Interreg
Baltic Sea Region

Baltic Blue Growth

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

EU STRATEGY FOR THE BALTIC SEA REGION
FLAGSHIP

MUSSEL FARMING IN DENMARK – NUTRIENT-CATCH CULTURES OF BLUE MUSSELS

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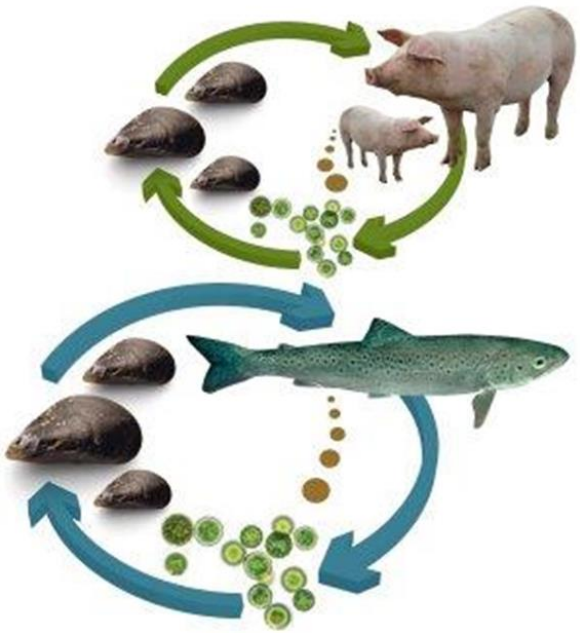
Baltic Sea Research Warnemuende

