Environment, Climate Change and Land Reform Committee

Environmental impacts of salmon farming

Written submission from Orkney Fisheries Association

Salmon farming has become increasingly important to Scotland's national and local economy; however, its rapid expansion is not without (environmental) costs. Orkney Fisheries Association is a trade body representing Orcadian fishers, and has seen the development of fish farms first hand. Orkney has over 20 active salmon farming sites, with the further expansion opportunities being explored.

Ultimately, OFA would like to see an increase in the research carried out in regard to the environmental impacts of salmon farming, informing the construction of a cohesive framework for aquaculture development that is in turn devolved into specific planning roadmap for coastal councils and communities. Orkney is an example of why this is needed: its aquaculture industry is rapidly expanding, yet no formal research has been carried out to assess the potential maximum capacity of aquaculture sites in Scapa Flow, nor has any formal plan been created by the government in monitoring cumulative impacts in these areas.

This review has revealed that much of the data underpinning the management of salmon and aquaculture facilities is partial or incomplete, and often stems from studies carried out in sea lochs, and thus may not translate when used to assess or model the impact salmon farms have on inshore areas or the open sea.

Sea Lice and Disease Impacts on Wild and Farmed Stocks

One of the major concerns held by OFA is the effect of sea lice treatments on juvenile shellfish species. As highlighted in the report (section 21.2) sea lice treatment includes the use of emamectin-benzoate. Emamectin-benzoate is a toxic compound, and although it has not been found to bioaccumulate in any organisms, it does have low water solubility, and will concentrate in sediments or particulate material which may have a negative impact on a local scale[1].

The use of emamectin-benzoate as a sea louse treatment has been associated with the death of non-target crustacean species such as lobster, and has also been associated with the disruption of normal moulting behaviour in crustaceans, as well as apoptosis, and the suppression of DNA repair (Song, et al., 2016). Scotland's fishing industry is heavily dependent on crustaceans such as brown, velvet, and green crab, as well as Norwegian lobster and scallops, which brought in over £90million to the economy in 2015[2]. There is a paucity of information on the impact chemical lice treatments have on these economically valuable species, particularly on their juvenile stages, which must be addressed to safeguard the future of the

[1]Scottish Environmental Protection Agency. (n.d.). *Scottish Pollutant Release Inventory*: http://apps.sepa.org.uk/spripa/Pages/SubstanceInformation.aspx?pid=171

[2]Scottish Government, 2015: http://www.gov.scot/Topics/marine/marine-environment/species/fish/shellfish

stocks. OFA would like to see further research carried out to address these knowledge gaps. Additionally, further research should be carried out on the impact of residues of the anti-louse treatment diflubenzuron in the flesh of polychaetes and crustaceans (page 75).

OFA supports the idea of making all historic and contemporary data on sea lice levels accessible for independent analysis and scrutiny (as suggested on page 16 of the report), as this will foster transparency between marine sectors.

OFA supports the option of leaving aquaculture sites to fallow for longer periods of time, as this will give the surrounding benthos the opportunity to recover. However, in cases where the sites are located near maerl beds (as is the case with multiple sites within Orkney), a longer time period may be required.

The potential for disease to spread from farmed salmonids to wild fish stocks has a potentially devastating impact on the Orkney fishing industry. OFA would encourage further research into this area so the risk in Scottish waters could be understood more clearly, as well as the wild fish stocks that are particularly at risk from an outbreak of disease (pages 17-18 in the report). OFA welcomes the proposal for using e-DNA samples to improve our understanding of how disease vectors are released into the environment, and their temporal and spatial pervasiveness.

OFA asks for further research to be carried out in regard to the effect of the use of hydrogen peroxide to treat amoebic gill disease and its impact on the environment.

The Discharge of Waste Nutrients and Their Interaction in the Wider Marine Environment

OFA agrees with the concerns made on page 22, that there is the potential of waste from salmon farms to build up in the environment, leading to the accumulation of pathogenic micro-organisms, and exceeding the capabilities of the natural environment in recycling this waste. OFA would like further research to be carried out on how waste is recycled in inshore areas, as well as research into the relationship between waste and pathogenic organisms.

OFA is particularly worried about the impact of waste and anoxic conditions on economically valuable benthic species, such as *Pecten maximus*, as well as protected species such as maerl beds and seagrass, both of which are present in Orkney, and have been found to be especially susceptible to anoxic conditions (page 29). While the cumulative effects of farms on the benthos of sea lochs seems to be well-understood (page 30), OFA would like to see more research being carried out on the cumulative effect of fish farms in inshore areas, which have different hydrodynamics to lochs and voes.

OFA would like the issue (highlighted on page 33 of the report) of the lack of recently synthesised data on the conditions of the benthos near fish farms to be resolved, as

well as extended research into acceptable levels of sediment loading for different sediment types.

Coralline red seaweed called maerl is found in high densities around Orkney, and many of the salmon farms that are in Orkney are located on or near a maerl bed (see figure 1). As the report states (page 57) salmon farms have a negative impact on maerl through the build-up of organic waste, causing reductions in live maerl cover and changes in associated fauna. Fallowing sites for a period of two years may not be enough to allow this slow-growing coral to recover. OFA urges a review of the planning processes to minimise the impact of fish farms on maerl beds and to improve zoning of aquaculture activities. OFA worries that the potential increase in salmon farms will have dire consequences for UKBAP features.

