Impact of kelp cultivation on the ecosystem - results of the KELPPRO project

KELPPRO

Kelp industrial production: Potential impacts on coastal ecosystems
2017-2020

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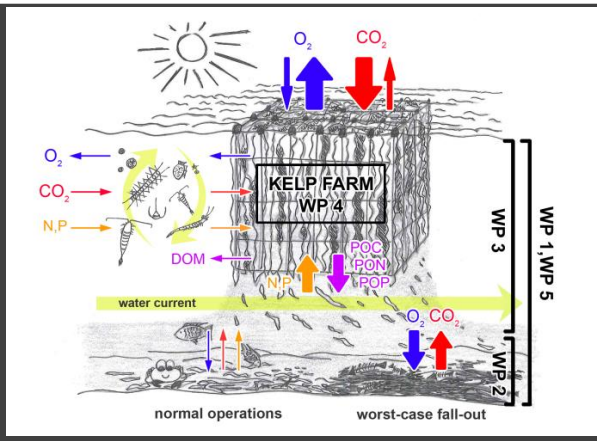
SIG Seaweed 6 conference – 26 November 2021



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Why spend time on environmental impacts?

Sangou Bay, Kina

Foto: SES/J Funderud 2016

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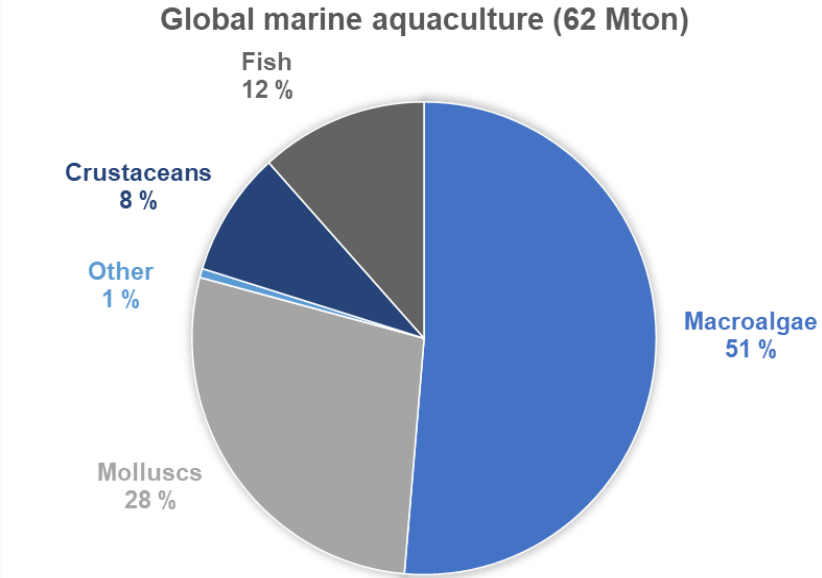
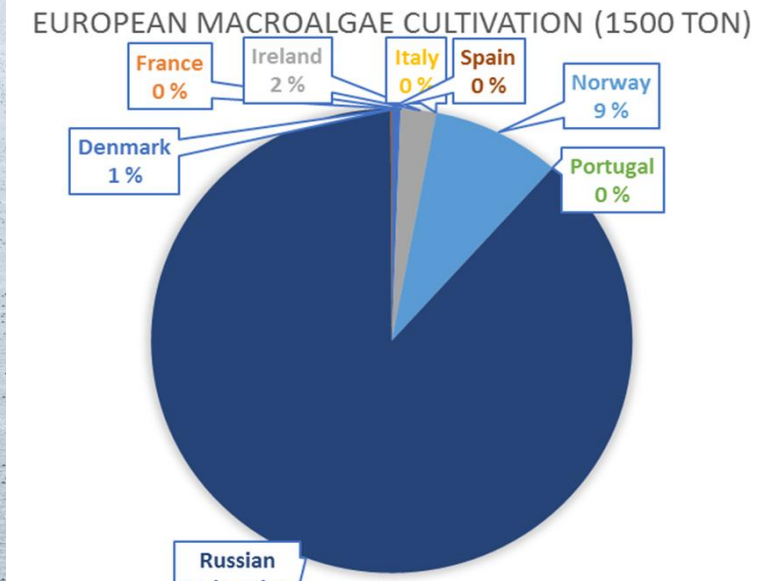




