

Salmon farming in Scotland

Submission from Coastal Communities Network Scotland

Introduction

The Coastal Communities Network Scotland is a network of 30 community-led coastal groups that aim to protect, restore, and sustainably use coastal & marine resources for the benefit of nature, people, and climate.¹ In 2018, CCN participated in an ECCLR Committee information session for the joint ECCLRC/RECC inquiry into salmon farming.² CCN is grateful to have also been asked to take part in the RAI Committee's information session on 5th June this year³, to examine the implementation of the recommendations of the REC Committee's session 5 report.

For ten years, CCN has represented groups in communities that care about Scotland's sea. Their members are economically-active and contribute greatly to the communities in which they live, volunteering to improve the sea on which they and their neighbours depend. They are well-informed about open net salmon farming and are deeply concerned about its impacts, given the industry's relentless push to expand.

Salmon Scotland dislikes those who argue that salmon farming can and should be done better. Its critics are not irresponsible activists. It is wrong to claim that people who farm salmon are best placed to know what coastal communities want. Many of them do not live in the communities most affected by the farms.

Salmon are farmed in open nets, using the sea for free waste disposal. The small amount of progress on the recommendations of the 2018 REC Committee's report shows that the industry is unable or unwilling to alter this model. Too often, the sector's regulators are failing to keep it within environmental and animal welfare limits. The four *Case Studies* below give examples of how slowly the Scottish Government and its agencies have acted to change the status quo, since the 2018 Inquiry. As a result, salmon farming is losing its social licence to operate, to the detriment Scotland's reputation as a world-class food producer.

CCN's groups know first-hand that every job matters in Scotland's coastal communities, but they believe there would be just as many jobs, and probably more, if salmon farming companies committed to being better neighbours, by reducing their impacts on the environment and on other users of the sea, and to farming fish humanely, with higher standards of animal welfare and far lower levels of mortality. Salmon farm operators could restore some social licence by following their own Community Engagement Charter and withdrawing new farm plans when a majority of a community's residents do not want them.

Climate change is an existential threat, with no real solution, which is being largely ignored by the planning system. The main bank that lends to Norway's salmon farmers says that the industry globally is losing its social licence as a result of hitting "its biological ceiling".⁹⁸ That seems to be the case here.

The latest Scottish Government Fish Farm Production Survey (published in October 2024) and the FHI's mortality figures, show that in 2023, salmon farming had the lowest production and highest mortality for decades, with poor animal welfare and direct farming jobs falling overall.

Salmon farmers must solve their many problems before being allowed to expand further.

¹ <https://www.communitiesforseas.scot/>

² <https://archive2021.parliament.scot/parliamentarybusiness/report.aspx?r=11359&c=2063596>

³ <https://www.parliament.scot/api/sitecore/CustomMedia/OfficialReport?meetingId=15919>

For additional references and sources of information, see the *More details* section below

Summary

I. Environmental impacts and regulatory reform, including interactions with wild salmon

The 2018 Inquiry called for urgent and meaningful action on environmental impacts and regulatory reform, before the industry could expand (rec. 2). Despite the subsequent large expansion, there has been little change from the status quo.

At that time, according to SEPA, salmon farming was the biggest polluter of Scotland's sea and the only one allowed to discharge large quantities of biocides into the sea, mostly where crustacean fisheries employ many more people than fish farms.^{59,60} As the pollution regulator, SEPA has not moved urgently to change this situation.

SEPA did bring in new seabed regulations in 2019, to nudge the development of bigger farm towards higher-energy sites, which can disperse more pollution. More seabed impact monitoring stations are required as well, but five years on, SEPA has still not applied these regulations to a significant proportion of existing farms.

This year, SEPA brought in a new sea lice regulatory framework (SLRF) that now applies to new farm proposals. It will not reduce the impact of sea lice from existing farms on wild salmon and sea trout for another 4 or 5 years. SEPA claims that until then, the SLRF will prevent deterioration in wild salmon populations, but, at best, it might only freeze the rate of decline. (See *Case Study 4* below)

This is not urgent or meaningful change - wild salmon are now classed as endangered but SEPA is not being properly precautionary (recs. 40, 46, 47, 48 & 49).

To prevent and reverse deterioration in salmon populations, due to sea lice, SEPA should set strictly enforced, precautionary springtime sea lice caps on high-risk farms, in high- and medium-risk areas, similar to the levels set in Norway. Caps should also be applied to farms in areas through which fish must pass from salmon breeding SACs and from freshwater pearl mussel SACs.

SEPA should also act now, in a precautionary way, to protect sea trout, year-round, in all areas.

On pesticides, during the next year SEPA has promised to review how toxic fish farm "bath" chemicals are being used. This seems like progress towards RECC recs. 31-33, albeit seven years after the Inquiry, however, following a recent review of one bath chemical (azamethiphos), SEPA is now allowing some salmon farms to increase discharges by 2-300%. Norway has banned the discharge of another bath chemical, hydrogen peroxide, from fish farms within 500m of shrimp fishing and spawning areas, but SEPA still sets no limits on its use.

Since 2017, SEPA has known that its environmental standards for another widely-used fish farm pesticide, emamectin benzoate, were not preventing harm to marine life. SEPA's letter to the RAIC shows that since then, it has allowed 196 existing salmon farms²⁹ to continue discharging the same harmful quantities of emamectin. In June, the Scottish Government confirmed that this will continue to happen until 2028.³⁰ (See *Case Study 1* below)

The RECC report commented on SEPA's "light touch" regulation of fish farming. While SEPA has made some changes that will eventually reduce some of the environmental harm that it allows fish farms to do, it is applying these changes so slowly that many of them will not take effect for years, in some cases more than a decade after the Inquiry.

Since 2014, SEPA has had a duty to achieve sustainable economic growth.⁴ This is inconsistent with its primary purpose, to protect the environment. This duty should be removed from its remit, and also from NatureScot's.

The 2018 Inquiry called for “more open and transparent reporting of regulatory breaches” and “a move away from the self-assessment culture that appears to be prevalent at present” (rec. 63).

In 2018, SEPA said that fish farming was the least compliant industry it regulates. Recently, SEPA told the RAIC that compliance rates have improved. It provided no proof. Non-compliance with the seabed impact regulations still seems to be high⁵ but the true extent is hard to assess because SEPA is so far behind in publishing its assessments of seabed compliance. Separately, it remains impossible for the public to check fish farms' compliance with their bath chemical discharge licences, and SEPA has produced no Compliance Assessment Scheme reports for companies since 2019.

The Scottish Government should follow the EU's and the UN's example, and its own commitment to OSPAR, and instruct SEPA to set a timeline for reducing, then ending the discharge of toxic chemical pollution from fish farms.

The 2018 Inquiry called for detailed spatial planning for fish farming (recs. 51 & 52) (also required by the National Marine Plan), but there has been no progress on this except for the new sea lice regulatory framework, which applies only in limited areas. Meanwhile, the Marine Directive has quietly abandoned its spatial planning system⁶ (the heat maps mentioned in rec. 51).

As a result, SEPA, the Marine Directive and NatureScot have still not assessed the cumulative impact of the whole industry on marine life, or on other users of the sea, so there is no way to know whether Scotland's seas can accommodate the industry's hoped for production of 300-400,000t of salmon by 2030.⁷ The National Marine Plan 2 may result in proper marine spatial planning, but that is some years away.

SEPA, the Marine Directive and NatureScot should fill knowledge gaps (rec. 31) on the cumulative impact of chemical discharges from all farms, on commercial species (as requested repeatedly by fishermen's organisations and others), on Priority Marine Feature species and habitats, and on MPAs and SACs. This should include their chronic effects over time. The cumulative impact of particulate waste and dissolved nutrients are also unknown and should also be assessed.

SEPA should also use its new sea lice modelling capability to assess the cumulative impact of sea lice emitted by all salmon farms, on Scotland's wild salmon and sea trout populations, and then make a national plan accordingly, as statutory advice for Local Authorities when they are considering salmon farm proposals, along with SEPA's site-specific sea lice risk modelling.

It is vital to understand how climate change is already affecting the viability of salmon farming, and where new and existing farms should and should not be sited. This must be reflected in updated regulations and statutory guidance.

The Government has not implemented the Inquiry's recommendations 48, 49 & 50, to issue guidance to Local Authorities and its agencies on how they should apply the precautionary principle to fish farm consenting decisions.

⁴ <https://www.legislation.gov.uk/asp/2014/3/section/51>

⁵ Scotland's Aquaculture https://aquaculture.scotland.gov.uk/data/environmental_monitoring_surveys.aspx

⁶ *'Improving Locational Guidance Project - Aquaculture Opportunity and Constraint'*

⁷ <https://foodanddrink.scot/helping-business/other-resources/publications/aquaculture-growth-to-2030-a-strategic-plan-for-farming-scotland-s-seas/>

Farmed salmon escapes are a serious threat to wild salmon. Marine Directive research has found farmed salmon genes in c.25% of sampled wild fish. In 2022, 52,463 farmed salmon escaped, with another 80,001 in 2023, yet the Government has made no progress on the 2018 Inquiry's recommendation 37, that companies should be fined when fish escape.

The Inquiry called for better data reporting. Sea lice counts are reported weekly - an improvement - but despite several of the Inquiry's recommendations, fish farm data remains incoherent and not fully transparent, with no integration of full mortality information alongside sea lice counts or chemical treatments and almost nothing on cleaner fish. The Scotland's Aquaculture website should be overhauled, funded by an industry levy (rec. 24). Norway's Barentswatch site is exemplary.

Millions of wild wrasse are fished for use as cleaner fish. They are a keystone species in rocky reefs and kelp forests, preventing urchin barrens from forming. The 2018 Inquiry (recs. 26-28) called for consideration of "the need for regulation of cleaner fish fishing to preserve wild stocks and avoid negative knock on impact in local ecosystems", and for the Government to, "assess whether management measures are appropriate and proportionate to the current and anticipated future levels of sustainable wild wrasse fishing in Scotland...as a matter of urgency".

Appropriate Assessments of removing wrasse from reef/kelp SACs are a legal requirement, but the Marine Directive has done none. The fisheries management measures introduced after the 2018 Inquiry are inadequate - Scotland needs similar wrasse fisheries measures to those introduced in England, with minimum & maximum landing sizes, spatial closures, and a seasonal closure during the wrasse breeding season. If the Scottish Government delays inshore fisheries management plans for two more years, including the wrasse fishery, then meaningful action on the RECC recommendations 26-28 will have been postponed for at least eight years.

The use of wrasse as cleaner fish, and then their slaughter, is unethical. It should be halted.

II. Animal welfare

The Scottish Government has failed to meet any of the REC Committee's recommendations on fish health and welfare.

The Inquiry called for enhanced and effective regulatory standards to properly manage fish health issues (rec. 60) and for urgent and meaningful action on fish health, before the industry could expand (rec. 2). Instead, overall mortality rose more than four-fold from 2018 to 2023⁸, according to FHI figures, and six-fold in seawater farms, while more than 60,000t of new salmon biomass was given planning consent during that time⁹. The actual mortality was substantially higher because the FHI's figures have significant reporting exemptions (see ANNEX).

High salmon mortality almost always indicates poor fish health and welfare. Cleaner fish mortality is also extremely high.

The Scottish Government's 2023 Fish Farm Production Survey shows that salmon mortality averaged 31.3% across all marine farms, for the most recent year-class of smolts (2021 input), during their time at sea¹⁰ - the worst death rate since 1991 and far above the long-term average¹¹. In the Western Isles, the average mortality for that year-class in sea farms was above 40%, which is appalling. Clearly the Government cannot claim that farmed salmon mortality rates are not rising.

⁸ Freshwater and seawater mortality combined.

⁹ 62,946t new farm biomass given planning consent since March 2018, 52,448t since RECC report (Nov 2018)

¹⁰ Table 28: 68.7% "Total % of year class harvested (survival)". <https://www.gov.scot/publications/scottish-fish-farm-production-survey-2023/pages/5/>

¹¹ (see Table 28 in *tables-scottish-fish-farm-production-survey-2023.xlsx*) <https://www.gov.scot/publications/scottish-fish-farm-production-survey-2023/documents/>

These figures exclude mortality in the earlier freshwater stage, during which more than 30% of fish often die, before the survivors are put to sea.

The Government has failed to bring mortality down, but it still says only that salmon farmers must achieve the lowest mortality that is possible. Even when it exceeds 80% there are no consequences for the farms' operators. There must be a backstop. The 2018 Inquiry called for farms with high mortality to become smaller, or move, or close (rec. 9), and for the regulatory system to be overhauled to permit robust intervention (rec. 10). These recommendations have been ignored.

The Inquiry also called for transparency in mortality reporting (recs. 12, 13, 23 & 33) but the Scottish Government's reporting remains fragmented, inconsistent and incomplete. Comprehensive annual mortality totals for salmon and cleaner fish are not published, unlike in Norway¹². SEPA has stopped even collecting data on the number of fish deaths and now only gives mortality data in kilograms, as if tens of millions of deaths are simply a commercial by-product.

The fish health and welfare system needs a radical overhaul, as the Inquiry said six years ago. (See *Case Studies 2 and 3* below.)

The Animal Health and Welfare (Scotland) Act 2006 is supposed to deliver high standards of farmed fish welfare but DEFRA's Animal and Plant Health Agency is failing to ensure that it does. The Government should set up a formal review to understand why APHA inspects so few farms, even those with exceptionally high mortality; why it fails to acknowledge the unnecessary suffering (illegal under the 2006 Act) that occurs during mass mortality events, prior to its inspectors visiting farms; why it has never handed evidence of poor farmed fish welfare to Local Authorities, to enable prosecutions, and why it believes that the suffering caused by the industry's practices are proportionate, with no consideration of alternatives that would cause less suffering (under Section 19 (4) of the Act).

To enable the status quo to change, the Scottish Government should issue formal guidance on farmed fish welfare. It should also define unnecessary suffering in farmed fish, including cleaner fish, as it has for other farmed animals.

It should ask an independent body (perhaps the SAWC), to investigate whether the huge amount of suffering caused to fish by physical and chemical lice treatments, and by the failure to separate cleaner fish before freshwater treatments, is really necessary. FHI reports show that many cleaner fish die when they are treated with freshwater.^{13,14,15}

Farms with repeated high mortality should be identified and downsized, moved or closed, to prevent further unnecessary suffering, and fish farming companies should be required by law to reduce mortality in each cycle, achieving a humane level within five years.

¹² <https://www.vetinst.no/rapporter-og-publikasjoner/rapporter/2024/fishhealthreport-2023>

¹³ FHI mortality report note, 2021, when 52,093 lumpsuckers died in Mowi's Caolas a Deas farm: "It has been accepted by industry that freshwater treatments will lead to elevated lumpfish mortalities. No alternative solution was given. Site manager said that it is difficult to dewater lumpfish as a result of size and shape. Staff try to remove fish as much as possible with hand nets. Increased handling may also contribute to mortalities."

