Effekt av strøm på økosystemene på dype bløtbunner ved oppdrettsanlegg

Bannister R.J.,Valdemarsen.T.B.,
Hansen P.K., Holmer M., Ervik, A.

INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

Ecosystem Responses to Aquaculture Induced Stress (ECORAIS). Prosjekt nr 190474, 01.01.2009 - 31.12.2011

Fellesprosjekt for å undersøke hvordan utslipp fra matfiskanlegg for laks spres og påvirker omliggende miljø

- partikkeltransport
- omsetning og bunnpåvirkning
- vekst av alger og filtrerende organismer

Havforskningsinstituttet

NIVA

Uni Research (UiB)

Background

- Norwegian salmon industry has rapidly grown since 1999
- Concerns on environmental sustainability
- Impact of intensive fish farming in shallow soft sediment benthic ecosystems
  - Biogeochemical processes (Holmer 2007)
  - Microbial processes (Valdemarsen et al. 2009)
  - Structure and biomass of faunal communities (Hargrave et al. 2008)
- Norwegian fish farms relocating to deeper, more dynamic locations

Project aims

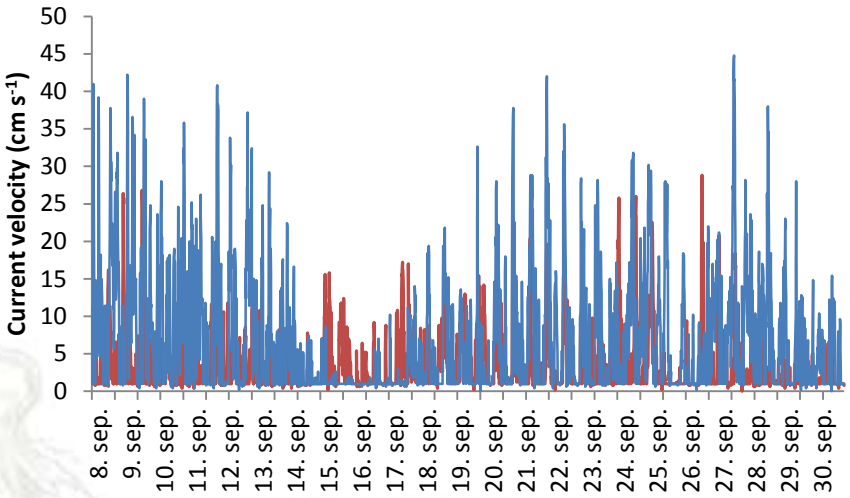
- Understand benthic ecosystem responses to aquaculture induced stress at 2 fish farming locations (similar production) with contrasting current regimes over a production cycle
  - High and low flow systems
  - Farming and reference sites (~700 m apart)
- Holistic approach
  - Mineralisation processes
  - Biogeochemical responses
  - Fauna community responses

Methodology

- Sedimentation and current measurements
- Benthic fluxes using sediment cores
  - Standard flux measurements (n=6)
    - **O_2**, TCO_2, NH_4^+
- Pore water chemistry (biogeochemical responses)
  - Slice sediment cores (n=3)
    - 0-1, 1-2, 2-4, 4-6, 6-8 and 8-10 cm depth
    - Extract chemical compounds
      - **SO_4^{2-}**, **TH_2S,** TCO_2, NH_4^+
- Infauna composition
  - Extracted from sediment cores (n=3)

