DiTail

Marine Disposal of Mine Tailings:

Impacts on Pelagic Ecosystem Components in Norwegian Fjords

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DiTail project

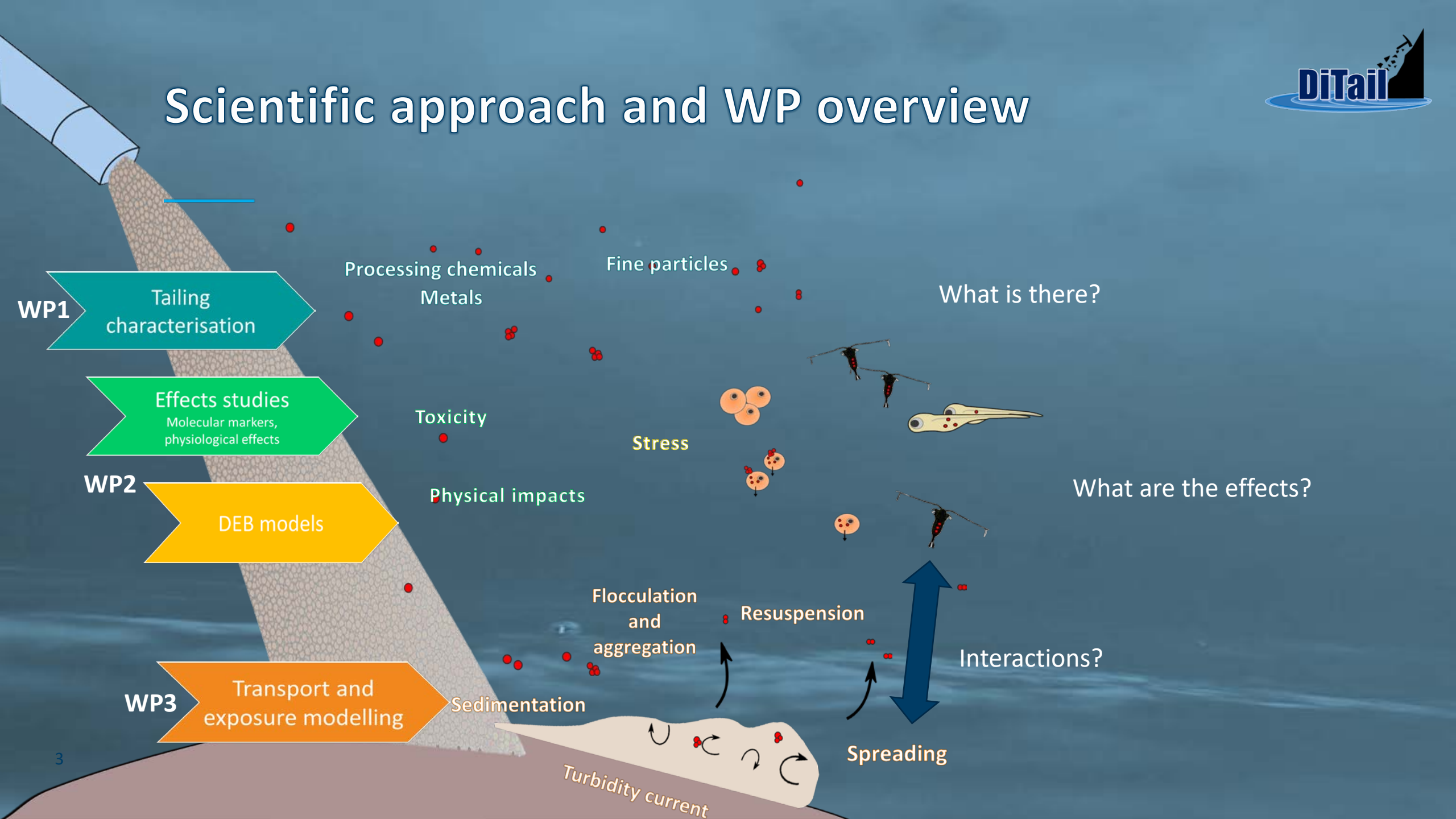
- **NFR research project**
- **3 years (Jan 2018- Dec 2020) + ½ year extension**

• Nord University, Bodø	Faculty of Bioscience and Aquaculture
• SINTEF Ocean, Trondheim	Environment and New Resources
• NTNU, Trondheim	Department of Biology
• BioTrix, Trondheim	Research provider
• DEBTox research (Netherlands)	Research provider
• University of Chile (Chile)	Department of Mining Engineering

