



# Interactions between wild and farmed cod within a fjord in Norway



## Introduction

Cod (*Gadus morhua*) aquaculture facilities are common along the coast and within the fjords of Norway. Wild fish are found to aggregate around these facilities, probably to feed on the uneaten food. The proportion of waste pellets in diet of cod around sea cages has been estimated to be around 30% (Dempster et al. unpublished data). The effects of wild cod consuming uneaten pellets is unknown. The gathering of wild cod around the facility can result in the transfer of pathogens between wild and farmed stocks, and the wild stocks could also act as vectors of pathogens between facilities (Uglem et al. 2009).

The aim of this study was to examine the potential interactions between wild and farmed cod, in terms of wild cod feeding on waste food and the potential for parasite transfer, resulting from the aggregation of wild cod around a sea cage.

## Materials and methods

- Gillnets were set around a cod aquaculture facility in Vanylvsfjorden (Fig 1) in March 2010.
- The cod caught were sexed, maturity stage established, examined for deformities, otoliths were taken for ageing, pelvic fin lengths were measured and the parasite fauna was examined.
- A sample of liver was taken for fatty acid profile analysis to establish the proportion of pellets in the diet.
- These were compared to cod from within the cage and also cod caught in a neighbouring fjord where no aquaculture facility is present.



Fig 1 Location of aquaculture facility. Image from [www.gulesider.no](http://www.gulesider.no)

## Results

- Only 1 wild cod out of 24 was caught outside the cage. The others were likely to be escaped cod deduced from age and length distribution, age-at length and pelvic fin length.
- Cod caught around the aquaculture facility and from within the cage had fewer parasites than cod from the neighbouring fjord.
- 12% of the fish caught outside the cage showed deformities compared to 40% inside the cage no deformities were found in the wild fish (Fig.2). There was a similar frequency of vaterite otoliths (Fig 3) in cod caught outside and inside the cage (16 and 20% respectively).
- Cod caught outside the cage were 85% female. The sex-ratio inside the cage was 1:1.
- We await the results of the fatty acid analyses.



Fig 2 Examples of deformities found in farmed cod.



Fig 3 Normal cod otolith (left) and vaterite otolith (right).

## Discussion

- There were very few wild cod around this facility. The reason is unknown but may be that cod have migrated to a spawning area or that the cod population in this fjord is very low.
- The difference in parasite fauna is likely a result of anti-parasite applications carried out in the farming facility. Therefore the transfer of parasites to the wild population is unlikely.
- The lower prevalence of deformities in the escapee fish indicate that deformed fish have a lower survival after escaping from the farm.
- The difference in sex-ratio indicates sex specific behaviour in farmed cod. Sampling was carried out during the cod spawning season so the males may have been attracted to spawning areas. It could also indicate that females are more likely to escape than males.

## References

Dempster et al. SINTEF Fisheries and Aquaculture, 7465 Trondheim, Norway

Uglem, I., Dempster, T., Bjørn, P., Sanchez-Jerez, P. & Økland, F. (2009) High connectivity of salmon farms revealed by aggregation, residence and repeated movements of wild fish among farms. *Mar Ecol Prog Ser* 384:251-260.