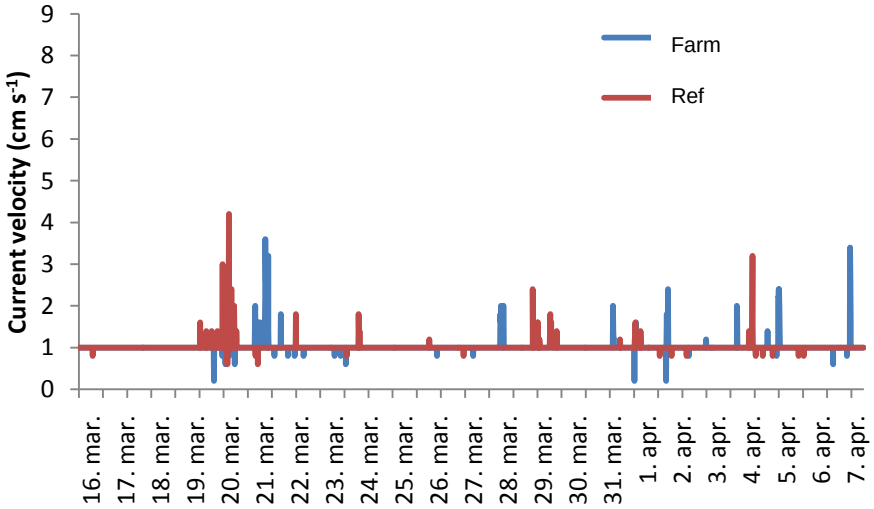
Current velocity

Outer fjord



Greater dispersal:
Lower localised benthic impact

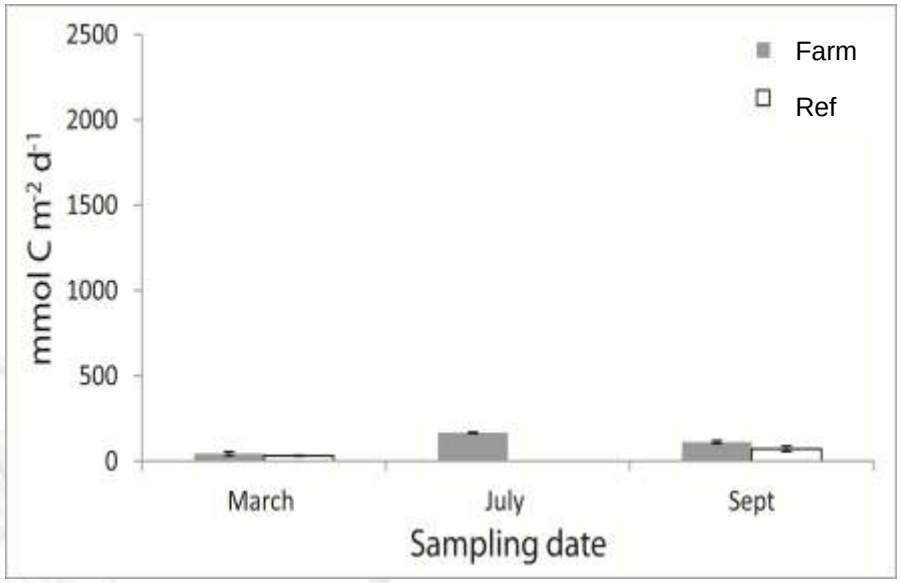
Inner fjord



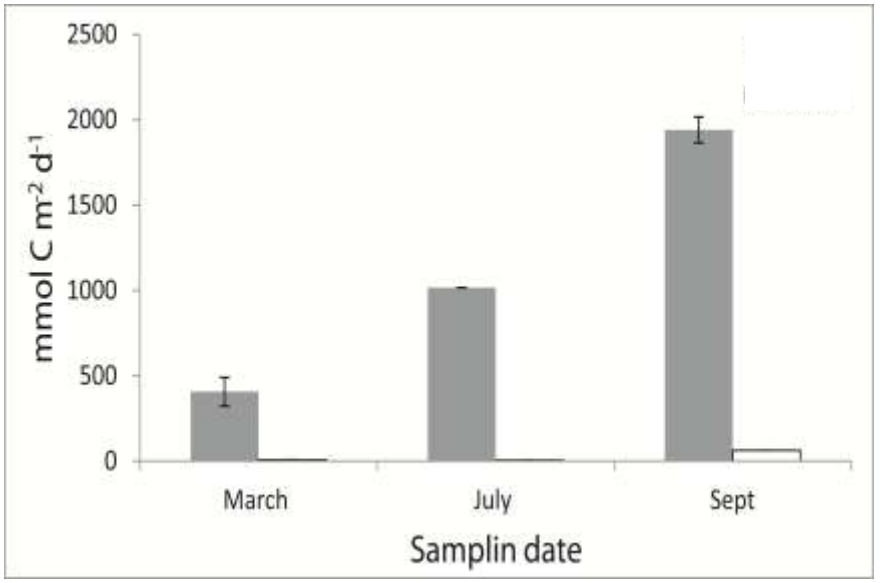
Lower dispersal:
Greater localised benthic impact