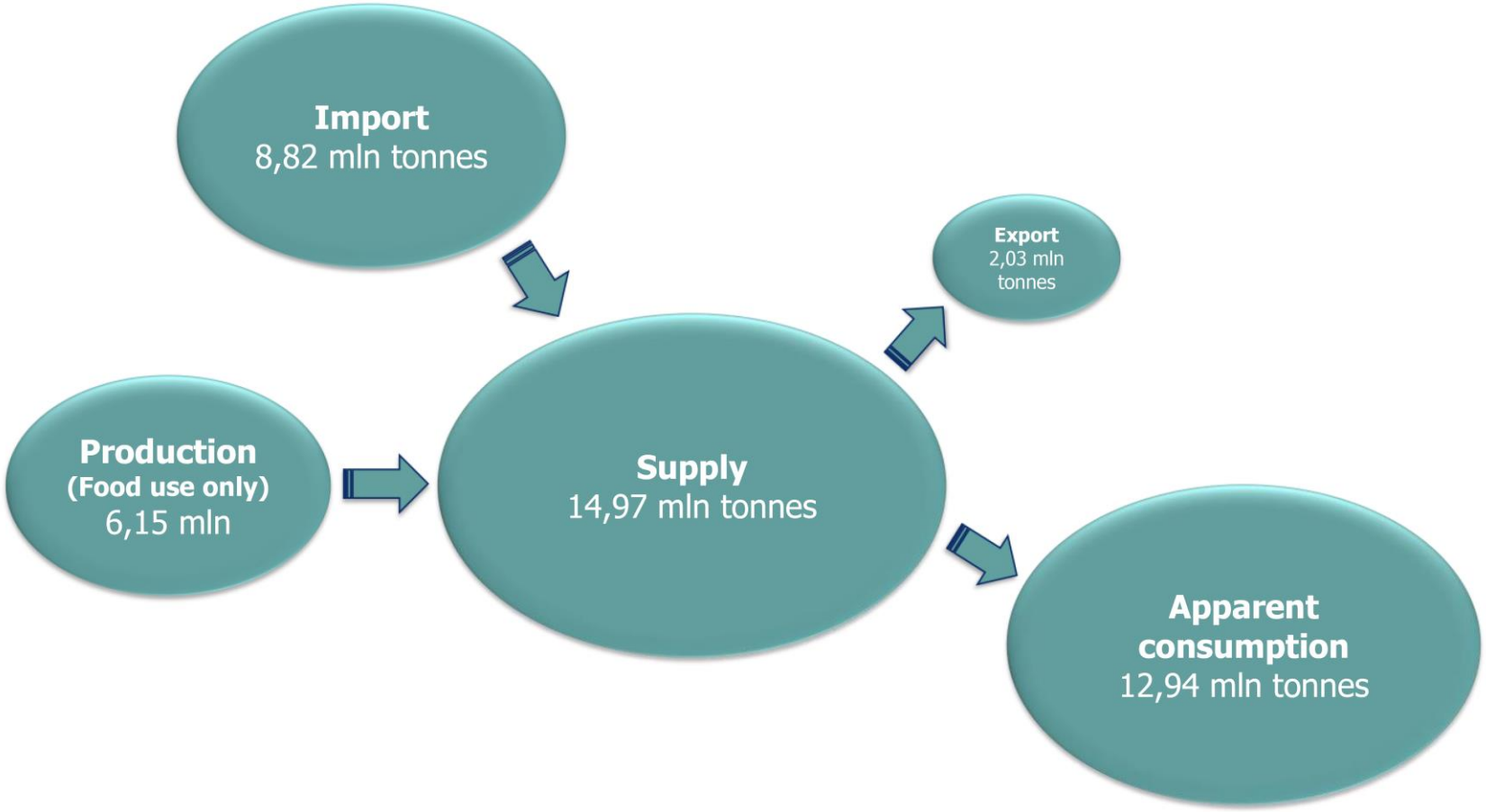
19. March 2019

You will be disturbed by

- Only goods and services for the environment?
- Mussels for food in the Limfjord
- Mussels for the environment in Mariager Fjord.



Closing gap between production and import by aquaculture??



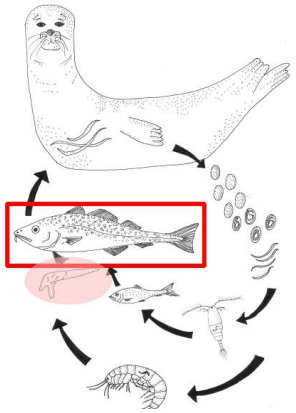
Production of Marine proteins in the Baltic

From a fishery community to an aquaculture community

Interactions with seals may explain collapse of cod stocks

DTU

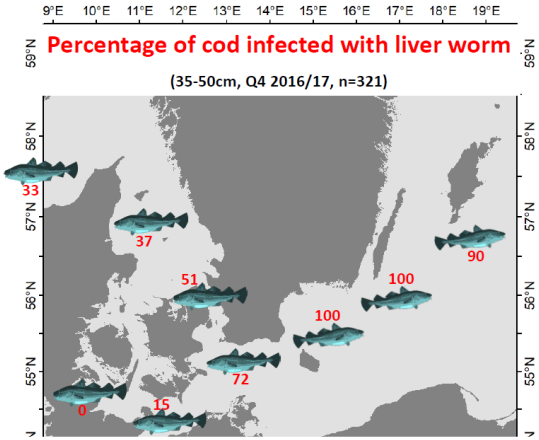
Cod liver worm (*Contracaecum osculatum*) lifecycle



ustration by Kurt Buchmann,
opyright International Wildlife
ssociation, from Haarder et al 2014