Pål Olsvik

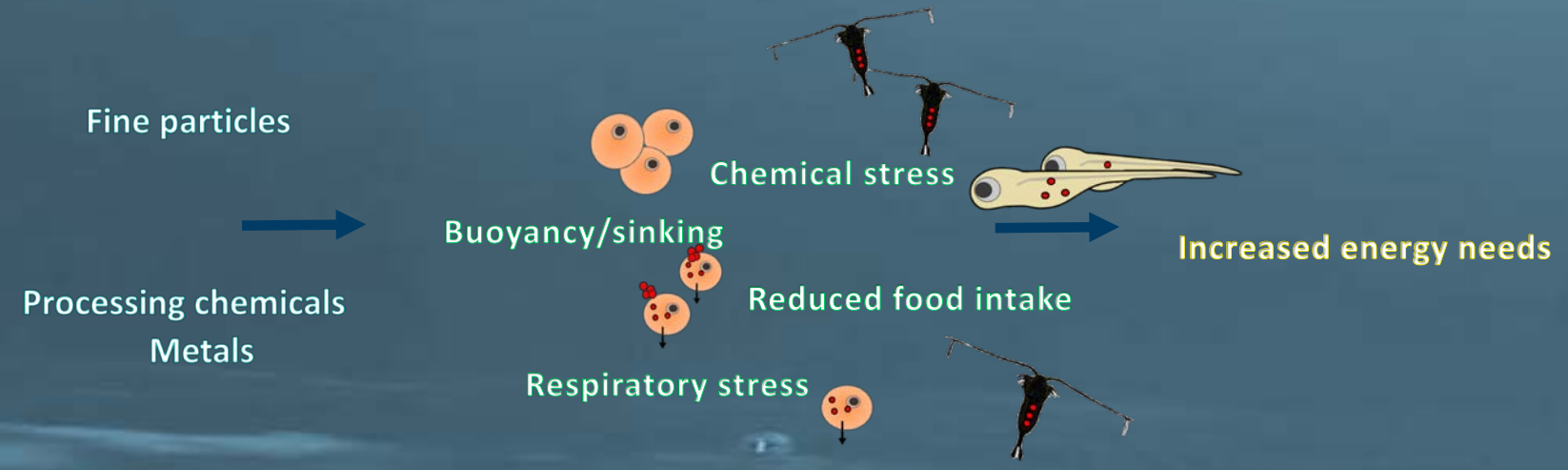
The Research Council of Norway

Scientific approach and WP overview

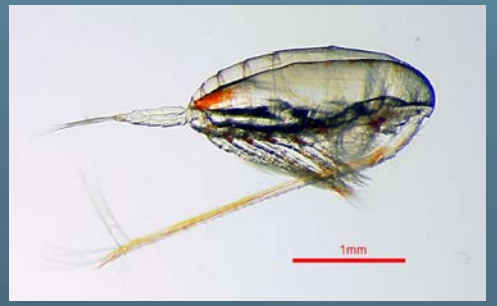


Effects

What can happen when organisms meet tailings?



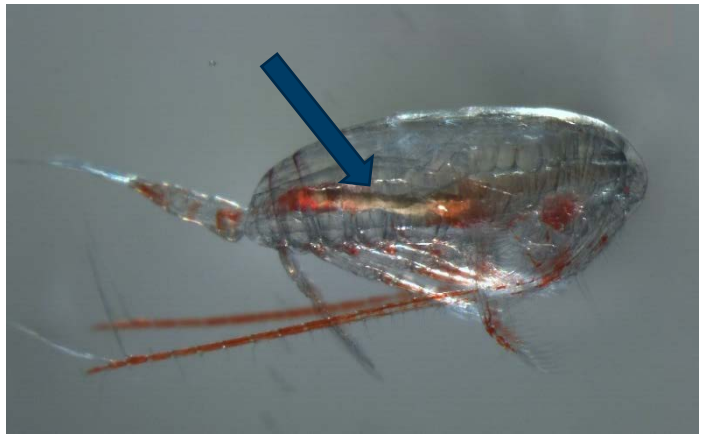
Calanus (raudåte; *Calanus finmarchicus*)



Cod (*Gadus morhua*) (+ haddock)