Sedimentation (POC)

Outer fjord



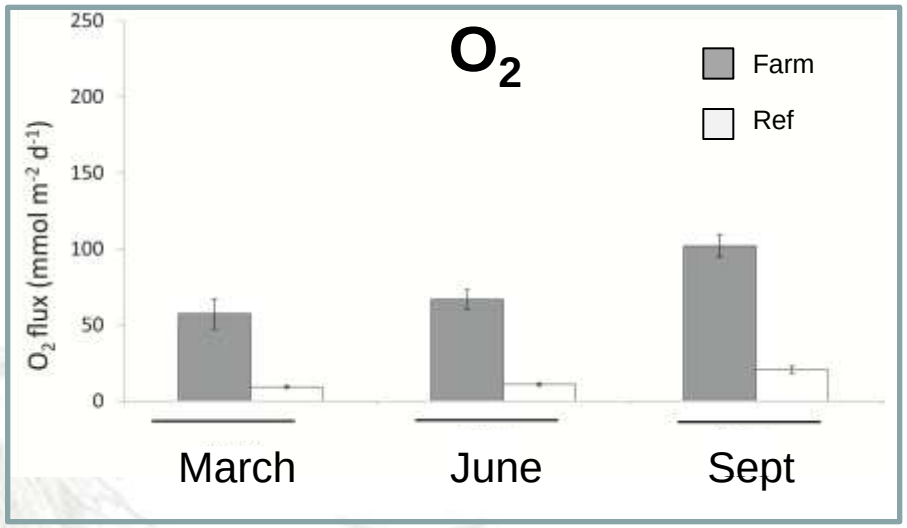
Inner fjord



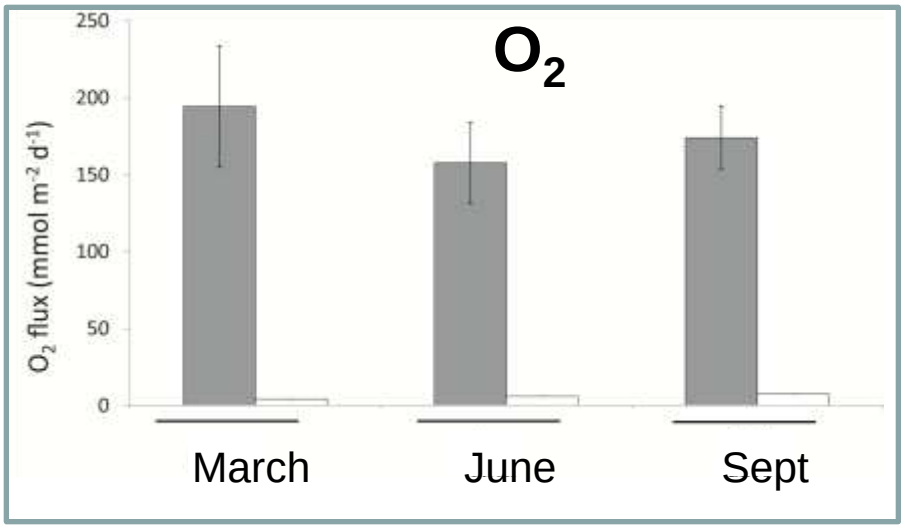
- 6 – 17 times higher deposition of organic carbon at inner-fjord location

