

RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SALMON FARMING IN SCOTLAND

SUBMISSION FROM OneKind

OneKind is grateful for the opportunity to contribute to this Inquiry. High standards of welfare are important in their own right and to the reputation of the salmon farming industry with consumers in the UK and globally. We were pleased to see consideration of fish welfare in the Environment, Climate Change and Land Reform (ECCLR) Committee report on the environmental impacts of salmon farming, published in March this year. We urge the Rural Economy and Connectivity (REC) Committee to give full consideration to the welfare of farmed salmon throughout the current inquiry.

Q1. Do you have any general views on the current state of the farmed salmon industry in Scotland?

In a number of respects, the current state of salmon farming seriously compromises the welfare of salmon. Mortality rates are estimated to be over 20%¹. In 2016, over 10 million salmon died on Scottish salmon farms². Recent data published by the Scottish Government on the Scotland's Aquaculture website suggests that this figure increased to over 11 million in 2017³.

The table below shows some of the ways in which the welfare of salmon is compromised on salmon farms.

Issue	Detail	Example
Containment	Being enclosed in cages means that salmon cannot escape adverse interactions. This could be from other salmon or other threats such as harmful algal blooms or jellyfish.	In 2016, 520,000 salmon died following exposure to a harmful algal bloom. ⁴
Industry Practices	Handling, grading, crowding and transportation can all cause stress, physical damage and death.	600 fish died from handling stress at Outer Eport ⁵ .
Diseases	There are many diseases that affect farmed salmon. This is not surprising given that the confined nature of salmon	The site MacLean's Nose ⁶ , which can have up to 2500 tonnes of salmon on site, reported the following percentage mortality

¹ <http://www.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S5W-13432&ResultsPerPage=10>

² Scottish Fish Farm Production Survey 2016 <http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/surveys>

³ Scotland's Aquaculture website: Fish farms monthly biomass and treatment reports.

http://aquaculture.scotland.gov.uk/data/fish_farms_monthly_biomass_and_treatment_reports.aspx

⁴ Fish Health Inspectorate, Published Case Information 2016. <http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/CaseInformation/caseinfo2016>

⁵ Fish Health Inspectorate, Published Case Information 2017. <http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/CaseInformation/caseinfo2017>

⁶ Marine Harvest Scotland- Gravid Sea Lice and Mortality Reports 2017

<http://www.marineharvestscotland.co.uk/2017/08/19/marine-harvest-scotland-gravid-sea-lice-mortality-reports-2017/>

	<p>farming creates the ideal conditions for the spread of disease.</p> <p>Diseases that impact farmed salmon include Amoebic Gill Disease (AGD), Cardiomyopathy Syndrome (CMS) Haemorrhagic smolt syndrome, Infectious Salmon Anaemia (ISA) and Pancreas Disease.</p>	<p>caused by CMS over a period of 7 months in 2017:</p> <ul style="list-style-type: none"> - 10.79% mortality in February - 11.17% in March - 12.6% in April - 13.96% in May - 9.77% in June - 4.07% in July - 4.15% in August
Sea Lice	<p>Sea lice feed on the skin and flesh of salmon. This can cause fin erosion, skin lesions, increased stress, reduced swimming capability and imbalanced water and salt levels.</p> <p>Sea lice also increase the susceptibility to disease, and can act as vectors, transmitting diseases such as ISA.</p>	<p>Research⁷ has found that infection with sea lice can lead to increased levels of the stress hormone cortisol, for up to 21 days after exposure.</p>
Treatment for sea lice and disease	<p>Treatment for sea lice and disease can cause stress, injury, and even death to salmon. Thermolicer, Hydrolicer, hydrogen peroxide and Salmosan have all had negative impacts on salmon.</p>	<p>The use of hydrogen peroxide resulted in the deaths of 92,000 fish at the salmon farm Sgian Dubh, in November 2015⁸.</p>

To fully understand the severity of these issues, it is important to acknowledge that salmon are sentient animals. This means that they are capable of feeling fear, pain and distress, as well as a sense of well-being, and this is why their welfare is protected by domestic and international legislation. In particular, fish have been shown to possess all the necessary attributes for feeling pain⁹. For example, exposure to a noxious stimulus has been shown to stimulate the area of the brain known as the telencephalon in Atlantic salmon. Further evidence that salmon are capable of feeling pain is that they alter their behaviour in response to an adverse experience¹⁰.