Exposure of *C. finmarchicus*

- No acute toxicity
- Uptake of tailings into digestive tract



Adult calanus exposed to tailings

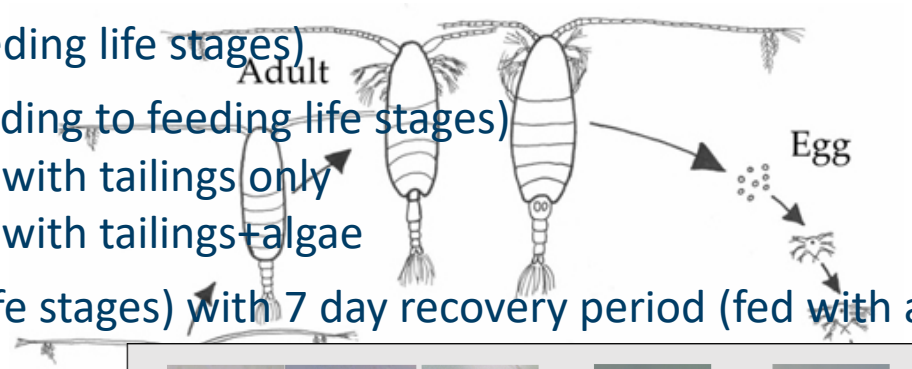
Calanus faeces: fed with algae

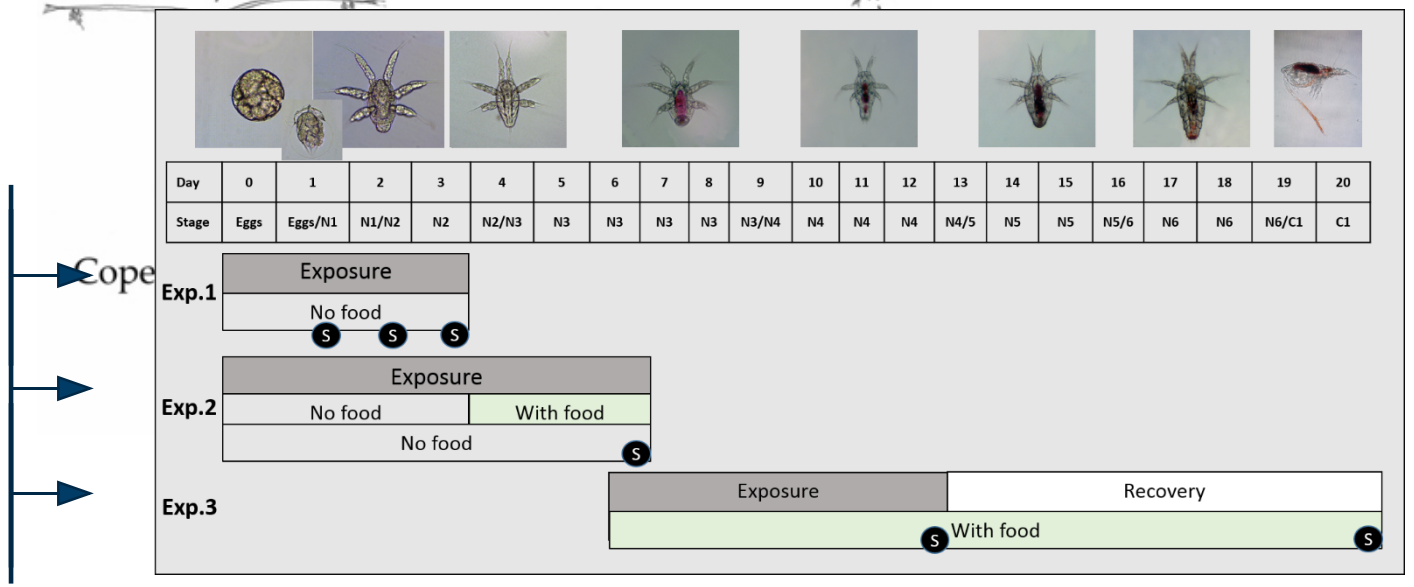
Calanus faeces: exposed to tailings/ tailings and algae

C. finmarchicus **early life stages**

3 EXPERIMENTS

1) Eggs to N2 (non-feeding life stages)
2) Eggs to N3 (non feeding to feeding life stages)
   groups with tailings only
   groups with tailings+algae
3) N3 to C1 (feeding life stages) with 7 day recovery period (fed with algae)





Results

1) Non feeding life stages

No significantly increased mortality

2) Early feeding life stages

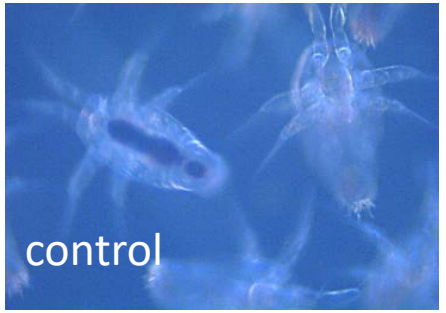
uptake of tailings

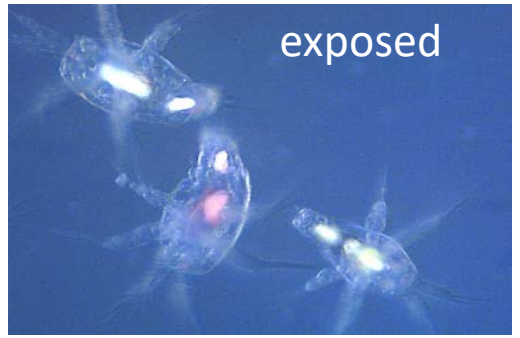
no significant developmental delay (energy reserves?)

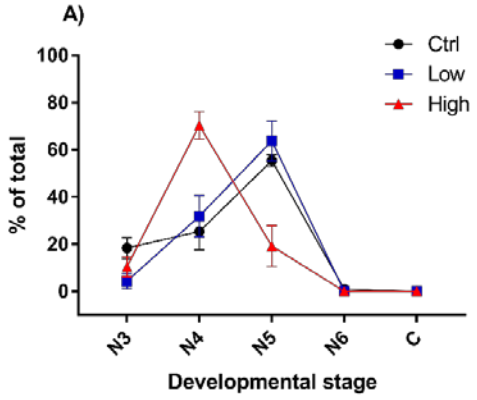
animals non-active in no food groups (immobilisation=mortality?)