¹⁴ FHI mortality report note, 2022, Mowi's Loch Greshornish farm: "No wrasse left on site due to freshwater treatments (44,000 fish lost) - site staff mentioned they did not have equipment to remove cleanerfish during FW treatments, issue raised with FHI senior management."

¹⁵ FHI mortality report note, 2023, SSC's Gravir farm, after 100% of the wrasse and the lumpsuckers (70,932) died: "...initially the site was treating with freshwater using one hour bath treatments increasing to 3 hour bath treatments around March/April, and more recently to 6 hour bath treatments. The site has sustained a 100% mortality of its cleanerfish stock this production cycle."

The Marine Directive should be required to produce annual farmed fish health analyses, as Norway's Veterinary Institute does, and to use these to determine the changes needed in farm management. They must include cleaner fish, whose mortality is extremely high¹⁶. (See *Case Study 3*)

The Government must set Key Performance Indicators for cleaner fish welfare and mortality, with a timeline, strict testing and real enforcement. Farmers must be required not to kill them all at end of each cycle. If these things are impossible, then the use of cleaner fish is unethical and should be stopped, as seems likely to happen in Norway, on ethical grounds.⁸⁶ The use of cleaner fish is not essential. Cooke Aquaculture seems not to use them, on welfare grounds.

The Scottish Government is over-reliant on 3rd party certification schemes, insisting, for example, that it need not make any changes because RSPCA Assured inspections ensure good welfare for farmed salmon and cleaner fish. To be certain that this is true, the Government should instigate an independent review of the actions taken by all third-party schemes (RSPCA Assured, Aquaculture Stewardship Council and Soil Association) following high mortality in their certified farms, which are not then removed from the assurance schemes. These schemes are conflicted by large payments and by advisory boards filled with industry representatives.

Climate change is already impacting fish welfare. Scottish Government research shows that 82% of the variation in farmed salmon mortality can be explained by the winter minimum temperature and by the number of farmed salmon in an area.⁷⁷ Mortality is generally higher where the water is warmer, in the south west of Scotland, especially in the Western Isles.

When companies are seeking to farm more fish in warmer areas, the fish health history of the companies and locations should be material considerations in Local Authority consenting decisions, as should the impact of climate change on the ability of every company to farm fish humanely, in all farm sites. This risk should be assessed by the Government and included in its statutory advice to planners. It is not at present.

On farmed fish welfare, the RAIC Committee should ask the Scottish Government to act on the RECC Inquiry's recommendation 2, by pausing expansion until:

- The worst farms have been properly assessed and action has been taken to improve welfare and greatly reduce mortality (recs. 2, 9 & 60), including production limits and closures, if necessary (rec. 10), and;
- until the industry has proven that it has resolved its fish health issues, by substantially and permanently reducing mortality (recs. 2, 9, 10 & 60), and;
- until a functioning system is in place to identify and deal with poor fish health and welfare (recs. 2, 10 & 60), for salmon and cleaner fish.

III. Economic and social benefit

The Inquiry made few recommendations about this.

All jobs matter in coastal communities, but the £760m GVA and 12,000 jobs "supported" by salmon farming have been overstated, because the costs of salmon farming to other users of the sea have never been assessed, only the benefits. Much of the sectors' profits are exported, as dividends, to shareholders overseas, and, according to the most recent Government-funded study¹⁰⁰, some of the

¹⁶ For instance, between January 2020 and July 2024, at least 65 salmon farms had cleaner fish mortality rates above 20% in at least one week, or >1,000 dead cleaner fish in at least one week. Treatments and handling killed cleaner fish in at least 23 farms. In 70 farms, the causes of death were unknown or not stated. (Data from all FHI mortality case reports that mention cleaner fish mortality)

These figures are all likely to be underestimates, as many farms reported no details.

indirect and induced jobs, and the GVA due to salmon farming, are double-counted with those due to other industries.

In addition, production has fallen for two successive years, by a quarter since 2021¹⁷, reducing efficiency. In 2023, direct jobs on farms were at their lowest since 2018, apparently due to this poor performance, automation, and farm and company consolidation.

The Government's Vision for Sustainable Aquaculture calls for "embedding consideration of the protection and development of social licence across all operations and management decisions"¹⁸, but instead, the industry is losing its social licence to operate in many coastal communities, where people can see the impacts first-hand. Trust is eroded further when companies persist with planning proposals against the wishes of the majority of residents in many communities, for example, on Gigha. The Clyde Fishermen's Association and Scottish Creel Fishermen's Federation also oppose fish farm expansion in the Clyde Sea and elsewhere, due to lost ground and pesticide concerns. They are routinely ignored by the sector, SEPA, the Marine Directive and Local Authorities.

Companies should abide by the Salmon Scotland Community Engagement Charter¹⁰⁷, to which they almost all subscribe, and withdraw proposals that communities have voted against.

They should also stop offering "community benefits", as bribes in advance of planning decisions, and concentrate instead on becoming good neighbours, by greatly reducing their impact on the environment and on the communities that bear the brunt of this, and by proving that they can farm fish humanely, before they expand any further. This requires the closure of farms that have persistently high mortality and the worst environmental impacts.

Salmon Scotland wrote to the RAI Committee that it is, "puzzled as to why our sector, which receives no financial support, receives committee attention to this level."¹⁹

Between 2009 and 2024-2025, publicly funded grants made to finfish aquaculture companies (not only to Salmon Scotland's members) appear to have totalled at least £44m. This includes UK Seafood Innovation Funds grants²⁰ but excludes £22.8m in Scottish Government funding for the Scottish Aquaculture Innovation Centre (2020 – 2024) and loans from the Scottish Infrastructure Bank.

Below are some examples of reported public funding for Salmon Scotland's member companies (2009 – 2024), including EFF and EMFF funding, delivered via the Scottish Government.

¹⁷ <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2024/10/scottish-fish-farm-production-survey-2023/documents/scottish-fish-farm-production-survey-2023/scottish-fish-farm-production-survey-2023/govscot%3Adocument/scottish-fish-farm-production-survey-2023.pdf> (Table 24)

¹⁸ <https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/07/vision-sustainable-aquaculture/documents/scotlands-vision-sustainable-aquaculture/scotlands-vision-sustainable-aquaculture/govscot%3Adocument/scotlands-vision-susta>

¹⁹ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-scotland-letter-25-oct-2024.pdf>

²⁰ <https://www.seafoodinnovation.fund/project-category/aquaculture/>

Company	Grants	Examples of sources & purposes
The Scottish Salmon Company (now Bakkafrost Scotland)	c.£5.2m	Including £2m from Marine Fund Scotland and £3m from HIE's Accelerating Aquaculture Innovation fund, for a new hatchery at Applecross
Scottish Sea Farms	c.£2m	Funded via SAIC, including £450,000 towards a thermolicer and £175,000 for lice control technologies
Landcatch Hendrix Genetics	c.£1.6m	Including £811,830 from Marine Fund Scotland
Loch Duart	c.£1.5m	Including £1.19m from HIE, and £0.3m from SAIC, for freshwater treatment equipment
Mowi Scotland	c.£1.3m	Including £752,192 towards a thermolicer and £141,690 towards a hydrolicer work boat, funded via SAIC
Cooke Seafood	c.£1.2m	Including £371,752 for a hydrolicer and £452,738 for high energy site development, funded via SAIC
Dawnfresh	c.£1.2m	From the EFF, EMFF and the Scottish Government
Wester Ross Fisheries	c.£1.7m	Including £802,431 from HIE and £951,310 from the EMFF and the Scottish Government
Dundas Chemical	c.£1.28m	Including £993,920 from Marine Fund Scotland and £287,518 from EMFF, for farmed fish waste processing equipment
Organic Sea Harvest	c.£1.1m	From the Marine Fund Scotland
Vonin Scotland	c.£1.08m	For net cleaning plant, from the Marine Fund Scotland
Otter Ferry Seafish	c.£0.68m	For cleaner fish breeding, from EMFF and via SAIC
GaelForce	c.£0.45m	For offshore pens, from the HIE Accelerating Aquaculture Innovation fund
Also, Kames Fish Farming (not a member of Salmon Scotland)	c.£0.9m	Towards a workboat and feed barge, from EMFF and the Scottish Government

Sources: EFF²¹, EMFF²², Marine Fund Scotland²³, via SAIC²⁴, HIE (AAI Fund)²⁵

²¹ <https://www.gov.scot/publications/european-fisheries-fund-beneficiaries/>

²² <https://www.gov.scot/publications/european-maritime-and-fisheries-fund-beneficiaries/>

²³ <https://www.gov.scot/publications/marine-fund-scotland-grants-awarded/>

²⁴ <https://www.gov.scot/publications/foi-19-00442/>

²⁵ <https://www.hie.co.uk/latest-news/2021/december/08/5m-for-aquaculture-rd-project-that-will-create-30-jobs/?returnUrl=%2Fsearch%2F%3FcurrentPageId%3D1157%26keywords%3Daccelerating%20aquaculture%20innovation%26page%3D2%26showAllResults%3Dfalse> and <https://www.hie.co.uk/latest-news/2018/december/07/914-000-innovation-project-to-enhance-aquaculture-industry/>

FOUR CASE STUDIES

These are examples of how the status quo has not changed, or has only changed very slowly, since the 2018 Inquiry. They are by no means unique.

CASE STUDY 1 - Emamectin benzoate (SEPA and Scottish Ministers)

Since the RECC report there has been a significant change in regulation, to reduce discharges of the in-feed pesticide emamectin benzoate, but this will not take effect until 2028.

SEPA's and Scottish Minister's inordinately slow process, outlined below, shows that the Scottish Government is unwilling to take the urgent action called for the RECC recommendation 2, when the fish farming industry has asked for delay.

In 2015, Scottish Government-funded statistical analysis concluded that, "the evidence suggests that benthic crustacea may not be adequately protected by the current regulation of EMB [emamectin benzoate] use in Scottish salmon farms".²⁶

In 2017, SEPA did its own seabed sampling and published its peer-reviewed analysis in 2018, concluding that emamectin benzoate had been causing harm to crustaceans around fish farms in Shetland, below the level of the current Environmental Quality Standard (EQS)²⁷, and that, "the results of the analysis have increased the now substantial weight of scientific evidence that the existing standards do not adequately protect marine life".²⁸

The industry then argued that it needed to continue to use the original quantities of emamectin, as the alternatives (bath/physical treatments and cleaner fish) were insufficient to control sea lice.

As a precaution, SEPA had set a much lower interim level in 2017, it but decided to apply this only to new fish farm biomass consented after that date.

SEPA confirmed to the RAIC²⁹ that it applied this interim, precautionary level to a very small minority of farms: 22 were licensed to use it in smaller quantities, but only four did. Meanwhile, SEPA has allowed 196 fish farms to continue discharging emamectin at the level that it has known since 2017 was highly likely to be causing harm.

A new environmental standard has now been agreed for emamectin benzoate. In June 2024, nine years after the original analysis showed there was a problem, Scottish Ministers directed SEPA to apply it to all marine salmon farms³⁰, but not until 2028, 13 years after they were first aware that the regulations were not protecting marine life as intended.

This long delay has favoured the salmon farming industry's needs over the environment.

²⁶ "At Reference stations, on a Per Production Cycle basis, there was strong evidence of a substantial decline, in crustacean richness and abundance, of 40% (4 - 63%) and 66% (29 - 87 %) respectively associated with 3 kg of EMB [emamectin benzoate] use. At Reference stations, on a Per Site Total basis, the EMB - crustacean association was more significant with expected reductions in richness and abundance being 64% (21 - 82%) and 96% (74 - 100%) **indicating wide-scale, cumulative impacts and incomplete recovery between successive EMB treatments**"

https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/48931330/sarf098_final_report.pdf

²⁷ Bloodworth et al. 2019. Negative effects of the sea lice therapeutant emamectin benzoate at low concentrations on benthic communities around Scottish fish farms

<https://www.sciencedirect.com/science/article/pii/S0048969719309428?via%3Dihub>

²⁸ [https://consultation.sepa.org.uk/sector-](https://consultation.sepa.org.uk/sector-plan/finfishaquaculture/supporting_documents/SEPA_position_statement_implementation%20of%20CAR.pdf)

[plan/finfishaquaculture/supporting_documents/SEPA_position_statement_implementation%20of%20CAR.pdf](https://consultation.sepa.org.uk/sector-plan/finfishaquaculture/supporting_documents/SEPA_position_statement_implementation%20of%20CAR.pdf)

²⁹ [https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-](https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-sepa-followup-reponse.pdf)

[committee/correspondence/2024/salmon-farming-sepa-followup-reponse.pdf](https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-sepa-followup-reponse.pdf)

³⁰ [https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-](https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-analysis/2024/06/consultation-new-environmental-quality-standard-egs-emamectin-benzoate-embz-implementation-timescales-consultation-analysis/documents/new-environmental-qual)

[analysis/2024/06/consultation-new-environmental-quality-standard-egs-emamectin-benzoate-embz-implementation-timescales-consultation-analysis/documents/new-environmental-qual](https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-analysis/2024/06/consultation-new-environmental-quality-standard-egs-emamectin-benzoate-embz-implementation-timescales-consultation-analysis/documents/new-environmental-qual) (about 1/6 of the previous standard)

CASE STUDY 2 - Very high salmon mortality and poor fish welfare in Loch Seaforth (FHI and APHA)

Mowi farms salmon in the Seaforth and Noster cage groups, in Loch Seaforth (Harris), under a single Marine Directive operating licence. More than a million salmon died in that farm between March 2023 and July 2024 - the largest number of deaths in a single fish farm's production cycle since FHI began publishing records regularly, and most likely the highest ever. Many more deaths will not have been recorded by FHI, due to its reporting exemption thresholds.

The company moved some salmon to another farm in the same waterbody, Trilleachan Mor, where around 250,000 more fish died during the same production cycle.

At that time, Mowi's farms in Loch Seaforth were certified by RSPCA Assured and the Aquaculture Stewardship Council. They have not been removed from either scheme. RSPCA Assured says this is because the deaths were a consequence of jellyfish, something the farmers were unable to prevent. The notes in the FHI's mortality records give the causes of death as: low oxygen, amoebic gill disease, progressive gill disease, salmon gill pox virus and bacterial infection, with huge numbers also killed by physical and chemical treatment losses (mentioned in 14 weekly reports). These are not all direct consequences of jellyfish.

Rather than the farm operators harvesting all the fish as soon as diseases were well-established, they chose to keep going for nine months, administering physical, chemical and freshwater treatments for sea lice and gill disease, to fish whose gills had been compromised. They must have known that this would cause suffering and the death of many of these fish.

The FHI inspected the Loch Seaforth farm during this disastrous production cycle but, astonishingly, the Animal and Plant Health Agency did not. Nor did APHA conclude that unnecessary suffering must have preceded any of the million plus deaths. APHA did not inform the Local Authority's Animal Health and Welfare team and it seems to have done nothing to ensure good fish welfare, at the time or afterwards.

