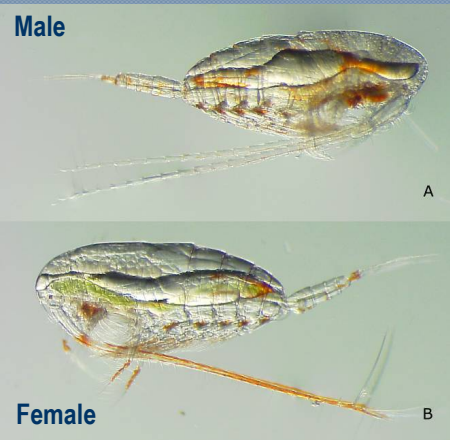


Effects of oil exposure on *Calanus finmarchicus* - the dominant zooplankton species in the Northern Atlantic Ocean

Bjørn Henrik Hansen, Dag Altin, Andy Booth, Trond Nordtug and Anders J. Olsen

Calanus finmarchicus

- Pelagic copepod (2-3 mm)
- Largest biomass in the North Atlantic Ocean and Barents Sea (300 mill tons/year)
- Marine ecological key species
- Important food resource for commercial fish
- Short generation time in culture (~80 days)
- Up to 50% of body mass is lipids
- Important transfer route for lipophilic contaminants in the marine food web

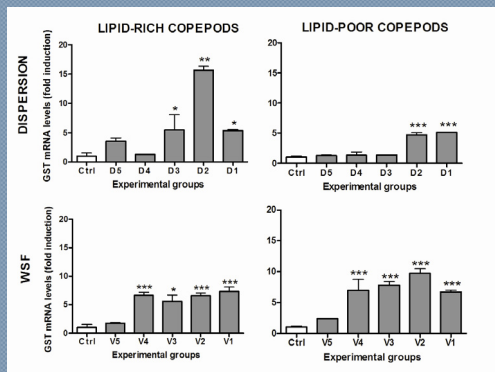


Calanus resources at Sealab

- Continuous multigenerational cultures running since 2004 (19 generations)
- Custom-made equipment for flow-through exposure for dispersed oil and the water soluble fraction (WSF) of oil
- OMICS technology: Metabolic fingerprinting and 15K *Calanus* oligoarray (in progress)
- Fluorescence microscopy
- *Calanus* single gene expression and *in situ* hybridization methodology
- *Calanus* population distribution model

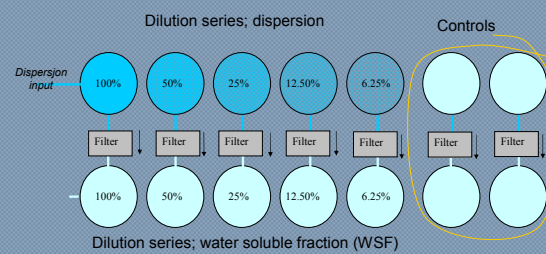


GST expression following exposure to dispersed oil and WSF



Increasing concentration of WSF/dispersed oil

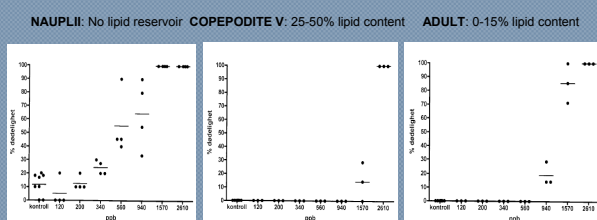
Experimental system



Custom-made experimental rig to assess the contribution of oil droplets to the toxicity of dispersed oil



Acute toxicity at different developmental stages



LC₅₀ value dependent on developmental stage. The developmental stage with largest lipid reservoir is least sensitive, and vice versa.

Survival of the fattest!

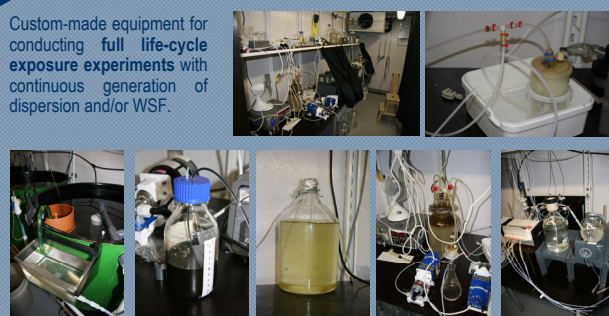
Acute toxicity of single oil compounds

Compound	LC50
Benzene	47.03 mg/L
Toluene	21.98 mg/L
Ethylbenzene 1	11.77 mg/L
Ethylbenzene 2	6.65 mg/L
Xylene	7.76 mg/L
Phenol	80.61 mg/L
Naphthalene	7.02 mg/L
P-cresol	18.42 mg/L

Acute toxicity of different oils and degree of weathering

Oil	Weathering	Loading	LC50
North Sea	Crude	1:40	6.6 mg/L
"	Crude	1:10 000	2.38 mg/L
"	200°C+	1:40	3.3 mg/L
"	200°C+	1:10 000	1.8 mg/L
Norw. Sea	Crude	1:40	6.3 mg/L
"	Crude	1:10 000	3.25 mg/L
"	200°C+	1:40	0.94 mg/L
"	200°C+	1:10 000	1.07 mg/L

Long-term effects



Custom-made equipment for conducting full life-cycle exposure experiments with continuous generation of dispersion and/or WSF.

Endpoints studied:

- Reproductive success (number and survival of eggs and nauplii)
- Growth and developmental rate
- Morphological alterations

Effects of oil droplet smothering

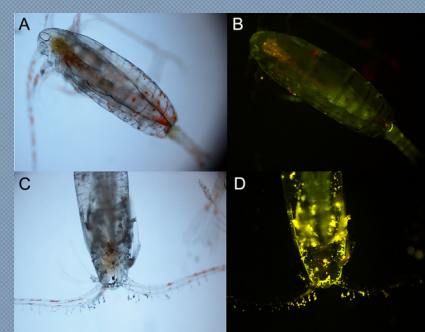
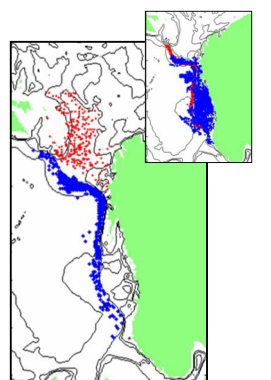


Photo by Dag Altin

Low dispersion exposure
Oil droplets visible inside stomach (A&B)

High dispersion concentration
Oil droplets cover surface of copepod and affects feeding (C&D)



Calanus distribution along the Norwegian coast at different times of the year

Projects related to *Calanus finmarchicus* have been financed by oil industry (StatoilHydro, ENI Norge, Shell), the Research Council of Norway and internal funding at SINTEF and BioTrix.

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