



Danish Ministry of the Environment

# Sustainable rainbow trout farming - regulatory approach

Copenhagen, June 12-13, 2014 The Danish  
Ministry of the Environment. Anders Vedel



# Content of the presentation

- Environmental approval of rainbow trout farms in Denmark
- Environmental impact of trout farming
- The Endelave Rainbow trout project



# Marine rainbow trout farms in Denmark

## Key numbers 2013

- Total number: 23 marine rainbow trout farms
- Total production: Approx. 10.500 tons/year
- Total discharge
  - N – 319 tons/year
  - P – 34 tons/year



# The approval stages

A process that lasts approximately 9-12 months including:

- Application
- Environmental Impact Assesment (screening)
- Hydraulic model
- Nature impact assesment (if close to Natura 2000 areas)



# Environmental approval

- Environmental approval (*Environmental Protection Agency*)
- EIA permission (*Environmental Protection Agency*)
- Placement permit (*The Danish AgriFish Agency*)
- Permits for Mussel farms (*The Danish AgriFish Agency*)
- Permits for Seaweed farms (*Danish Coastal Authority*)



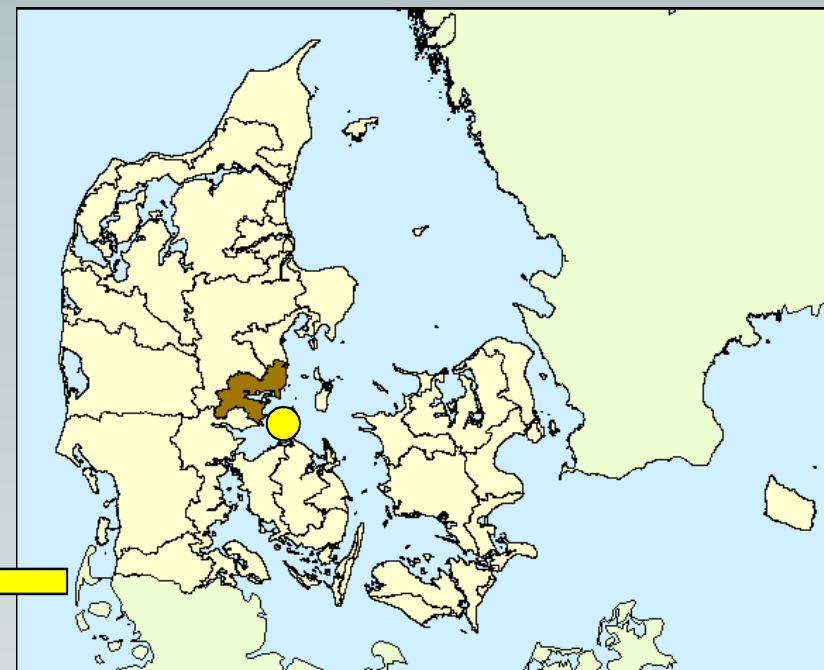
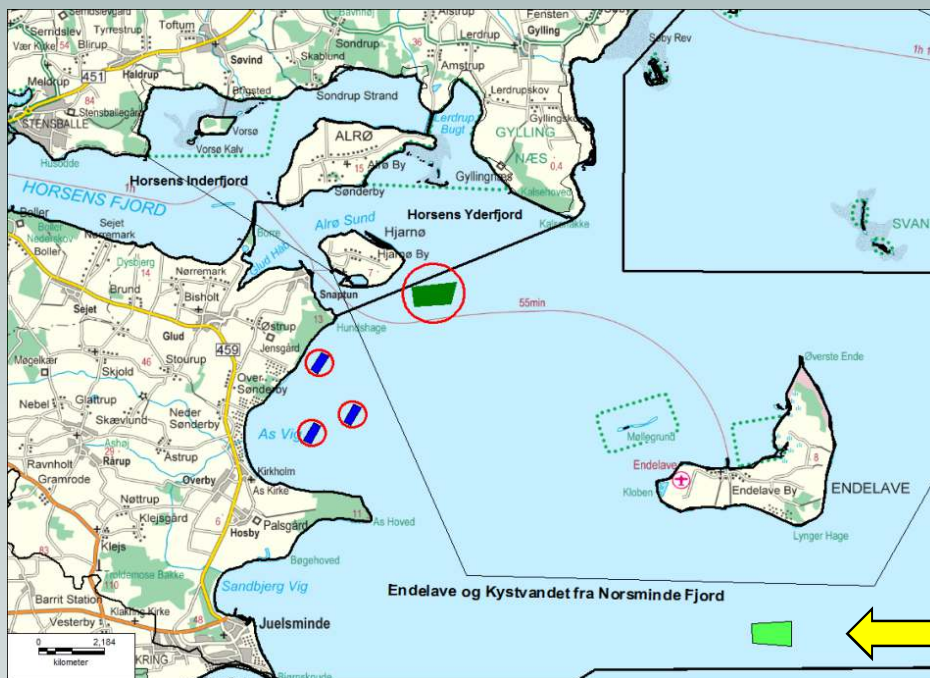
# Environmental impacts