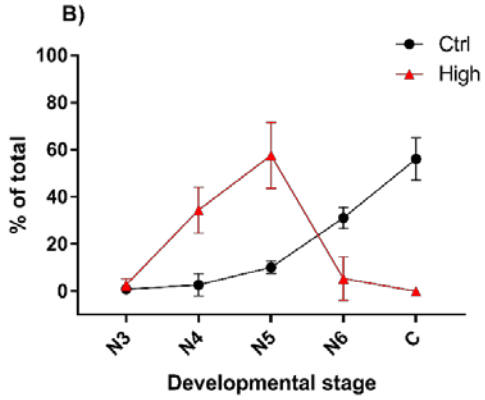
3) N3 to C1 feeding life stages

significant developmental delay even after 7 days recovery





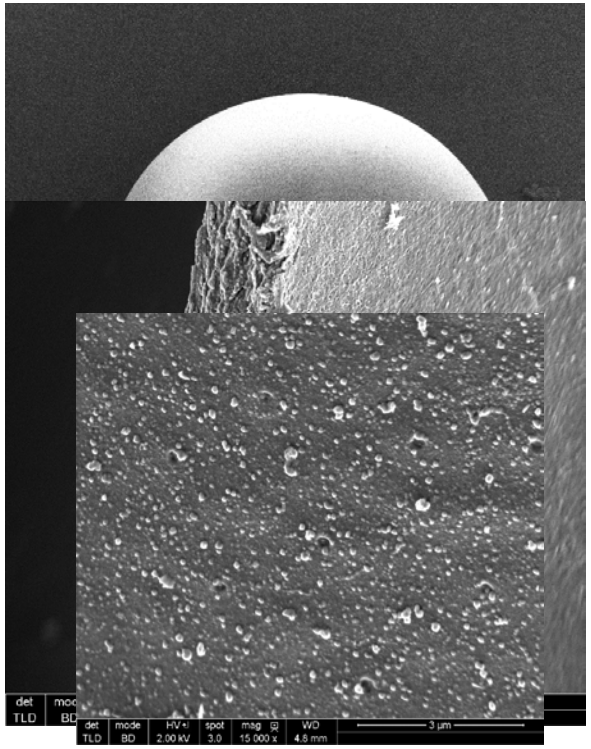




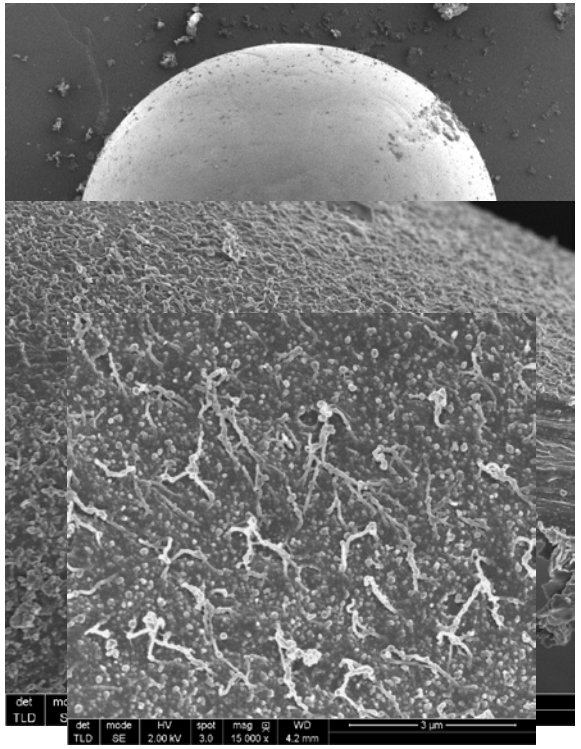
Fish early life stages