- Global seaweed production **>31 mill. tonnes** (FAO 2018)

- Norway produce >300 tonnes in 2021
- Future prospect is **20 mill. tonnes** by 2050 (Olafsen 2012)

- This requires an area of 2000-3000 km^2, equivalent to an area of the Hardangervidda national park

Sangou Bay, Kina

Foto: SES/J Funderud 2016

Why spend time on environmental impacts

Sangou Bay, Kina

Kelp industrial production: Potential impacts on coastal ecosystems

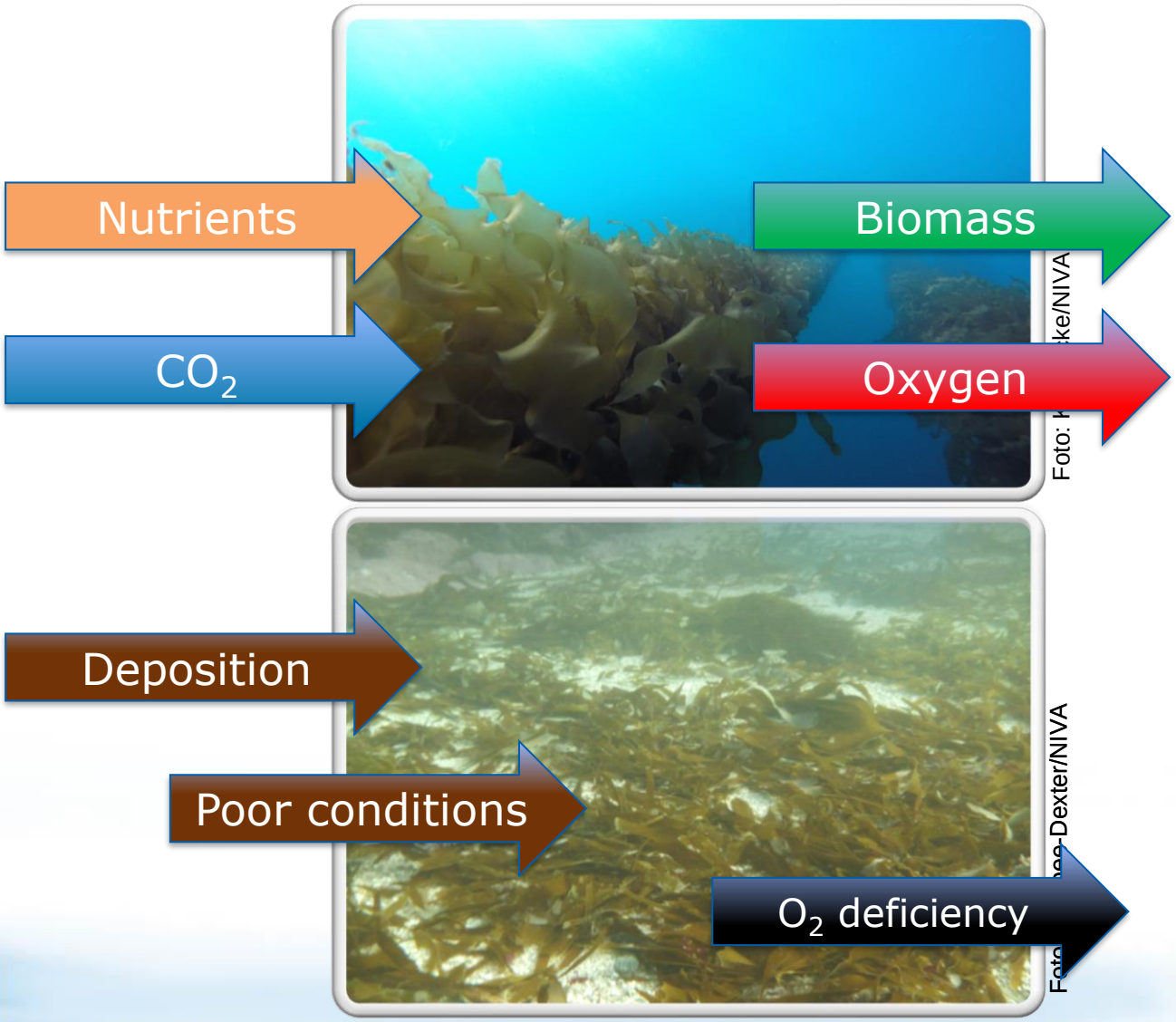
Aim:

