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Vedrørende klage på rapport fra SINTEF Fiskeri og Havbruk

Vi viser til henvendelsen fra dere 7. juni 2011. Den nasjonale forskningsetiske komité for naturvitenskap og teknologi (NENT) behandlet henvendelsen på møtet 18.-19. september og 10. november. Som opplyst i brev tidligere ble det bestemt at komiteen ville oppnevne en gruppe bestående av to uavhengige sakkyndige og be om å få faglige vurderinger av artikkelen "*Proxy measures of fitness suggest coastal fish farms can act as population sources and not ecological traps for wild gadoid fish*". På bakgrunn av vurderingene ville komiteen deretter ta stilling til påstandene om brudd på forskningens overordende forpliktelse og god forskningspraksis. I henvendelsen hevdes det for det første, at rapporten har utelatt vesentlige fakta. For det andre, fremholdes det at rapportens hensikt er betenkelig. Det påpekes også at forskerne i etterkant har kommet med påstander i media som underbygger påstandene. NENT bes om å vurdere artikkelen i henhold til *Forskningsetiske retningslinjer for naturvitenskap og teknologi*, med vekt på punktene 2, 6, 8, 10 og 17.

I forkant av møtet 10. november hadde medlemmene fått tilgang til vurderingene fra de sakkyndige, og saken ble på nytt tatt opp til diskusjon. Vurderingene er vedlagt brevet. Komitémedlem Svein Nordenson erklærte seg inhabil og forlot rommet under behandlingen av saken.

Sakkyndig (1) påpeker at konklusjonen - at oppdrettsanlegg er gunstig for fiskens vekst og utbredelse - bygger på en usikker antakelse. Forfatterne har trolig har rett i at villfisk under bedre forhold har forbedret gyting sammenlignet med villfisk under dårligere betingelser, og at de dermed er forventet å produsere flere egg. Det er imidlertid problematisk å overføre denne sammenhengen når man diskuterer oppdrettsfisk. Forfatterne, samt sakkyndige og redaktørene burde derfor ha formulert en mer balansert tittel og dessuten nyansert teksten i sin helhet. Det påpekes også datainnsamlingsmetoden til en viss grad utelater dokumentasjon av forskjeller i helsetilstanden mellom villfisk og oppdrettsfisk, og at denne begrensningen burde vært adressert. Dette representerer imidlertid ikke grove brudd på god vitenskapelig praksis, men utgjør snarere en overtolkning av resultatene. Dataene som er brukt for å underbygge konklusjonen er tilgjengelige for leserne, og den rette arenaen for en videre diskusjon av saken bør derfor være i den vitenskapelige litteraturen, ikke i en nasjonal forskningsetisk komité, hevdes det.

Sakkyndig (2) konkluderer med at artikkelen i det store og hele er basert på prinsipper for god forskningspraksis. Metodene som er valgt er adekvate i forhold til hypotesetestingen og relevante referanser er brukt. En hovedinnvending er at presentasjonen av hovedfunnene i sammendraget (*Abstract*) strekkes lenger enn det data faktisk rapporterer. Det påpekes imidlertid at artikkelen må evalueres i sin helhet, ikke bare på bakgrunn av sammendraget. Konklusjonen i begge vurderingene er at dette ikke dreier seg om grove brudd på god vitenskapelig praksis.

I *Forskningsetiske retningslinjer for naturvitenskap og teknologi* punkt 6, påpekes det at det at "uredelighet innebærer en bevisst vilje til å fordreie virkeligheten". Mer bestemt er det uredelig "å framsette som resultater noe forskeren vet eller burde vite at det ikke er dekning for i data eller teori, eller å unnlate å legge fram viktig ny kunnskap." I lys av de sakkyndige vurderingene mener komiteen at det ikke er grunnlag for å si at forskerne har gjort seg skyldige i brudd på god forskningspraksis. Komiteen fremholder at det må skilles mellom overtolkning av resultater og bevisst vilje til å fordreie virkeligheten. Basert på vurderingene som er gitt, er det heller ikke grunnlag for å hevde at forskerne har unnlatt å ta hensyn til relevante kilder.

Komiteen mener imidlertid det er grunn til å minne om forskerens ansvar ved forskningsformidling. I *Forskningsetiske retningslinjer for naturvitenskap og teknologi,* punkt 10, fremheves spesielt forskerens plikt til å klargjøre forskningsresultatenes relative sikkerhets- og gyldighetsområde. Selv om også andre grupper (for eksempel journalister) har ansvar for rimelig forskningsformidling, fritar ikke dette forskere for et medansvar for hvordan resultater av forskning brukes og eventuelt utnyttes i ulike sammenhenger (jf *Forskningsetiske retningslinjer for samfunnsvitenskap, humaniora, juss og teologi,* punkt 45). Ved formidling i massemedier blir forskningsfunn gjerne forenklet. Slik forenkling trenger ikke å være problematisk, men kan være det dersom for eksempel formidlingen går utover det dataene gir holdepunkter for. Basert på tilgjengelig informasjon, mener komiteen at forskerne her med fordel kunne ha engasjert seg i diskusjoner om rimelig tolkning og forsvarlig bruk av forskningsfunnet for å klargjøre dets sikkerhets- og gyldighetsområde.