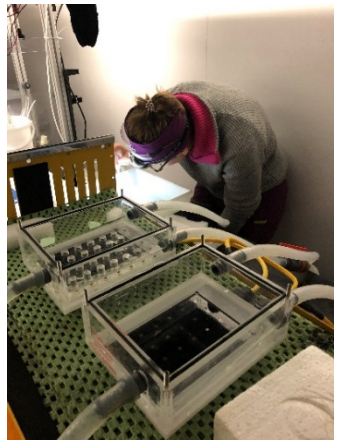
Tailing exposure

HADDOCK



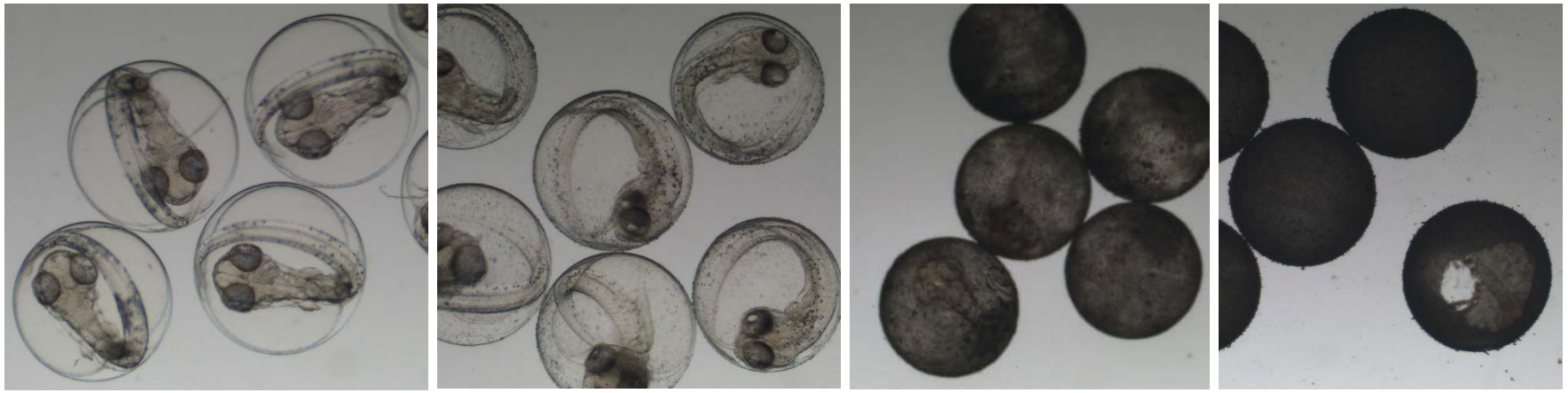
COD





Preliminary results

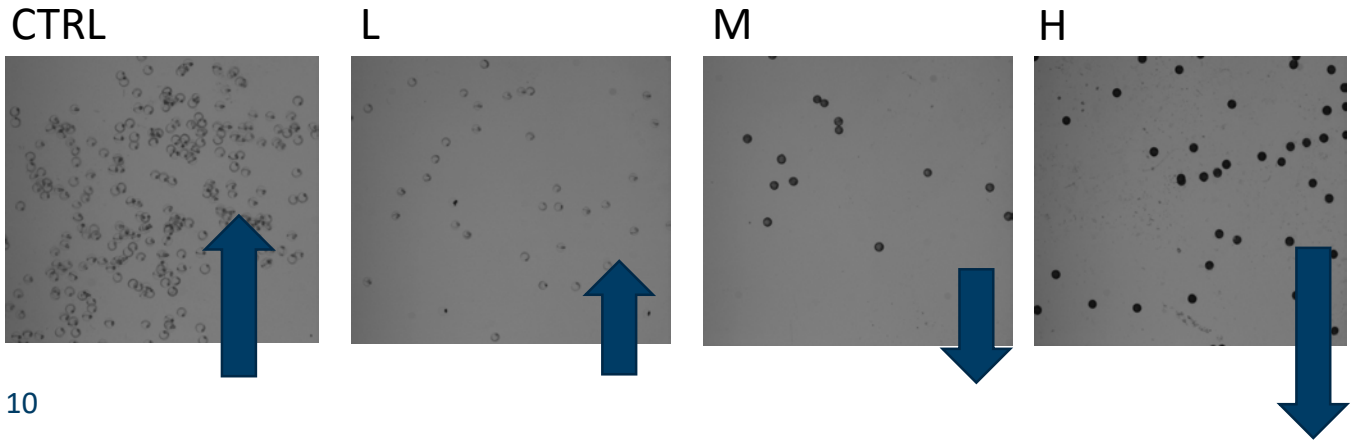
- Rapid attachment of tailings to eggs
- Tailings stay on eggs also in recovery and until hatch