DTU

Spatial occurence of liver worm in cod



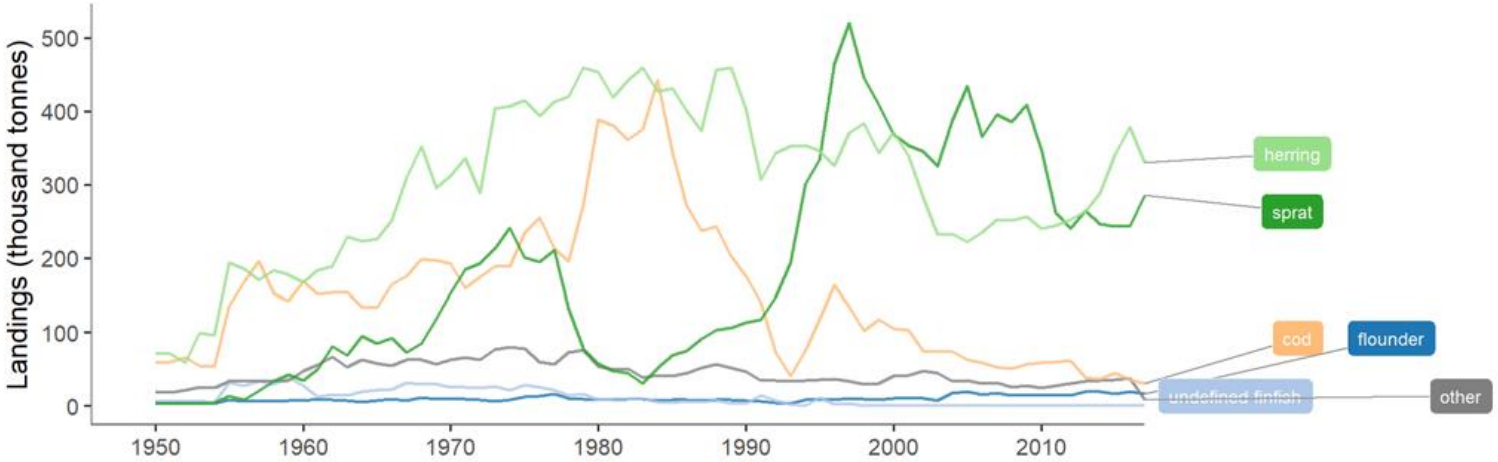
Adapted from Sokolova et al 2018
doi.org/10.3354/meps12773

ICES **Baltic Sea Ecoregion – Fisheries overview**

-Fishery for cod reduced
-Fishery for herring and sprat- used for feed

How can the cod fishery be replaced by aquaculture – recirculation of nutrients by mussels and use of local produced feed from herring/sprat.

Herring and sprat fisheries remove 20.000 t N ~ 2.000.000 t mussels



Historical Nominal Catches 1950-2010,
Official Nominal Catches 2006-2016,
Preliminary Catches 2017. Accessed 2018/August. ICES, Copenhagen.

Benefits from aquaculture

- ✓Fish-farming based on local produced feed and/or in combination with musselfarming. RAS or offshore open systems.
- ✓Mussels important as feed and as nutrient catch in IMTA
- ✓The used fishfeed are cleaned for dioxine and other toxins – Healthy fat fish from the Baltic.
- ✓High outtake of fish from the system due to low mortality
- ✓Production can be wellplaned – and all biomass landed and useed incl sidestreames.
- ✓New jobs in coastal areas on the harbours

BLÅ BIOMASSE A/S

HEDESELSKABET

Grøn innovation siden 1866

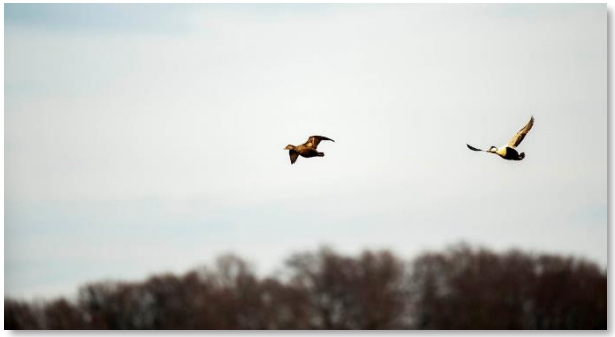
Miljø- og Fødevareministeriet

gudp

ORBICON

DEVELOPMENT OF MUSSEL FARMING AND PRODUCTION OF MUSSELMEAL

- Hedeselskabet have invested 7 mio. DKK since 2011 in development of industrial production of mussels.
- Blå Biomasse A/S was established in May 2016 as a joint venture between Hedeselskabet and local participants with experience in farming mussels.
- The owners see great oppportunities in development of sustainable and circular usage of the potential within the marine environment in Denmark.