Q2. Do you have any views on action that might be taken to help the sector grow in the future?

We note the aquaculture industry’s aspirations to double in size by 2030¹¹, and we have concerns over some of the proposed directions that salmon farming may take.

⁷ Mustafa *et al.* (2000). Effects of sea lice (*Lepeophtheirus salmonis* Kröyer, 1837) infestation on macrophage functions in Atlantic salmon (*Salmo salar* L.)

⁸ Fish Health Inspectorate Publication of Case Information 2016. <http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/CaseInformation/caseinfo2016>

⁹ Sneddon (2015). Pain in aquatic animals.

¹⁰ Bjorge *et al.* (2011). Behavioural changes following intraperitoneal vaccination in Atlantic salmon (*Salmo salar*).

¹¹ <http://scottishsalmon.co.uk/wp-content/uploads/2016/10/aquaculture-growth-to-2030.pdf>

One of these is a potential move to closed containment systems on land. Closed containment is more expensive than keeping salmon in seawater pens. To compensate for the increased expense, it is expected that the industry will stock salmon at higher densities. Higher stocking densities can compromise welfare through:

- Decreased water quality. Greater numbers of fish can mean increased production of waste and a reduction in dissolved oxygen¹².
- Increased aggressive interactions. Research¹³ has shown that placing salmon in high densities increases the incidence of fin damage, largely because of fin biting by other salmon.
- Exacerbating disease transfer. Placing fish within cages with large numbers of other fish is likely to exacerbate the transfer of diseases and parasites.

Another direction that the industry may take is moving farms further offshore. If this were to happen then salmon would be exposed to harsher sea conditions, which would likely result in a higher risk of escapes and mortalities. Offshore fish farms would also be harder to access, making monitoring of fish health and welfare challenging.

OneKind believes that the proposed growth of aquaculture can only be regarded as sustainable and ethical if it results in positive improvements to the welfare of farmed fish. Given the many welfare threats identified under the current system, we believe that this will be challenging.

Q3. Do you have any views on how fish health and environmental challenges might be addressed?

Fish Health

As noted previously, salmon on Scottish farms suffer from a plethora of diseases associated with the conditions in which they are reared.

While disease is, in itself, a welfare issue, the current methods of treating disease and sea lice can also compromise the welfare of salmon. Certain treatments have been shown to cause high mortality levels, including:

- **Thermolicer.** 95,000 fish died at Greshornish¹⁴ following the use of Thermolicer.
- **Hydrogen peroxide.** 50,000 fish died following hydrogen peroxide treatment for AGD at the fish farm site Cairidh¹⁵.

¹² Compassion in World Farming report "Closed waters: the welfare of farmed Atlantic salmon, rainbow trout, atlantic cod & atlantic halibut"

¹³ Canon Jones *et al.* (2011): Social network analysis of the behavioural interactions that influence the development of fin damage in Atlantic salmon parr (*Salmo salar*) held at different stocking densities.

¹⁴ BBC news. Scottish salmon farming's sea lice "crisis" <http://www.bbc.co.uk/news/uk-scotland-38966188>

¹⁵ Fish Health Inspectorate, Publication of Case Information 2016.

- **Salmosan** treatment resulted in the death of 20,718¹⁶ fish at the salmon farm Gob a Bharra (Loch Fyne)

Undergoing treatment causes stress to fish because handling, crowding and exposure to adverse environments are all part of the process. There is also no guarantee that treatment will work, meaning that fish are often exposed to multiple, stressful treatments.

