

RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SALMON FARMING IN SCOTLAND

SUBMISSION FROM FIDRA

Who we are

[Fidra](#) is a charity based in East Lothian, Scotland. We seek to find ways to engage local concerns over current and emerging environmental issues, and use this to contribute to wider dialogue at national and international levels. We use scientific evidence and best practice to establish how best to influence positive environmental change. Our current Best Fishes project is looking at traceability of Scottish salmon and certification standards used by the aquaculture industry. We welcome the opportunity to provide written evidence to the inquiry.

1. Do you have any general views on the current state of the farmed salmon industry in Scotland?

There is cause for concern over many areas of the industry, in particular the potential environmental impacts of poor siting; effluent discharge; pesticide and antibiotic use; the use of forage fish in feed; sea lice on farmed and wild fish; proximity to Marine Protected Areas (MPAs) and exploitation of wild wrasse populations. All have the potential to impact the wider ecosystem and leave a legacy of irreversible damage to Scotland's marine environment.

The concerns are compounded by a lack of data, transparency, adequate monitoring and evidence of enforcement. For example, there is limited data on environmental parameters that are regularly monitored, such as sea lice and water quality, and available data is often not comprehensive. In Norway a government website gives easy access to information on levels of pollutant and pharmaceutical chemicals in farmed salmon and sea lice numbers¹. Sea lice numbers are reported weekly and published online². Regular environmental monitoring below and around fish farms is required and the results published by the Norwegian Directorate of Fisheries³. In Australia an example of best practice is shown by the company Huon Aquaculture, which publishes live data on several parameters including antibiotic use, environmental measurements and mortality of wildlife⁴. While the Scottish Salmon Producers Organisation has published monthly lice averages with its quarterly Fish Health reports since 2013, this just gives an overview and cannot usefully be correlated with farm by farm sediment survey or treatment data on the Scottish Aquaculture⁵ or Scottish Environment⁶ websites. Published farm by farm lice data would increase transparency and enable analysis of individual farms or smaller areas i.e. individual lochs⁷. Information on regulation and enforcement is also not in the public domain, which makes it difficult to know how effective it is. For example, FOI requests on sea lice data show apparent enforcement in the use of warning letters, the step preceding an enforcement notice according to current guidance.

There is a lack of clarity on punitive measures, as to whether there are penalties in legislation or regulations, and whether penalties are enforced. This does not promote confidence in the effectiveness of present regulation. The Scottish Government can draw from and build on the Norwegian and Australian examples. Transparency in data collection and dissemination will encourage good management practices and innovation. The use of farm-level data now available in Norway has shown that location of farms significantly impacts losses due to sea lice⁸. Scotland can become a world leader for environmentally sustainable salmon farming, ensuring Scottish salmon remains a prime product long into the future. Protecting the marine environment is essential to achieve this longevity and will require difficult decisions, in particular more stringent regulation and the closure of sites rated 'unsatisfactory', as well as significant funding of research and innovation. This is of increased importance at a time when salmon farming faces challenges around the world. Washington State in the USA is phasing salmon farms out altogether⁹ and in Norway a recent cap on expansion of farm sizes and number of farms, and the introduction of research and development licenses, is supplemented by stricter regulations on sea lice counts¹⁰.

2. There have been several recent reports which suggest how the farmed salmon industry might be developed. Do you have any views on action that might be taken to help the sector grow in the future?

A strong precautionary approach is needed regarding the potential environmental impact of any growth of the sector, either through increasing biomass at present sites, or development of new sites. A moratorium on further expansion should be considered until it can be shown that any growth in the industry will have no adverse environmental impact. The recent SAMS review on salmon farming in Scotland concludes that increased nutrient input from food and faecal waste is not of concern if dispersion is adequate, indicating that thorough investigation of new sites and reassessment of current sites is needed to ensure that is the case¹¹. Possible inaccuracies in dispersion modelling make this highly pertinent, in particular as there is a lack of knowledge of how increased nutrient concentrations impact the dispersal of treatment chemicals. Adoption of new technology and research into mitigation of nutrient and chemical deposition in the marine environment is essential for any growth to have minimal environmental impact.

