The EXPLOIT Project

"Exploitation of nutrients from salmon aquaculture“

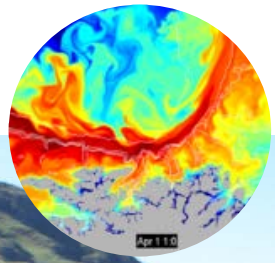
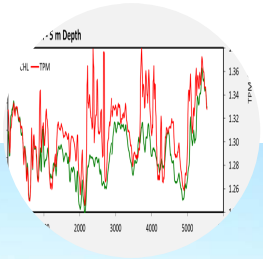
Funded by The Research Council of Norway (216201/E40)

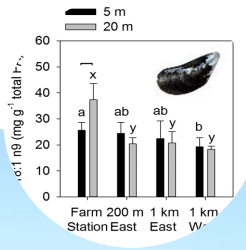
NTNU – Trondheim
Norwegian University of
Science and Technology

SINTEF

INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET



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BELLONA YSFRI UNIVERSIDADE FEDERAL DE SANTA CATARINA UNB UNIVERSITY of NEW BRUNSWICK WAGENINGEN UR For quality of life Fisheries and Oceans Canada UNIVERSIDAD DE LOS LAGOS

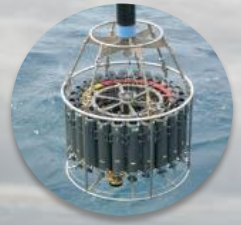
Western Norway, Coastal Area

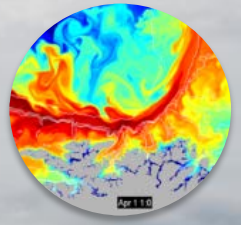
Flåtegrunnen outside Florø

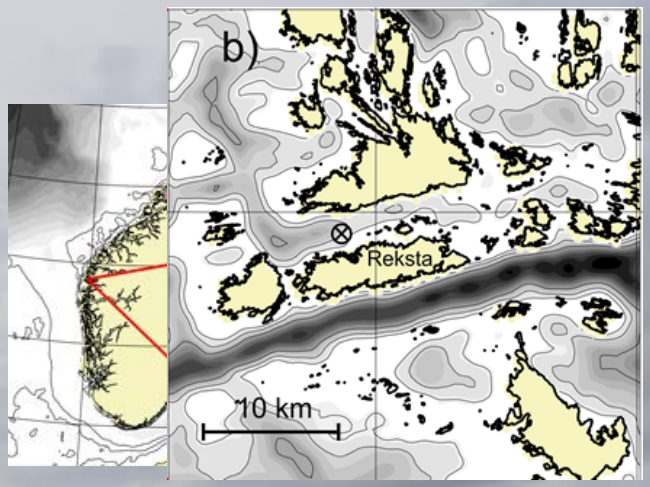
6000 tons salmon production (18-20 months)

75-200 m depth

ENVIRONMENT – CULTIVATION - MODELLING







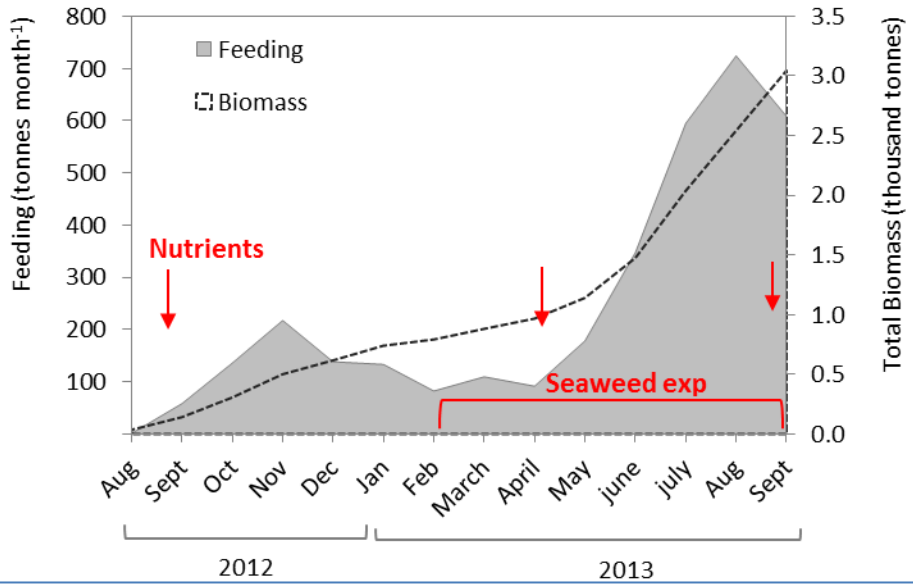
←
1200 m
(ref west)