Loch Seaforth is Scotland's second largest salmon farm, which did contribute to its record-breaking mortality figures, but it is clearly also an unhealthy site - its production cycle mortality percentages have risen from around 10% in 2018, to 23% in 2020 and to 58.7% in 2024.³¹ Other farms were also subject to jellyfish and warmer water during 2023-24, but lower proportions of fish died in most of them.

A significant proportion of Scotland's salmon farms are in locations that are consistently unhealthy. There are alternatives to farming salmon inhumanely in these places - the worst farms could be closed, or moved, or their biomass could be reduced. These options never seem to be considered by FHI or APHA.

³¹ Whole production cycle cumulative mortality data, published by Salmon Scotland

CASE STUDY 3 - Very high cleaner fish mortality and poor fish welfare in the Bagh Dail Nan Cean & Poll na Gille farms (FHI and APHA)

Fish Health Inspectorate case reports describe the mass mortality of cleaner fish in two finfish farms in Argyll.³² These are particularly bad examples but they are by no means unique - 100% of cleaner fish have died in other farms as well.

Both farms were visited on 17/11/2022.

The Bagh Dail Nan Cean farm report says:

“During the inspection it was found that the site had suffered 100% mortalities of their lumpfish since input. Of these, 86,614 were recorded with cause and around 100,000 had not been recorded. This has been referred to the Animal and Plant Health Agency, as they have responsibility for welfare. As ~100,000 mortalities of lumpfish were not recorded, these were not reported to the FHI, or the company vet.”

Lumpfish mortality: 182,756 - 100%.

Wrasse mortality: 31,484 since input across the site.

The Poll na Gille farm report says:

“Lumpfish mortality over 75% since input in May 22: Lumpfish mortality by month:

May 22 - 562, June – 8,162, July - 15,979, **August – 126,067** and September – 3,564.

Lumpfish mortality since input: 155,645 - freshwater treatment in August.

Wrasse mortality since input: 9,982 - background mortality.”

A third of a million lumpsuckers died in these two farms in seven months, and 41,466 wrasse.

Freshwater treatment was implicated.

The farm operators did not report 100,000 of the lumpsucker mortalities to FHI. Their welfare could not have been assured because their cause of death was unknown.

The report says that FHI informed APHA, but FHI has subsequently said that it cannot find any record of this having happened. APHA did not inspect the farm and did not inform Argyll and Bute Council’s Animal Health Service of the mortalities.

These are not the only farms where hundreds of thousands of cleaner fish have died. In total, millions have died across Scotland’s salmon farms. Their deaths are not properly recorded or reported.

FHI and APHA seem to do little or nothing about this.

In all salmon farms, all the surviving lumpsuckers are slaughtered after one salmon production cycle. Wrasse are sometimes reused in a second production cycle before being killed.

No other vertebrates are farmed or captured solely to pick parasites off another farmed animal, and then killed. Surely this is unethical.

Cleaner fish are not essential. Cooke Aquaculture seems not to use them, for welfare reasons.

³² Case Reports 2022-0578 and 2022-0579

<https://www.gov.scot/binaries/content/documents/govscot/publications/transparency-data/2022/03/fish-health-inspectorate-case-information-2022/documents/november-2022/additional-cases-20220578-20220579/additional-cases-20220578-20220579/govscot%3Adocument/>

CASE STUDY 4 - Sea lice regulatory framework and existing salmon farms (SEPA)

SEPA's sea lice regulatory framework (SLRF) is capable of reducing the risk to wild fish due to sea lice from new farms, but SEPA is acting too slowly to reduce the risk posed by existing farms.

In 2018, the RECC inquiry stated that "urgent and meaningful action needs to be taken to address regulatory deficiencies ... and environmental issues before the industry can expand".

It also recommended that, "a precautionary approach should be taken which will seek to minimise the potential risk to wild salmon stocks wherever possible", and that a, "precautionary approach must be taken in Scotland to assist in mitigating any potential impact of sea lice infestation on wild salmon".

SEPA says that it might take action to reduce lice pressure on some existing farms, in some of the areas where they pose the highest risk to wild salmon and sea trout, but not until 2028-9, ten years after the RECC Inquiry. Recommendations 2, 40 and 46 have not yet been met, as regards the impacts of sea lice from existing farms on wild salmon, and they have very little chance of being met for at least four or five years.

RECC recommendation 45 called for a precautionary approach to sea lice impacts, similar to Norway's, but SEPA has chosen not to follow Norway's more precautionary approach.

Norway strictly enforces a very low lice ceiling in all farms during the spring (0.2 adult female lice per fish). SEPA says that its more nuanced regulations will reduce the risk for wild fish, in a proportionate and cost-effective way.

Under its SLRF, SEPA will continue to allow new and existing farms to be sited in the vicinity of known migratory routes for wild salmon. It will take action to reduce the risk from fish farm sea lice under these limited circumstances:

- When proposals for new farms are in areas modelled by SEPA as already posing a high risk to wild fish (and only in the spring, when most young salmon migrate);
- when hard evidence shows that lice from existing farms are harming wild fish, in higher-risk areas (which will most likely not happen until 2028-9, if at all), or;
- if existing farms in high-risk areas are individually assessed by SEPA as posing the highest level of risk, then their lice counts in the spring must not exceed their highest recent levels.

SEPA refers to the last of these and its measures for new farms, as a "no deterioration condition" but this cannot prevent wild salmon populations from deteriorating due to sea lice, if the fish are already declining under the lice load from existing farms. At best, SEPA's condition might lock in the current rate of decline. It is not precautionary to take 4-5 more years before possibly reducing the number of lice in the worst farms.

This is urgent - Atlantic salmon are now endangered but SEPA has already taken six years to reach this point, with no tangible benefit yet to wild salmon or sea trout.

There are other reasons for their decline as well, but SEPA should take action now to prevent and reverse the deterioration in wild salmon and sea trout populations due to sea lice, in high- and medium-risk areas, by setting precautionary springtime sea lice caps on higher-risk farms, similar to the levels set in Norway.

It should also set precautionary springtime sea lice caps on salmon farms that contribute sea lice to areas through which salmon must pass from salmon breeding-river SACs, as well as to farms in areas used by salmon and sea trout that breed in freshwater pearl mussel SACs.

Salmon farming in Scotland - Progress on the 2018 Rural Economy and Connectivity Committee Inquiry's recommendations

More details

This section assesses, in greater detail, the recommendations of the 2018 REC Committee report, noting where progress has or has not been made, across these themes:

- I. Environmental impacts and regulatory reform, including interactions with wild salmon
 - II. Animal welfare
 - III. Economic and social benefit
-

I. Environmental impacts and regulatory reform, including interactions with wild salmon

REC Committee overall recommendations

2 The “status quo” in terms of regulation and enforcement is not acceptable.

Urgent and meaningful action needs to be taken to address regulatory deficiencies as well as fish health and environmental issues before the industry can expand.

60 ...maintaining the status quo in terms of the regulatory regime in Scotland is not an option.

...there is a need to raise the bar in Scotland by setting **enhanced and effective regulatory standards** to ensure that that fish health issues are properly managed and **the impact on the environment is kept to an absolute minimum**. The Committee therefore recommends that **a comprehensively updated package of regulation** should be developed by Marine Scotland and other regulatory bodies, both to ensure the sector will be managed effectively and to provide a strong foundation on which it can grow in a sustainable manner.

Slow change to the status quo

There has been little sign of the urgent and meaningful change called for by the 2018 inquiry.

In SEPA's RAI Committee information session, it gave the impression that many of the REC Committee's recommendations have been met, but the Scottish Government and SEPA have moved extraordinarily slowly. The industry has benefitted from the delay, at the environment's expense.

The *Case Studies* mention the delay of more than a decade before reducing the discharge of emamectin benzoate from almost every Scottish salmon farm, despite the existing standard being known to cause harm, and the similar delay before SEPA will consider reducing the impact of sea lice from existing fish farms, on wild salmon and sea trout.

In addition, SEPA has still not transferred a high proportion of salmon farms to the new regulatory framework for seabed pollution that it announced in 2019.

In the RAIC information session on 19th June 2024^{Error! Bookmark not defined.}, SEPA said: “I think that we are sitting at 35 per cent of active licences still to be transferred over during this year, so 65 per cent of active salmon farms are currently operating under the new licence template.” SEPA's letter to the RAIC contradicts this, saying: “As of June 2024, around one third of active farms are authorised under SEPA's updated regulatory framework's permit”.³³

Both cannot be true.

³³ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-sepa.pdf>

Either way, the environmental benefits that SEPA claims, from having changed its regulations on seabed pollution in 2019, still do not apply to many existing farms, five or six years after the process started. This is hardly the urgent action recommended by the RECC report.

SEPA's and NatureScot's duty to promote economic growth

SEPA's slow progress may be due, in part, to shortages of staff and years of budget cuts. However, SEPA and NatureScot also seems to be affected by their spurious secondary duty to achieve economic.³⁴ Both agencies must be able to give impartial advice, and to operate without fear or favour, to minimise, reduce and reverse environmental harm. SEPA should be under no obligation to ensure that the measures needed to control pollution are cost-effective for the polluter, for example. An urgent review is needed of whether SEPA's and NatureScot's core functions are being compromised by their duty to encourage economic growth.

i. Impacts on wild salmon and sea trout

REC Committee recommendations on the impacts of escapes and sea lice on wild salmon and sea trout

[The Committee] ... has heard from the industry that escapes do not currently appear to be a significant issue in Scotland. However, it cautions against complacency on this issue as **there is potential for even a single escape event to have a significant impact on the genetic integrity of wild salmon.**

37 The Committee notes that strict **penalties** are in place in Norway **to deal with escapes** and recommends that appropriate sanctions should be developed and introduced in Scotland.

40 ...a **precautionary approach should be taken which will seek to minimise the potential risk to wild salmon stocks** wherever possible.

41 ...the **siting of salmon farms** is key to managing any potential risk to wild salmon stocks and ensuring that the sector is managed responsibly and sustainably

45 ...the **siting of farms in the vicinity of known migratory routes for wild salmon** must be avoided.

46 ...a **precautionary approach must be taken in Scotland to assist in mitigating any potential impact of sea lice infestation on wild salmon.** It therefore recommends that there should be **an immediate and proactive shift towards siting new farms in more suitable areas away from migratory routes** and that this should be highlighted in the strategic guidance on the siting of salmon farms.

Scotland's wild salmon and sea trout populations are in steep decline. Both species are Scottish Government Priority Marine Features. The International Union for the Conservation of Nature has reclassified the Atlantic salmon as endangered.

It is disingenuous of Salmon Scotland to tell the Committee that, "the [RAI] committee has also heard from two senior SEPA executives who have both stated that sea lice from farmed salmon are not and have not been the cause of the declines we have seen in Scottish (and global) Atlantic salmon stocks: Peter Pollard (Head of Ecology), Nov. 2020 said 'I will start with the big picture. Do we think that sea lice from farmed fish are responsible for the declines that we have seen over the decades in wild fish? No'."¹⁹

Salmon Scotland has taken this quote out of context.

³⁴ Added to SEPA's remit by the Regulatory Reform (Scotland) Act 2014
<https://www.legislation.gov.uk/asp/2014/3/section/51>

In full, Mr Pollard said: “I will start with the big picture. Do we think that sea lice from farmed fish are responsible for the declines that we have seen over the decades in wild fish? No. There is a complex range of reasons, some of which are probably to do with high seas changes.

The issue is whether the state of the populations at the moment can be affected by the added pressure of further sea lice as they migrate to sea. That is not to suggest that the declines over the past few decades are due to fish farming. **The concern is whether the additional pressure of sea lice is now significant, as wild stocks are at such low levels.”**

SEPA’s Lin Bunten also did not tell the RAI Committee, as Salmon Scotland suggests, that sea lice from farmed salmon are not and have not been the cause of declines in Scottish (and global) Atlantic salmon stock. She actually said that, “the salmon interactions working group has identified sea lice as a potential impact”.

There is no real doubt that sea lice from fish farms can impact wild salmon and sea trout.

The Scottish Government has acknowledged that sea lice from fish farms are one of several threats to wild salmon. The Wild Salmon Interactions Group (including Ben Hadfield (Mowi) and Ann Anderson (now at SSF)) reported that sea lice from fish farms pose a risk to wild salmonids.

On 2nd May 2018, Mr. Hadfield told the REC Committee: “As a company, and increasingly as an industry, we start with the view that excessive levels of farm-derived lice retained within a sea loch or any contained water body pose a hazard to wild fish. It could put additional strains on them ...

I suggest that the way forward for the industry is a gold standard of transparency and then to minimise lice levels and the farming presence in sensitive areas over time. We need to grow in areas that are away from migratory fish systems.”³⁵

The Scottish Government’s summary of science on the impacts of lice from fish farms on wild salmonids³⁶ says that salmon farms are a much more important contributor than wild fish to the total number of sea lice in the Scottish coastal zone, and that concentrations of larval lice sampled in areas near farms relate to the local farm lice loads.

Scottish Government research published this year, based on wild fish monitoring data, shows that high sea lice numbers on farms are associated with sea lice numbers on wild sea trout that are consistent with causing an increase in mortality. It also found varying levels of sea lice infestation pressure on wild smolts, from no risk to a high-risk of lice-induced mortality. This is consistent with some farms posing a higher level of risk than others.

Fisheries Management Scotland wrote to the RAIC³⁷ that, “in certain west coast rivers, fish farming is the most significant human pressure”³⁸, particularly for juvenile wild fish that cannot tolerate more than a few sea lice.

FMS also pointed out that fish in east coast rivers face different pressures than those in the west, so the decline in salmon populations in eastern rivers has no bearing on whether fish farming is impacting wild salmon in the west.

³⁵<https://webarchive.nrscotland.gov.uk/20220725204739/https://archive2021.parliament.scot/parliamentarybusiness/report.aspx?r=11503&c=2088553>

³⁶ <https://www.gov.scot/publications/summary-of-information-relating-to-impacts-of-salmon-lice-from-fish-farms-on-wild-scottish-sea-trout-and-salmon/>

³⁷ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-inquiry-fms.pdf>

³⁸ <https://fms.scot/wp-content/uploads/2023/02/230224-Regional-and-National-Assessment-of-the-Pressures-Acting-on-Atlantic-Salmon-in-Scotland-Summary-Report.pdf>

Escapes of farmed fish

The UK is party to the North Atlantic Salmon Conservation Organisation (NASCO) which obliges the Scottish Government to ensure that:

- 100% of farms have effective sea lice management, such that there is no increase in sea lice loads or lice-induced mortality of wild salmonids attributable to the farms;
- 100% of farmed fish are retained in all production facilities.

In September 2021, the Scottish Government's response to the Salmon Interactions Working Group committed to penalising salmon farms for failing to prevent escapes. FMS's letter pointed out that this still has not happened, so RECC recommendation 37 has not been met. It should be met, as a matter of urgency, because genetic introgression is a major threat to wild salmon. Marine Directive research has found farmed salmon genes in around a quarter of all the wild salmon it sampled.³⁹

The industry told the RAIC that fewer fish have escaped recently. However, the Government's Fish Farm Production Surveys show that 52,463 salmon were reported to have escaped from farms at sea in 2022.⁴⁰ In 2023, 80,001 escaped.¹⁷ This is not trivial.