As the sector is already experiencing challenges, for example with high sea lice counts requiring increased chemical treatment use, growth should not be considered until present concerns have been adequately addressed. There is a pressing need for Scotland to show increased transparency and enforcement, as well as adoption of and research into new technologies such as closed containment¹², offshore farms¹³ and aquaponics¹⁴. Any increase in salmon production is likely to mean increased escapes and larger farm sizes may mean more fish escape in a single incident, both raising the risk of genetic introgression into wild salmon populations¹⁵. Effective mitigation against this would be to use alternative farming methods such as

offshore and onshore closed containment, which could be enabled and encouraged through Government incentives. Increased demand for salmon feed that will result from any growth in the industry will impact the environment through the demand of retailers for high omega-3 content in salmon, which requires fishmeal and fish oil in salmon diets, sourced from wild fisheries and by-product trimmings¹⁶. Increased recycling of by-catch and waste from fish processing can mitigate this, but alternative sources such as cultivated micro-organisms or genetically-modified oil-seed plants may be needed in the long-term, which may not be accepted by public opinion or Scottish government policy¹⁷.

3. The farmed salmon industry is currently managing a range of fish health and environmental challenges. Do you have any views on how these might be addressed?

In addition to measures mentioned above, immediate changes in farming practice should be considered, such as fallowing during sensitive periods for wild fish and prolonged growth of smolt stages before transfer to open sea pens. A review of present available seabed survey and sea lice data could be used to identify poorly performing farms which may no longer be viable sites in environmental terms. Relocation to more suitable sites or complete closure should be required in such cases. A strong precautionary approach and Environmental Impact Assessments should be used when selecting new sites. New farms should not be located within MPAs and those already within them should be assessed for relocation. MPAs are at risk of environmental degradation from effluent, pesticides and antibiotics as well as the impact of diseases and parasites associated with salmon farming operations. Siting farms at a suitable distance from MPAs has been shown to remove the risk of farm-sourced sea lice impacting the health of wild fish within them¹⁸.

Increased research into alternatives to chemical treatments are essential for a sustainable farmed salmon industry. Merely using lower levels of treatments may lead to increased resistance¹⁹, already apparent for many in use²⁰. In addition there is a lack of knowledge of the long term effects that low levels have on other species in the receiving environment²¹. A complete ban on emamectin benzoate should be considered. The uptake of new and emerging technologies proving successful in scientific trials²² should be encouraged and subsidised. Closed containment with recirculating aquaculture systems (RAS) on land could be a solution in areas where open water sites are not tenable. Development is already underway in Scotland²³. In Norway research into various designs of at sea closed containment systems has none presently in commercial use²⁴. Additional non-chemical treatment methods are developing rapidly, such as the hydrolicer²⁵ and the use of cleaner fish²⁶. It should be noted that the increasing use of cleaner fish requires strict regulation, with concerns already apparent on the use of wild-caught wrasse²⁷. There should be no increase in biomass on present farms and no new farms until the industry can show compliance with present regulations. Of particular concern are the exceedance of lice limits and unsatisfactory seabed surveys, for which strong penalties should be

considered early on rather than, for example, after 3 breaches and a warning letter, as is the case for sea lice²⁸.

4. Do you feel that the current national collection of data on salmon operations and fish health and related matters is adequate?

Much of this is not in the public domain, giving the impression that it is inadequate and indicating a need for all auditing and monitoring data to be available. Certainly collection and publication of weekly lice data as done in Norway is desirable, on a farm by farm scale. Monitoring of chemicals and effluent can be improved by increasing measurement sensitivity and co-ordinating chemical sampling with sampling of the seabed community. The lack of long-term research on seabed impacts means subtle and long-term effects of chemicals on the marine environment are poorly understood, indicating a need for more long-term data collection. This is of particular significance for areas of sensitive biodiversity, such as in MPAs which have been set up to protect sensitive species and are now becoming hotspots for salmon farm development.