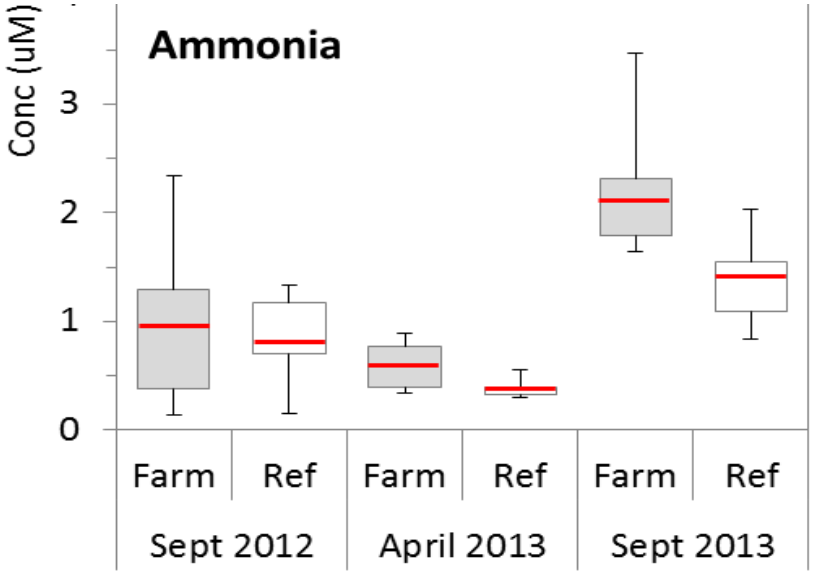
100 m **200 m**
(Farm)

1200 m (ref east)