More and larger farms are being sited in locations exposed to high winds and waves, increasing the risk of fish escaping, particularly as climate change is making more severe storms more frequent. Most recent large escapes have been from exposed farms, during storms.⁴¹

Siting of salmon farms to protect wild salmon and sea trout

RECC recommendations 40, 45 and 46 call for a precautionary approach to avoid siting farms where they could do harm to wild salmon. Since 2018, SEPA has been tasked with doing this, regarding sea lice.

The industry claims that SEPA's approach is over-precautionary. For instance, Ben Hadfield told the RAI Committee that SEPA's sea lice predictions were c. 4-5x worse than is realistic.⁸¹ In practice, SEPA is being cautious in some respects but is over-generous in others. CCN believes that these opposing effects more or less cancel out, leaving SEPA's predictions of the risk to wild fish fairly close to the actual risk, with minimal precautionary safety margins.

Taking a "precautionary approach to minimise the potential risk to wild salmon stocks" & SEPA's "No deterioration condition"

SEPA is moving too slowly to protect wild fish from sea lice from existing farms (*Case Study 4*).

In 2018, the RECC Inquiry recommended that "a precautionary approach should be taken which will seek to minimise the potential risk to wild salmon stocks wherever possible", and that a "precautionary approach must be taken in Scotland to assist in mitigating any potential impact of sea lice infestation on wild salmon".

Its recommendations 2, 40 and 46 have not been met, as regards the impacts of sea lice from existing farms on wild salmon, and they have very little chance of being met for at least four or five more years because SEPA says that it will not take action to reduce lice pressure on any existing farms until 2028-2029 – at least ten years after the RECC's inquiry.

³⁹ <https://data.marine.gov.scot/dataset/national-assessment-influence-farmed-salmon-escapes-genetic-integrity-wild-scottish-atlantic>

⁴⁰ <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2023/10/scottish-fish-farm-production-survey-2022/documents/scottish-fish-farm-production-survey-2022/scottish-fish-farm-production-survey-2022/govscot%3Adocument/scottish-fis>

⁴¹ For example: Colonsay, Hellisay and Carradale

RECC recommendation 45 has not been met either, because SEPA has chosen not to follow Norway's more precautionary approach to protecting wild salmon. SEPA will continue to allow new and existing farms to be sited in the vicinity of known migratory routes for wild salmon, instead of enforcing a very low lice ceiling in all farms during the spring⁴².

SEPA will only take action to reduce the risk to wild salmon and sea trout from fish farm sea lice under these limited circumstances:

- When proposals for new farms are in areas modelled by SEPA as already posing a high risk to wild fish (and only in the spring, when most young salmon migrate);
- when hard evidence shows that lice from existing farms are harming wild fish, in higher-risk areas (which will most likely not happen until 2028-9, if at all), or;
- if existing farms in high-risk areas are individually assessed by SEPA as posing the highest level of risk. These farms are being told by SEPA only that their lice counts in the spring cannot exceed their highest levels in the recent past.

SEPA refers to the last of these and its measures for new farms, as a “no deterioration condition”. This cannot be the deterioration of wild salmon populations due to sea lice because they are already declining under the current lice load from existing farms. At best, SEPA's no deterioration condition might lock in the current rate of decline due to sea lice. For SEPA to take another 4-5 years before possibly reducing the number of lice in the worst farms is not precautionary.

Even the small proportion of wild salmon that breed in Scotland's most highly protected sites (Special Areas of Conservation) are not afforded any extra protection by SEPA's regulations. NatureScot is in discussions with SEPA about the need to act in a more precautionary way, when modelling and sea lice monitoring on sea trout show that salmon from Special Areas of Conservation may be at risk.

This is a matter of urgency. SEPA should take action now to prevent and reverse deterioration in wild salmon and sea trout populations, in high- and medium-risk areas, by setting precautionary springtime sea lice caps on higher-risk farms, similar to the levels set in Norway.

It should also set caps on the salmon farms that contribute sea lice to areas through which salmon must pass from salmon breeding river SACs, as well as those in areas used by salmon and sea trout that breed in freshwater pearl mussel SACs.

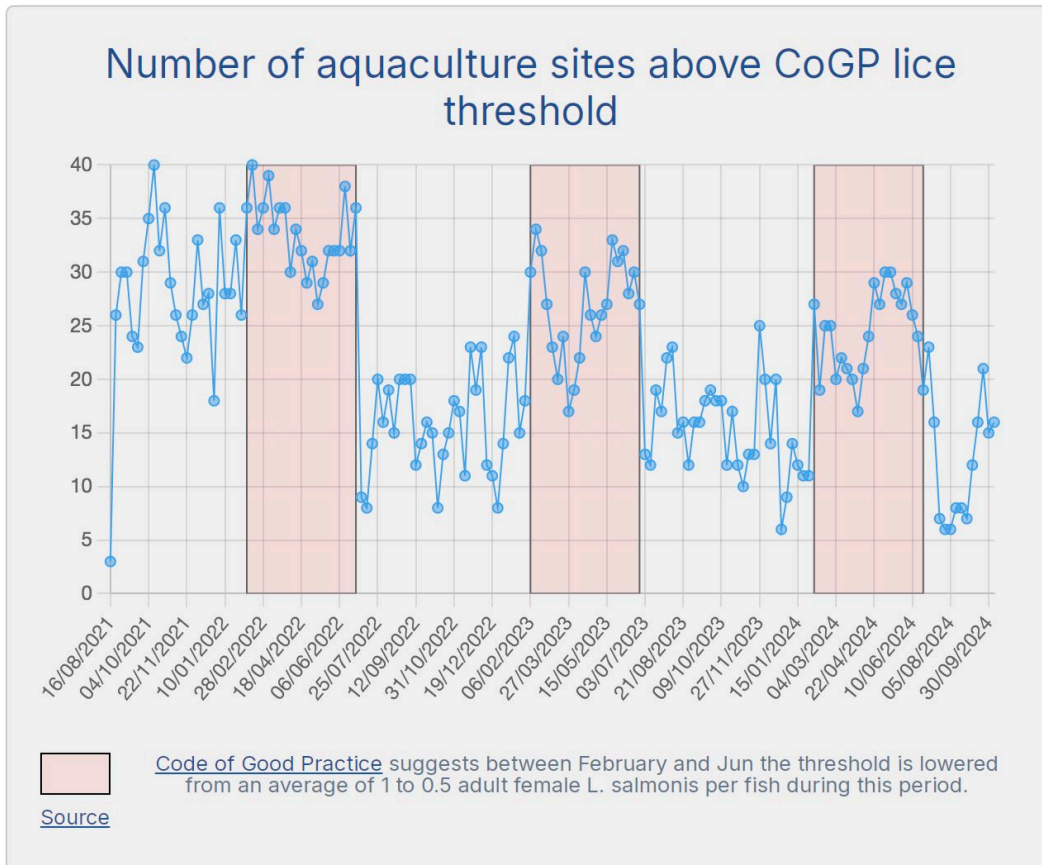
Are fewer sea lice being released by fish farms?

Salmon Scotland insists that lice levels are “the lowest since published records were first available”, but does not specify when this was. Weekly lice counts per farm were first published in March 2021.

The chart below shows that sea lice numbers in 2024 so far have been lower than in 2022 or 2023. Even so, up to 30 of the 146 farms that were stocked in May 2024⁴³ had lice numbers above the industry's voluntary Code of Good Practice springtime lice levels of 0.5 adult female lice per fish. Lice from these, and other farms in high risk areas, may be harming wild salmon and sea trout.

⁴² 0.2 adult female lice/fish in all farms in Norway, in the spring

⁴³ <https://www.salmonscotland.co.uk/reports/monthly-mortality-rate-may-2024>



Lice counts reported on SEPA’s Scotland’s Aquaculture website⁴⁴

Although the number of lice reported per farmed fish has fallen recently, the number of fish being farmed has increased. There is no public information about how many fish are in each farm, so the total number of lice in the environment cannot be assessed as accurately as it should be. It may have fallen, remained static, or risen. FHI and SEPA do not know. SEPA needs this information to model the risk accurately, but some companies are claiming commercial confidentiality. They should be obliged to hand over this information.

Sea trout and the Northern Isles

SEPA has not yet implemented specific plans to protect sea trout from fish farm sea lice. Unlike salmon, sea trout are present in the sea all year, so they are at greater risk. They also breed in the Northern Isles, where wild salmon do not, but SEPA’s regulations do not yet include the Northern Isles. It promises to do this next year. Wild sea trout are a PMF and they are declining. SEPA must act to help them now, in a more precautionary way, as the 2018 Inquiry recommended. SEPA should include sea trout and the Northern Isles in its sea lice regulatory framework immediately.

Cumulative impacts of sea lice on fish populations

SEPA should also use its sea lice modelling capability to assess the overall impact of the sea lice from all of Scotland’s salmon farms on wild salmon and sea trout populations, and then make a national plan accordingly. This information must become part of the statutory advice given to Local Authorities when they consider all salmon farm proposals.

⁴⁴<https://scottishepa.maps.arcgis.com/apps/webappviewer/index.html?id=2218824350e5470e8026076d4138da58>

ii. Cumulative impacts, spatial planning and the Precautionary Principle

Cumulative impact assessment

Assessing fish farm impacts on a case-by-case basis is a poor way to regulate the cumulative impact of existing and proposed fish farms and other activities. It is the antithesis of marine spatial planning, as required in the National Marine Plan and recommended in the REC Committee's report.

Local Authorities have a statutory duty to only provide "support to finfish developments, subject to there being no significant adverse effect (directly, indirectly, **or cumulatively**)"⁴⁵

However, a Government-appointed Reporter for the Planning & Environmental Appeals Division stated a different view: "... it is also not for this appeal to consider objections which relate to matters that are attributable to the established fish farm operation ... It is the effect of that expansion which must be considered, rather than anything wider."⁴⁶

This presumes that because the impacts of all existing farms have already assessed individually, before the farms were consented, only the extra impacts due to each new farm need to be assessed. This misses the vital point that environmental harm may be caused by the cumulative impacts of many farms, none of which is solely responsible.

SEPA now accepts that this is true for the impact of sea lice from multiple farms.

It also knows that the discharge of dissolved nutrients from multiple fish farms can promote harmful planktonic blooms and that there may be chronic effects of multiple exposure to plumes of bath chemicals, which are not limited in frequency by SEPA.

At present, SEPA does not routinely assess these risks. The impacts of bath pesticide discharges are not monitored at all, only modelled.

SEPA should assess the cumulative impact of all discharges from all farms, including the chronic effects over time of pesticide discharges on commercial species, as requested repeatedly by the Clyde Fishermen's Association and others, and on PMF species and habitats.

SEPA should also be required to assess the overall capacity of Scotland's inshore waters to accommodate the expansion of salmon farming, before that expansion occurs.

Case-by-case assessment cannot enable systemic improvements, for instance by reducing overall pesticide discharges. Instead, the total amount of pollution only ever increases, as new farms are consented.

SEPA says that it has no remit to reduce the amount of pollution being dumped in the sea, only to apply and enforce the environmental standards set by the Scottish Government. This seems wrong, given that there are good reasons to question whether pesticide discharges are regulated correctly at present.

For instance, in 2017, Professor Ian Boyd (then Chief Scientist at DEFRA) wrote:

"The current assumption underlying pesticide regulation — that chemicals that pass a battery of tests in the laboratory or in field trials are environmentally benign when they are used at industrial scales — is false."

⁴⁵ e.g Highland Council LDP policies 50, 57 and 58. Policy 50 (Aquaculture)

⁴⁶ "It is also not for this appeal to consider objections which relate to matters that are attributable to the established fish farm operation. I am required to assess this proposal in the context that the principle of a fish farm in this location is well established. That operation is already permitted to hold 2500 tonnes of biomass, so this proposal represents a relatively modest expansion. It is the effect of that expansion which must be considered, rather than anything wider." (Loch Hourn planning appeal. 2023) <https://www.dpea.scotland.gov.uk/CaseDetails.aspx?id=122572&T=20>

“Standard environmental toxicity tests used to license pesticides are performed on particular test species and have limited predictive power when chemicals are used widely. Diffuse environmental effects that arise from ecosystem connectivity at a landscape scale are hard to measure but may still be appreciable.” “There is no consideration of safe pesticide limits at landscape scales [in the UK]”. “Without knowledge of safe environmental limits, the total pesticides used — and therefore the total environmental dose — is governed by market demand rather than by a limit on what the environment can endure.”

Professor Boyd added that: “The drive to avoid multiple jeopardy and to protect commercial confidentiality does nothing to promote transparency and trust in the regulatory system. Possibly as a result of this, I also saw that the agri-chemical and farming industries appeared to misunderstand the duty they have to promote transparency in how they supply and use pesticides. Too often, it seemed that, to them, the function of regulation was to protect their business interests rather than to deliver public goods.”⁴⁷

He was writing about terrestrial pesticides, but the use of pesticides at sea suffers from the same lack of assessment of their impacts at the largest scale, and the same refusal by pesticide companies to disclose the industry-commissioned research that underpins the environmental standards, on the basis of commercial confidentiality. Even SEPA only sees summaries.

The Scottish Government should instruct SEPA to set a timeline for reducing and ultimately ending the discharge of chemical pollution from fish farms.

The Precautionary Principle

The Precautionary Principle is one of the five Guiding Principles on the Environment.

In order to comply with the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021⁴⁸, all responsible authorities, in doing anything in respect of which the duty under section 1 of the Environmental Assessment (Scotland) Act 2005 (“the 2005 Act”) applies (requirement for environmental assessment), must have due regard to the guiding principles on the environment.

Scottish Ministers, in making policies (including proposals for legislation), must also have due regard to the guiding principles on the environment.

The Scottish Government’s Vision for Sustainable Aquaculture says: “In developing this Vision, we have reflected the intent of the principles, and the duty will apply to future development of policies under the Vision for Sustainable Aquaculture”.⁴⁹

Scottish Ministers are also obliged to publish guidance on the guiding principles on the environment, which may include how the duties relate to other environmental duties, and how those who are subject to the duties should demonstrate that they have complied and are complying with the duties. This includes all Scottish public authorities.

REC Committee general recommendations on the Precautionary Principle:

48 The Scottish Government should provide strong and clear leadership in ensuring that the precautionary principle is applied, producing appropriate policy and guidance documents as necessary. These should make clear that the potential impact on the environment, known wild salmon migratory routes and other species must be

⁴⁷ https://research-repository.st-andrews.ac.uk/bitstream/handle/10023/13347/Milner_Boyd_Toward_pesticidovigilance_AuthorAcceptedMS.pdf?sequence=1

⁴⁸ <https://www.legislation.gov.uk/asp/2021/4/contents>

⁴⁹ <https://www.gov.scot/publications/vision-sustainable-aquaculture/>

comprehensively and robustly assessed and fully taken into account as part of the consideration of salmon farm applications.

