Environment, Climate Change and Land Reform Committee

Environmental impacts of salmon farming

Written submission from Fisheries Management Scotland

Fisheries Management Scotland are the representative body for Scotland's District Salmon Fishery Boards and Fisheries Trusts. We work closely with Scottish Government, Agencies and the aquaculture industry with a view to ensuring that wild salmonid fish are protected from the environmental effects of aquaculture. District Salmon Fishery Boards are statutory consultees in the aquaculture planning process. Fisheries Trusts undertake annual monitoring of wild fish, the results of which are referenced in the SAMS report.

We welcome the opportunity to provide views on the SAMS report. Overall we consider the report to be an excellent description of the current situation. We have however provided some comments below with a view to providing further clarity on some specific issues. We have limited our comments to the sections of the report relating to interactions between salmon farming and wild salmonid fish.

Section 2

2.1.1.
In the subsection entitled 'Sea lice effects on wild salmon populations' the following sentence is included: *Mortality levels due to sea lice have been predicted to cause a fall of 1% to 20% in adult salmon abundance (Jackson et al., 2013; Krkošek et al., 2013)*. This gives the impression that Jackson *et al*. found a fall of 1%, whereas Krkošek *et al.* found a fall of 20%. However, this difference is actually a difference in the interpretation of the results. This is clarified in Krkošek *et al.,* 2014[1] and is discussed further below:

Estimates of population-level impacts of lice infestation have been made in Atlantic salmon smolts through a series of long-term studies in Ireland and Norway. These studies involve the release of paired groups of smolts (the juvenile stage of salmon/sea trout which migrate from freshwater to sea water), half of which are treated with a chemical to protect them from sea lice infestation, the other half of which are untreated.

The data is interpreted by most researchers in terms of the loss of returning adult salmon, due to sea lice. This corresponds to a 20% loss in adult salmon abundance due to sea lice – for every 5 fish that return in the treated groups (95% mortality), four fish return in the untreated group (96% mortality). In other words, 1 in 5 (20%) returning fish are lost to sea lice.

The other means of interpreting such data is as an absolute difference in marine mortality between treated fish and untreated fish. In this case the mortality attributable to lice has been estimated at around 1% (i.e. the difference between 95% (treated) and 96% (untreated)). This 'additional' mortality is interpreted as a small number,

[1] Krkošek, M., Revie, C. W., Finstad, B. and Todd, C. D. (2014), Comment on Jackson et al. 'Impact of *Lepeophtheirus salmonis* infestations on migrating Atlantic salmon, *Salmo salar* L., smolts at eight locations in Ireland with an analysis of lice-induced marine mortality'. J Fish Dis, 37: 415–417.

compared to the 95% mortality from treated groups. As far as we are aware, Jackson *et al*. are the only authors who have interpreted, and published, results in this manner.

The second interpretation has led some who wish to downplay the impact of sea lice on wild fish to question why wild fish managers appear to ignore the 95% of mortality arising from other pressures, rather than the 1% attributable to sea lice. However, it is important to recognise that the vast majority of marine mortality is a natural part of the Atlantic salmon's life strategy - Atlantic salmon produce vast numbers of offspring precisely because marine (and indeed freshwater) mortality of juveniles is naturally high. It is also important to emphasise that the studies in question focus only on the effects of sea lice. Other pressures will affect both experimental groups of fish equally, thereby allowing the effects of sea lice to be examined in isolation. In other words, the sea lice effect is *in addition* to all other pressures.

We would also emphasise, as recognised in the SAMS report, that the 1%/20% figures quoted above represent an average effect, with considerable variation in effect over time and geographical location.

It is important to recognise that a small increase in marine mortality, due to sea lice, can result in losses of Atlantic salmon which may be the difference between a river meeting its conservation limits or not – this might be the difference between being categorised as Grade 2 rather than Grade 3, under the Scottish Government conservation measures. It is also important to emphasise that sea trout are a very important component of west coast fisheries and are Priority Marine Features in their own right.

2.1.2
This section makes reference to the current legislative framework and the powers of the Fish Health Inspectorate. However, it is important to recognise that the legislative powers conferred by this legislation are limited to the health and welfare of the fish *within* the cages and cannot be used to regulate any impacts on wild fish outside the cages. This is also the case in relation to the consideration that SEPA gives when consenting biomass – the impact of sea lice from that biomass on wild fish is not considered. We note under the Nature Conservation (Scotland) Act (2004), all public bodies in Scotland are required to further the conservation of biodiversity when carrying out their responsibilities.

In the subsection entitled 'Recent changes in management', we highlight and endorse the following statement:

"*…there is no published scientific account of the basis for the setting these levels. Furthermore, it is not clear why these trigger levels are above the recommended CoGP levels requiring treatment, which are 0.5 or 1 lice per fish depending on the time of year. No data have yet been published on the results of this new approach. Therefore, it is unclear how successful it has been in keeping sea lice numbers down*."