marineharvest

Fish biomass, feed use and measured ammonia

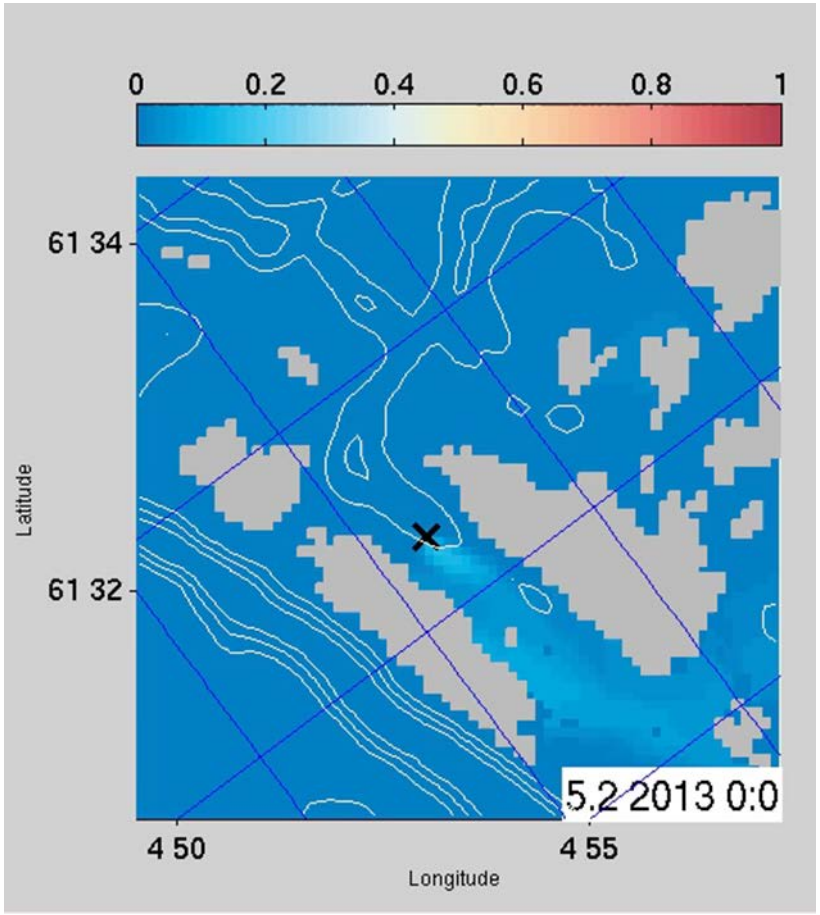




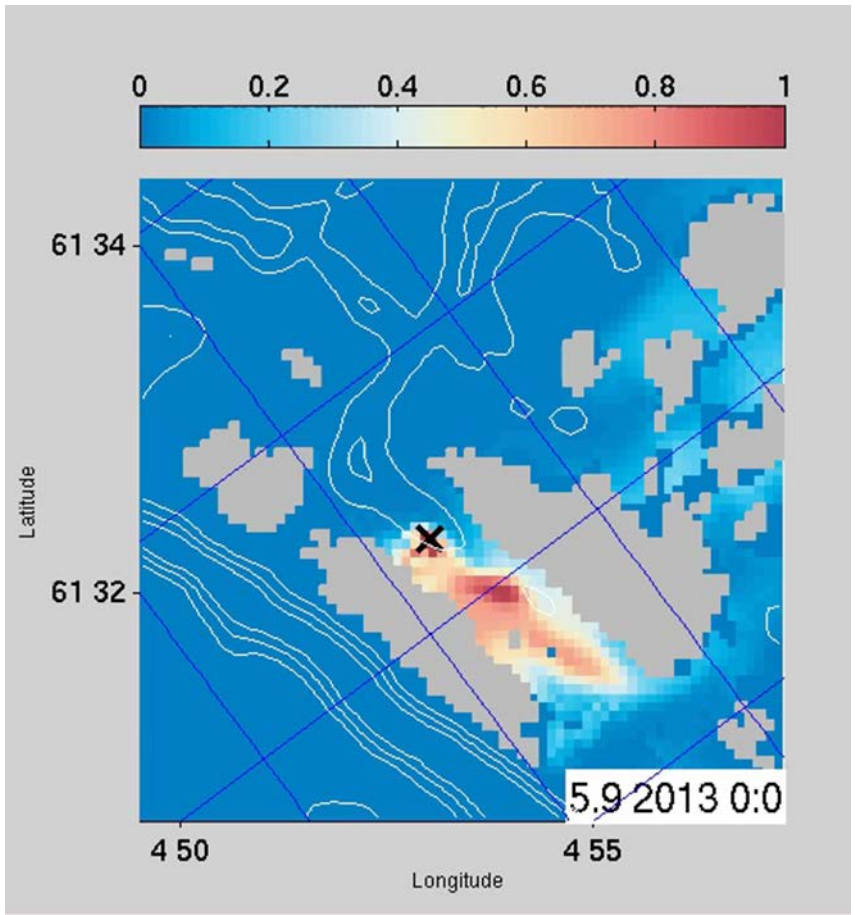
"background"