49 The Scottish Government should support and assist planning authorities by **producing planning guidance which sets out clearly how the precautionary principle should be applied and managed.**

In 2023, the Scottish Government published statutory guidance on the precautionary principle for policy makers⁵⁰ but, as far as CCN can tell, it has still not produced statutory guidance for planning authorities on the application of the precautionary principle, as recommended by the 2018 Inquiry (recs 48 & 49).

This is important because Local Authorities admit that they are averse to applying the precautionary principle. One senior planning officer said: “It would not be appropriate to routinely refuse applications on a precautionary basis simply because definitive information was not available.”⁵¹ This is the antithesis of the precautionary principle.

Local Authorities, the industry and the Marine Directive all prefer Adaptive Management, where mitigating action is taken once harm is imminent, or has already been detected. This requires frequent, high-quality monitoring, which is expensive. Monitoring cannot always detect harm before it has occurred and some harm cannot be easily undone, e.g. to maerl beds.

The Government should issue guidance to Local Authorities and other decision makers on how the precautionary principle is to be applied to fish farm consenting decisions, as the 2018 Inquiry recommended.

The Government should also issue guidance on how Local Authorities should assess cumulative impact. They are obliged to make this assessment, but they do not do so consistently.

Spatial Planning

REC Committee recommendations on spatial planning

51 Scottish Government should, as a matter of priority, initiate a spatial planning exercise with a view to developing strategic guidance specifying those areas across Scotland that are suitable or unsuitable for siting of salmon farms.

52 ...strategic guidance on the siting of salmon farms should also be viewed as a material consideration in planning terms, which would help guide the industry in making applications and planning authorities in deciding on these. The Committee calls on the Scottish Government to consider how this might operate in practice and to **consider whether any changes in planning guidance might be required.**

Recommendations 51 and 52 have not been met, with the exception of SEPA’s sea lice regulatory framework (and only as it affects new farms, so far).

⁵⁰ <https://www.gov.scot/publications/scotlands-guiding-principles-environment-statutory-guidance/>

⁵¹ Angus Gilmour Head of Planning, Housing and Regulatory Services. Argyll & Bute Council, to CCN member group. 2 May 2018: “The precautionary principle is invoked sparingly in planning, as in many cases decisions have to be founded upon anticipated rather than definitive outcomes. It would be exercised in cases where the receiving environment is particularly sensitive, such as within European Natura nature conservation designations where significant adverse impacts are anticipated, or in cases of ‘reasonable scientific doubt’. In other cases it is incumbent upon planning authorities to arrive at decisions having had regard to the full range of information available. It would not be appropriate to routinely refuse applications on a precautionary basis simply because definitive information was not available. To do so would impose an unjustifiable moratorium upon the fish farming industry and thus risk based judgments necessarily have to be made.”

Six years after the Inquiry, the capacity of Scotland's seas to cope with potentially doubling the impact of salmon farming remains unknown. The point of marine spatial planning is to understand these limits and where they apply.

On 18th November 2020, the REC Committee asked SEPA what progress it had made on developing a spatial plan for salmon farming.⁵²

Mike Rumbles MSP: “It is two years on from our report in which we said that [spatial planning] is a major issue. I will put a layman’s point to you. The process has been that a fish farm company comes along at the pre-application stage and says to the council and to the other regulators, ‘We’d like to build a fish farm here’. At that point, everything kicks in. The committee basically said that that is the wrong way around, and that we should have a strategic approach to where fish farms should be located and where they should not be located. Mark Harvey said that, in theory, that that would be part of the process. It strikes me—correct me if I have misunderstood—that nothing much has been done on this important point.”

Terry A’Hearn (SEPA): “... it is fair to say we have not - if I have the input from others right - formally started that process of developing the type of plan that you have talked about. Convener, **I am happy to take up with Annabel Turpie, the new director of Marine Scotland, about where we are up to on the issue and how we can work together in the future, if that would help.**”

Convener: “It would.”

Since then, nothing seems to have happened (sea lice regulations aside).

For instance, in the RAIC meeting on 19th June 2024, when Edward Mountain MSP asked SEPA: “Do you have a map of the waters around Scotland showing where it is suitable to have aquaculture and where it is not? That is what the recommendation called for.”

Lin Bunten (SEPA) replied: “No, we do not. The answer is no.”⁵³

In 2018, Mark Harvey (Highland Council planning officer) told the REC Committee: “Aquaculture is very much focused on planning applications; they are individually assessed and so on. We lack an overall framework - something that would indicate that an area is or is not particularly suitable for aquaculture - that would enable the planning system to match more closely future housing demand with future job creation. At the moment, it all happens application by application, which is not how the development planning system should operate. It is difficult to plan ahead on that basis.”⁵⁴

The planning system still does not consent fish farms on a strategic basis. This is despite the National Marine Plan (2015) requiring marine planners and decision-makers to undertake spatial planning, to rule out areas that are unsuitable for aquaculture.⁵⁵

⁵² Extract from exchange between Mike Rumbles MSP, Peter Pollard and Terry A’Hearn (SEPA) in the Official Report. <https://archive2021.parliament.scot/parliamentarybusiness/report.aspx?r=12961>

⁵³ <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-19-06-2024?meeting=15947&iob=136127>

⁵⁴ <https://webarchive.nrscotland.gov.uk/20220725205334/https://archive2021.parliament.scot/parliamentarybusiness/report.aspx?r=11469&c=2082918>

⁵⁵ Scotland’s National Marine Plan. 2015. Marine Planning Policies: “AQUACULTURE 1: Marine planners and decision makers should seek to identify appropriate locations for future aquaculture development and use, including the potential use of development planning briefs as appropriate. System carrying capacity (at the scale of a water body or loch system) should be a key consideration”, and:

“AQUACULTURE 2: Marine and terrestrial development plans should jointly identify areas which are potentially suitable and sensitive areas which are unlikely to be appropriate for such development, reflecting Scottish Planning Policy and

Nine years after the National Marine Plan, the Regional Spatial Plans that it required have still not been developed in most areas. The National Marine Plan 2 position statement consultation⁵⁶ suggests that spatial planning will again be called for, but actually doing it is likely to take many more years. Meanwhile the fish farming industry is relentlessly expanding. Under the National Planning Framework 2, it was the only industry exempted from having to ensure net biodiversity gain, to compensate for major developments.

The 2018 Inquiry's recommendation 51 noted, "...that Marine Scotland is already working to develop heat maps which would identify areas suitable for farmed salmon expansion and is of the view that this work might usefully inform a wider spatial planning exercise" but that spatial planning project⁶ was quietly abandoned by the Scottish Government, leaving SEPA's sea lice risk framework as the only form of spatial planning for fish farming that the Scottish Government has initiated since the RECC report. It applies mostly to constrained waterbodies, and not yet in the Northern Isles.

Rachel Shucksmith told the RAIC that five-year spatial plans would soon be out-dated because the industry is innovating so quickly.⁹⁶ While this may be true for new farms, there are clearly places where any open net fish farm is inappropriate. Identifying these unsuitable sites would save the industry a lot of work, and communities a lot of angst. In some cases, older farms were consented in enclosed waterbodies that cannot accommodate their pollution, or in MPAs and SACs, where they would now be turned down. Spatial planning should reflect this too.

It is essential to understand the capacity of Scotland's coastal waters to accommodate the industry's hoped for doubling in production by 2030, as stated by Scotland's Food and Drink, in 2016.⁵⁷ Ben Hadfield told the RAI Committee that the industry's intention was now to double the value of production, rather than its volume.⁸¹

The siting of fish farms in relation to MPAs, SACs and PMFs

RECC Recommendations on the siting of fish farms in relation to MPAs, SACs and PMFs

51 Scottish Government should, as a matter of priority, initiate a spatial planning exercise with a view to developing strategic guidance specifying those areas across Scotland that are suitable or unsuitable for siting of salmon farms. This work should take full account of existing strategic documents such as the Marine Plan, and incorporate an assessment of the potential impact of salmon farms on Marine Protected Areas (MPAs) and Priority Marine Feature (PMFs) and the species which inhabit them.

Potential relocation of existing sites ... as the salmon industry in Scotland has evolved in recent decades, farms may have been located in areas which are now recognised as being environmentally sensitive (such as MPAs or PMFs) or are less well-suited to production ... welcomes the fact that some operators are already actively looking to relocate poorly sited farms or to consolidate farms in less sensitive areas.

any Scottish Government guidance on the issue." <https://www.gov.scot/publications/scotlands-national-marine-plan/pages/8/>

⁵⁶ <https://consult.gov.scot/marine-scotland/national-marine-plan-2-planning-position-statement/>

⁵⁷ <https://foodanddrink.scot/helping-business/other-resources/publications/aquaculture-growth-to-2030-a-strategic-plan-for-farming-scotland-s-seas/> "A working Group of leading aquaculture businesses and organisations came together to create a growth strategy for aquaculture in Scotland to 2030. The aim was to deliver an ambitious, industry-led plan for sustainable growth across the entire aquaculture value chain." The SSPO (precursor to Salmon Scotland, Marine Harvest (now Mowi) and the Scottish Salmon Company (now Bakkafrost Scotland) were all involved.

ECCLR Committee recommendations on the siting of fish farms - MPAs, SACs and PMFs

109 The Committee queried the siting of fish farms in relation to MPAs, SACs and priority marine features.

The Committee received evidence from Marine Scotland confirming there are 288 farms directly on or in a PMF area, of which 103 are currently registered active (no buffers applied). 159 sites are located within 500m of a PMF and 192 sites are located within 1000m of a PMF. The NTS confirmed that of the 227 active salmon farms in the sea, 22% are within MPA's, 18% are in SACs and 2% are in SPAs. They said in total, 32% are within some form of protected area.

... The Marine Conservation Society raised "particular concern" about "the rather light consideration of a range of PMFs and Scottish MPA designated features within the report. We simply do not know the impacts of salmon farms on most individual PMFs and MPA designated features, or the wider cumulative impact of multiple farms in sea loch systems containing many PMFs, underlining the importance of the precautionary principle when planning and licencing".

137 The Committee remains deeply concerned that it appears a precautionary approach has not been, and is not being, applied to the development of fish farms and in particular to farms in MPA's or in the vicinity of a PMF. The Committee questions this approach and the environmental consequences.

Clearly this is important but the current process of assessing whether SACs, in particular, might be damaged by fish farms is not sound. In particular, NatureScot says it lacks a mechanism to limit potentially harmful activities that pre-date the creation of SACs. Appropriate Authorities are obliged to know beyond reasonable doubt that new and existing activities are not causing harm to the features of SACs, a high bar, consistent with the precautionary principle, but SEPA refuses to act on that basis concerning pollution.

This is no way to approach the biodiversity emergency. The impasse must be resolved.

The protection of PMFs depends on a judgement about whether each proposed farm will affect the national population of any PMF. This is very hard to decide, given that there are large uncertainties about many PMFs' national populations and that cumulative impacts are largely ignored.

To its credit, SEPA has turned down two farm proposals in Orkney, which would have been on top of maerl beds. Subsequently, however, SEPA and NatureScot have allowed Mowi to change the layout of its Hellisay farm, despite the cages being very close to a maerl bed which could be damaged. Maerl is a PMF.

At the RAI Committee's communities meeting in Oban, Mowi said that it has moved or closed a few farms for environmental reasons - Isle Ewe, for example, but this remains very unusual.

Wrasse fishery

RECC Recommendations on the impact of the largely unregulated and assessed fishery for wild wrasse, for use as cleaner fish:

26 ...there is an urgent need for an assessment of future demand for cleaner fish as well as all associated environmental implications of the farming, fishing and use of cleaner fish.

27 Complete the assessment of wild wrasse fishing as urgently as possible

28 Scottish Government consider the need for regulation of cleaner fish fishing to preserve wild stocks and avoid negative knock on impact in local ecosystems.

The REC Committee's recommendations 26-28 concerned the impact of removing large numbers of wrasse from the wild. They have not been met satisfactorily.

Wrasse are a key-stone species of rocky reef habitats and kelp forests. They eat sea urchins, so removing them can lead to urchin barrens, with no kelp. Some rocky reefs are designated as SACs,

where there is a legal obligation on the Scottish Government to assess the overall environmental implications of activities that would degrade the designated features of the SACs (Appropriate Assessments). This has still been done. An investigation by ESS has made some progress, in that the Marine Directive has recently agreed to do Appropriate Assessments.

There has been some regulation of the wrasse fishery since 2018 but the management measures are almost useless. For instance, the Marine Directive has recently acknowledged that it had no information on wrasse spawning seasons when it set these measures. Even the most basic wild wrasse capture data is inconsistent and incomplete.

Scotland needs similar wrasse fisheries measures to those introduced in England, with minimum and maximum landing size, spatial closures, and a seasonal closure during the wrasse breeding season. The closure here is during the winter, when wrasse hibernate and cannot be caught anyway. If the Scottish Government intends to further delay the development of inshore fisheries management plans for two more years, until 2026, and if this includes the wrasse fishery, then meaningful action on the RECC recommendations 26-28 will have been postponed for at least eight years.

This is an example of the Government's failure to act on the RECC recommendations 22-24, about data gathering and publication, and on recommendation 57, on closing knowledge gaps, as well as the broader failure to take urgent and meaningful action to improve regulatory deficiencies.

iii. Pollution

The assumption that the sea can and should dispose of all fish farm waste, for free, is outdated and wrong. We are in a biodiversity crisis - there are strong reasons to reduce marine pollution.

Action to achieve this is happening in the EU and the UN and the OSPAR Agreement 2021-01: North East Atlantic Environment Strategy 2030⁵⁸, commits the Scottish Government to:

- Tackle eutrophication, through limiting inputs of nutrients and organic matter to levels that do not give rise to adverse effects on the marine environment (Strategic Objective 1), and to;
- Prevent pollution by hazardous substances, by eliminating their emissions, discharges and losses, to achieve levels that do not give rise to adverse effects on human health or the marine environment with the ultimate aim of achieving and maintaining concentrations in the marine environment at near background values for naturally occurring hazardous substances and close to zero for human made hazardous substances (Strategic Obj. 2).

Pollution - Fish farm pesticides ("medicines")

In 2018, SEPA stated that fish farming was the largest source of pollution of Scotland's sea⁵⁹ and that no other industry is permitted to discharge biocides into the sea - compounds that are highly toxic to crustacea, being discharged into areas where much of Scotland's valuable crustacean fishery operates.⁶⁰

⁵⁸ <https://www.ospar.org/documents?v=46337>

⁵⁹ Anne Anderson, Head of Compliance and Beyond at SEPA, letter to a CCN member group (02/08/2018): "There is no other single sector making discharges to the water environment which have the same total cumulative extent of impacts as fish farms..." "The approach used by SEPA accepts that the zone where impacts may occur from fish farm discharges is generally very much larger than from discharges made from other industrial sectors." "SEPA does not collect or produce data on crustacean fisheries or on the stocks that are pursued by fishermen."