A record of inspections and actions taken by regulatory bodies that is easily accessible to the public is needed, to increase the transparency of the industry. This would be particularly helpful for stakeholders when involved in consultations for new farms or changes to existing sites. At present the Scottish Environment website presents a clear but basic graphical summary of seabed survey and treatment data, with more detailed data available on the Scottish Aquaculture website. The latter is not user-friendly and to look at more than one parameter being measured on a single farm is a convoluted process. A more accessible system would amalgamate the Scottish Aquaculture website data for individual farms and link it to the Scottish Environment website. There is a reliance on other bodies to collect data, such as rivers and fisheries trusts monitoring impacts on wild fisheries. An overarching body should be put in place to collate and co-ordinate data collection, with greater emphasis on monitoring environmental factors adjacent to farm sites by both industry and regulatory bodies. The SAMS review produced for the ECCLR committee reported a lack of detailed feed information in Scotland²⁹, which is important when considering the wider environmental impact of the industry through depletion of marine resources for feed.

5. Do you have any views on whether the regulatory regime which applies to the farmed salmon industry is sufficiently robust?

Again, much of this is not in the public domain. For example in its evidence to the ECCLR committee inquiry, SEPA stated it had reduced the permitted biomass at a number of farms where there were unacceptable impacts on the health of the seabed, yet details of this information is not available to the public. Similarly, farm by farm information on the Scottish Environment website shows 'unsatisfactory' seabed surveys but no detail, or if any remedial action was required. The use of lethal control measures for marine mammals and birds is also lacking in effective monitoring and regulation³⁰. Significant improvements since 2011 have resulted in a marked

decrease in seal deaths, but a reliance on self-reporting and lack of independent verification means license conditions can be breached. In addition the use of Acoustic Deterrent Devices (ADDs) on fish farms to deter seals is not monitored or licensed. Concerns about the impact of ADDs on other marine species such as cetaceans means this needs to be addressed, i.e. through recording on a national marine noise register³¹. The remainder of the regulatory regime lacks rigour and robustness, an example being the decrease in SEPA visits, including a proportionally greater decrease in unannounced visits³². There is a lack of evidence of enforcement of present regulations, and apparent lack of punitive legislation such as penalties for breaching licence conditions. All data on breaches and punitive action should be available to public view. An overarching regulatory body for aquaculture is now essential, and is a role suited to institutions already involved such as SEPA or Marine Scotland.

6. Do you have any comments on how the UK's departure from the European Union might impact on the farmed salmon sector?

Present European Union Directives have been used extensively to shape UK legislation, and departure from the EU risks losing this structure and guidance. There is a need to ensure present guidelines are maintained and improved on. The Water Framework Directive commits EU member states to achieve good qualitative and quantitative ecological and chemical status of all water bodies, and can require measures to be taken to achieve and maintain this. Chemical status is assessed against environmental quality standards set at EU level in the Environmental Quality Standards Directive. The EU Marine Strategy Framework Directive (MSFD) aims to achieve 'Good Environmental Status' in marine waters by 2020, for which 11 descriptors of the state of the environment have been defined: biodiversity, non-indigenous species, commercial fish, food webs, eutrophication, sea-floor integrity, hydrographical conditions, contaminants, contaminants in fish and seafood, litter, and underwater energy such as noise³³. As part of this healthy populations of birds and marine mammals are required. Under the EU Habitats Directive, seals are listed as species of community interest for which disturbance, injury or killing may be subject to management measures. The grey and common/harbour seal are both listed in Annex II which requires Special Areas of Conservation to be designated for them. Birds are also protected under the Wild Birds Directive, which emphasises protection of habitat for rare species through Special Protection Areas. The marketing of all veterinary medicines is regulated by the EU's directives. The use of authorised chemicals is additionally controlled through Scottish regulations designed to comply with the Water Framework Directive and the Dangerous Substances Directive. The latter mandates a requirement to impose standards and safety factors on all chemicals discharged into the marine environment. Maximum Residue Limits in all food products are presently set by the EU. Other potentially relevant legislation are the Environmental Impact Assessment and the Strategic Environmental Assessment Directives, and Regulation on invasive alien species.