Provide an **integrated assessment of positive and negative impacts** of industrial-scaled kelp farming on the marine ecosystem

Three main questions:

1) Will large scale kelp farming **impact the coastal ecosystems** – open water and sea floor habitats and functioning?
2) Will farmed kelp detritus provide **valuable bio-resources or pose a threat** to natural coastal ecosystems?
3) Will kelp farming facilities provide ecosystem functioning as '**artificial' forest habitats**?

Potential environmental impacts of extensive seaweed cultivation

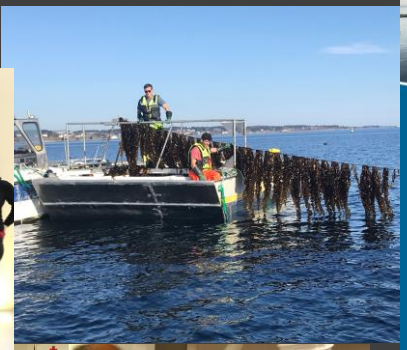


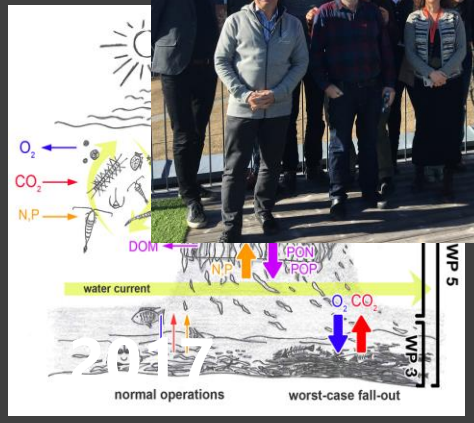
Positive impacts are

- **Nutrient uptake, reducing eutrophication**
- **CO_2 uptake, reducing ocean acidification**
- **Oxygen** production
- **Increased primary production**
- Stimulate **biodiversity**

Negative impacts are

- **Reduced light** availability
- **Depletion** of limited nutrients
- **Depositing** of organic matter on the seafloor, leading to
- **poor environmental conditions**,
- **oxygen deficiency**,
- change in natural **biodiversity**
- Spreading of **unwanted species, genetic material and diseases**