⁶⁰ Douglas Sinclair, SEPA Aquaculture Specialist - from internal SEPA emamectin benzoate options paper. FOI, 2017: "Fish farming is unique in that it is a sector which is allowed to discharge substantial quantities of biocides..." "...the waters in which salmon farming is practiced are usually the same waters in which Scotland's valuable crustacean fisheries are located..."

The industry describes five substances as “medicines” that would be recognised more widely as pesticides, since they are used to treat external parasitic sea lice. Four of these (deltamethrin, cypermethrin, azamethiphos and hydrogen peroxide) are administered by bathing the fish in them, either in the farm cages or in well-boats alongside. In all cases, the pesticides are then discharged into the sea, mixed in seawater. Hydrogen peroxide is also used to treat amoebic gill disease. The fifth compound, emamectin benzoate is fed to salmon, then excreted in their faeces over several months. This persistent chemical can remain toxic on the seabed for more than four years, according to SEPA. Other substances that would be more usually recognised as medicines (such as antibiotics) are also discharged into the sea, in the fishes’ faeces.

RECC Recommendations on medicine use:

31 The Committee strongly believes in the benefits of **transparency** for the industry and those interacting with it ... Any **data and analysis gaps related to the discharge of medicines and chemicals** into the environment should be addressed by both the industry and regulators.

32 [The Committee]...calls on SEPA and the Scottish Government to similarly **consider the environmental impact of other medicines by the industry.**

33 ...**information and data on medicine use by the industry should be made publicly available, on the same platform as that relating to sea lice and mortality rates.**

As mentioned elsewhere, recommendation 33 has not been met. SEPA publishes data on farmed salmon deaths alongside chemical use data, but only by weight, which is of little use.

Data on the numbers of dead salmon is published by FHI, separately from aquaculture data on medicine/chemical use.

SEPA says it has taken significant action since the REC Committee report in 2018. In that time there have been two significant changes to bath pesticide discharges. One has decreased pollution discharges and the other has increased them:

- In 2019, SEPA reduced the quantity of cypermethrin that could be discharged by fish farms by a factor of 267, making it effectively unusable. It did so without any public explanation. Presumably, new information had shown that cypermethrin was 267 times more toxic to marine life than SEPA had been assuming. Cypermethrin had been in widespread use since 1997.
- In October 2020, the Veterinary Medicine Directorate updated its summary of product characteristics for Salmosan Vet (azamethiphos), reducing its half-life in seawater from 8.9 days to 5.6 days. SEPA then matched this change in its modelling of the dispersion and breakdown of azamethiphos. Since then, fish farmers have been applying to SEPA to allow them to increase the discharge of azamethiphos by 200-300%, each time they treat a farm. SEPA has been granting these licence variations.

In October 2024, SEPA told CCN that next year it intends to review bath chemical use by salmon farmers, including hydrogen peroxide for the first time. CCN has been asking for this to happen since 2017. Hydrogen peroxide discharges are not capped at all by SEPA and FOIs show that a total of 2,224 tonnes was discharged into the sea in 2022. SEPA claims that hydrogen peroxide breaks down too quickly to do much harm, but Canadian state-sponsored research shows that this is often not the case. The Norwegians have banned discharges within 500m of shrimp fishing and spawning areas.⁶¹

⁶¹ <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0240894>

This year, SEPA started publishing data on hydrogen peroxide discharges for the first time.⁶² One farm discharged 120 tonnes in Jan-Feb 2024 alone.⁶³

SEPA says that it plans to collaborate with the Canadian pollution regulator, in its review of bath chemicals. This review represents some belated progress towards the RECC recommendations 31-33. However, there remain many knowledge gaps that SEPA should fill (rec. 31 & 32) and areas where action should be taken to reduce or eliminate the impact of these discharges.

The *Case Study* of the very slow implementation of new environmental standards for emamectin benzoate, shows that SEPA and the Scottish Government are in no hurry to change the status quo for salmon farmers.

Pollution - organic (particulate) pollution

RECC Recommendations about organic (particulate) pollution

29 ...essential that **waste collection and removal is given a high priority** by the industry, the Scottish Government and relevant agencies. **It is clearly one of the main impacts on the environment and needs to be addressed as a matter of urgency.**

Fish farm waste collection and removal has not been prioritised by the Scottish Government. Waste in this sense refers mainly to fish faeces, deposited on the seabed. The SAMs report for the 2018 Parliamentary Inquiry into salmon farming said that, "Scotland's target of producing 200,000 tonnes salmon in 2020 will likely emit organic waste equivalent to that of about half of Scotland's human population of 5.3 million".⁶⁴

SEPA's 2019 regulatory framework deals only with the deposition of this waste on the seabed. It allows farms to be much larger, and to discharge much more waste, providing they are in locations where stronger currents can disperse that waste. The regulations also require more seabed monitoring stations. They make it somewhat less easy for farms to expand in less dispersive locations. If organic waste was to be captured instead of dumped in the sea, SEPA would be more likely to allow larger farms in less dispersive locations.

Scotland's first proposed semi-closed salmon farm, in Loch long, which would have captured some of its waste, has been rejected by the Local Planning Authority. Scottish Ministers have called in that decision, following an appeal by the farm's developers. A second proposal by the same company for an 8,000t semi-closed salmon farm in Loch Linnhe appears to be on hold.

The fraction of particulate waste that can be captured in semi-closed salmon farms is disputed. Even if it was not, they would still discharge a great deal of pollution, particularly as dissolved nutrients, which can promote harmful planktonic blooms.

The major advantage is that these farms are less likely to have problems with sea lice, making them less likely to use and discharge pesticides. However, closed containment farms have much higher stocking densities than usual, to offset their higher operating costs, with inherent animal welfare and health concerns. Gill disease is still a high risk and fish may also escape, to harm wild salmon by interbreeding.

If consented, these huge farms are likely to be used to rear fish for about a year. These would then be moved to open net farms elsewhere, for growing on.

⁶² https://aquaculture.scotland.gov.uk/data/other_data.aspx

⁶³ Stulaigh Island

⁶⁴ https://webarchive.nrscotland.gov.uk/3/archive2021.parliament.scot/S5_Environment/General%20Documents/2018_0125_SAMS_Review_of_Environmental_Impact_of_Salmon_Farming_-_Report.pdf

Closed- or semi-closed fish farms can only reduce the overall amount of particulate and pesticide pollution, and sea lice, if they replace existing open net farms.

So far, their proposed uses are to expand salmon farming into sites that currently have no salmon farm pollution (e.g. upper Loch Long), or where there are already so many farms that no new open net farms could be so large (Loch Linnhe - 8,000t). Used in this way, these farms will add to the overall pollution and the risk of escapes and poor fish welfare.

Pollution - Dissolved nutrients

Most of the fish waste discharged by salmon farms is in the form of dissolved nutrients, especially nitrogen. The impact of this pollution in promoting harmful algal and other planktonic blooms, including heterotrophic bacteria and micro-jellyfish, has not been properly assessed.

At present, the Marine Directive issues Locational Guidance for fish farms⁶⁵, using an outdated and over-simplistic model that hardly limits site choice at all.

SEPA has state-of-the-art nutrient modelling capabilities but it has yet to take over doing this analysis, although it says that it plans to. The need is urgent. Harmful planktonic blooms have already caused mass mortality in some salmon farms, for instance in Loch Creran.

Relocating existing farms

As mentioned already, some older farms are in places where they ought not to have been consented, for environmental reasons. A spatial planning exercise is needed to identify which farms are doing the most harm, to inform decisions about how best to modify, close or move them.

RECC Recommendation on the relocation of existing farms

53 there should be immediate dialogue with the industry to **identify scope for moving existing poorly sited farms**. It recommends that this should be led by Marine Scotland and encouraged with appropriate incentives for operators, such as giving favourable consideration towards allowing increased capacity at replacement sites that are known not to be environmentally sensitive. The Committee considers it to be important, however, that there is **no deviation from due process in terms of granting approval for replacement sites**.

This recommendation makes sense now, as it did in 2018, but it has not been met meaningfully.

Mowi seems to be the only company to have closed an active farm (Isle Ewe) for environmental reasons. During the RAIC's Oban meeting, Stephen Macintyre (Mowi Scotland) said that the company has also closed or moved three other farms. The Committee could ask Mowi to provide more details. Some companies, such as Scottish Sea Farms, have kept more farms than usual empty in recent years, particularly those in enclosed waterbodies that have had high mortality (e.g. Loch Creran), presumably waiting until they can breed larger "super smolts" that will spend less time in these sub-optimal locations for fish health. Several companies also plan to consolidate several smaller farms into fewer larger ones, in locations where the large amount of pollution from the new sites will be dispersed by strong currents. None want to close existing farms unless they already have permission to open new ones elsewhere, with at least the same amount of biomass, for example, Scottish Sea Farms has recently received planning permission for a new farm, Billy Baa, in Shetland, conditional on surrendering its licences for four smaller farms, which have been used for years. Two are classed as disused, so this represents a large increase in farmed fish biomass.⁶⁶

Farms that are doing harm, or those with repeated poor fish health, should be closed or moved, but this should not depend on the companies first finding new sites for fish farming.

⁶⁵ <https://www.gov.scot/publications/authorisation-of-marine-fish-farms-in-scottish-waters-locational-guidelines/>

⁶⁶ <https://www.fishfarmermagazine.com/2024/05/10/green-light-for-scottish-sea-farms-shetland-plan/>

The role of SEPA, and transparency

RECC Recommendations on the role of SEPA, and transparency:

62 ...essential that SEPA introduces a **significantly enhanced regulatory and monitoring regime under which it will robustly and effectively enforce compliance with environmental standards.**

63 ...introduction of mechanisms to provide **more open and transparent reporting of regulatory breaches** is needed - there needs to be a **move away from the self-assessment culture that appears to be prevalent at present.**

In 2017, SEPA admitted that fish farming was one of Scotland's least compliant industries.⁶⁷ The current situation is hard to judge, as SEPA has not published any company compliance assessments since 2019. SEPA says it is developing a new compliance reporting method (PAS) but that it will not publish any of these assessments until at least 2025.⁶⁸ SEPA told the RAIC that compliance was improving⁵³ (meaning compliance with the seabed pollution standards) but it has not provided any evidence to support this claim.

As of October 2024, the seabed quality monitoring surveys for more than a fifth of active fish farms (46 farms) were marked as "to be evaluated".⁶⁹ Some date back more than 18 months. Some of these unevaluated farms are presumably non-compliant, but many will already have been restocked, apparently with no management changes to restore seabed quality. For example, in October 2023, SEPA informed Mowi that its Carradale South farm had breached its seabed standards. Mowi had collected the seabed samples in September 2021, but did not submit the results to SEPA until November 2022. The farm was restocked a year later, while still non-compliant. SEPA has admitted that some farms that are currently not compliant with the 2019 seabed regulations, may become compliant without having to reduce their pollution, once they are moved into the new regulatory framework. The goalposts have been moved.

This is not urgent or meaningful change. Nor is it a move away from light touch regulation, or the culture of self-assessment that the 2018 Inquiry called for.

Data reporting

REC Committee recommendations on data reporting:

22 ...a **comprehensive, accessible reporting system of a similar standard to that which is already in operation in Norway** should be introduced in Scotland.

23 ... there should be a suite of data available covering mortality, sea lice infestation, medicine application and treatment information.

24 It considers that **the associated costs should be borne by the industry**, and calls on the Scottish Government to discuss with industry representatives how this might be achieved.

⁶⁷ "SEPA state that Aquaculture is ... one of the least compliant sectors regulated by SEPA. Around 21% of marine finfish farms and 7% of freshwater finfish farms were not compliant in 2015. Non-compliance was mainly due to unsatisfactory seabed surveys, exceedance of biomass or discharge limits, and effluent quality failures. This poor compliance performance must change." Salmon Farming in Scotland - SPICe 2018 report, quoting from:

⁶⁸ <https://www.sepaview.com/2017/06/a-framework-for-a-sustainable-future-for-finish-aquaculture-in-scotland/>
⁶⁸ <https://www.sepa.org.uk/regulations/authorisations-and-permits/environmental-performance-assessment-scheme/>

⁶⁹ https://aquaculture.scotland.gov.uk/data/environmental_monitoring_surveys.aspx

33 ...recommends that information and data on medicine use by the industry should be made **publicly available**, on the same platform as that relating to sea lice and mortality rates.

These have been mentioned above. In short, there has been little change, except that weekly sea lice counts are now included on the Scotland's Aquaculture website, joined recently by information on hydrogen peroxide discharges and antibiotic use. The website is difficult to use and data is fragmented. Incomplete mortality information is published elsewhere by FHI.

Research on salmon farming impacts

RECC Recommendations on research on salmon farming impacts

57 ...notes that the ECCLR Committee's report identified a range of **significant gaps in knowledge, data, analysis and monitoring around the adverse risk the sector poses to the environment**. It strongly endorses the ECCLR Committee recommendation on the **need for more research in these areas**.

There are several substantial gaps:

- The industry's ability to cope with climate change is a profoundly important knowledge gap, including the impact on fish welfare and mortality;
 - The impact of fish farm pollution on MPAs/SACs and PMFs is largely unknown, as is the impact of removing wrasse, to be used as cleaner fish;
 - The overall impact of the discharge of fish farm pesticides has not been assessed, for commercially-caught or other species;
 - The socio-economic cost of the salmon farming industry on other users of the sea is also significant, but remains largely unassessed.
-

II. Animal welfare

Fish health and mortality are intrinsic to considering the welfare of farmed salmon.

Most of the publicly available data concerns mortality, so this is the only Key Performance Indicator available to assess trends in farmed fish welfare.

It cannot be true, as RSPCA Assured told the RAIC, that welfare standards have improved⁷⁰, despite mortality increasing, both by monthly percentage and by the number of dead fish.

Mortality occurs in the freshwater stage of salmon farming, as well as in the seawater stage, but the mortality figures usually discussed are only for the seawater stage. Including freshwater mortality gives an overall average mortality of farmed salmon of around 50%.

Lumpsuckers and wrasse, used as cleaner fish, are also aquaculture species, so their welfare also matters. Cleaner fish welfare and mortality data is even more sparse than it is for salmon.

Mortality and fish health

REC Committee recommendations on mortality and fish health:

2 ... the “status quo” in terms of regulation and enforcement is not acceptable.

Urgent and meaningful action needs to be taken **to address** regulatory deficiencies as well as **fish health** and environmental issues **before the industry can expand.**

9 the current level of mortalities to be too high in general across the sector and it is very concerned to note the **extremely high mortality rates at particular sites...no expansion should be permitted** at sites which report high or significantly increased levels of mortalities, until these are addressed to the satisfaction of the appropriate regulatory bodies.

10 ambitious targets should be agreed to achieve a significant and evidenced reduction in mortality for salmon and trout and that these should be world-leading... practical action is also required and that there should be a process in place which allows **robust intervention by regulators when serious fish mortality events occur.** This should **include appropriate mechanisms to allow for the limiting or closing down of production until causes are addressed.**

60 ...maintaining the status quo in terms of the regulatory regime in Scotland is not an option.

