MARINE RESEARCH NEWS

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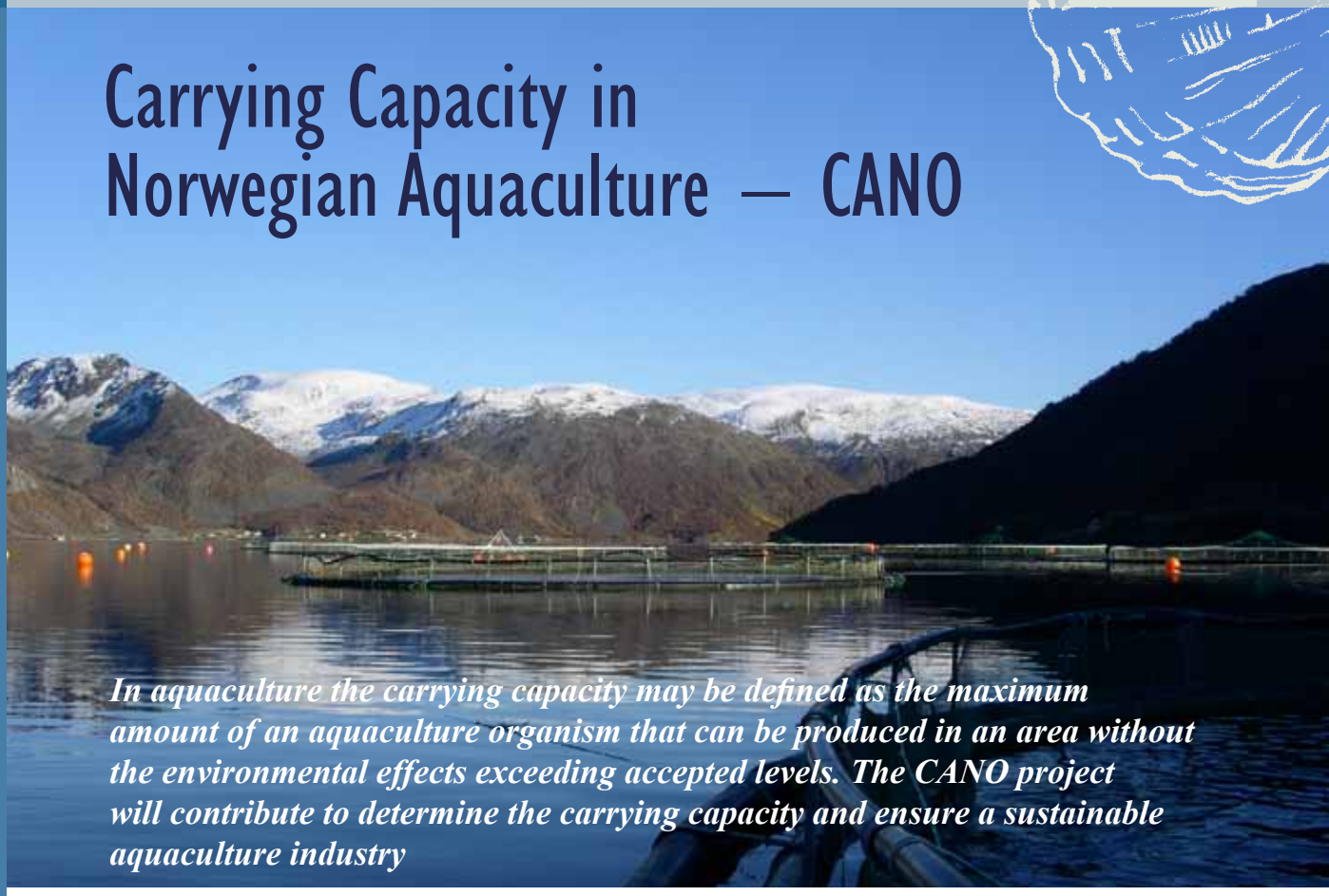
Carrying Capacity in Norwegian Aquaculture — CANO



In aquaculture the carrying capacity may be defined as the maximum amount of an aquaculture organism that can be produced in an area without the environmental effects exceeding accepted levels. The CANO project will contribute to determine the carrying capacity and ensure a sustainable aquaculture industry

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CARRYING CAPACITY FOR INTENSIVE FISH FARMING

The aim is to determine the flux of organic waste from fish farms into the marine system to establish the effects and the production capacity of aquaculture areas.

Fatty acids and stable isotopes are used as tracers to study the flux of fish farm organic waste. Experiments with fish and shrimp have shown that the composition of fatty acid and stable isotopes changes after a switch from a natural diet to fish feed.

Such changes has also been demonstrated in fish and shrimp caught close to fish farms. The shrimp also tended to be "fatter" compared with shrimp from areas with no fish farm activity.

The same tracers are currently being studied at other taxonomic levels and in sediments, and we have sampled at several fish farms and reference stations throughout a year.

CARRYING CAPACITY OF SUSPENSION FEEDING BIVALVES

This part of the programme shall provide knowlege and modelling tools for scientific and practical application that can meet the demands on assessments of carrying capacity of bivalve suspension feeders.

We have shown that the scallop *(Pecten maximus)* and the mussel *(Mytilus edulis)* feed efficiently and grow at much lower food quantities than previously arrogated. This new knowledge is crucial for as-

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sessments of carrying capacity and site selection in Norwegian waters.

Bio-energetic model (DEB) is used as a tool to increase our understanding of how food and temperature affects growth and reproduction of mussels. The model is also used for development of indicators for farm site selection.

Currently we are studying the role of suspended bivalves (on farm scale) in nutrient dynamics of Norwegian coastal waters.

A farm scale model is used to determine how the flux of food and the design of long-line farms (line distance and length) influence on growth within the farm and the carrying capacity.

We have demonstrated how forced upwelling of deeper water can enhance algae production (favouring non-toxic groups) and the carrying capacity of fjords.

Results from the project have been implemented in a demo-version of an operational web based tool (MOLO) for locating sites and support integrated management for mussel farming.

CARRYING CAPACITY IN SEA RANCHING – EUROPEAN LOBSTER

The aim of this part of the programme is to estimate carrying capacity in early life-stages of released European lobster *(Homarus gammarus)*.

Young-of-year juveniles of European lobster has never been found in the wild. A number of species predate on newly released lobster juveniles. Hiding/sheltering is probably an important anti-predator mecanism during the most vulnerable early life stages.

One of the limitations in sea ranching lobster is related to low survival of the released animals. A series of experiments were run in 2007 and 2008 to estimate density under controlled conditions.

In 2007, larvae (stage IV) were released at densities of 21 and 41 animals per m^2. The larvae were offered empty shells of great scallop as possible shelter. After 8 months, 8 to 10 juveniles were found per m^2. Highest mortalities were found in the experiments with highest release density. In 2008, release densities varied from 41 to 164. After 7 months, from 7 to 20 animals were found per m^2. There were indications that the carrying capacity had not been reached in the experiments with the lowest release density (10 per m^2).

Further experiments will be carried out, with varying number of shelters and release densities, as well as *in situ* experiments.

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