- N & P discharge
- Antifouling agents (copper)
- Organic material
- Drug residues
- Fish escape
- Spread of disease
- Spread of parasites - salmon lice (*L. salmonis*)





# Rainbow trout farm, Endelave



# Rainbow trout farm, Endelave

## Dimensions:

Rainbow trout farm: 24 ha

Mussel farm: 18,5 ha (56 ha)

Seaweed farm: 100 ha

Total 1,8 km<sup>2</sup>

Waterdept: 26 meter

Strong ocean currents/high dilution





# Rainbow trout farm, Endelave

## Production:

Rainbow trout production, 2105 t/year

Fodder consumption 2315 t/year

Mussel production, 7.500 t/year

Seaweed production, 700 t/year

## Discharge:

N – 88 tons/year (zero t after comp.)

P – 9,6 tons/year (2,9 t after comp.)



# Rainbow trout farm, Endelave

## Sustainability:

- N compensation – 115%
- P compensation – 70%
- No antifouling treatment (nets)
- Organic mussel production
- Organic seaweed production
- Organic rainbow trout production (2015)



# Challenges of environmental approval

- The national river basin management plan leaves no room for extra emissions of N
- There is uncertainty associated with mussel and seaweed production
- Area needs are great because of mussel farms and seaweed production (24/56/100 ha) 1,8 km<sup>2</sup>
- The project interacts with local recreational interests
- There is a general reluctance from local citizens and NGOs