...there is a need to raise the bar in Scotland by **setting enhanced and effective regulatory standards to ensure that that fish health issues are properly managed** and the impact on the environment is kept to an absolute minimum.

The Committee therefore recommends that **a comprehensively updated package of regulation should be developed by Marine Scotland and other regulatory bodies,** both to ensure the sector will be managed effectively and to provide a strong foundation on which it can grow in a sustainable manner.

11 – 13 and 33 On the **publication of fish farm data** (see later).

ECCLR Committee recommendations on mortality and fish health:

⁷⁰ Sean Black. RSPCA Assured: “Fish welfare is improving ... but mortality has not improved”, and, “...we have no idea of the actual number of fish that die on farms. I think that fish welfare has got a little bit better, but we acknowledge that mortality has not improved.” <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-05-06-2024?meeting=15919&iob=135889>

81 The issue of mortalities of farmed fish was not discussed significantly in the [SAMS] report but it was raised in evidence to the [ECCLR] Committee. Marine Scotland Fish Health Inspectorate stated: “Throughout the 1990s and 2000s there was around 20% mortality of farmed salmon throughout the production cycle. This seems to have increased from 2014 to the present day.”

95 ...The Committee is concerned that the industry and regulators appear to be incapable of reducing the level of mortality. These levels would not be considered acceptable in other livestock sectors and should not be considered to be acceptable in the salmon farming industry

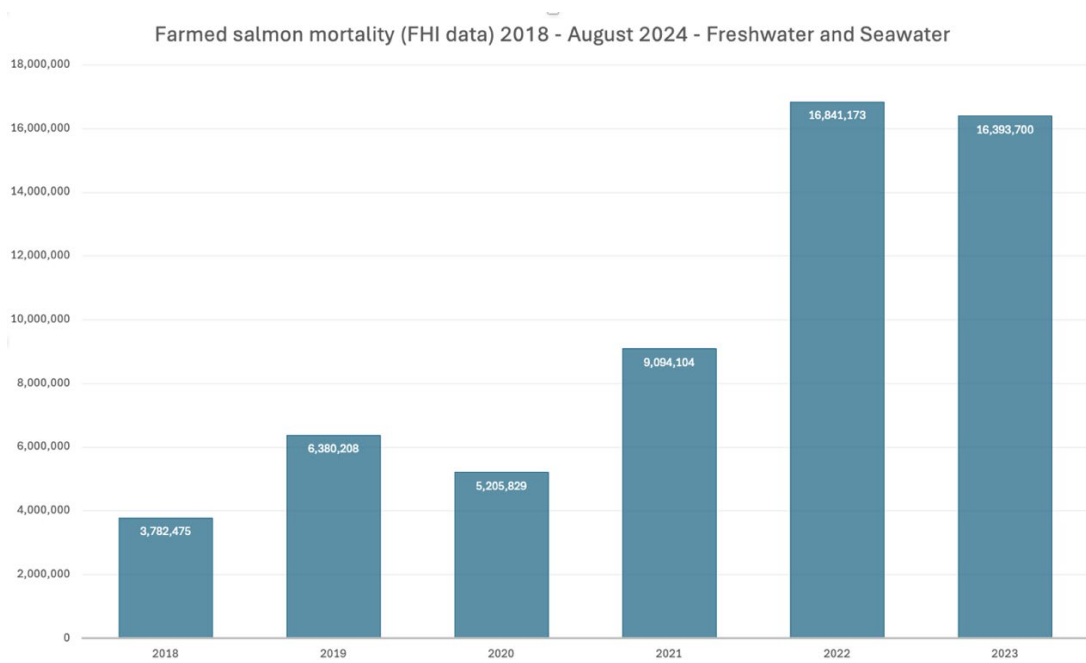
96 The Committee is concerned that salmon mortality will increase if production is doubled and considers fish health problems should be addressed across the sector, with a related decline in mortality rates, before further significant expansion of the sector.

How many fish die each year in Scotland’s salmon farms?

Unlike in Norway, the Scottish Government does not publish the most basic mortality information – the total number of farmed salmon that have died each year.

The Fish Health Inspectorate does publish mortality figures, but many deaths are excluded because the FHI has quite high reporting exemptions.⁷¹ FHI Director, Mr Allan, told the RAI Committee that this is “all mortality that is considered to be significant. The reporting threshold was agreed with the sector - it does not lie in legislation - and it was designed to report areas of concern”⁷², by which he means that these partial figures are sufficient to highlight outbreaks of the diseases that FHI seeks to control.

In the worst case, these exemptions could allow up to 50% of deaths in a marine salmon farm to go unreported, over a 21-month production cycle.⁷³



Source: FHI mortality reports⁷⁴ subject to FHI reporting exemptions

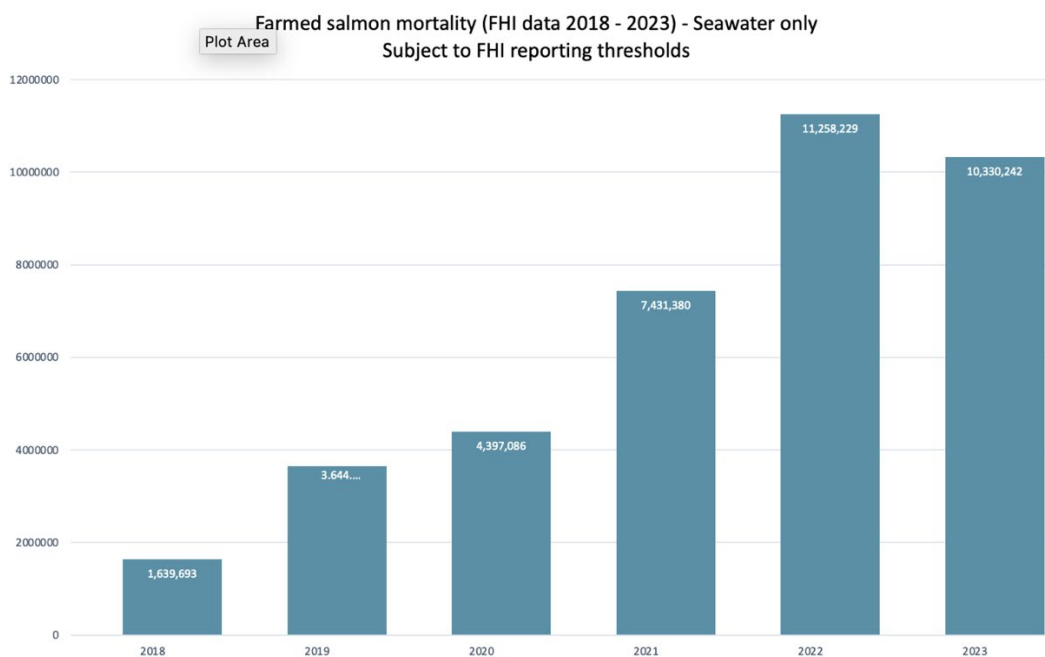
⁷¹ <https://www.gov.scot/publications/fish-health-inspectorate-mortality-information/> FHI mortality data exclude all deaths below quite high weekly thresholds of 1.5% or 1% of salmon in each farm (depending on their weight) as well as any smolts that die in their first six weeks at sea (see ANNEX – Fish mortality calculations)

⁷² <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-12-06-2024?meeting=15934&iob=136030>

⁷³ Analysis by CCN from Local Authority planning decisions. Spreadsheet available on request.

⁷⁴ <https://www.gov.scot/publications/fish-health-inspectorate-mortality-information/>

Between 2018 and 2023, farmed salmon mortality in seawater and freshwater farms, increased more than four-fold (above) and increased more than six-fold in seawater farms (below), according to FHI.



Source FHI mortality reports subject to FHI reporting exemptions

(Note - 2024 mortality figures are not included as they are incomplete. Up to August, they were lower than in 2022-23. Mortality always becomes worse in the autumn, so it is too soon to be sure that 2024 will be a better year. However, the sea has been cooler, which ought to help.)

How many fish actually die, if you include deaths excluded by FHI reporting exemptions?

SEPA used to collect data on the numbers of fish that die but it stopped doing so in 2020, without explanation, and now only publishes mortalities by weight. SEPA's data does not have the FHI's reporting exemptions.

Comparing the SEPA and FHI mortality data by weight shows that the FHI always under-reports marine mortalities, sometimes by up to 250% (see ANNEX - *Fish Farm Mortality Calculations*).

It is possible to estimate the number of fish deaths that FHI does not publish, by comparing the weight and number of fish with SEPA's weight records.

By this calculation, it seems likely that more than 17 million salmon and rainbow trout died in 2022, just in Scotland's seawater farms, and more than 13.8m died in 2023 (See ANNEX) (Rainbow trout account for an estimated 6% of the total).

FHI's figures for salmon mortalities in 2022 and 2023 were 11,258,229 and 10,330,242 respectively - a huge discrepancy.

Combined mortality in freshwater and seawater farms

The true proportion of fish that die in salmon production only becomes clear when the figures for the freshwater and seawater stages are combined.

The Government's Fish Farm Production Survey shows that the average mortality rate for the 2018 - 2023 year-classes of ova was 31%⁷⁵.

Combining this with the year-class mortality for the same smolts, at sea, gives an average mortality approaching 50% from the ova being laid down until the surviving fish are ready to harvest from the sea cages (see ANNEX).

⁷⁵ Between the ova being laid down and the smolts being ready to be put to sea

Is there a trend in percentage mortality?

The Scottish Government says that there is no trend of increasing mortality rates for year-classes of fish, in seawater farms. The long-term average is around 24%.

This very high proportion has become normalised by familiarity. Meanwhile, the industry has expanded, so even a constant average percentage mortality would represent an increasing number of dead fish, which surely matters.

However, the percentage mortality has risen far above the long-term average, to 31.3% in the latest figures.⁷⁶

Monthly mortality rates have also risen, according to Scottish Government researchers, who noted that a, “plot of national losses over time 2003-2018 indicate an increase in average monthly proportion loss rate after 2010.”⁷⁷

2010 was roughly when sea temperatures became warm enough for the amoeba responsible for a severe gill disease to survive the winter. Amoebic Gill Disease has been killing increasing numbers of fish since then. Mortality has worsened again since 2018 (the most recent data included in the analysis above) but this is not yet fully reflected in the Government’s Fish Farm Surveys.

Government Fish Farm Production Survey data is published far in arrears

The Government’s Fish Farm Production Surveys report mortality only for full year-classes of smolts, so the most recent full data is for fish that were put to sea in 2021. The Surveys are published ten months after the end of the years to which they refer. The latest one (for 2023, published in late October 2024) shows only the start of the increase in mortality associated with the abrupt rise in sea temperature that began around 2021. Mortality is likely to be even higher for the 2022 year-class.

The Scottish Government must acknowledge that the overall mortality of farmed salmon has risen.

How much has the industry expanded since 2018?

Mr Allan suggested to the RAI Committee that expansion has been slow: “...the number of consents to produce farmed fish are increasing. However, the placing of smolts in the sea and the tonnage that is produced are not expanding at the same rate. There is an increased capacity to produce more, but the farms are not necessarily using all that consented tonnage.”⁷²

This is not borne out by publicly available data, showing that over 60,000t of new biomass has received planning consent since early 2018⁷⁸, and by the Fish Farm Production Survey, which shows that the number of smolts put to sea each year increased by 21% between 2018 and 2022⁷⁹, roughly consistent with the proportionate increase in consented biomass.

Is the number of fish dying related only to the larger number of fish being farmed?

Loch Seaforth (*Case Study 2*) is Scotland’s second largest salmon farm, licensed to hold 4,310 tonnes of fish, but its record number of deaths did not only happen because it contains so many fish.

The proportion of fish dying in the worst affected farms has also risen in recent years, pushing the overall numbers ever higher. For instance: 86.8% died in the latest cycle at the Culnacnoc seawater farm, the highest ever, and 82% died in both Druimyeon Bay and East Tarbert Bay, according to data published by Salmon Scotland.

⁷⁶ Scottish Government Fish Farm Production Survey 2023. For the 2021 year-class of smolts

⁷⁷ Moriarty et al. Preventive Veterinary Medicine 178 (2020) 104985. Modelling temperature and fish biomass data to predict annual Scottish farmed salmon, *Salmo salar* L., losses: Development of an early warning tool <https://doi.org/10.1016/j.prevetmed.2020.104985> Fig. 4.

⁷⁸ Analysis by CCN, available on request

⁷⁹ Scottish Government Fish Farm Production Survey 2022. Table 29 - 45,513t (2018) to 55,261t (2022)

Treatment losses

A large proportion of the deaths reported to FHI each year are due to “treatment losses”, resulting from fish being crowded before being treated with pesticides or freshwater, and then being harmed by the de-licing machines and pesticides.

Mowi states that “treatments” are its largest non-infectious cause of fish death, globally.⁸⁰

The industry has been unable to prevent millions of fish dying in these ways, despite spending nearly a billion pounds on “fish health”⁸¹, which includes these inhumane treatments.

Regional differences in salmon mortality, and climate change

The Fish Farm Production Surveys reveal significant differences in mortality rates between salmon farming regions.

In the Western Isles and the South West (essentially Argyll), average mortality was 38.8% and 31.4%, respectively, for the 2020 smolt year-class (all harvested by 2022), while in Shetland and Orkney it was 19.9% and 20.3%. Mortality in the North West (Highland) region was 16.5%.

For the most recent smolt year-class (harvested by 2023): average mortality was 40.7% in the Western Isles. In Shetland and Orkney it was 29.1% and 17.6%. Mortality had risen in the North West (Highland) and South West regions. These figures also include movements between regions but these are typically small, according to Moriarty et al.⁷⁷

Although there are variations between years, southern and western areas experience higher water temperatures. This difference is going to become more marked as the climate warms further. The Northern isles are likely to be the only areas where mortality rates can be at acceptable levels.

The industry knows that climate change poses an existential threat - industry stakeholders quoted in a 2021 Seafish report to the UK Government on climate change risk adaptation in aquaculture sourced seafood, said: “Sea lochs are generally shallower than deep Norwegian fjords so Scotland will suffer more quickly from higher temperatures than Norway and changing weather patterns can affect Scotland more than deep fjords. The very south of Scotland and southern Norway will be impacted more acutely by higher water temperatures. Investment is responding to modelling of increased temperatures and waves e.g. Icelandic farms are being set up on the basis of future conditions being warmer, rather than current conditions.”⁸²

This is not going to happen at the end of the century, it is happening now. The Government should be straight about this with the communities required to host salmon farms and to put up with their impacts.

Statutory advice on climate change and fish health in planning decisions

The likelihood that climate change is already making it impossible to farm salmon humanely in the Western Isles and Argyll should be part of the statutory advice given to Local Authorities, but it is not. FHI does routinely give advice to LAs about fish health, as Charles Allan told the RAI Committee, but this advice never mentions the impact of climate change on fish health, welfare or mortality.

Local Authorities say that these are not material considerations, but they should be.

