The rationale behind choosing C. finmarchicus as a model target for ecotoxicity testing of petrogenic emissions to the sea water column

C. finmarchicus constitutes a significant biogeochemical cycle in the pelagic community of the Barents Sea and North Atlantic. Seeding potential has been estimated to be more than 2.8 mill. tons and annual production up to 300 mill. tons. In some areas, the species may constitute up to 85% of standing catchpopulations biomass.

C. finmarchicus forms a crucial trophic link between primary production and secondary consumers. Important consumers include commercial important fish species as cod and herring. A significant decline in production or standing biomass of C. finmarchicus is considered to have a marked effect on several fish stocks.

The species C. finmarchicus is fairly well suited due to a comprehensive field research over a number of years.

C. finmarchicus accumulates large amounts of oil, even in the form of sea water. Hence, the species has pronounced bioavailability relative to lipophiles compounds from the water, including oil components. Such compounds may be transferred to higher trophic levels during the food chain.

Few of the presently known sea urchs used for ecotoxicity testing represent a good model for C. finmarchicus. A common used species as Daphnia is, for instance, very much smaller and does not accumulate lipids to a comparable level.

C. finmarchicus is now considered a very relevant candidate for commercial exploitation, and technology for catching and freezing is under development.

Detailed information on the biology of the species and its vulnerability to pollution should therefore be described.

Experiments on reared C. finmarchicus

In general:

- Controlled experiments may be performed throughout the year, on un-damaged specimens with known history and status

Exposure conditions:

- Acute exposures may be done on whatever developmental stage
- Long-range experiments may be performed across the entire life span of the species, or across defined developmental periods.
- Some experiments may be subjected to sublethal or chronic conditions, such as the effects of oil quantity or quantity on their ability to accumulate petrogenic oil compounds or regarding chemical toxicity.

Adaptation to laboratory conditions:

- C. finmarchicus now show a well-tested laboratory adaption, especially concerning behaviour. This may indicate a genetic adaptation to laboratory conditions. This, in turn, should be considered when using the material for specific purposes.
- There is no known evidence of salinity between reared and wild specimens.
- There is currently no reason to suggest a significant change in chemical sensitivity or reared species. We will, however, perform tests to confirm this assumption.
Exposure equipment for petrogenic oil suspensions or water extracts

Several exposure systems have been constructed. Systems are generally custom-made, and the design depends on experiment layout (e. g. few or many individuals), the size of the animals (e. g. nauplii or adults), or the medium (e. g. water with oil or oil-free). As an example, a system for long-range (chronic) exposure to sea water with divided chemical components is shown below.

Endpoints

A number of endpoints are addressed, of which some are presented below. Selected endpoints should preferably give information about impacts on biological functions of high adaptive value to the species, to reveal visible consequences on population level:

- Stage-specific development time
- Stage-specific mortality
- Biomass measures:
  - A standard scheme has been established
  - Induction of metamorphosis to add adaptation ability or development
- Energy measures:
  - Fat deposition and composition
  - Adenosine charge (high-energy phosphates)

Reproductive deficiencies:

- Impaired sexual development
- Egg production
- Hatching rate

Stage-specific mortality

Gene expressions and other molecular measures:

- (This topic will be covered by Dr. Bjørn Henrik Hansen in the next presentation)

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Invitation to co-operation

We do think the establishment of the C. finmarchicus cultures at SINTEF/NTNU Sealab could be of interest for researchers who outside our own research group and associates. We would therefore invite to cooperation on research involving mechanistic or other detailed studies on the species. Our research facility is brand new, with state of the art laboratories and supply of good quality seawater from Trondheimsfjorden.

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