INDUSTRIAL MUSSELPRODUCTION

FULL USAGE OF THE BIOMASS

Mussel farming

breeding via Smart Farms (new technology)

Advantages:

- Automatized processes with innovative technology that reduces labour expenses and permit harvesting of mussels multiple times a year, and thereby utilizing the full production potential.
- Farmed mussels have a higher percentage of meat than bottommussels

All mussels are sold or utilized

Consumption DK/export

Mussels < 4,5 cm for feed production

Musselmeal

Mussels < 4,5 cm

Mussels are processed and dried to a meal

Fertilizer

The portion not used for musselmeal, can be used as a fertilizing product

PROCESSING METHODS

- Skrewpressing and drying
- Hydrolysis by enzymes or heat
- Impuls cooking
- Insects

NEW AND INNOVATIVE CHAIN OF VALUES ESTABLISHED AROUND SEVERAL COMPANIES

MUSSEL FARMING	MUSSELMEAL	SALMON FODDER	SALMON FARMING
BLÅ BIOMASSE A/S	TRIPLE999 FISH MEAL FACTORY	Feed producer	LERØY SEAFOOD, NORWAY

Blå Biomasse A/S

- Breeding of 50,000 t mussels by 2022
- Cost effective processing of the biomass

Triple999 Fiskemelsfabrik

- Proteinfraction steamed/dried to musselmeal

Feed producer

- Formulation of fodder product for salmon containing up to 10% musselmeal

Lerøy Seafood

- The growth and welfare of atlantic salmon are documented as a result of musselmeal in the salmon's fodder.

CHALLENGES AND AREAS OF DEVELOPMENT

Chain of values:

- Optimization of mussel production including harvest strategy
- Optimization of logistics
- Demonstration and optimization of processing.
- Feeding experiment in regards to estimating the performance of the product

Environmentally:

- Documenting the influence of bed conditions during mussel farming in in regards to clarity and plancton dynamics.
- Recording removed Nitrogen (N) and Phosphorus (P)

FARMING OF 50,000 TONNES OF MUSSELS HAS GREAT SOCIETAL VALUE

The compensating effect of mussel farming can form part of the fulfilment of goals in the National strategies for bioeconomy and development og nutrient-catch systems acccording to the WFD:

- The project will have a positive effekt on the aquatic environment and is expected to remove a minimum of 500 t nitrogen (N) and 40 t phosphorus (P) each year from 2022 and on.
- The economical cost of removal of nitrogen (N) has been estimated at 70-90 DKK per kilo nitrogen. This means that a yearly removal of 500 t nitrogen has a societal value of 35-45 mio DKK

FARMING OF 50,000 TONNES OF MUSSELS HAS GREAT SOCIETAL VALUE

- Financially and enviromentally effective means to cleaning the Danish coastal areas.
- Sustainable growth in aquaculture
  - Blå Biomasse A/S has already established cooperation with Danish marine fish farms, seeing as they need a market for the mussels produced.
- Job creation in the areas.
  - The project can create approx. 300 new jobs

NUTRIENT-CATCH MARIAGER FJORD

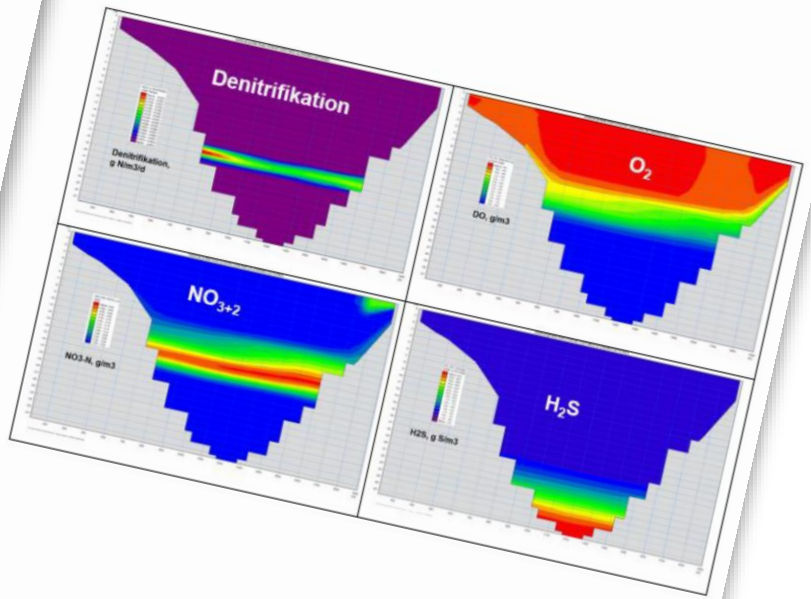
Mariagerfjord Kommune

Forretningsplan for kompensationsopdræt af blåmuslinger i Mariager Fjord

13. MARTS 2018

Modelanalyse af N-fjernelse i Mariager Fjord ved iltning af "Dybet" og ved muslingeopdræt