Modelled ammonium-N dispersal

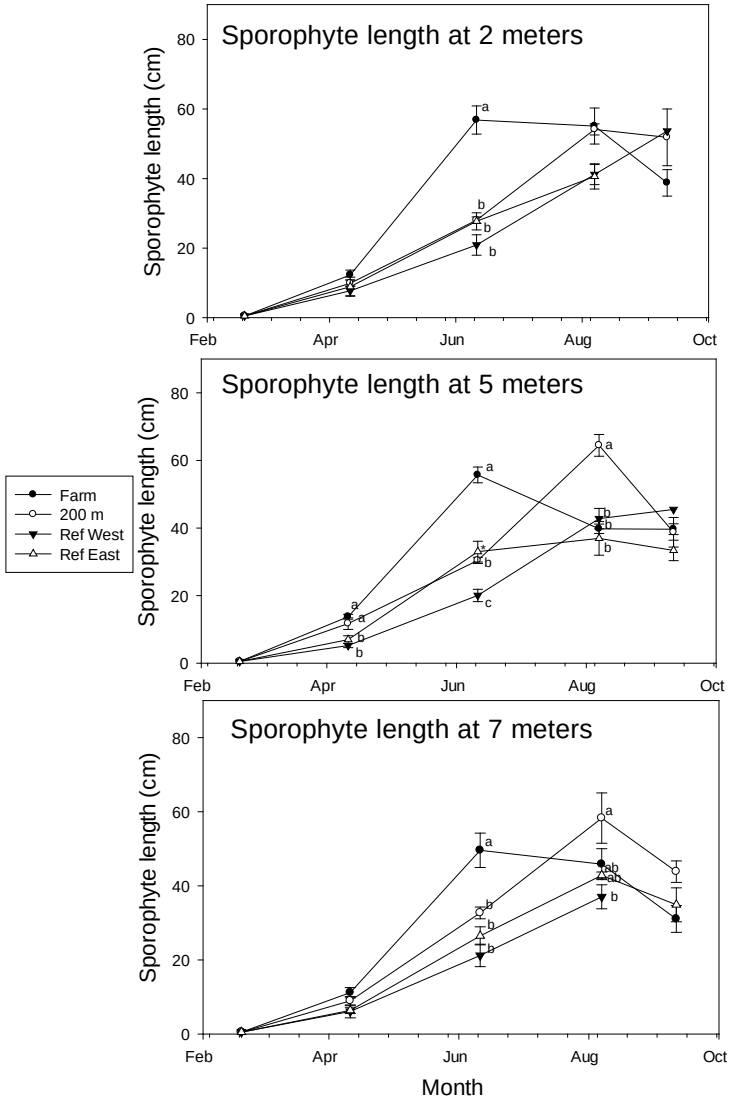
February



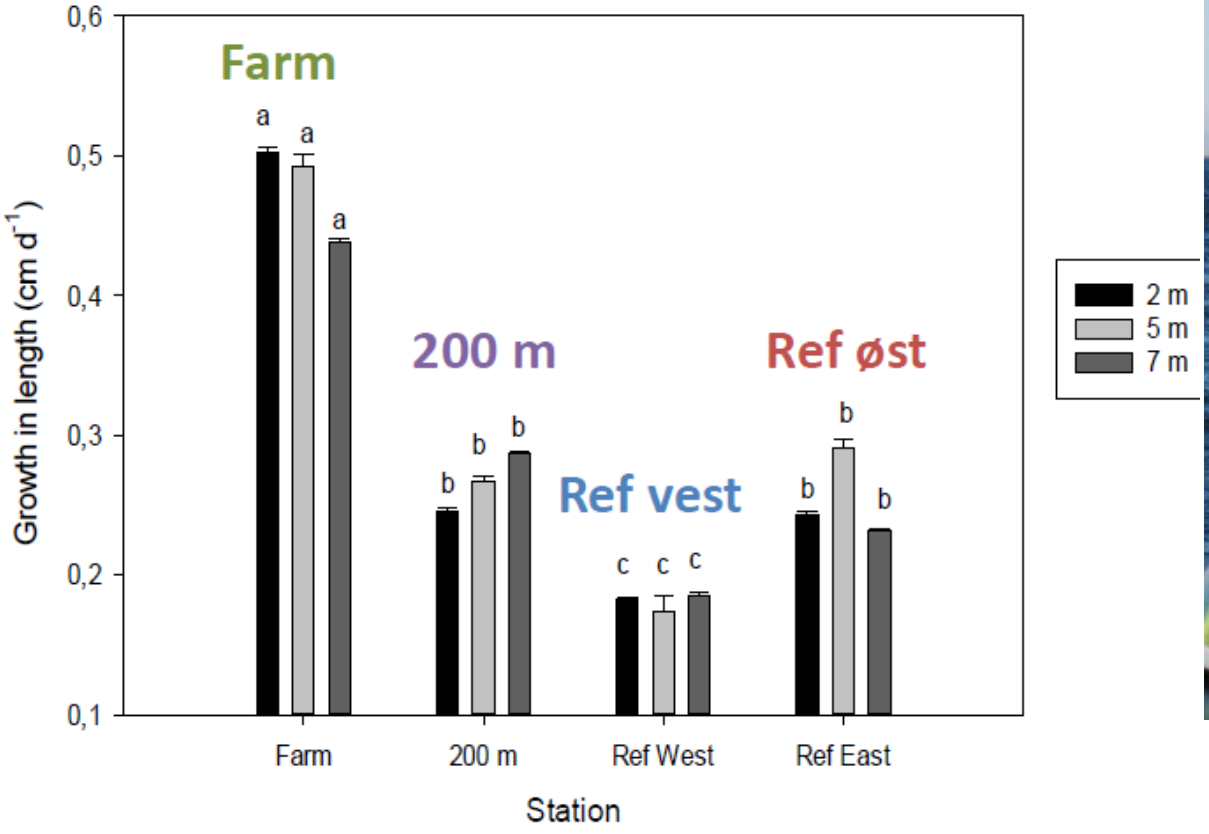
September



Growth of sugar kelp (Feb-Oct)