Benthic fluxes

Outer fjord



Inner fjord

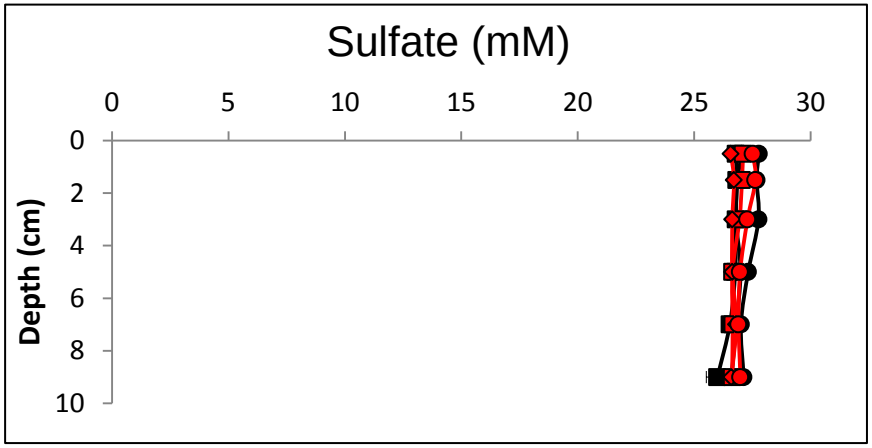


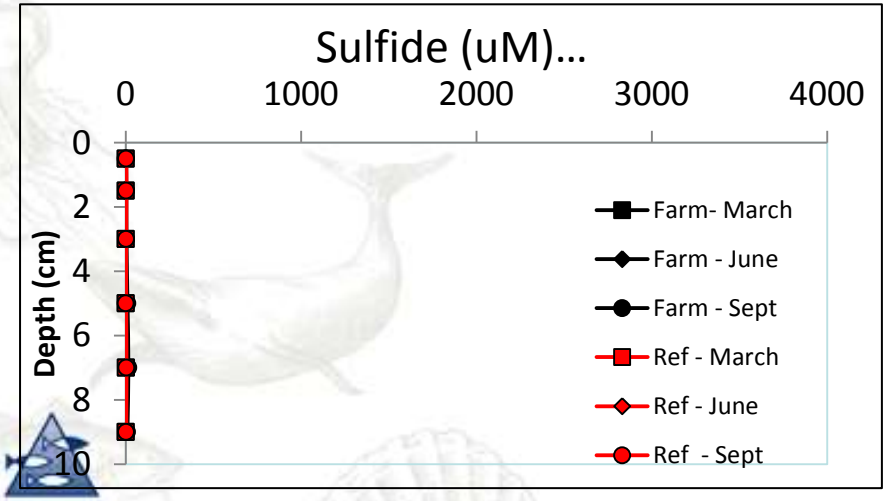
- Up to 6 X higher O_2 consumption at farm location

