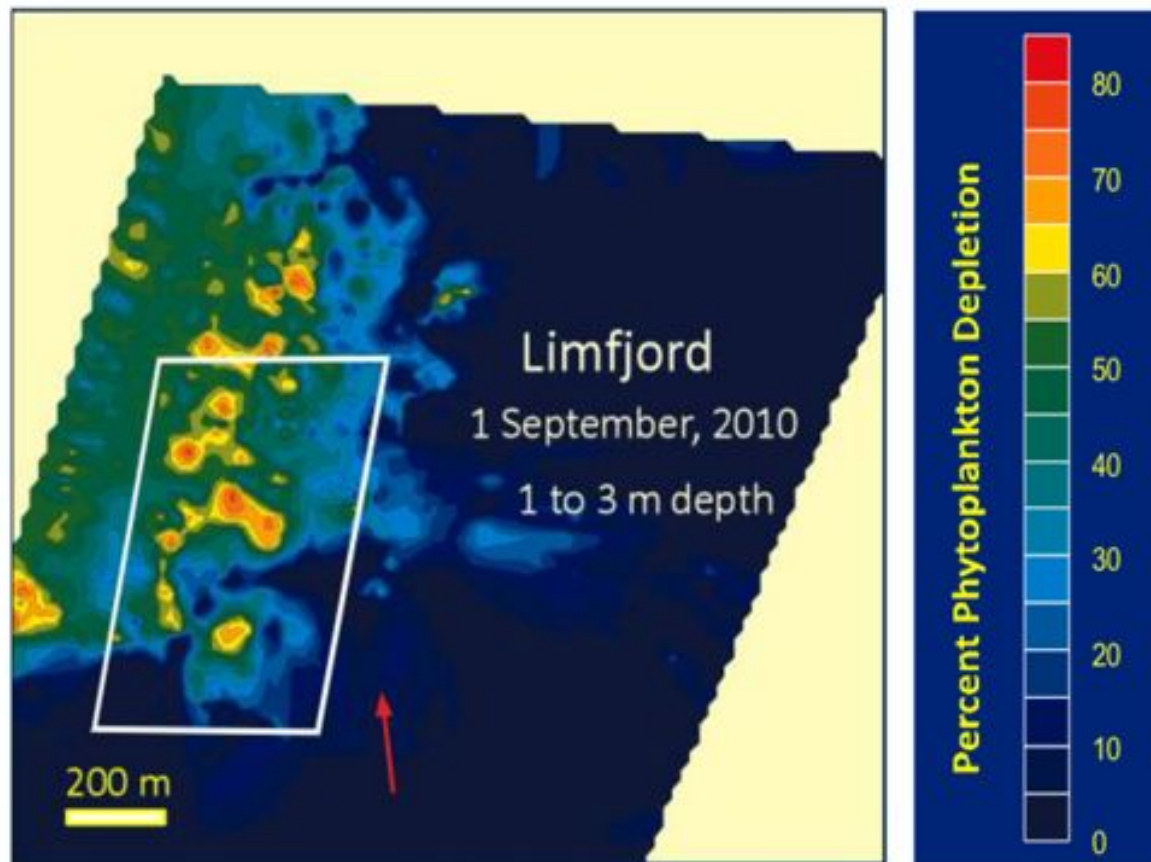




# MUMIHUS

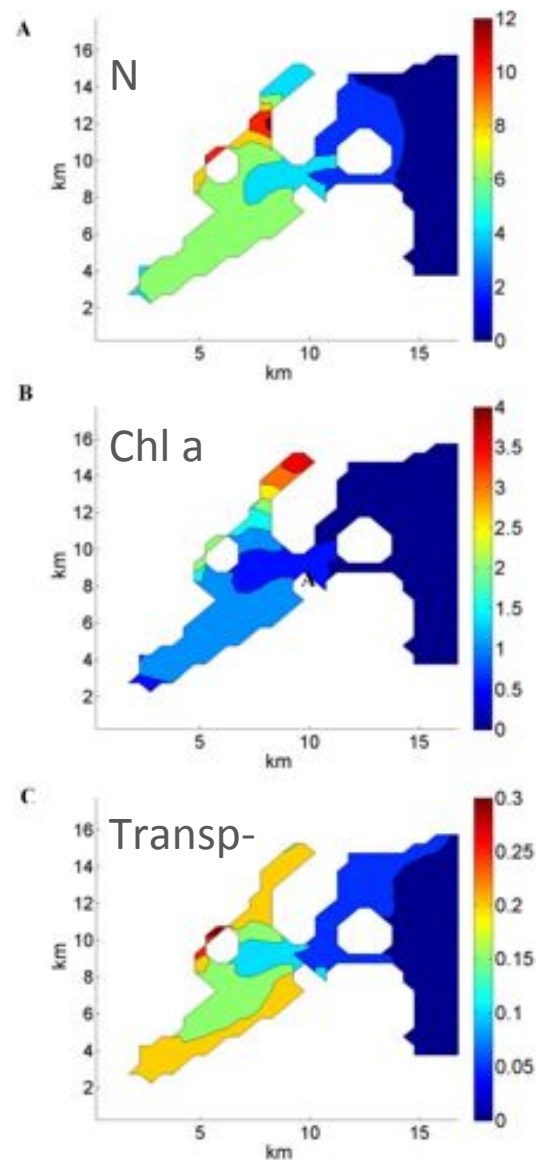
17 t N from Nutrient-extraction

116 t N from increased transparency

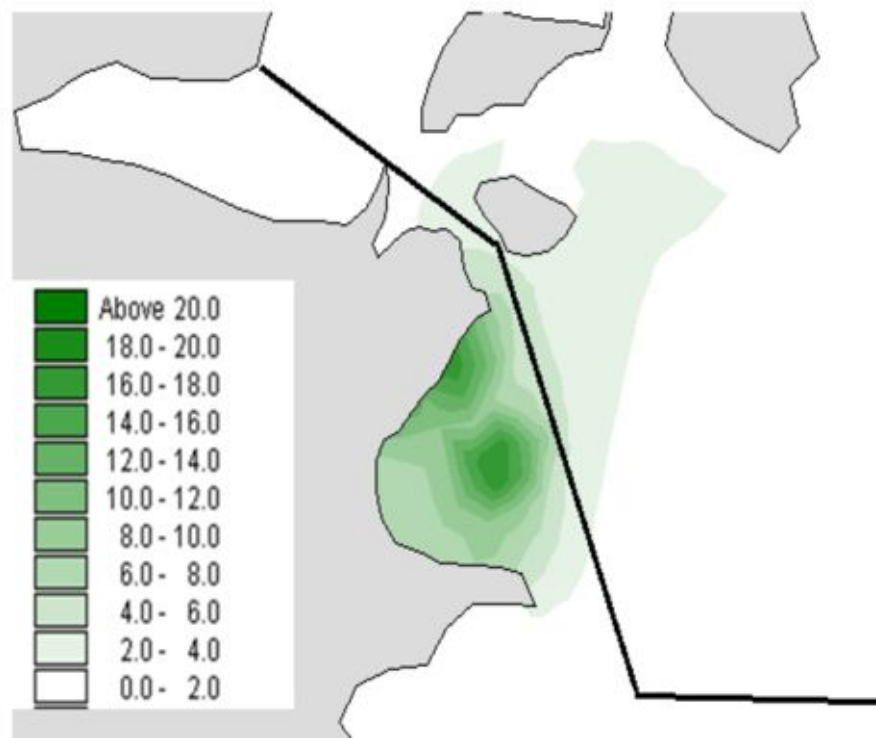


Figur 2.3. Udtynding af fytoplankton i Skive Fjord i og omkring et opdrætsanlæg. Den hvide firkant angiver anlæggets placering.

# DCE Horsens Fjord



# Horsens Fjord



Figur 1 Procentuel forbedring af sigtdybde i As Vig ved etablering af tre kompensationsopdræt med blåmuslinger med en total produktion på 7500 tons muslinger.



# Challenges for implementation of nutrient extraction by mussel farming



**Optimize production at low cost**

**Production**

**Predation**

**Harvest**

**Impact on ecosystem**

**Development of a market for the mussels**

**Optimization of management - get paid for ecosystem restoration not nutrient extraction – Holistic approach**

**Not in my backyard – Perception, site selection and regulation**