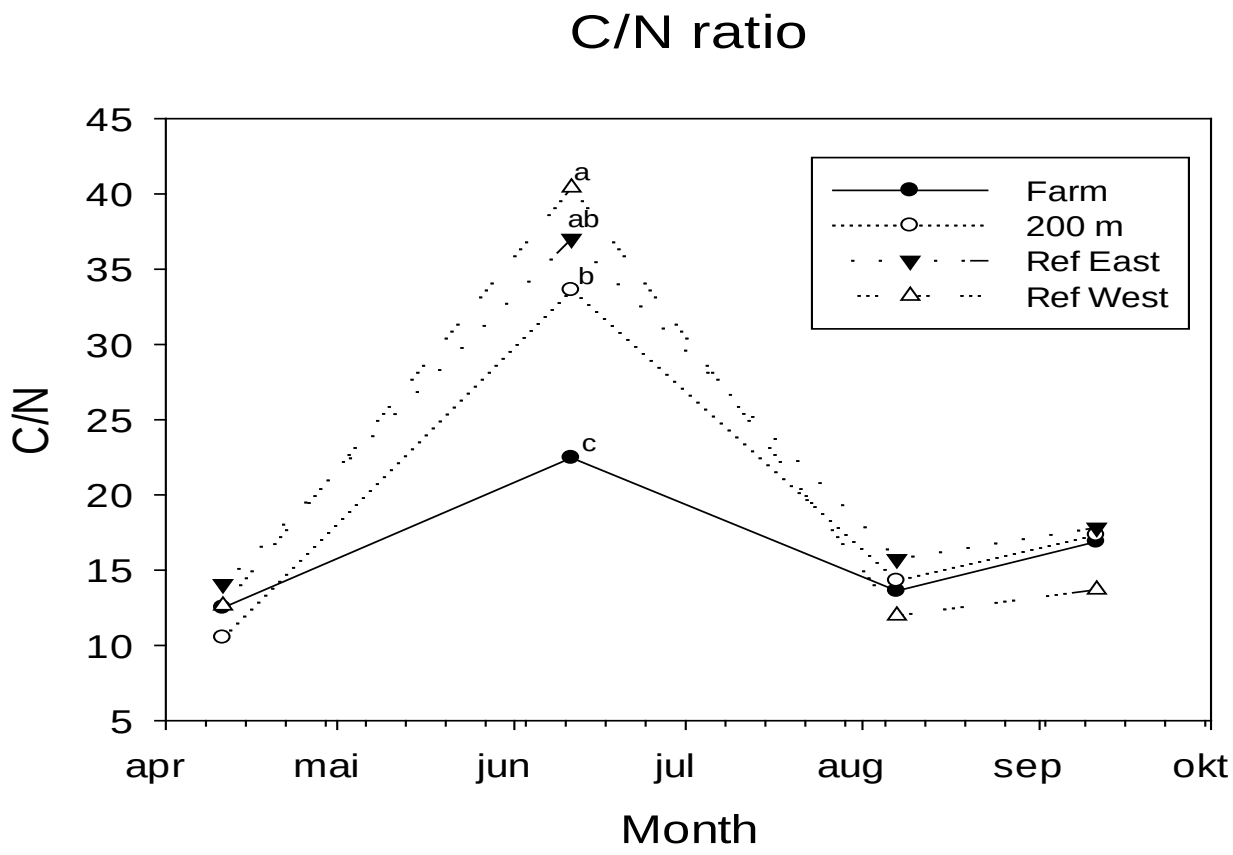


Average growth of sugar kelp (Feb-Jun)



Fossberg J. et al. Growth and composition of the kelp *Saccharina latissima* cultivated in salmon-driven IMTA (in prep)