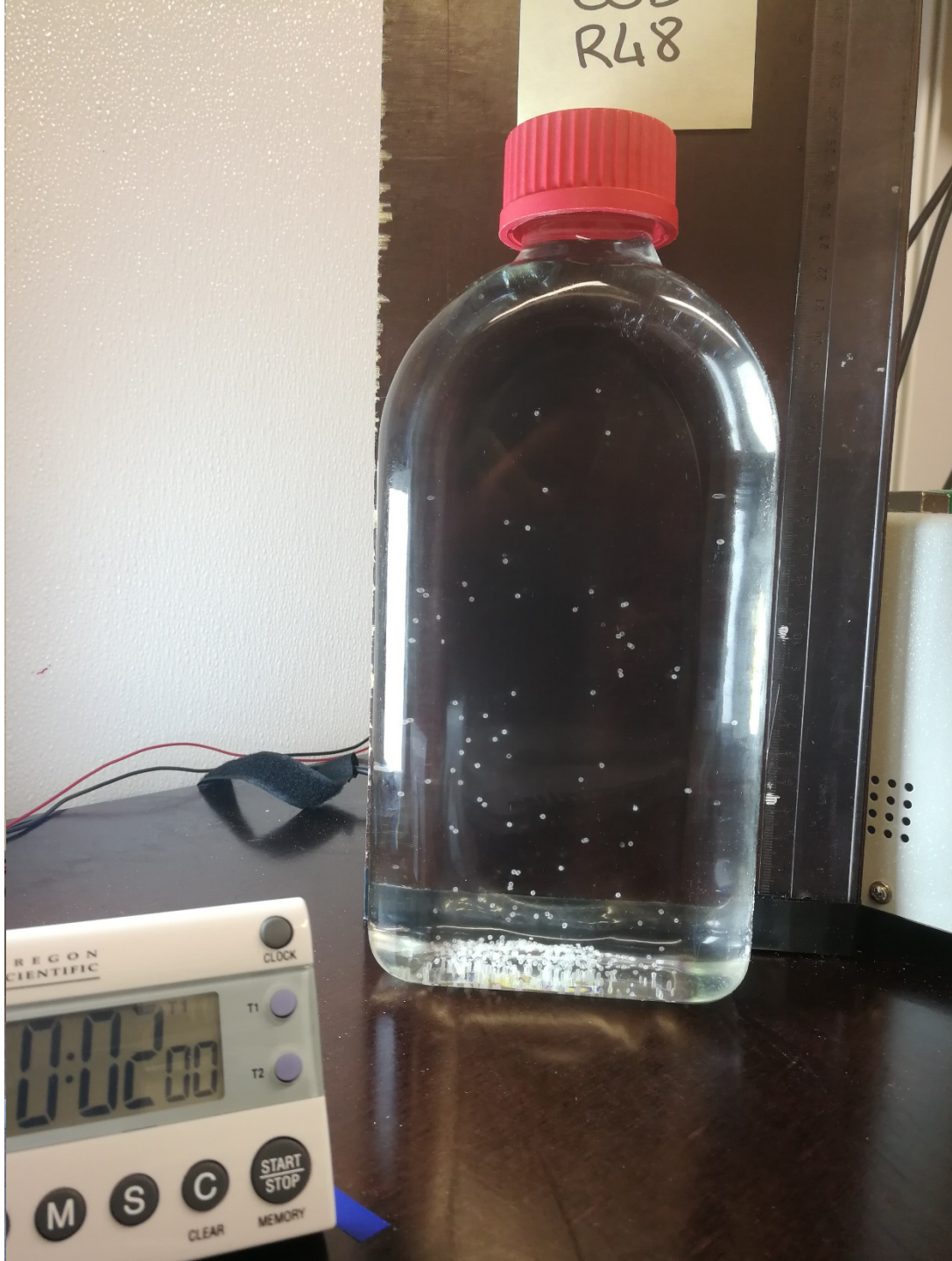


Sinking of eggs

- Reduced buoyancy and sinking
- Cod more "susceptible" than haddock

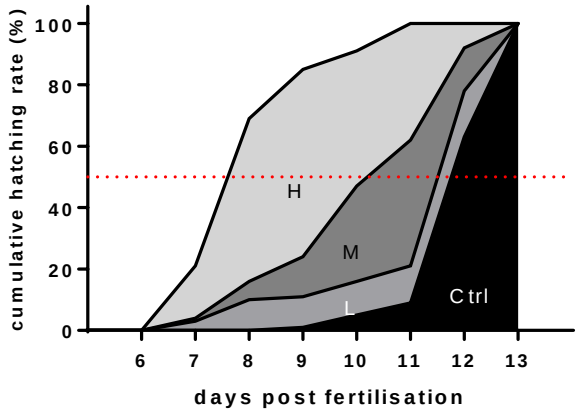
  - Cod eggs sinking in H and M exposures
  - Reduced buoyancy in L exposures