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- ¹ <https://www.regjeringen.no/en/topics/food-fisheries-and-agriculture/fishing-and-aquaculture/farmed-salmon/id495344/>
- ² <http://lusedata.no/>
- ³ <https://www.fiskeridir.no/English>
- ⁴ <https://dashboard.huonaqua.com.au/>
- ⁵ <http://aquaculture.scotland.gov.uk/data/data.aspx>
- ⁶ <https://www.environment.gov.scot/data/data-analysis/marine-fish-farm/>
- ⁷ <https://beta.gov.scot/publications/foi-17-02754/>
- ⁸ Abolofia *et al* (2017) *Marine Resource Economics*, **32**, 329-349.
<https://doi.org/10.1086/691981>
- ⁹ <https://www.smithsonianmag.com/smart-news/washington-state-bans-atlantic-salmon-farming-180968600/>
- ¹⁰ <https://www.reuters.com/article/norway-salmon/norway-introduces-new-salmon-farm-regulation-to-combat-sea-lice-idUSL5N1GL3JU>
- ¹¹ SAMS Review of the Environmental Impacts of Salmon Farming in Scotland – page 51;
http://www.parliament.scot/S5_Environment/General%20Documents/20180125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf
- ¹² <https://www.fishfarmingexpert.com/article/marine-harvest-ready-to-hatch-egg-by-2019/>
- ¹³ <https://www.fishfarmingexpert.com/article/all-going-swimmingly-on-offshore-salmon-farm/>
- ¹⁴ <https://thefishsite.com/articles/char-and-salmon-stocked-in-groundbreaking-aquaponics-site>
- ¹⁵ Karlsson *et al* (2016) *ICES Journal of Marine Science*, **73**, 2488-2498.
<https://doi.org/10.1093/icesjms/fsw121>
- ¹⁶ Shepherd *et al* (2017) *Aquaculture*, **467**, 49-62.
<https://doi.org/10.1016/j.aquaculture.2016.08.021>
- ¹⁷ SAMS Review of the Environmental Impacts of Salmon Farming in Scotland – page 102;
http://www.parliament.scot/S5_Environment/General%20Documents/20180125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf
- ¹⁸ Serra-Llinares *et al* (2014) *Aquaculture Environment Interactions*, **5**, 1-16. <http://www.int-res.com/articles/feature/g005p001.pdf>
- ¹⁹ Overton *et al* (2017) *Pest Management Science*, **74**, 535-540.
<https://doi.org/10.1002/ps.4751>
- ²⁰ Aaen *et al* (2015) *Trends in Parasitology*, **31**, 72-81.
<https://doi.org/10.1016/j.pt.2014.12.006>
- ²¹ SAMS Review of the Environmental Impacts of Salmon Farming in Scotland – page 81;
http://www.parliament.scot/S5_Environment/General%20Documents/20180125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf
- ²² Oppedal *et al* (2017) *Pest Management Science*, **73**, 1935-1943.
<https://doi.org/10.1002/ps.4560>
- ²³ <https://www.fishfarmingexpert.com/article/foreign-buyers-eye-machrihanish-ras-plant/>
- ²⁴ <http://ctrllaqua.no/>
- ²⁵ <https://hydrolicer.no/?lang=en>
- ²⁶ Powell *et al* (2017) *Reviews in Aquaculture*, **0**, 1-20. <https://doi.org/10.1111/raq.12194>
- ²⁷ <http://www.openseas.org.uk/2017/10/30/cleaning-up-the-cleaner-fish/>
- ²⁸ <http://www.gov.scot/Resource/0052/00522428.pdf>
- ²⁹ SAMS Review of the Environmental Impacts of Salmon Farming in Scotland – page 93;
http://www.parliament.scot/S5_Environment/General%20Documents/20180125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf

³⁰ SAMS Review of the Environmental Impacts of Salmon Farming in Scotland – page 107; http://www.parliament.scot/S5_Environment/General%20Documents/20180125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf

³¹ Merchant *et al.* (2017) *Conservation Letters*, **00**, 1-9. <https://doi.org/10.1111/conl.12420>

³² http://www.parliament.scot/S5_Environment/General%20Documents/053_Sepa_supp_2.pdf

³³ European Commission (2016) In the application of the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) in relation to aquaculture