Seasonal C/N ratio



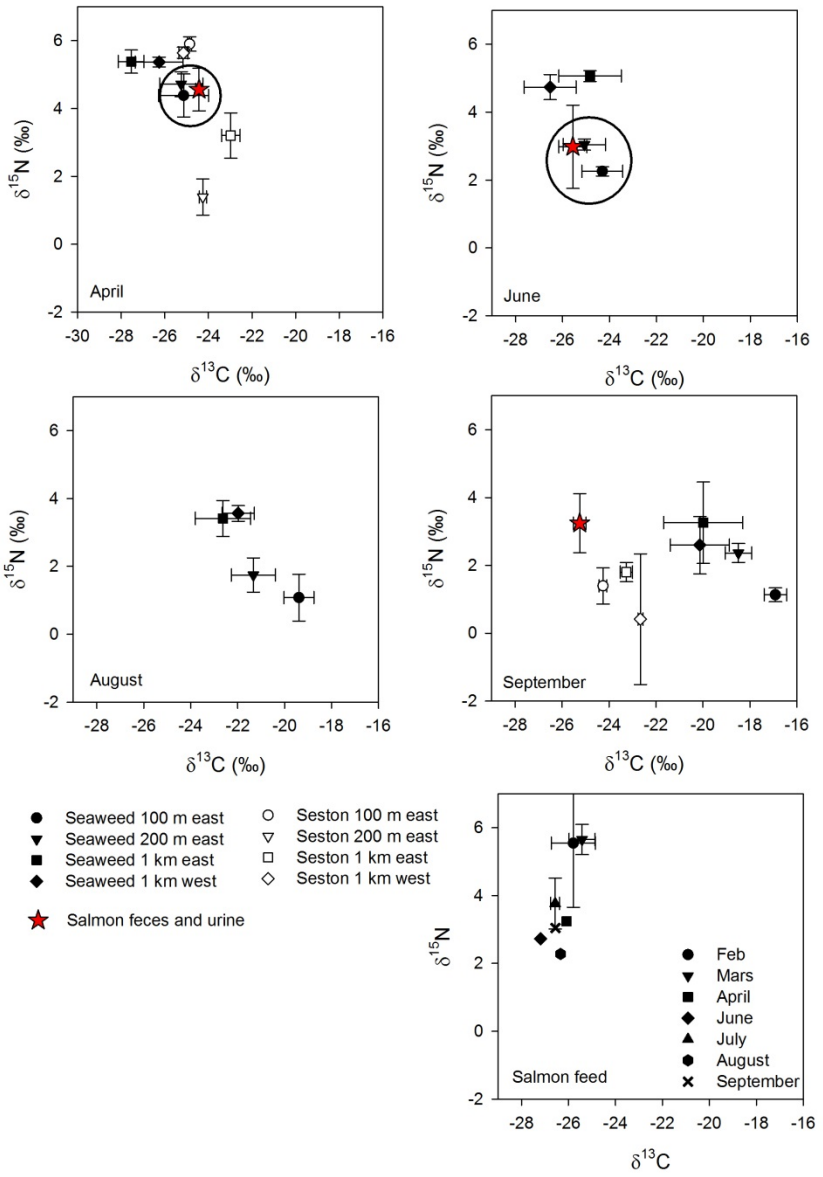
- Seasonal C/N ratio in kelp at five meters depth showing pronounced seasonal differences (mean, n=5).

