

## **Environment, Climate Change and Land Reform Committee**

### **Environmental impacts of salmon farming**

#### **Written submission from Professor Randolph Richards**

I welcome the opportunity to comment on the SAMS Consortium document "Review of the Environmental Impacts of Salmon Farming in Scotland". My expertise is in the area of fish health, having spent the last 43 years working at the Institute of Aquaculture of the University of Stirling. I have chaired a number of government/industry working groups and was, for 6 years, a member of the Veterinary Products Committee, to which the Veterinary Medicines Directorate reports and which licenses animal medicines in the UK. Approval of almost all currently licensed fish medicines took place during my VPC tenure.

Generically, the SAMS consortium has carried out a fair assessment of the available scientific literature and highlighted gaps in knowledge. Many of these are impossible to fill because of lack of sufficient numbers to sample or extreme complexity of interactions. In such cases, risk assessment is commonly used to address policy issues. Expertise within Marine Scotland and from other outside agencies has been utilised to provide the required information.

I would also offer the observation that published scientific literature represents only part of the story surrounding the development of the Scottish salmon farming industry. There are many other sources of information, including from the regulatory agencies and from within the industry itself which, taken together, paint a more comprehensive and accurate picture of salmon farming in the 21<sup>st</sup> century.

### **Sea Lice & Disease Impacts on Wild & Farmed Stocks**

#### **Sea Lice Impacts**

The question is posed as to whether transfer occurs from farmed to wild fish and whether significant harm occurs to populations of wild salmon. There is no clear evidence from research carried out in Scotland that significant harm has occurred to wild salmon populations from sea lice in farmed fish. However, there have been population declines in salmon stocks on the east coast of Scotland and, more recently, in England and Wales, where marine salmon farming is not occurring. In fact, declines in populations have been described across the entire natural range of the Atlantic salmon. Work quoted from other countries, which often utilises various forms of mathematical modelling, varies dramatically in terms of possible effects on wild fish.

The review describes the legislation used to control sea lice numbers in farmed fish and its oversight by the Fish Health Inspectorate. The 2016 Review of one aspect of the Aquaculture and Fisheries (Scotland) Act 2007 prompted a new policy on reporting levels. The review authors query why levels are cited above the CoGP current levels suggesting treatment. In individual sites, it may not always be possible to carry out effective treatment because of a range of factors including gill damage resulting from algal blooms. The solution in such cases is generally an early harvest which results in reductions in site tonnage produced.

The review also comments on the need for improved treatments. The industry is proactive in achieving this through the development of non-medicinal intervention including 'engineering' methods such as the use of elevated temperatures and washing systems with removal of dislodged lice from the water. Biological controls, through the use of wrasse and lumpfish as 'cleaner fish' and use of selective breeding for salmon resistant to sea lice infection also figure in the industry's approach to integrated lice management and control. Some new medicines are also in development, but there have been problems in obtaining SEPA consents to carry out field trials, and this has contributed to delays in new medicines being introduced.

New fish-holding structures are also currently being trialled which utilise extraction of deeper water which does not contain sea lice infective stages, which filter out incoming or discharged water, or which create barriers to the movement of infective lice stages onto farmed fish.

### **Diseases and other parasites.**

The eye fluke *Diplostomum spathaceum* chosen as an example of parasitic disease in salmon is an unfortunate one. Eye fluke in farmed salmon is not a problem as husbandry methods allow the complex life cycle to be broken and prevent cataract development. Such parasitic cataract development does not occur in smolts when put to sea. Cataract development resulting in financial losses reported in Menzies et al (2002) was, in fact, the consequence of a nutritional deficiency and not parasitic infection. The other reference (Voutilaenen et al (2009)) refers to cataracts in wild salmon populations raised in hatchery conditions in Finland where no attempt had been made to break the life-cycle.

While the consequences of disease for farmed fish populations may not be comprehensively recorded in the published literature, they are very well understood by farm health teams and their veterinary advisors. Farm records also attribute cause to mortalities where this has been verified.

In the first paragraph of page 18 of the report, the review suggests that 'when there are increased levels of outbreaks, they can be demonstrated to negatively impact wild salmonids'. However, no publication is cited in support of this statement, nor is any other supporting evidence provided.