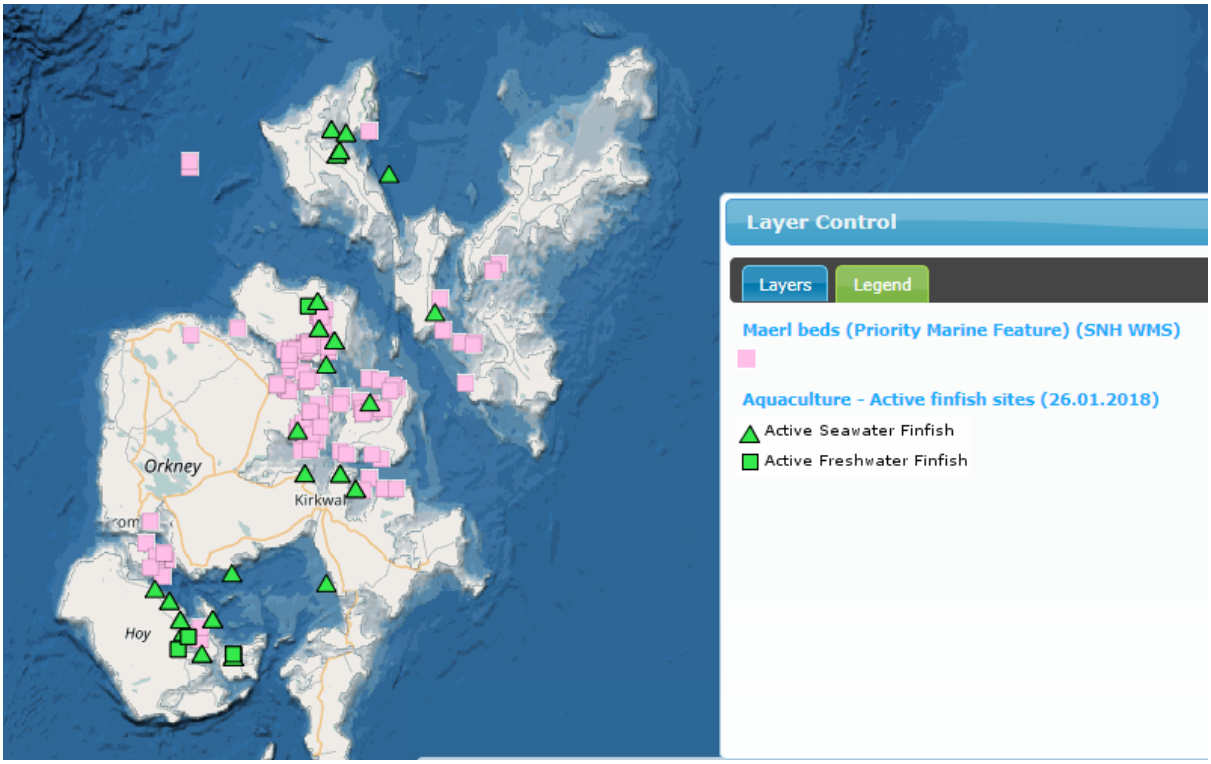

Figure 1:- Maerl beds (pink squares) alongside active salmon farms (green triangles) in Orkney. Data from National Marine Plan Interactive

Effect of the Discharge of Medicines and Chemicals from Salmon Farming

OFA would like to see the data held on the use of hydrogen peroxides, other disinfectants, antibiotics, and antifouling paints in salmon farming, made publicly available to promote industry transparency.

OFA would like to see more data collected on the impact of medicines and chemicals used in salmon farming on the environment- both individually and collectively. The impact of zinc pyrithione and its on species, communities, and food webs has been highlighted by the report as a major gap, and should be addressed as such.

There are still an alarming number of unknowns that must be addressed- relating to both exposure and effects of aquaculture chemicals in the marine environment, including lack of knowledge of the impact of the chemicals on certain species, the long-term effects of exposure to these chemicals, and a lack of knowledge of bio-accumulation and in-combination effects (page 82). This is particularly important when considering commercially important species, which have been found to have residues of the anti-louse treatment diflubenzuron (page 75).

The lack of knowledge surrounding the degradation of chemicals used in treatments in salmon farms must also be addressed- particularly in the case of metals which do not degrade and can change form (page 72). Research must be carried out to explore the potential for the retainment of anti-louse medicines in the seabed following treatment, and the subsequent impact this may have on the benthos. Metals are particularly risky, as they do not degrade and can change form (page 72), affecting the environment and the species within it. Research must also be carried out on the impacts of several chemicals acting in concert at low concentrations (page 73).

Escapees from Fish Farms and Potential Effects on Wild Populations

While the use of ‘cleaner fish’ may help reduce the quantities of chemicals used in aquaculture, OFA urges strict controls over the use of wild-caught species to meet the demand in the aquaculture sector. An increased fishing pressure can have a large impact on the long-term health of the targeted stocks, and may have wider consequences for the biological community. However, where possible OFA would encourage the use of cleaner fish over the use of chemical treatments.

Summary of Response

This report has been successful in its ability to gather all available knowledge of the impacts salmon farming has on the ecosystems. However, in doing so, it has highlighted a paucity of data on the long-term consequences of salmon farming on the environment, particularly with the long-term consequences of the input of chemical treatments into the ecosystem. The effects of many chemical treatments may not be immediately apparent, and OFA encourages further research to be done on assessing the impact of chemicals -both singularly and collectively- on species.

OFA would also like to see further research being carried out using salmon farms in inshore or open sea areas. Many of the current models and research used by the industry rely on work carried out in sea lochs, and this may not always be translatable to the distinct hydrographic patterns that characterise more open areas of sea.

Fiona Matheson