Rapport december 2017



The expert in WATER ENVIRONMENT

HEDESELSKABET

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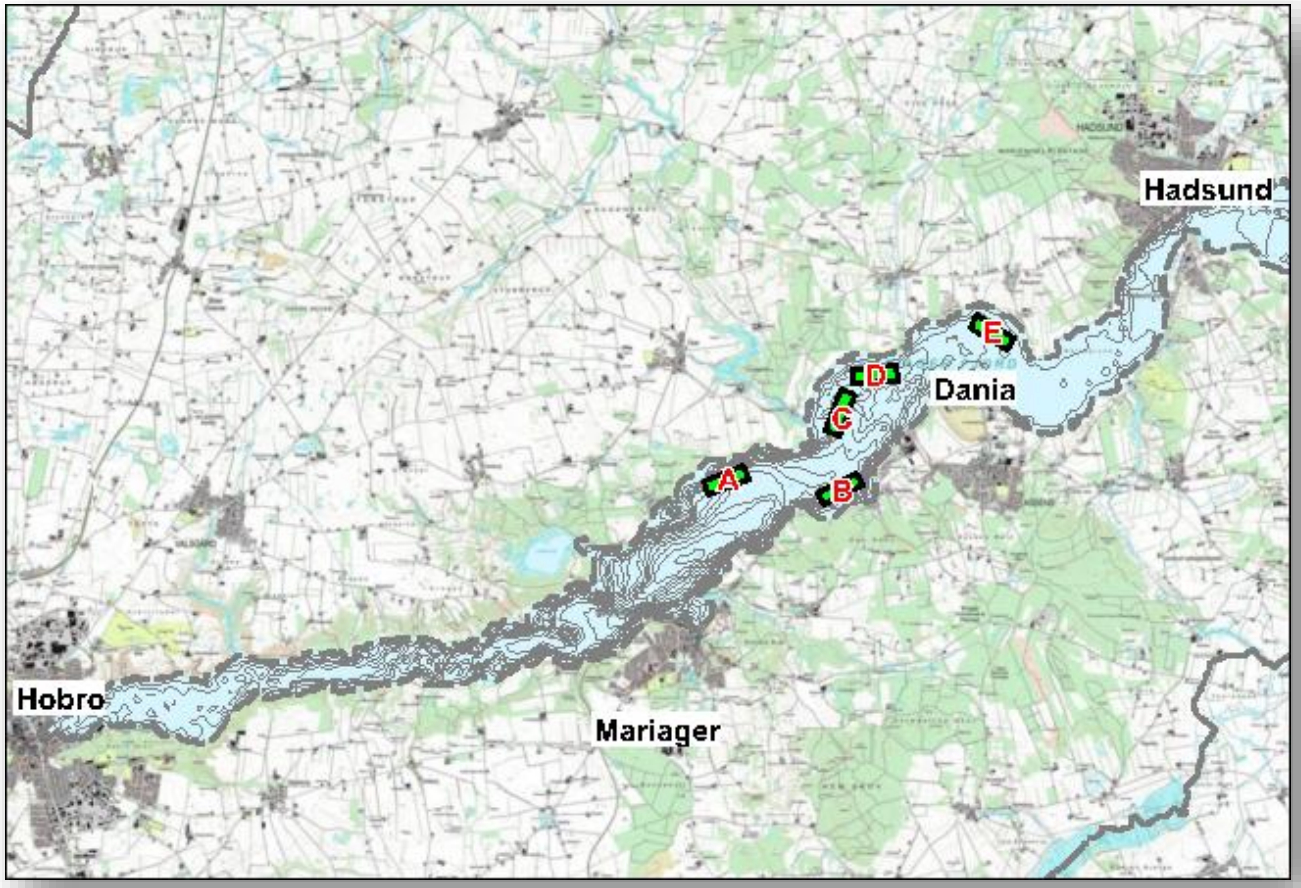
LOCATION OF 5 MUSSEL FARMS