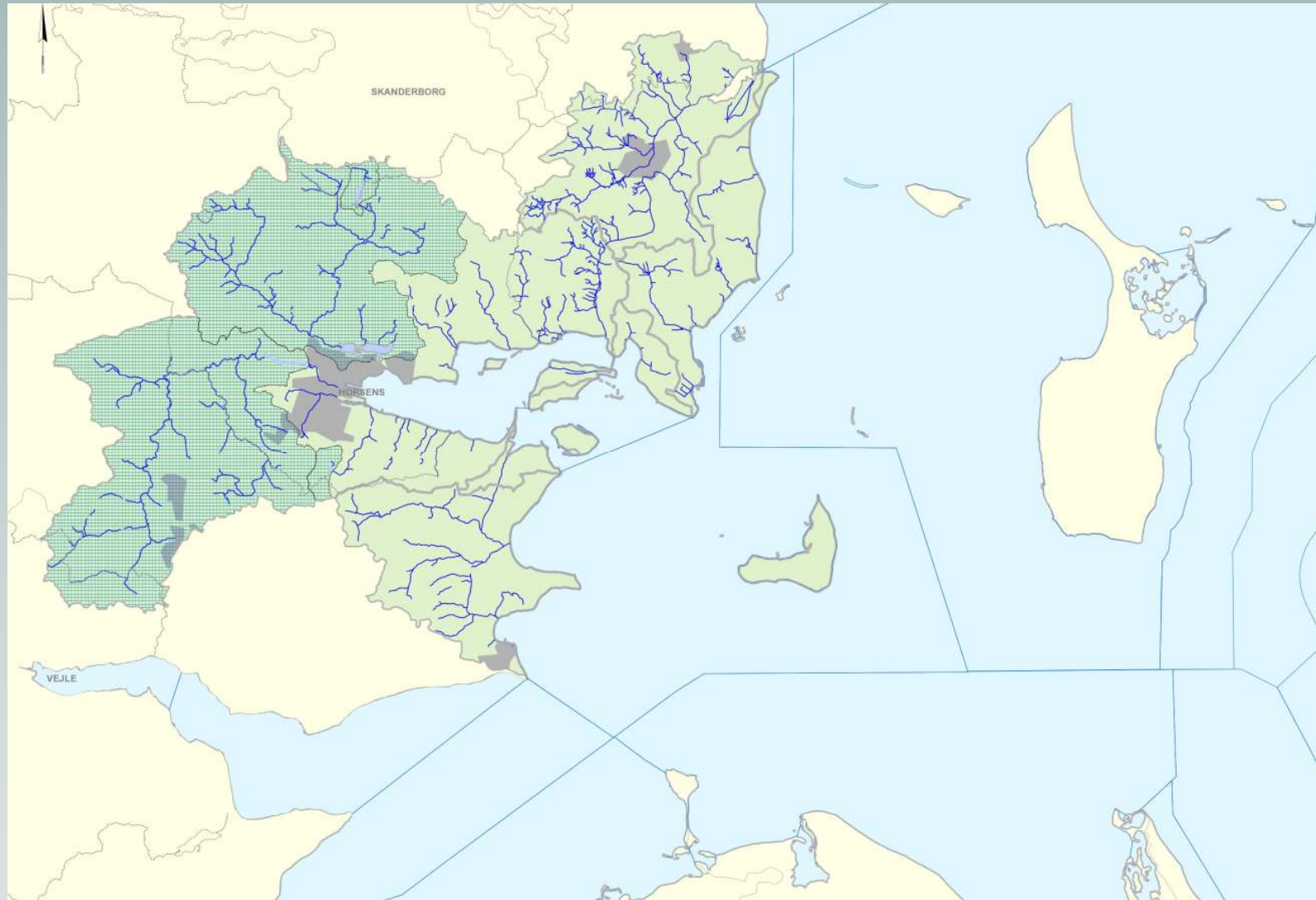
# National Water Management

- EU Water Framework Directive and Marine Strategy Framework Directive must be complied with
- **“Good ecological status”** means “low levels of distortion resulting from human activities, but deviating only slightly from undisturbed conditions”
- River basin management plan 2015 requires a reduction of 30 tons of N by 2015 in the area “Endelave and Coastal waters from Norsminde Fjord”





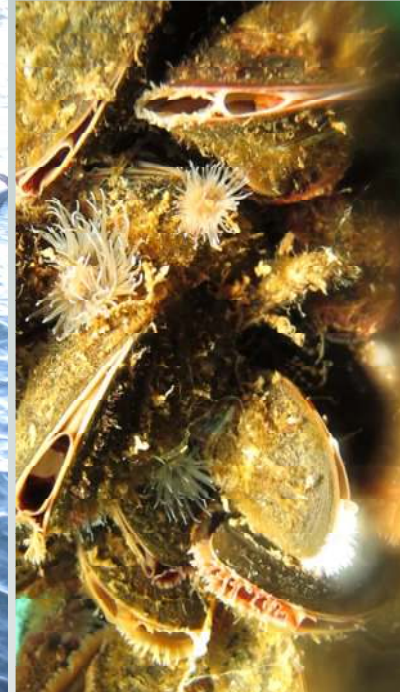
# River basin Horsens Fjord





# N and P compensation with mussels

- 3 mussel farms a 2.500 tons/year each (7.500 tons)
- N content in mussels 1,3 %: Total 97,5 tons N
- P content in mussels 0.08%: Total 6 tons P



# N and P compensation with seaweed

- 1 seaweed farm a 700 tons/year
- N content in seaweed 0,4 %: Total 2,8 tons N
- P content in seaweed 0.04%: Total 0,28 tons P



# Conditions for compensation

- Compensation must be in the same water body as the trout farm
- Mussels and seaweed to be harvested and removed from the water body
- N and p content in mussels and seaweed must be tested at harvest
- N & P accounts shall be drawn before and after the growing season
- Accounting for sales and balance of mussels and seaweed must be available to the authority
- Fish production may be down-regulated or stopped by lack of compensation