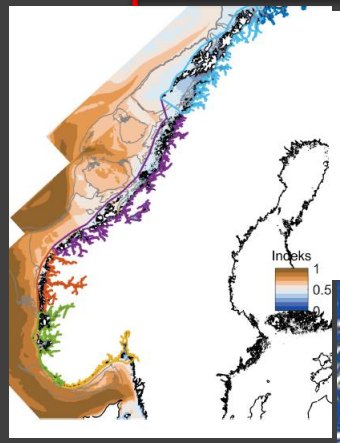


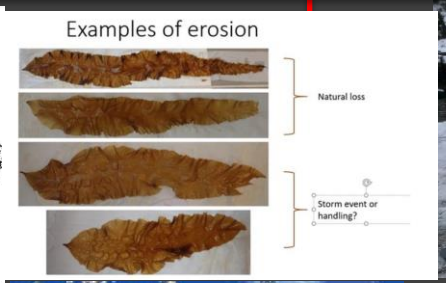
2018

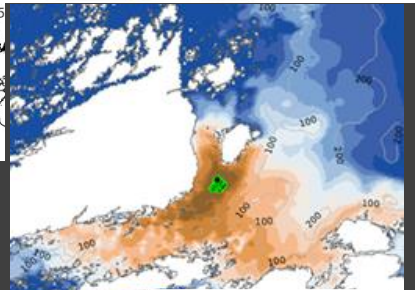
2019

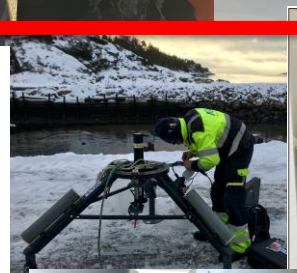
2020

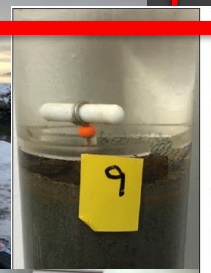
2021

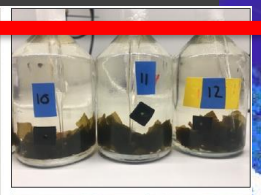


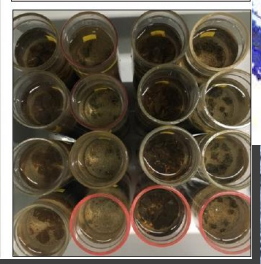


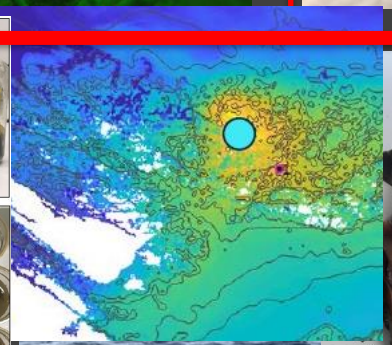


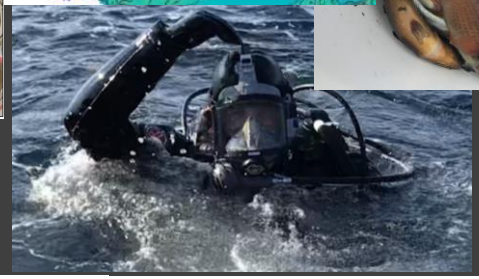












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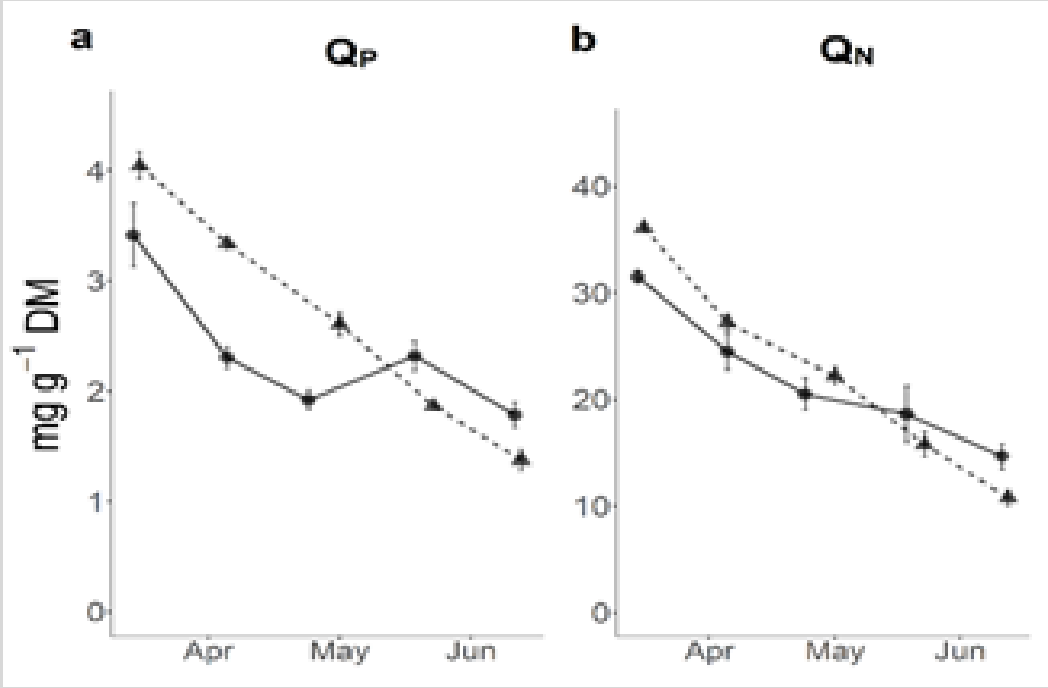
Effects on life in the water column