- Up to 46 X higher O_2 consumption at farm location

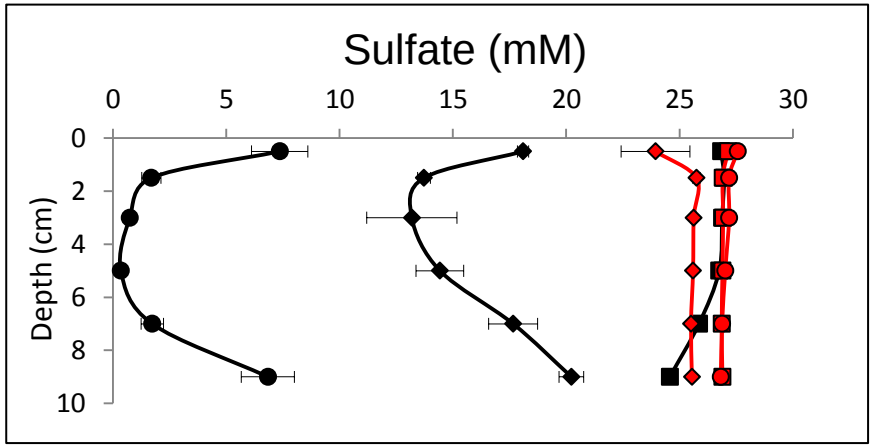
Porewater chemistry

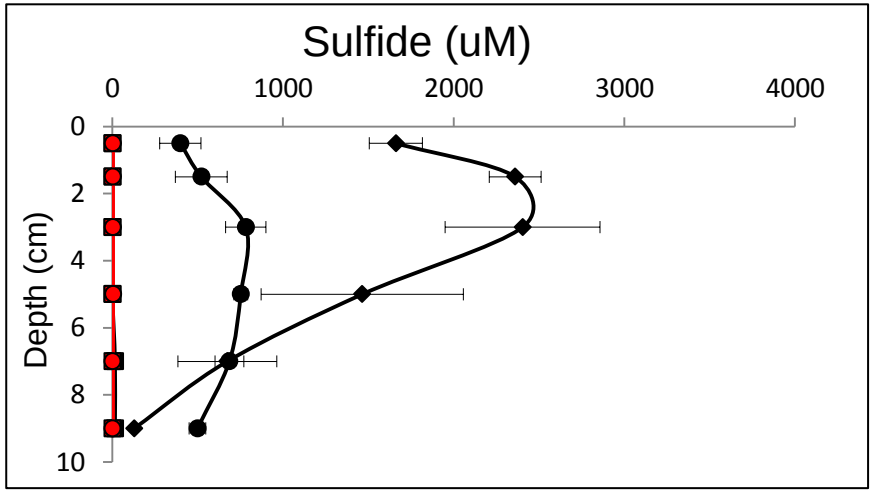
Outer fjord





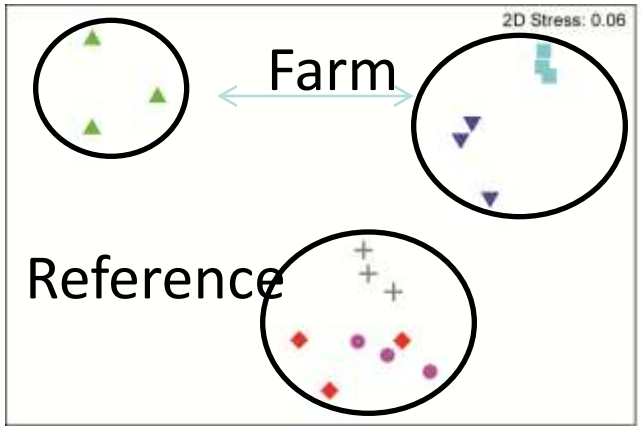
Inner fjord





Infauna composition

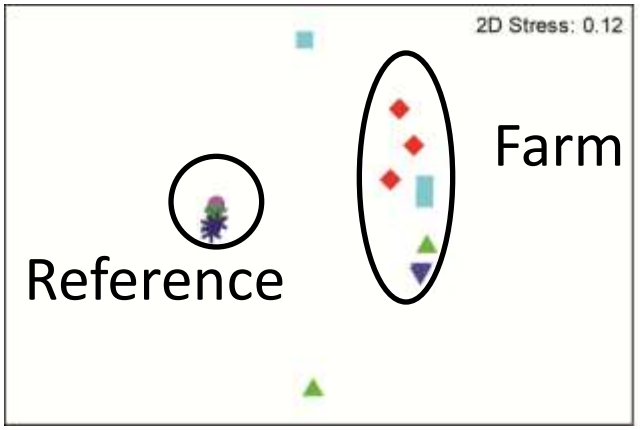
Outer fjord



Farm	March '10	June '10	Sept '10
Diversity H'	2.39	2.40	1.48

Reference			
Diversity H'	2.71	2.66	3.14

Inner fjord



Farm	March '10	June '10	Sept '10
Diversity H'	0.15	0.24	0.00

Reference			
Diversity H'	2.11	2.45	2.08

Ref

Summary of results

- Benthic responses differ between contrasting fish farming locations
  - Environmentally driven (current velocity)
- Increased benthic fluxes at outer fjord farm
  - Lower diversity and shift in infauna composition
  - No impact on porewater chemistry
- Organic overloading at inner fjord farm
  - Extinction of fauna
  - Breakdown in biogeochemistry
    - Changes / reduction in biological/microbial processes

Utilisation of results for advice

- First detailed measurements in a Norwegian aquaculture setting over a production cycle and at deep localities
  - Biological and biogeochemical responses
- Two tools for monitoring/advice giving for aquaculture
  - MOM-System (revise) – Benthic impacts
  - AKVAVIS (development) - ICMS
- Combining data with existing literature aim to establish thresholds for organic input on benthic responses

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  - Access to fish farms and farming data
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  - Sample analysis and lab space
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  - Sample processing
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