DISTANCE HOBRO-HADSUND 20 KM



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DHI: RESULTS FROM MODELLING

- 86,7 ha in 5 mussel farms
- Catch of 71 t N og 4,7 t P annually
- Productionssystem impact nutrietcatch: longline versus Smartfarm

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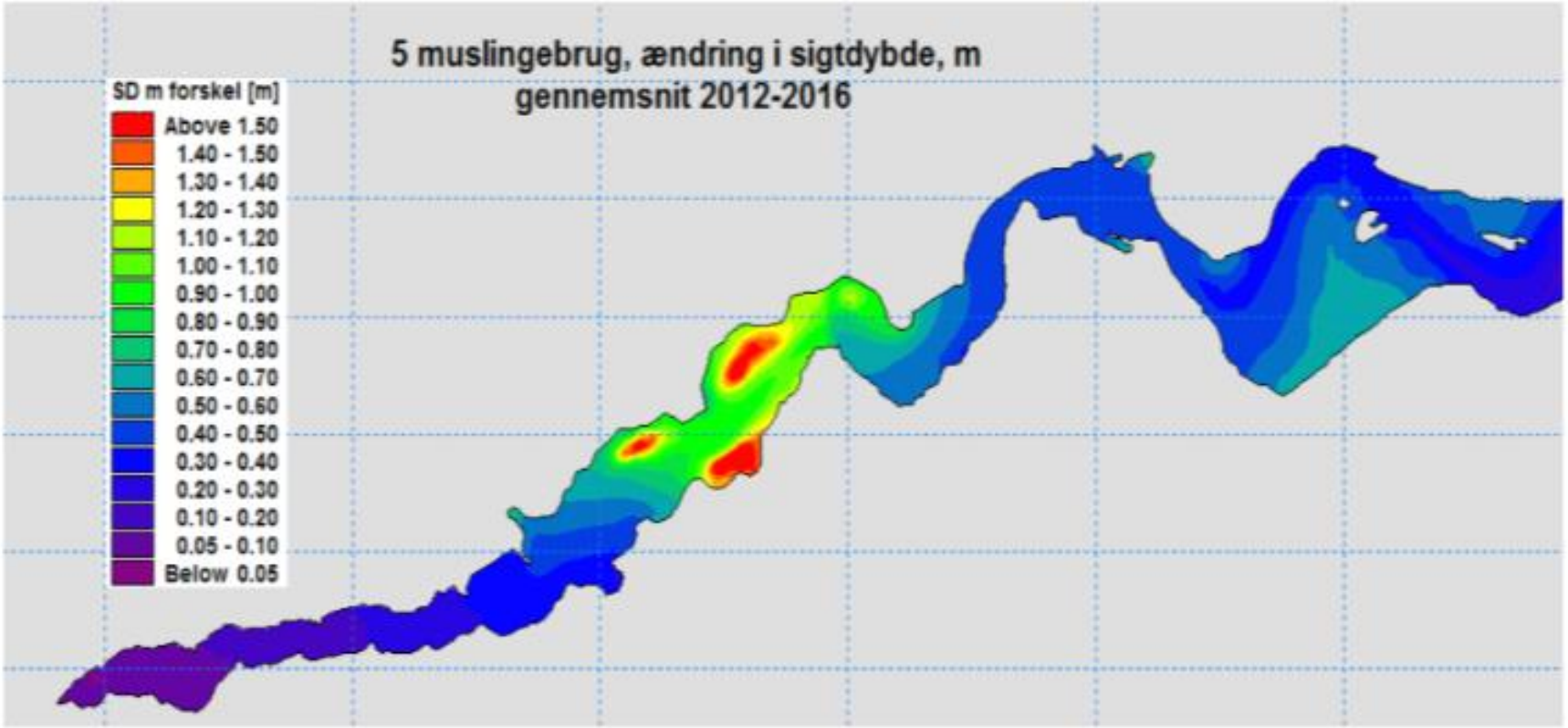
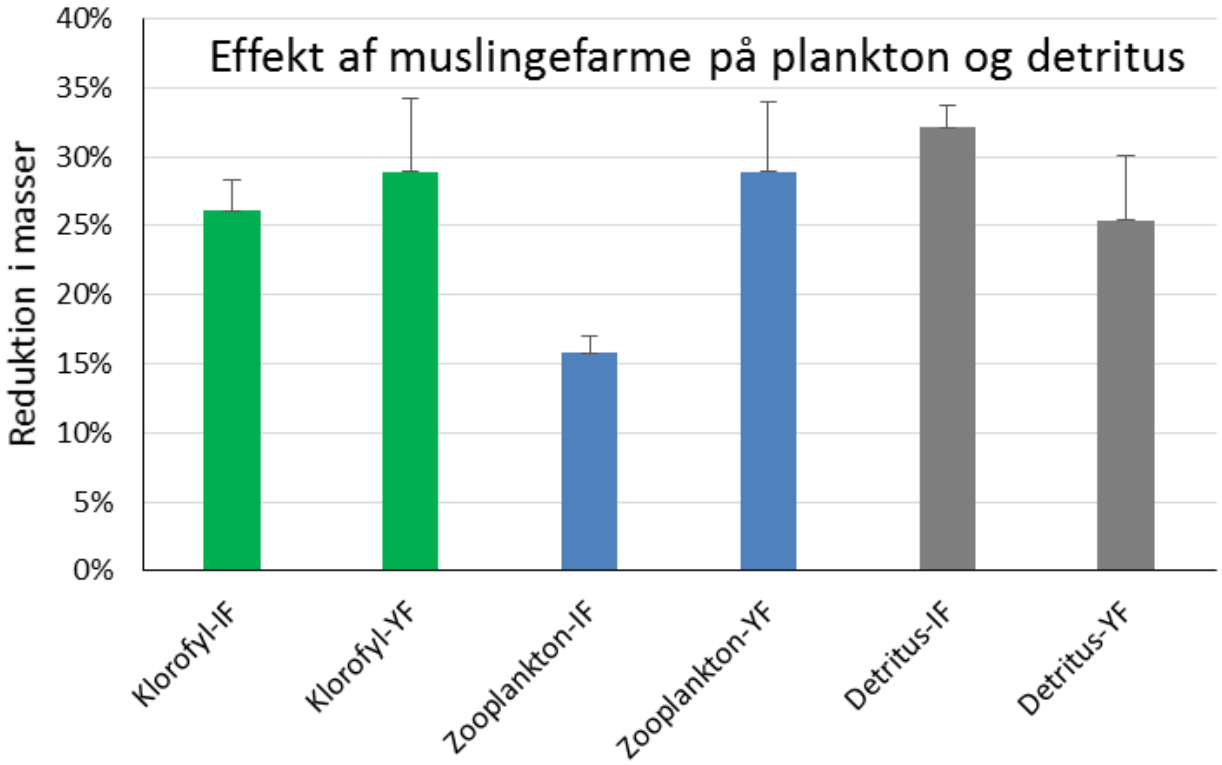
SECCHIDYBDE




Effekt af muslingefarme på plankton og detritus
Reduktion i masser
40%
35%
30%
25%
20%
15%
10%
5%
0%
Klorofyl-IF
Klorofyl-YF
Zooplankton-IF
Zooplankton-YF
Detritus-IF
Detritus-YF

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MARIAGER FJORD: BUSINESS DEVELOPMENT – HOW TO SET UP THE BUSINESS

- Who can produce 8-10,000 tonnes of mussels
- Payment for risk
- Ownership of equipment
- Biomass used for food or feed
- 25 new jobs??

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ECONOMY – WHAT IS THE COST FOR NUTRIENT CATCH

Models for payment:

- Fixed price
- Windfarm model
- Dependent of marketprice

- Incitament bonus if > benchmark