Med vennlig hilsen

Dag E. Helland
Leder NENT

Helene Ingierd
Sekretariatsleder NENT

Kopi: SINTEF Fiskeri og Havbruk
Vedlegg: Vurderinger fra sakkyndige

Reviewer 1: Based on email from Dag E. Helland dated 13 October 2011, my assignment was to undertake a peer review of the paper by Dempster et al. (2011) for "Den nasjonale forskningsetiske komité for naturvitenskap og teknologi" (NENT).

General comments:
The paper by Dempster et al. (2011) deals with the effects of fish farms on wild gadoid fish. The main objective of the study is to evaluate if salmon farms along the Norwegian coast act as ecological traps, i.e. attract wild gadoid fish to ecologically inferior artificial habitats, or if they act as population sources by promoting better growth, condition, and eventually supporting higher total offspring survival of local wild gadoid fish. These investigations were carried out by sampling cod and saithe in the vicinity of salmon farms, and in local control sites considered to be far enough away from fish farms. The fish were sampled during the summer months by standardised hook and line fishing gear, and in total 570 saithe and 349 cod were sampled in three regions (Ryfylke, Hitra and Øksfjord). Of these, 526 fish were considered farm associated (FA) and 393 un associated (UA). The sampled fish were subject to standard measurements such as fork length and body weight, used to estimate Fulton condition index (FCI), and liver and gonad weight used to calculate hepatosomatic index (HSI) and gonadosomatic index (GSI). In addition the sex was determined in most cases as well as the occurrence of external and internal parasites. The FA and UA fish were contrasted for the various measures using Generalized linear models (GLM), and their stomach content (diet) were compared using a non-parametric multivariate MDS technique. The authors documented a generally higher condition of FA cod and saithe compared to the UA control fish as well as an uptake of fish feed in FA fish. There were in addition some differences in parasitic load, although these were not as consistent across sites and groups. The authors concluded that there was no evidence that salmon farms act as ecological traps, but rather had a potential as population sources due to documented elevated fish condition of FA fish and presumed higher reproductive output. A major premise of the paper is that fish condition is a proxy measure of fitness since under normal circumstances, fish fecundity is positively related to condition.

The assumption that fitness relates to condition (or "fatness") as in this study, is somewhat troublesome. Although the authors undoubtedly are right in suggesting that wild fish with higher condition typically have higher fecundity than other wild fish with lower condition (everything else being equal), and as such should produce more eggs than those with lower condition, the linking of wild fish condition with semi-cultivated fish condition to fitness is in doubt for several reasons. First it implies that the survival potential of the offspring for both groups of fish should be similar. This is not at all documented by the collected data nor by references presented in the paper. The authors could have used examples from the literature on salmonids to illustrate the differences in fitness related measures between (fatter) farmed salmon (including escapees), and (leaner) wild salmon. In this case, it is doubtful that they would have obtained much support for their assumptions. Secondly, it implies that the reproductive behaviour of the semi-cultured fish will be as adapted as the wild counterparts, and that they indeed will be maturing at a suitable time period, undertaking necessary spawning migrations and movements, and displaying appropriate courtship behaviour. Cod for example display an intricate spawning behaviour involving energetically intense paired swimming bouts. It is not at all evident that cod with higher levels of liver lipids will have more success in these behaviours. Although the authors do mention some of the assumptions relating to offspring survival explicitly in their discussion (p. 6 in Discussion), a stricter editorial practice on the title and abstract should have been in place.

One other problematic issue with the paper is the choice of sampling method. By using hook and line, the authors have to some extent precluded the documentation of differences in disease related status between FA and UA groups. This because one of the first behavioural changes during the development of a disease will be a reduction, or even a complete loss of appetite. Hook and line sampling methods are typically targeting actively feeding fish and without any documentation of the fraction of non-feeding fish in both groups, this will provide an incomplete picture of the health status in FA and UA groups. This limitation of the study is not properly acknowledged by the authors.

Other specific comments:
- The section on parasite sampling in the Materials and methods is limited to only two references. More references could have been included here, also some that refer to the risk of disease transfer from fish in densely populated farm pens to wild fish in the immediate surroundings. This is mentioned on p. 7 in the Discussion, however, but it is not stated why this was not followed up since this obviously has the potential to negatively affect the FA fish.
- The analysis of parasitic load is carried out using GLM analysis after log transformation. It is unclear why the authors did not use a poisson-type error distribution (suitable for count data) and thus avoid the transformations (and some underlying assumptions) altogether. Many of the tests regarding parasitic load where marginally significant, and the use of inappropriate distributions and assumptions in these analysis may have influenced the outcome of the tests.
- Further, by carrying out repeated tests in a site specific manner, the authors have missed out on some of the advantages of an ANOVA-type analysis (e.g. documentation of site and group specific interactions), and may as well have inflated the occurrence of type I errors. This will lead to more significant test results than what is really supported by the data, and could easily have been avoided by implementing a Bonferroni correction (in this case the critical p-value for each variable tested should be 0.05/3).