2.1.5.
We agree with this subsection and indeed Fisheries Management Scotland and our member DSFBs and Trusts are actively pursuing many of the suggestions highlighted.

2.2.
We note the uncertainty surrounding disease transfer from farmed to wild fish and the technical challenges of sampling diseased fish in the wild. On that basis, assessing the extent of any impacts from disease is very challenging. We support the prognosis and mitigations included in section 2.2.7.

Section 5

We believe that this section represents an excellent description of the potential impacts of escapes on wild fish. We would highlight however, that work undertaken in 2011/12 by Rivers and Fisheries Trusts of Scotland (RAFTS) in conjunction with the Fisheries Trusts concluded that 25.1% of sampled juvenile fish on the west coast of Scotland showed evidence of hybridisation between farmed and wild fish.

It is notable that in Norway, escapes of farmed fish are considered to be the greatest threat to wild salmon. This was the conclusion of the recent risk assessment of the environmental impact of salmon farming in Norway mentioned in Section 8 (Taranger *et al.*, 2015).

Section 8

We note the conclusions set out in the paper and offer the following additional observations.

We would draw attention to the statement in Section 1.2. relating to the comparative number of farmed and wild fish in Scotland. '*In 2014, when Scottish production was about 179 thousand tonnes, about 48 million smolts were 'put to sea' and about 34 million salmon harvested (Ellis et al., 2016). In comparison, the stock of spawning salmon in UK rivers was estimated as about 0.6 million in 2012 (Anonymous, 2013).'*

We consider that the biomass of farmed fish within a production area is a crucial factor determining the extent of any impacts on wild fish. The potential impacts of sea lice arising from farmed fish are a function both of the number of farmed fish within an area and the number of lice per fish. We therefore endorse the statement in section 2.1.5. that: "*measures could be put in place to ensure all historical and current information on sea lice levels is accessible for independent analysis and scrutiny, thus providing the basis for the assessment of the long-term efficacy and sustainability of existing approaches to sea lice control*". However, we consider that a vital component of this information is the publication of the number of fish (rather than the weight of fish) within that area.

We consider that Recirculating Aquaculture Systems (RAS), or closed containment, have a significant role to play in the future of the Scottish salmon farming industry. Whilst we recognise that the technology is not currently ready to roll out in Scotland, we are aware that significant investment is occurring in Norway, incentivised by the Norwegian Government, and significant investment is taking place in Scotland in closed containment production of smolts. We are strongly of the view that incentives should be made available in Scotland in order to facilitate the development of such technology in Scotland. In the first instance, a reduction of the marine phase to less than 1 year through growing fish to 1kg or greater in closed containment, and ideally incorporating fallow periods during the wild smolt run, would be a significant step

forward. There is now a great deal of evidence, as recognised in Section 2 of the report, that lice levels in the environment are significantly higher in the second year of the production cycle. By harvesting fish before production moves into the second year, and fallowing the production area, there is the potential to reduce the number of sea lice in the environment to the benefit of wild fish.

We also support the suggested adaptive management approach and this is a key component of the changes that we wish to see to the planning and regulatory regime in Scotland. Fisheries Management Scotland and the Atlantic Salmon Trust recently co-hosted a workshop for local fisheries managers, salmon farmers, Local Authorities, SEPA, Marine Scotland and the Aquaculture Stewardship Council, to discuss the potential benefits to wild fish of Aquaculture Stewardship Council certification. This certification scheme includes many examples of adaptive management, including monitoring of impacts on wild fish, with a feedback to farm management. We see such adaptive management mechanisms as the only means, short of full closed containment, through which the salmon farming industry can demonstrate environmental sustainability. The regulatory system for the salmon farming industry is unusual in that there is no formal requirement for pre-application or post-consent monitoring of wild fish. This is not the case with terrestrial wind farms, marine renewable development, hydro schemes, or a range of other developments.

Our final observation is that the SAMS report, like previous reports, highlights uncertainty around the extent of several of the pressures studied. However, we would highlight the following statement which we believe to be an excellent summary of the current situation:

However, there is a gradually emerging body of evidence, from studies elsewhere, that sea lice not only have the potential to have a negative effect on wild salmon, but that in many situations this is likely to be the case (Gargan, 2000; Finstad et al., 2000; Bjørn et al., 2001; Butler, 2002; Ford & Myers, 2008; Otero et al., 2011; Skaala et al., 2014; Vollset et al., 2014; Taranger et al., 2015; ICES, 2016; Gargan et al., 2017). With the currently high marine mortality rate for wild salmonids, and threatened status of many river stocks, any additional pressure, such as increased sea lice burdens, is undesirable, and could further erode the conservation status of vulnerable wild populations.

A key component of EU Environmental legislation is the precautionary principle. Given the statement highlighted above, we consider that a greater degree of regulation is required to provide assurance that the aquaculture industry can operate in a truly environmentally sustainable manner.

Fisheries Management Scotland would welcome the opportunity to explore any of these issues further with the Committee.