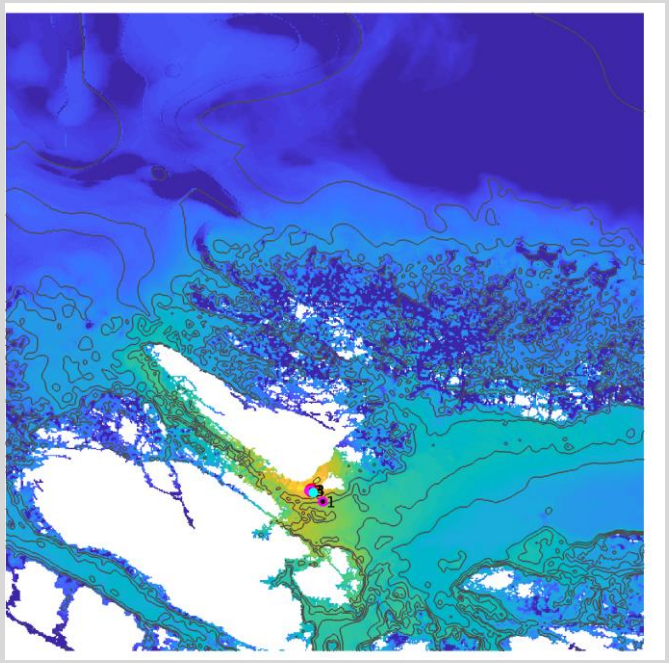
Competition on nutrients between microalgae and kelp?

- Kelp take up nutrients in early spring and growth largely on that throughout the season
- Phytoplankton has a much faster and more efficient nutrient uptake and kelp (>10 times)
- **No significant negative influence found of kelp cultivation on natural phytoplankton and the pelagic foodweb**



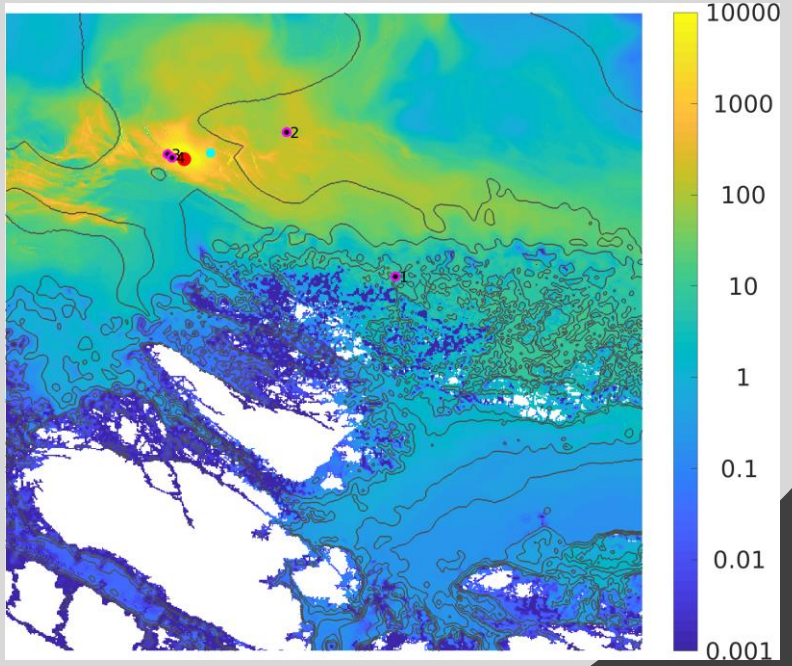
Content of phosphor (a) and nitrogen (b) in cultivated kelp (Saccharina latissima), through season 2018.

Hancke et al 2021; Njåstad, Olsen et al. in prep.