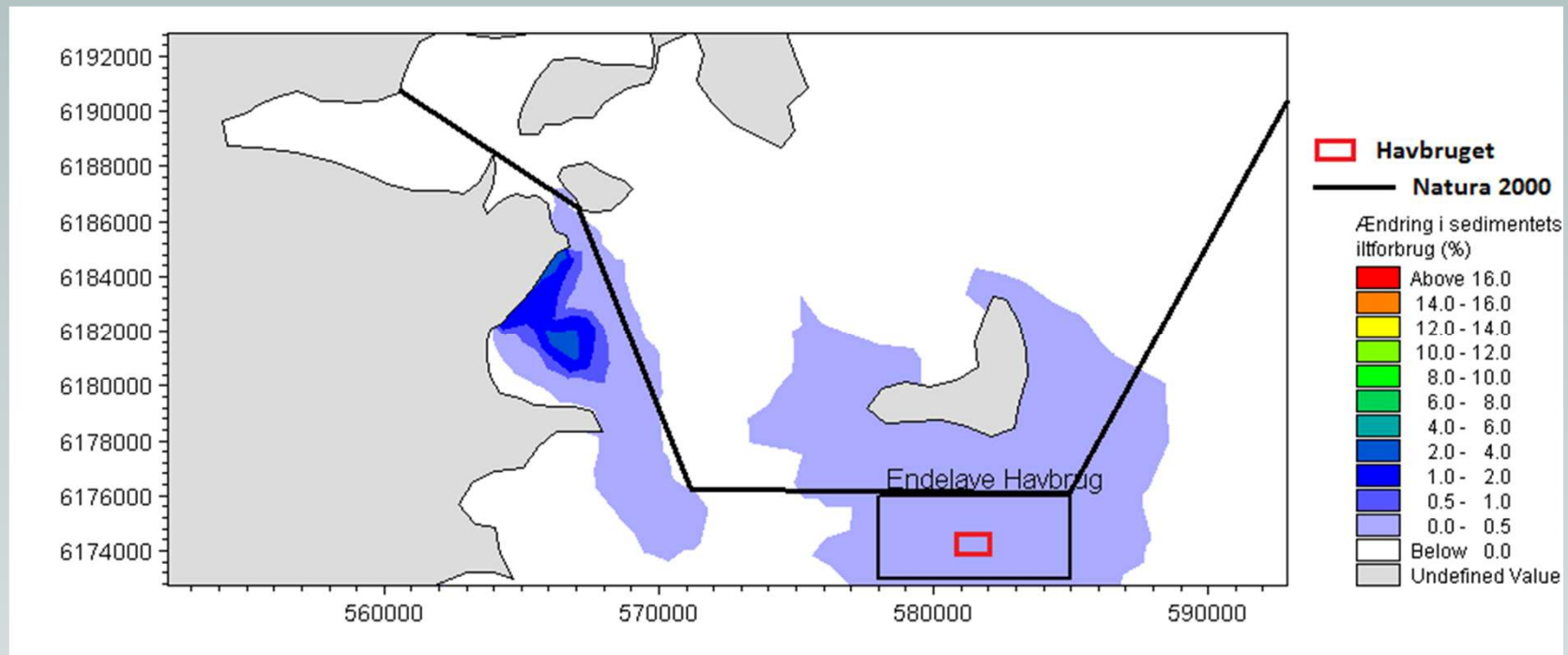


# Monitoring program for water and sediment

- Water parameters: Oxygen, temperature and salinity twice weekly in the top and bottom of the water column at the trout farm
- Sediment parameters: Nitrogen, phosphorus, organic matter and dry matter at 10 stations near the trout farm every spring
- Video: Video mapping each fall in oxygen depletion season