The Wallace et al (2017) review concerns 6 key pathogens in wild fish of a number of species. Of these, *Aeromonas salmonicida*, IPN and SAV are all controlled in farmed salmon through vaccination. VHSV does not affect Atlantic salmon and *Renibacterium salmoninarum* and ISAV are both notifiable diseases, rare in Scotland and effectively controlled through movement control and slaughter policies. The conclusion of the paper was that, despite the large number of samples taken, there was limited evidence for clinical disease in wild fish due to these pathogens and they are likely to have had a minimal impact on Scottish wild fish. Similarly, the SAMS consortium review reports that in Norway, there is limited infection of wild fish with most viral and bacterial pathogens experienced on farms and researchers have assessed this aspect to be of low risk to wild fish.

An area highlighted under 'research needs' in this area is the use of eDNA sampling. Whilst this technology may provide interesting information, it is important to remember that presence of pathogen does not indicate the presence of disease.

### **The discharge of waste nutrients.**

SEPA's role is highlighted in controlling the potentially adverse effects on the environment from waste nutrients. The effect is now strictly regulated by predictive modelling and by sampling around farm sites. Anoxic benthic environments beneath netpens are a thing of the distant past and SEPA and industry control this proactively. Comment is also made on the limited footprint created by cages compared to the total area of the loch floor and the very limited contribution that fish farms make to the organic load on Scotland's seas compared to the land derived organic load. Regarding eutrophication, OSPAR (2009) comment that following extensive monitoring of lochs containing fish farms in Scotland, all have been assessed as 'non-problem areas' and various types of analysis 'point to the conclusion that Scottish sea lochs have not been rendered eutrophic by fish farming.

### **Effect of discharge of medicines & chemicals from salmon farming.**

The licensing of veterinary medicines for aquaculture involves a thorough assessment of environmental impacts carried out by the VMD and independent experts on the VPC in close association with SEPA. This results in the setting of Environmental Quality Standards (EQS) which take account of toxicity to sensitive non-target species and also apply very substantial safety factors to further reduce the potential for adverse environmental impact. For instance, the use of Pyceze (bronopol) is discussed and it is reported to be moderately toxic to marine invertebrates and slightly toxic to marine fish (the most sensitive species). However, the product is used to treat Saprolegnia infection in freshwater and is not used in the marine environment.

VMD & VPC licensing, together with the use of CAR licences issued by SEPA, ensures compliance with environmental law and protection of the aquatic environment. This applies on a site by site basis. Use of veterinary medicines is also controlled through veterinary prescription and adherence to Veterinary Health Plans produced by a site's veterinary supervisors. Such activity is also included in the SSPO Code of Good Practice and is monitored by the Marine Scotland Fish Health Inspectorate.

The currently very topical issue of Antimicrobial Resistance (AMR) development is also covered in the review. Antibiotic use in Scotland is very low compared to all other fish farming countries and is estimated to be between .0.02 – 0.38 gm/tonne of harvested fish. Scottish aquaculture is frequently cited as an excellent example of reduction of antibiotic use where effective antibacterial vaccines have been developed. The review quotes work in Chile where an increase in resistant bacteria was found adjacent to an aquaculture site, but there is much greater antibiotic usage in Chile where health control is poor. Prior to the production of effective vaccines, there was considerable use of antibiotics in salmon farming to control the bacterial disease furunculosis caused by *Aeromonas salmonicida*. Strains of the organism resistant to a number of antibiotics developed but following vaccination, such strains died out, presumably because of their lesser ability to compete with wild-type strains

in the absence of antibiotic. There was no indication of antibiotic resistance spreading into other organisms in the environment.

The review also confirms that there is no evidence that chemicals used in aquaculture persist and accumulate in the food chain.

The Scottish Government Expert Working Group on Siting of Aquaculture Facilities has also assessed the sensitivity of protected habitats. EQS values are precautionary and take risk into account, thus ensuring that any threat is minimal. It is further pointed out that enrichment/smothering of a habitat is more of an issue than problems with chemical use. This latter possibility is controlled through the planning process and SEPA controls.

### **Sustainability of Feed Supply**

I note that salmon aquaculture is now a net producer of marine protein and salmon have an excellent food conversion factor compared with land-based animal production.

### **The use of Wrasse as Cleaner Fish in the Salmon Farming Industry.**

Although concerns have been expressed about the removal of wrasse from the wild, the salmon farming industry is investing considerably in the farming of wrasse and lumpsuckers in order to reduce any possible impact. Industry has already embarked on a series of initiatives designed to demonstrate that, where wrasse are accessed from the wild, this is done in a sustainable manner.