Sheltered
30m deep

mg C m^{-2}



Offshore
255m deep

Cultivated kelp settling on the seafloor –results from modelling

- Farm export 8-15% of harvested biomass under normal production scenarios. And >50% after the summer (*Fieler et al. 2021*)
- Exported kelp only deposition in thin amounts under the farm but **spread from 1 to 10 to 100's of kilometers**
- **Kelp typically spread over large areas in thin layers depending on physical surroundings and geography of the region. *Sometimes in thick layers.***

Hancke et al 2021; Broch et al. in prep.

Seafloor biodiversity

Kelp can provide a food source to seafloor fauna or pose a thread to life at the seafloor

- At normal farming conditions effects on seafloor fauna is minimal
- By ‘massive’ accumulations of kelp on the seafloor (>8 kg m^{-2}) biodiversity decreased and a few species increased in numbers
- **The documented effect was short: >90 % was gone in three months and conditions normalized**

Borgersen et al. in prep.

Hancke et al. in prep.

Kelp farms as artificial reef

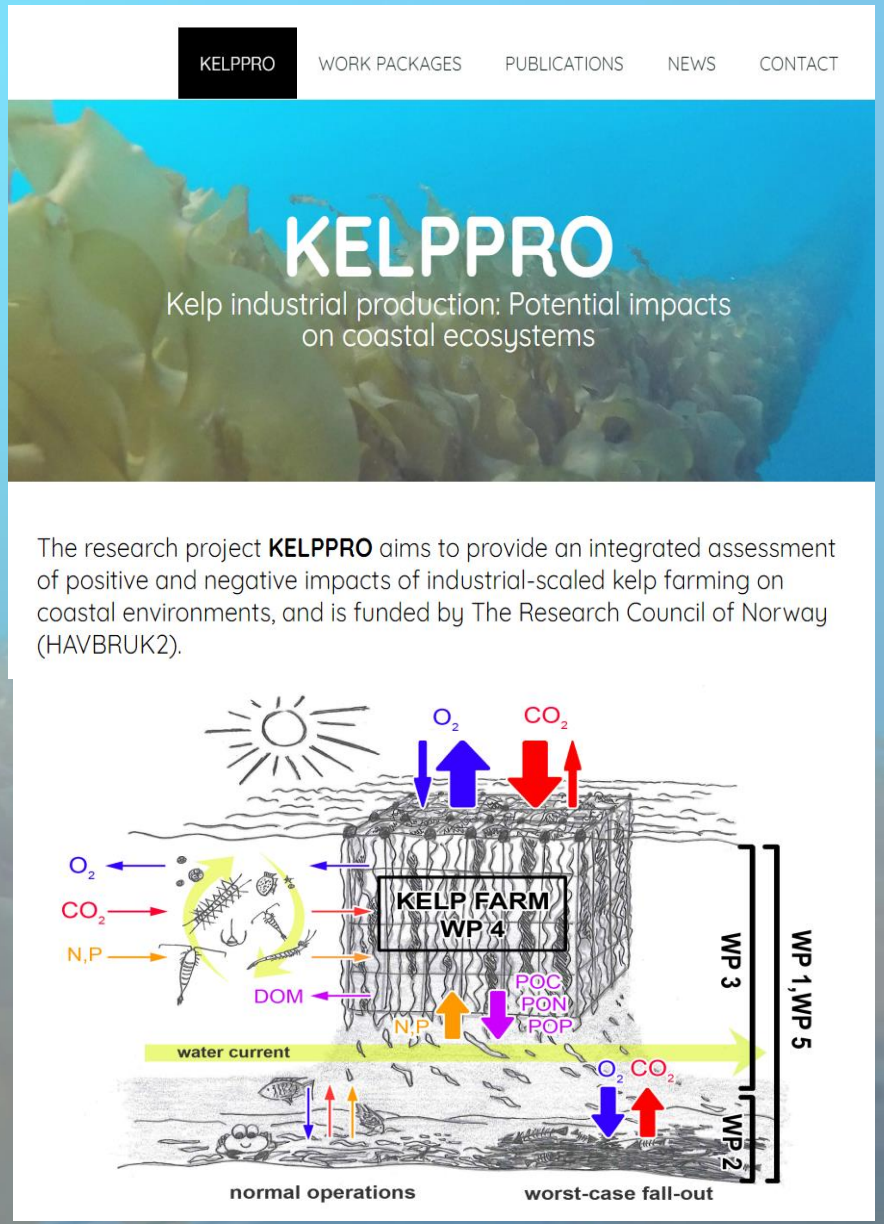
- Kelp farms provide an ‘artificial’ ecosystem
- Length of the grow season impact the fauna community
- **Kelp farms can be a vector for alien species and spreading of genetic material**
- **Scientific documentation is sparse**

«Large quantities of *Caprella mutica* was found late in the fall

Hancke et al 2021;
Bekkby et al. in prep.