Fossberg J. et al. Growth and composition of the kelp *Saccharina latissima* cultivated in salmon-driven IMTA (in prep)

Førde H. et al. Development of bryozoan fouling on cultivated kelp (*Saccharina latissima*) in Norway (in prep)

Stable isotopes analysis

- Different ^{15}N signatures in kelp at different stations -> from different N sources
- The ^{15}N signature in kelp close to the salmon farm is similar to the ^{15}N signature in salmon feces (April og June).
- Higher growth rates during spring can be due to extra N from the salmon farm in April – June.



Conclusions

- **Fast growth of seaweed in IMTA, but:**
  - There is a seasonal mismatch between seaweed growth and peak N-discharge from the fish farms
  - There are scaling issues considering industrial production in IMTA:
    - Stable isotope analysis suggests N-assimilation up to 200 m away in coastal environments
    - How much seaweed growth can this support? If, at a 10 cage salmon farm this can supply e.g. 30 ha with seaweed, this would yield up to 5.000 tons seaweed production pr year – (This must be further investigated and elaborated)
- **Does the N-source matter? No, not really**
  - Large seaweed monocultures may indirectly balance the N-input from salmon farming at both regional and annual scale

Improved sustainability of salmon farming through economies of scale in **exposed** areas challenges the IMTA concept

Source: Aqualine

1985	→	**2010**
In-fjord	→	off-coast
40 m	→	157 m (C)
4 m	→	30 m (d)
550 m^3	→	60.000 m^3(V)
180 t	→	1.200 t (BM)
6	→	2 persons

Improved sustainability of salmon farming through new **closed** systems with possible combined mechanical and biological waste treatment encourages the IMTA concept