Conclusion:
Dempster et al. have documented a significantly higher condition among farm associated (FA) cod and saithe compared to farm un-associated (UA) cod and saithe. This was in line with their hypotheses as outlined at the end of the Introduction. A rather uncritical use of fish condition as a proxy of fitness, led them to conclude in the title and abstract that fish farms act as population sources rather than ecological traps. It would have been appropriate for the authors, as well as the reviewers and journal editors, to have sought a more modest wording in the title and paper itself. It is much less likely however, that this paper represents a serious breach of misconduct of proper scientific practice, but rather an over-interpretation of the obtained results. The basic underlying data are available for the readers to judge by themselves, and the appropriate arena for the a continued discussion of the matter should therefore be in the scientific literature and not, in my opinion, in a national science ethics committee. **I therefore conclude that the paper by Dempster et al. in spite of its examples of over-interpretation, and inadequacies, does not represent a serious breach of acceptable scientific practice.**

References:
Dempster, T., P. Sanchez-Jerez, D. Fernandez-Jover, J. Bayle-Sempere, R. Nilsen, P. A. Bjorn, and I. Uglem. 2011. Proxy Measures of Fitness Suggest Coastal Fish Farms Can Act as Population Sources and Not Ecological Traps for Wild Gadoid Fish. PloS one **6**. DOI 10.1371/journal.pone.0015646

Reviewer 2

Dempster T, Sanchez-Jerez P, Fernandez-Jover D, Bayle-Sempere J, Nilsen R, Bjorn PA, Uglem I (2011). **Proxy Measures of Fitness Suggest Coastal Fish Farms Can Act as Population Sources and Not Ecological Traps for Wild Gadoid Fish**. Plos One 6

The main objectives of this report were to evaluate the methods and references in relationship to the conclusions in the above paper.

Relationship between methods and conclusions
In general the methods used in the paper are appropriate to test the hypothesis, this goes for the studies of size, diet and condition indices, and parasite load. Also the use of statistical methods seems appropriate.

However, the presentations of the main findings in paper are not 100% consistent, and the conclusions could be misunderstood if you only read the Abstract, as illustrated by the citations below:

Main objectives (from **Introduction**)

> "Here, we tested the hypotheses that the diets, indices of condition and parasite loads of cod and saithe associated with salmon farms differed from those of fish present at locations distant from salmon farms. To ensure broad generality of the results, we sampled fish in three intensive fish farming areas along the latitudinal extent of salmon farming in Norway (59°N to 70°N)."

Main conclusions (from **Discussion**)

> "The results provide no evidence that salmon farms act as ecological traps for wild cod and saithe that aggregate in their vicinity, provided that: 1) the modified fatty acid distributions and elevated organohalogen levels in fat stores in livers that results from a fish farm modified diet [35,36] does not negatively affect physiological processes, vitellogenesis or egg and larval quality; 2)salmon farms do not amplify any of the numerous pathogens not investigated here that salmonids and gadoids share [27]; and 3)that attraction to farms does not disrupt natural spawning migrations or behavior. Future research should seek to discern the effects of both salmon and cod farms during the spawning season for cod resident in fjords containing farms, as a range of different effects are possible during this period, including mass spawning of farmed cod in cod farms [37] and possible avoidance of fjords containing salmon farms by spawning cod [38]."

Conclusions and **Significance of the findings** in Abstract:

> "Proxy measures of fitness provided no evidence that salmon farms function as ecological traps for wild fish. We suggest fish farms may act as population sources for wild fish, provided they are protected from fishing while resident at farms to allow their increased condition to manifest as greater reproductive output."

In the Abstract, the conclusions are stretched too far in relation to the data. Further, "proxy measures of fitness" is not defined in the Material and Method, but appears the first time in the Discussion. Since proxy measures of fitness is included in the title of the manuscript, and also a central part in the Abstract, this terms should have been defined in the Material and Methods.

Are relevant references used?

The paper cites 41 papers, mainly from primary journals, and are overall well balanced. Citation from the end of the Discussion:

> "Therefore, to ensure farms do not act as ecological traps for cod via increased fishing mortality alone, restrictions on the fishing of cod in the vicinity of farms could be introduced.".

Today, at least in Norway, you must keep a distance of more than 100 meters from the closest fish farm when fishing, (www.fiskeridir.no), and restriction on fishing in the vicinity of farms are already implemented.

Conclusions

This is a well written paper, mainly based on sound scientific principles. My main criticisms are related to the presentations of the main findings in the Abstract. However, a paper has to be evaluated in total, and not by the Abstract alone.