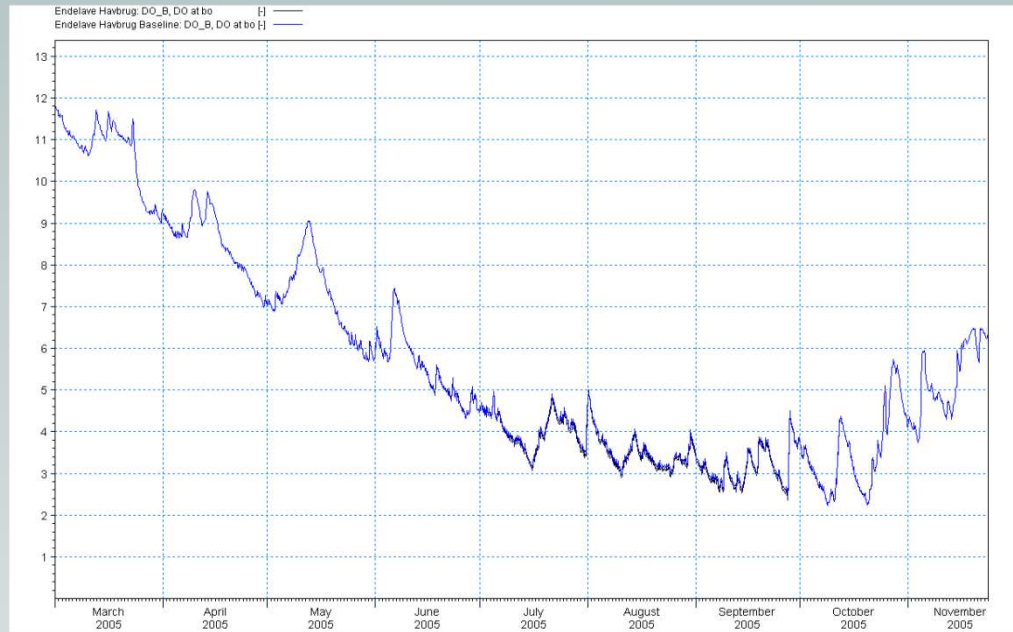
# Changes in sediment oxygen demand



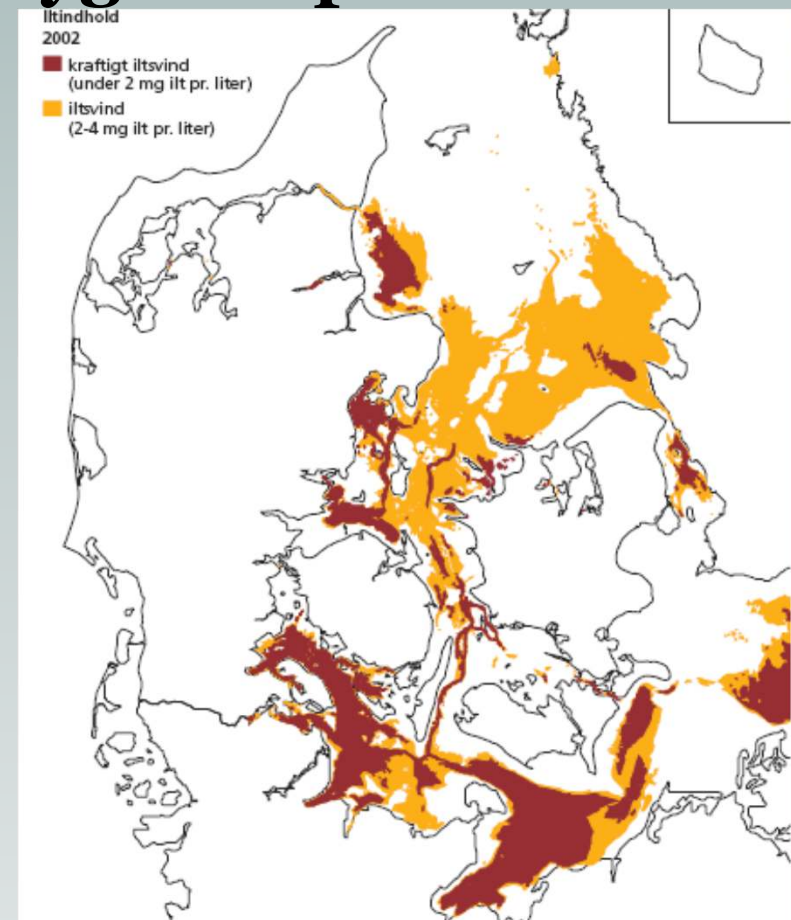


# Oxygen depletion in the water column

## Oxygen in water column



## Oxygen depletion 2002



# Is N & P compensation with mussels and seaweed the solution ?

- Mussel- and seaweed production on large scale requires great expertise and economy
- There is uncertainty associated with mussel and seaweed production
- Area needs are comprehensive because of the mussel farms and seaweed production
- The area requirement is a major challenge in areas of high traffic and high recreational use
- Common mussels (*Mytilus*) and seaweed (*Saccharina*) grow poorly in brackish water.







*Thank you for your attention...*




























# Water Framework Directive (WFD)

Water Management plan units  
 4 River Basin Districts and  
 23 Sub-basins in Denmark

Miljøcentergrænser.shp

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|  Nordjylland        |  Kalundborg           |
|  Limfjorden         |  Roskilde Fjord       |
|  Mariager Fjord     |  Øresund              |
|  Nissum Bredding   |  Smålandsfarvandet   |
|  Randers Fjord    |  Køge Bugt          |
|  Djursland        |  Østersøen          |
|  Århus Bugt       |  Bornholm           |
|  Ringkøbing Fjord |  Odense Fjord       |
|  Horsens Fjord    |  Lillebælt          |
|  Vadehavet        |  Storebælt          |
|  Kruså / Vidå     |  Det Sydfynske Øhav |
|  Lillebælt        |  |