Dissolved nutrients

Seaweed biofilter

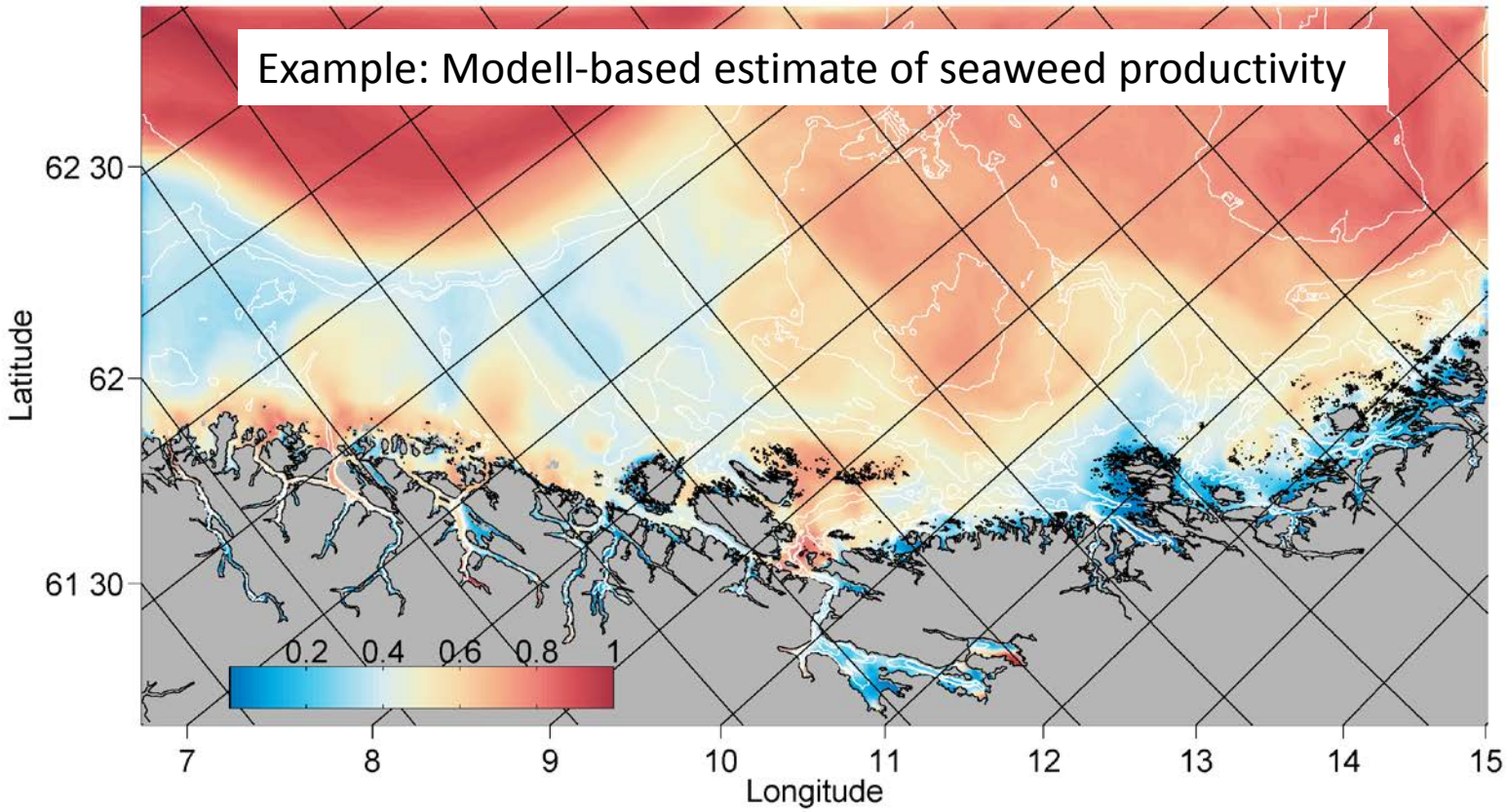
- ✓ Food
- ✓ Feed
- ✓ Biochemicals
- ✓ Bioenergy

Particulate nutrients

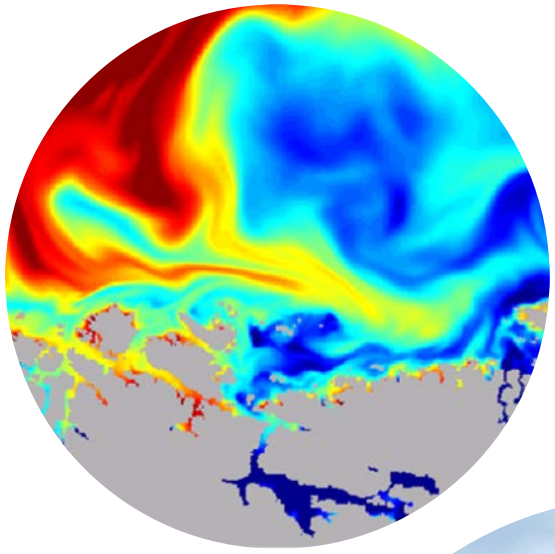
- **Bottom grazers** in closed systems (also valid for open systems?)
- **Collection of sludge:**
  - ✓ Feed for polychaetes as new feed resource?

Next step: Low-Trophic Aquaculture Index for Norwegian Coastal Waters

- How much does the N-input from salmon farming contribute to the total supply?
- How does the contribution vary with season?



Broch OJ. et al. Coastal scale dynamics and effects of dissolved nutrients from Norwegian aquaculture. (in prep)



Thanks for your attention!