Whilst argued to be an environmentally friendly alternative, the use of cleaner fish-wrasse and lumpsucker – also raises welfare concerns. The projection that 10 million cleaner fish will be needed in Scottish salmon farming by 2020¹⁷ raises serious concerns. There is very little research into how the biology and behaviour of cleaner fish is suited to captivity. Furthermore, cleaner fish welfare can be compromised on salmon farms through aggressive interactions with salmon, poor husbandry, disease spread, disposal after a production cycle, and treatment mortalities.

An incident at the salmon farm Nevis B, reported in 2016¹⁸, illustrates how the welfare of cleaner fish can be compromised. 22,000 wrasse had been introduced to the site from the hatchery at Machrihanish, but soon after many fish died, leaving only 12,000 wrasse left on site.

Treatment needs to be improved so that it does not compromise fish welfare, but we believe that emphasis should also be placed on the prevention of sea lice infestation, for example, through the use of fallowing, and sea lice snorkels¹⁹. However, as with treatments, preventative measures should be assessed for welfare implications before use.

Environmental challenges

In 2016, over 300,000 fish²⁰ escaped from farms. At the time of writing, so far in 2018 there have been five escape incidents from Scottish salmon farms²¹. In one incident at Loch Snizort, an estimated 21,700 salmon escaped.

Salmon on fish farms have been selectively bred for fast growth, meaning that other aspects of their biology are often compromised. Research shows that they often have an abnormal heart shape²², abnormal swim bladder²³, and are often deaf²⁴. This means that farmed salmon are no longer well adapted to a life in the wild. Consequently, once they escape their welfare will be compromised. Despite this

¹⁶ Fish Health Inspectorate, Publication of Case Information 2016.

¹⁷ Powell et al. (2017). "Use of lumpfish for sea-lice control in salmon farming: challenges and opportunities"

¹⁸ Fish Health Inspectorate, Publication of Case Information <http://www.gov.scot/Resource/0051/00517227.pdf>

¹⁹ Stien et al. (2016). 'Snorkel' sea lice barrier technology reduces sea lice loads on harvest-sized Atlantic salmon with minimal welfare impacts

²⁰ <http://www.bbc.co.uk/news/uk-scotland-41327433>

²¹ Scottish Aquaculture data on fish escapes http://aquaculture.scotland.gov.uk/data/fish_escapes.aspx

²² Poppe et al. (2003). Heart morphology in wild and farmed Atlantic salmon *Salmo salar* and rainbow trout *Oncorhynchus mykiss*

²³ Poppe et al. (1997). Swimbladder abnormality in farmed Atlantic salmon *Salmo salar*

²⁴ Reimer et al. (2017). Rapid growth causes abnormal vaterite formation in farmed fish otoliths

there is evidence that escaped farmed salmon can interbreed with wild salmon²⁵. Their progeny will likely have reduced fitness as a result.

One of the proposed solutions to potential interbreeding due to escapes is the use of triploid fish, which are sterile. However, triploid fish are more likely to have spinal deformities²⁶, are more vulnerable to temperature stress²⁷, and, when mixed with diploid salmon, are more likely to face aggression from others than their diploid counterparts²⁸. As a result, triploids face reduced survival compared to diploid salmon, as well as poorer welfare.

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

Collection of data on fish health currently fails to reflect fish as individual, sentient beings. Whilst mortality weight data is currently published on the Scottish Aquaculture website, the number of fish that have died is not available. We believe that this data should be published.

We also agree that sea lice data should be published on a farm by farm basis. We were therefore pleased to hear that data on mortality and sea lice abundance will be published on a farm by farm basis. We urge that this happens as soon as possible.

²⁵ Karlsson et al. (2016). Widespread genetic introgression of escaped farmed Atlantic salmon in wild salmon populations

²⁶ Fjellidal and Handsten (2010). Vertebral deformities in triploid Atlantic salmon (*Salmo salar* L.) underyearling smolts

²⁷ Fraser *et al.* (2012): Welfare considerations of triploid fish

²⁸ Carter *et al.* (1994): Food consumption, feeding behaviour, and growth of triploid and diploid Atlantic salmon, *Salmo salar* L., parr.