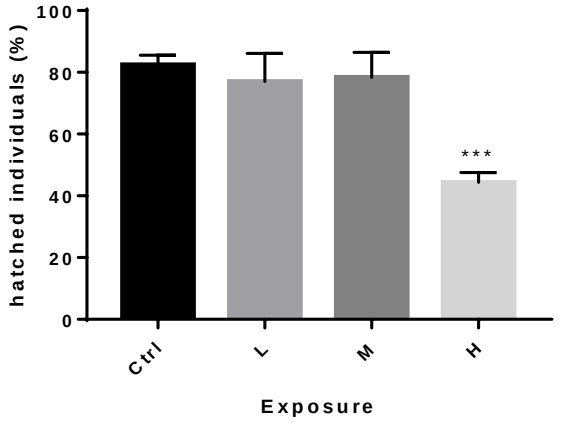




Hatching time and success

HADDOCK





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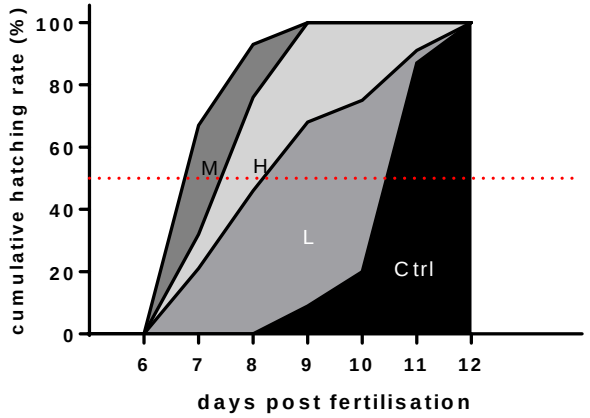
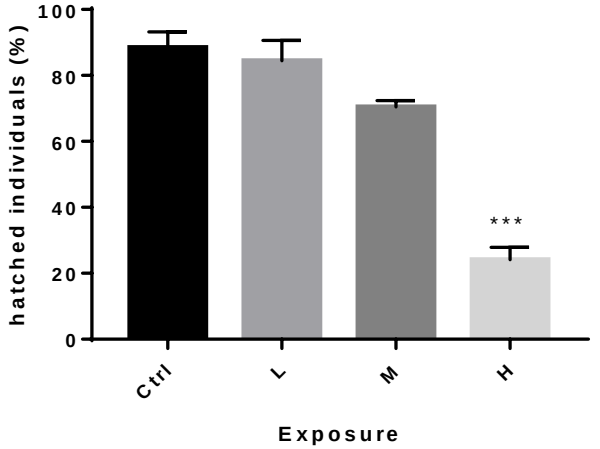
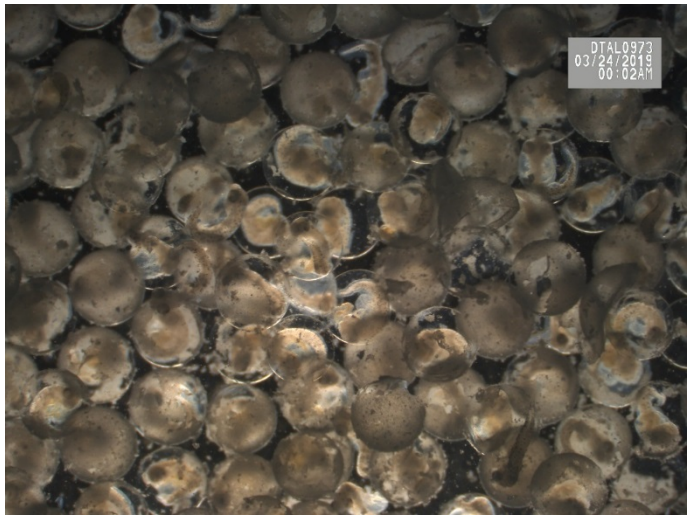




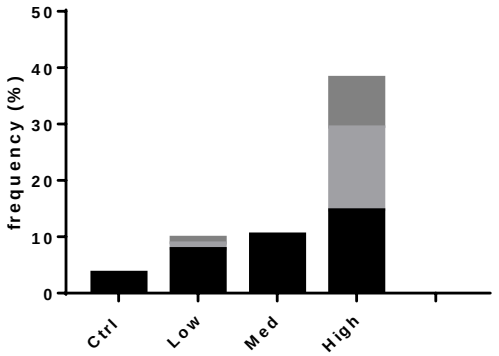
- Early hatching in exposed groups
- Reduced hatching success in H exposure groups