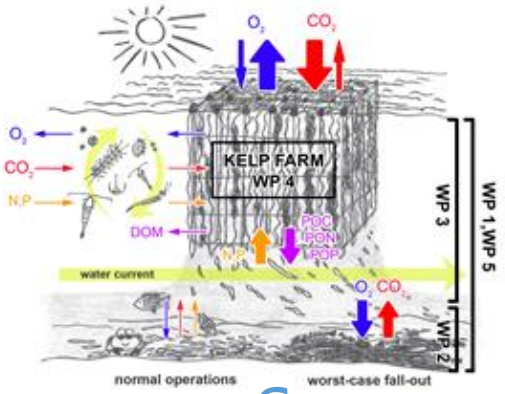
Short summery

- **No larger negative impact of kelp cultivation** on phytoplankton or functioning on life in the open water column
- Kelp biomass from farms **spread over large areas** and settle on the seafloor
- **No significant impacts** of present-day kelp cultivation were documented **on seafloor fauna** (business as usual)
- **Large scale cultivation** and deposition of kelp on the seafloor **might negatively impact seafloor biodiversity**
- **Kelp farms may act as a vector for alien species and genetic transportation**, but data foundation is spare still



K Hancke/NIVA

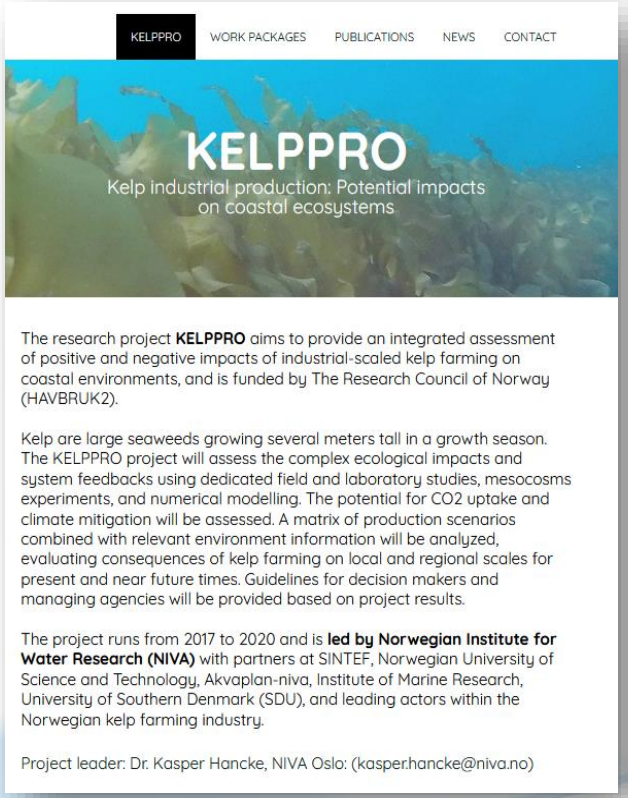
Main outputs



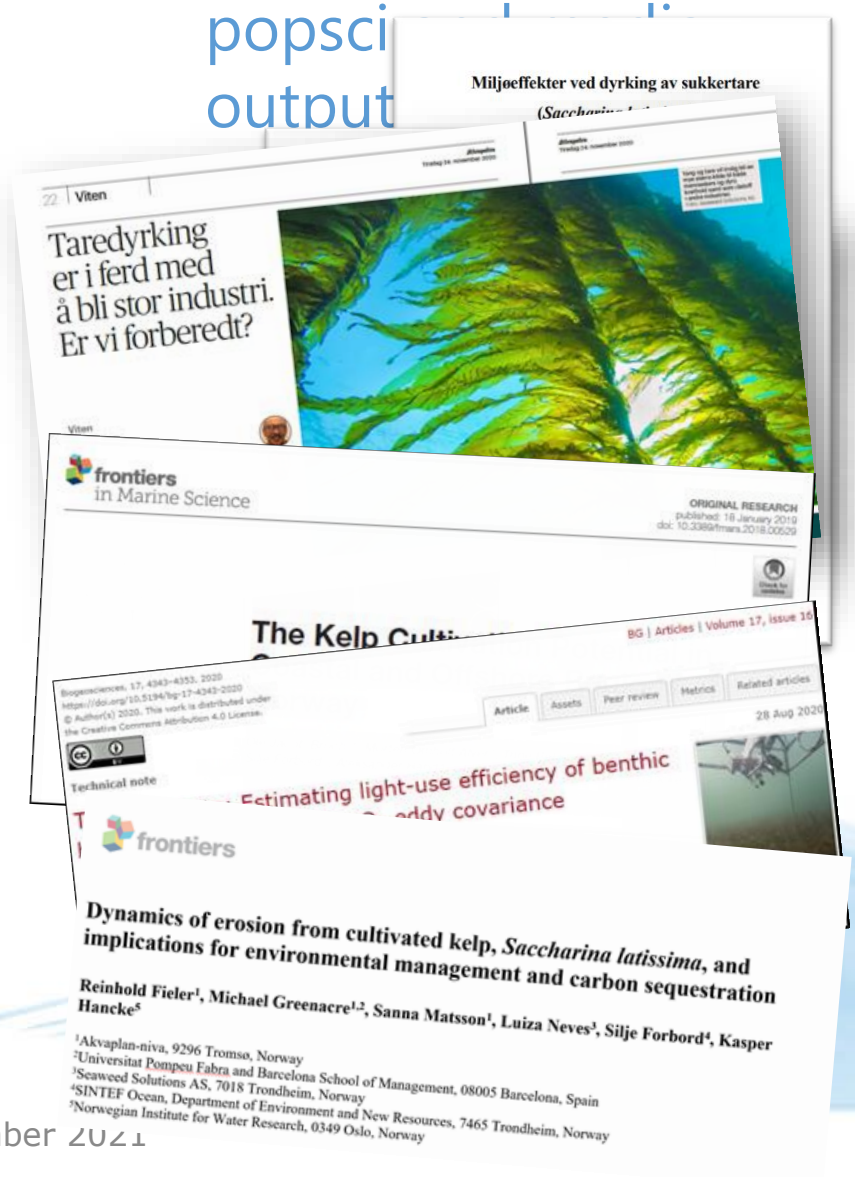
Summery report

(In Norwegian, abstract in English)

Website

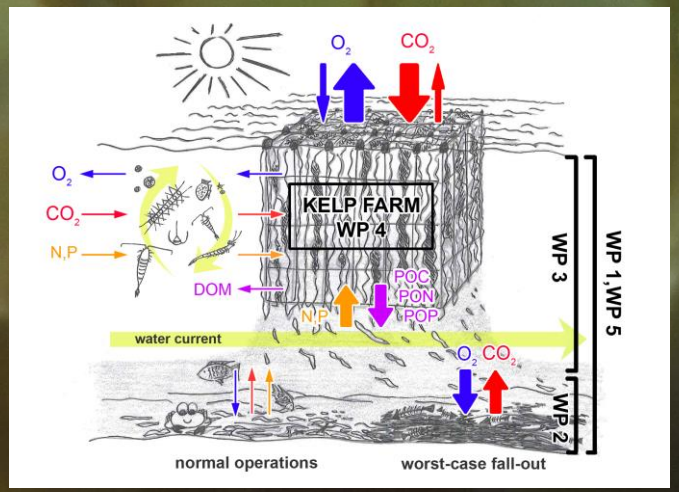


Papers, MSc thesis, popsci [illegible] output



Thank you for your attention!

More information on
www.kelppro.net



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- Students
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- Stakeholders
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