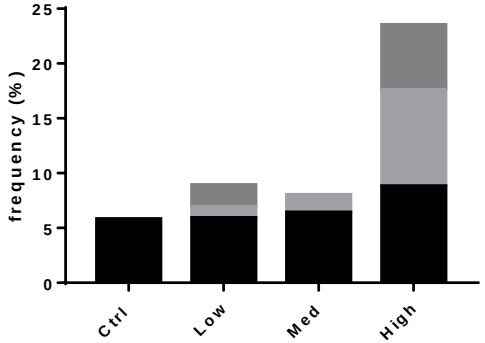
Deformations

Haddock

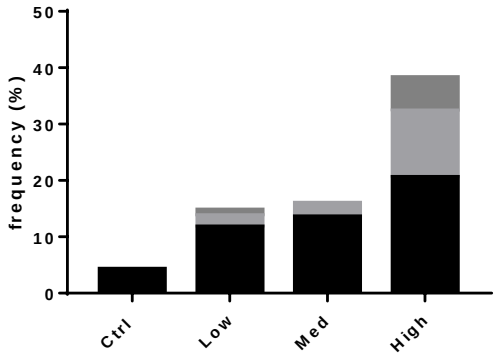
A) spine deformations

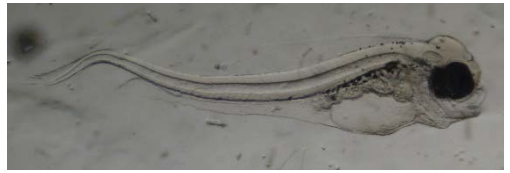


B) craniofacial deformations

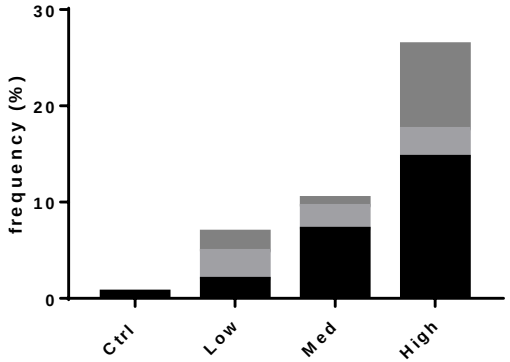


C) jaw deformations

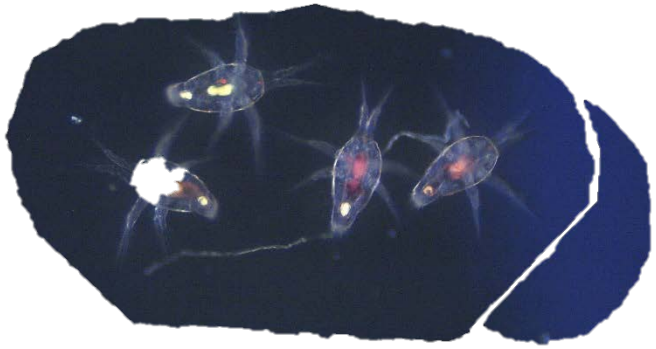




C) tail deformations

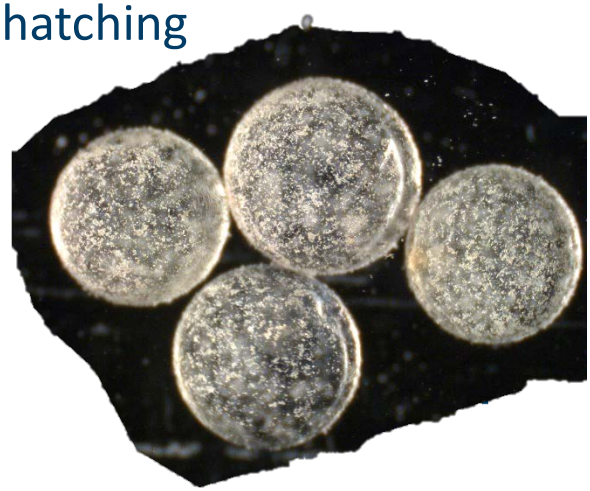


Summary and outlook



- Long term development of calanus
- Effects on energy assimilation

- Why do the particles attach - chemicals?
- Comparison with particles only/natural particles/other tailings
- How fast does this happen? Contact time in field?
- Mechanisms that lead to early hatching

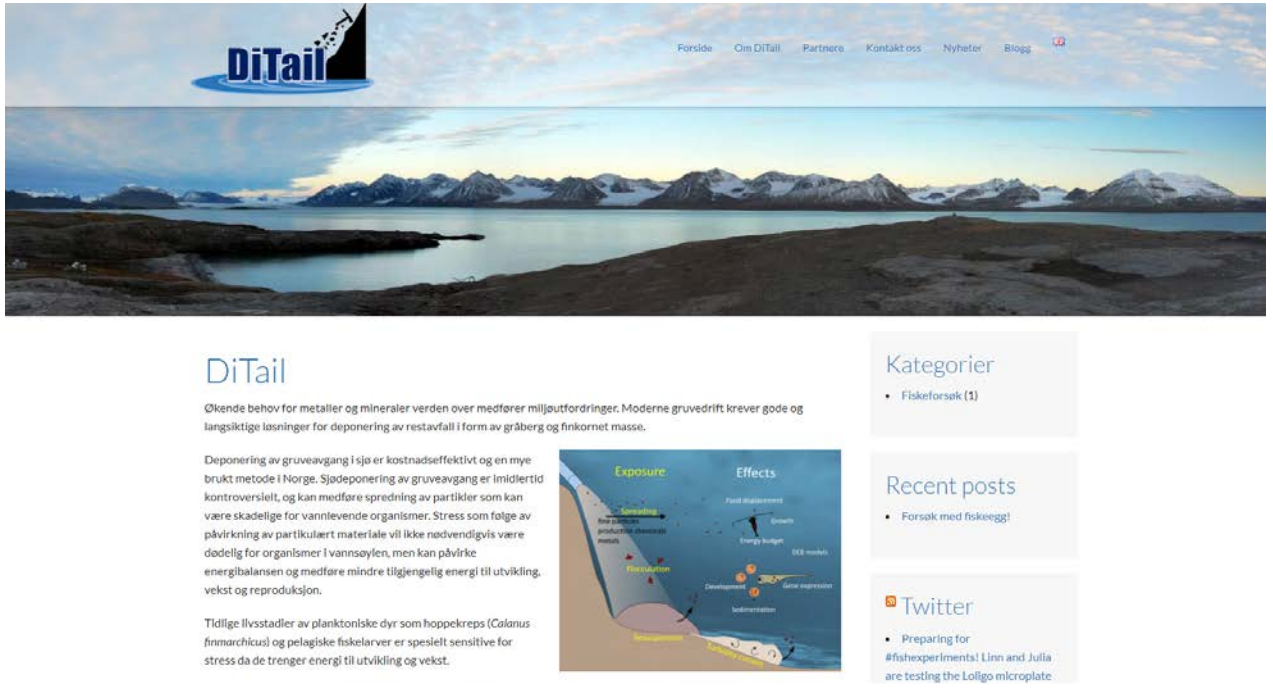


- Other tailings?

Thank you for your attention!

http://ditail.no/

https://twitter.com/di_tail



SINTEF

Teknologi for et bedre samfunn