Peer-reviewed Scottish Government research has shown that the minimum winter temperature and the number of salmon being farmed in an area, together explain 82% of the variation in farmed

⁸⁰ <https://www.calameo.com/read/00665208129e27ebb2ce9> (page 70)

⁸¹ <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-02-10-2024?meeting=16039&iob=136946>

⁸² Garrett et al. Understanding and responding to climate change in the UK seafood industry: Climate change risk adaptation in aquaculture sourced seafood. A Seafish report to the UK Government under the Climate Change Reporting Power. 2021. Annex 4. <https://www.seafish.org/document/?id=d92ae159-d7bf-41a2-b5b1-c8459e9a0500>

salmon mortality during the following year.⁷⁷ The more fish hosts there are in an area, the worse are the consequences of disease outbreaks and the more likely that sea lice treatments administered to fish with compromised gills will result in many of them dying.

The sea temperature threshold for maintaining fish health seems to be around 8°C in winter.⁸³ Otherwise, disease-causing organisms survive the winter in greater numbers.

The Scottish Government must assess this systemic risk and ensure that it is explained to Local Authorities, making the impact of climate change on fish health and welfare a material consideration, when deciding on the location of fish farms.

Cleaner fish welfare and mortality

There is an urgent need to ensure the welfare of cleaner fish.

Charles Allan told the RAI Committee that, “mortality that occurs in cleaner fish deployed in aquaculture cages is higher than we would like”, and that, “...we have seen losses in excess of 50 per cent, sometimes heading higher. It is something that concerns me.”⁷²

The published mortality figures do not include all cleaner fish deaths, but they certainly are “heading higher” than 50%. For example, *Case Study 3* shows that 100% of the lumpsuckers died in the Mowi farm, Bagh Dail nan Cean (BDNC) in 2022⁸⁴, with around 100,000 of those deaths unexplained and not reported to FHI. Mass cleaner fish mortality, often unexplained, is not unusual.

Some of the worst examples in FHI case reports⁸⁵ include:

Vacasay (Bakkafrost)	2018	100% of the lumpsuckers & 80% of the wrasse;
Geasgill (SSC)	2019	62,400 lumpsuckers;
Vacasay (Bakkafrost)	2020	53,000 lumpsuckers;
Tarbert South (SSC)	2020	100% of the wrasse;
Plocrapol (SSC)	2020 & 2022	100% of the lumpsuckers;
Hellisay (Mowi)	2021	91.7% of the lumpsuckers (43,746);
Taranaish (SSC)	2021	100% of the wrasse;
Fishnish B (Scottish Sea Farms)	2021	100% of the lumpsuckers;
Ardintoul (Mowi)	2021	44,499 lumpsuckers;
Pol na Gille (Mowi)	May - September 2022	154,334 lumpsuckers.
Bagh Dail nan Cean (Mowi)	2022	182,756 lumpsuckers (100%) & 31,484 wrasse;
Torridon (Mowi)	2022	69,876 wrasse & lumpsuckers;
Fishnish A (Scottish Sea Farms)	2023	100% of the lumpsuckers;
Glenan Bay (SSC)	2023	51,026 wrasse;
Tabhaigh (Mowi)	2023	133,119 wrasse;
Seaforth (Mowi)	2023-24	30,709 lumpsuckers;
Marulaig Bay (Mowi)	2023-24	69,782 lumpsuckers;
Stulaigh (Mowi)	2024	67,971 lumpsuckers & 64% of the wrasse;
MacLean’s Nose (Mowi)	2024	94,769 lumpsuckers.

Reporting varies between companies, so it is possible that Mowi’s farms appear on this list more often than other companies because it reports mortalities in more detail.

Analysis of all FHI mortality reports that mention cleaner fish (January 2020 - July 2024), shows that at least 65 farms reported mortality rates of more than 20% in at least one week, or more than 1000

⁸³ https://www.youtube.com/watch?v=M2ZX0-vhnT4&ab_channel=fishfarmermag

⁸⁴ 17/11/22 FHI case report number: 2022-0578.

<https://www.gov.scot/binaries/content/documents/govscot/publications/transparency-data/2022/03/fish-health-inspectorate-case-information-2022/documents/november-2022/additional-cases-20220578-20220579/additional-cases-20220578-20220579/govscot%3Adocument/>

⁸⁵ FHI mortality reports published Jan. 2020 - July 2024

dead cleaner fish in at least one week. Deaths caused by treatments and handling were mentioned in at least 23 farms. The cause of death was not recorded in 70 farms. These are underestimates as many farms reported no details.

The FHI notes accompanying some of these reports show that it is almost impossible for farm operators to separate cleaner fish, before treating salmon with freshwater for gill disease and sea lice. This is killing huge numbers, along with the stress of handling.^{13, 14, 15} This clearly constitutes unnecessary suffering and the Scottish Government should act now to prevent it happening. Cleaner fish are also eaten by the salmon, for instance when feed is withdrawn before harvesting, others are killed by disease, heat (lumpsuckers) and cold (wrasse). The survivors are slaughtered, after one production cycle (lumpsuckers) or two (wrasse).

The Scottish Government should set strict KPIs for cleaner fish welfare and mortality, with a timeline, testing and effective enforcement. Farmers must be required not to kill them all at end of each cycle. If these things are impossible, then the use of cleaner fish is unethical and it should be stopped. In Norway, their use may soon be phased out or scaled back, on ethical grounds.⁸⁶

Mr Allan also pointed out that the FHI's remit does not include the welfare of farmed fish, only some aspects of their health. He confirmed that farmed fish welfare is the responsibility of DEFRA's Animal and Plant Health Inspectorate and said that FHI notifies APHA when it has cause for concern about fish welfare. FHI and APHA sometimes jointly inspect these farms.

This system is flawed. For example, APHA did not inspect the Loch Seaforth farm, during its most recent production cycle, despite more than a million fish dying there.

Animal and Plant Health Agency & the Animal Health and Welfare (Scotland) Act

Farmed fish welfare is supposed to be ensured by the Animal Health and Welfare (Scotland) Act 2006, but the Act is not achieving this.

Fish welfare is the responsibility of the Animal and Plant Health Agency (APHA) but APHA investigates only a small sub-selection of reports of poor animal welfare on fish farms, if FHI (and occasionally third parties) notify it of high mortality events. It does not always inspect even the farms with the highest mortality.

APHA's letter to the RAIC⁸⁷ implies that it issues care notices to farm operators who need to improve fish welfare, and that it prosecutes the most wayward of them, but APHA has acknowledged in FOI disclosures that it has never issued any care notices to salmon farms and that there have been no prosecutions of fish farmers for failing in their duty to prevent unnecessary suffering, or for failing to meet an animal's needs (section 24 of the 2006 Act).

APHA also says that its role is not to take cases to the procurator fiscal, as that falls to Local Authorities.

APHA's inspectors' farm welfare reports never seem to include the suffering that must have preceded mass mortality events. In one quite typical example, the mass mortality event that had triggered an inspection was over by the time of the visit. The inspector then recorded seeing just three fish experiencing unnecessary suffering. The farm was given a clean report regarding fish welfare because those fish were euthanised promptly.⁸⁸

⁸⁶ <https://www.intrafish.no/fiskehelse/derfor-slutter-salmar-med-rensefisk/2-1-1719177>

⁸⁷ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-apha-26-september.pdf>

⁸⁸ Loch Creran (B) <https://www.gov.scot/binaries/content/documents/govscot/publications/transparency-data/2020/04/fish-health-inspectorate-case-information-2020/documents/november-2020/additional-cases-20200481-20200486/additional-cases-20200481-20200486/govscot%3Adocument/>

APHA says that Section 19 (4) of the 2006 Act⁸⁹ allows for situations where causing suffering is not necessarily an offence, if it is proportionate and for a legitimate purpose, such as medical treatment. For example, APHA says: “Freshwater immersion [of salmon] is intended to manage sea lice infestations and to treat gill health issues on farmed fish. It is undertaken under the overall direction of a veterinarian, who would appropriately assess if the stress caused by the treatment during freshwater immersion was proportionate in the circumstances for the benefit of controlling sea lice infestation or gill disease, which itself could cause suffering in farmed fish if not treated.”⁹⁰

APHA’s position is that there are no alternatives that would avoid or reduce the suffering and that a humane person would take that course of conduct, under those circumstances. As a result, it seems to accept that any amount of suffering is necessary in fish farming, as long as the practices causing it are in common use in the UK industry.

Neither the Scottish Government nor APHA have set a ceiling on fish deaths and suffering, so the industry alone decides which practices and equipment it uses, including some that have very severe impacts on animal welfare, for example physical treatments such as thermolicers, and the use and subsequent slaughter of millions of cleaner fish every year.

The alternatives, for example, improving welfare by farming fewer fish, or farming in healthier locations, seem never to be considered by APHA, no matter how high mortality has been, even repeatedly at the same farms.

Despite this, APHA’s letter to the RAI Committee says: “In our experience, the working relationship between FHI and APHA is delivering well to support welfare standards in the fish farming industry”.⁹¹ APHA may believe this, but it is manifestly not true, given the exceptionally high level of mortality in Scottish salmon farms.

High mortality is the most basic indicator of poor animal welfare. Whatever APHA believes it is doing to “support the welfare standards in the fish farming industry”, it is not working.

The Scottish Government should set up an independent Inquiry (perhaps by the Scottish Animal Welfare Council) to assess the welfare of farmed salmon, identifying the risks and failures in current practices, and making recommendations for improvement. The SAWC is already investigating cleaner fish welfare. The Inquiry should be required to invite independent fish welfare specialists, such as Professor Sneddon, to take part.

It should assess:

- The degree of suffering involved in all practices used in salmon farming, in freshwater and in seawater, including the practice of culling large numbers of slower growing but healthy fish;
- The suffering implicit in the very large number of deaths due to “treatment losses”;

⁸⁹ Section 19 (4): The considerations to which regard is to be had in determining, for the purposes of subsections (1) to (3), whether suffering is unnecessary include -

- (a) whether the suffering could reasonably have been avoided or reduced,
- (b) whether the conduct concerned was in compliance with any relevant enactment or any relevant provisions of a licence or code of practice issued under an enactment,
- (c) whether the conduct concerned was for a legitimate purpose, for example—
 - (i) the purpose of benefiting the animal, or
 - (ii) the purpose of protecting a person, property or another animal,
- (d) whether the suffering was proportionate to the purpose of the conduct concerned,
- (e) whether the conduct concerned was in the circumstances that of a reasonably competent and humane person.

<https://www.legislation.gov.uk/asp/2006/11/section/19>

⁹⁰ APHA FOI. November 2024

⁹¹ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-apha-26-september.pdf>

- The predictable suffering that is a direct consequence of companies choosing to restock farms in locations that have a history of high mortality;
- The suffering that results from decisions made for economic reasons, to retain salmon in farms where micro-jellyfish, disease, sea lice and treatments have been killing large numbers of fish, instead of moving or harvesting the fish early, and;
- The need for a new process, independent of industry, to assess the degree of suffering involved in any new technique or equipment, with regular reviews of current practices, as Norway does.

The Inquiry should also investigate how APHA assesses the welfare of farmed salmon and cleaner fish, how APHA decides whether the duty of care to meet an animal's needs has been achieved and how APHA defines "unnecessary suffering", in the context of salmon farming.

This would determine whether APHA's application of the 2006 Act is fit for purpose, or legal.

The Inquiry should also consider the failure of Local Authorities to prosecute under the 2006 Act, given that they depend entirely on APHA for evidence, and on APHA and the Marine Directive for advice.

The Scottish Government should issue official guidance on the welfare of farmed salmon, as it has for other species, describing how farmers can meet their legal responsibilities, and recommending how to go beyond the legal minimum to achieve higher welfare. This would allow enforcement of the Animal Health and Welfare (Scotland) Act 2006. APHA and/or Local Authorities must then be required to enforce the Act properly.

If they are incapable of doing so, then the Scottish Government should establish its own farmed fish welfare inspection and enforcement body, to replace APHA (a UK agency).

The RECC's recommendation 2 said, "...that urgent and meaningful action needs to be taken to address regulatory deficiencies as well as fish health and environmental issues before the industry can expand". This has clearly not happened. It is long overdue.

Should fish be treated differently to other livestock?

The sector tries to justify its very high mortality rates by saying that fish are biologically different to mammals and birds. While it is true that salmon produce many more eggs than a hen, and that a high proportion of them would die in the wild, it is not valid to compare farmed and wild animals.

Farmed salmon are protected from predators, vaccinated and treated with antibiotics and other medicines, they are fed as much as they need and they do not have to make a hazardous migration to the Arctic and back, so a far smaller proportion of farmed fish should die.

Also, the salmon's mass production of young happens in the freshwater stage of salmon farming.

This cannot be used to justify the very high mortality rates that occur in the seawater farming stage as well. These are higher than in Norway, higher than Scotland's historic rates and higher than for other farmed fish species (see Waitrose mortality KPI data below).

Regarding animal welfare, Professor Sneddon told the committee that fish should not be considered differently to birds and mammals, as salmon are sentient and feel pain.⁹²

The British Veterinary Association's policy position on UK sustainable finfish aquaculture echoes this: "There has been growing research and evidence to show that fish feel pain...Their status as sentient beings was enshrined into law in the Animal Welfare (Sentience) Act 2022."

"To be considered sustainable, aquaculture systems must provide for the five animal welfare needs, positive health outcomes and adhere to World Organisation for Animal Health (WOAH) standards for

⁹² <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-05-06-2024?meeting=15919&iob=135889>

animal health and welfare. Systems should aspire to offer stimulating environments to allow for the performance of highly motivated behaviours; opportunities for positive welfare outcomes, such as comfort, pleasure, interest and confidence; and excellent health outcomes.⁹³

Clearly, salmon farms where there are repeated high mortality events are not providing the five animal welfare needs, or positive health outcomes. Nor do they offer stimulating environments for salmon.

In a humane society, there must be some limit to the number of farmed animals that are allowed to die prematurely, yet the Scottish Government insists that it is too difficult to cap the maximum acceptable mortality percentage in salmon farms, putting itself in the untenable position of having to accept that 86.8% was the lowest mortality rate that the farm operators at Culnacnoc could achieve. By showing no intention to prevent that and other high mortality farms from restocking, it also accepts that such large numbers of deaths are part and parcel of salmon farming in Scotland.

Farmed salmon is the UK's largest food export. The high levels of suffering and death in this industry are undermining the brand as well as Scotland's claim to being a Good Food Nation.

What is a reasonable rate of mortality for farmed salmon?

During the RAI Committee meeting on 2nd October, Ben Hadfield (Mowi Scotland) was reminded that he had told the REC Committee that 5% average production cycle mortality at sea was possible, compared to c. 25% at present.

The Norwegian union that represents many fish farm health technicians agrees. This year it has threatened to strike, unless the country's salmon farming industry is required to lower mortality at sea to a maximum of 5% within five years.⁹⁴

Waitrose deserves credit for publishing its animal welfare policy and Key performance Indicators for livestock and farmed fish.⁹⁵ The company says: "Most of our supply chains show decreasing or stable levels of livestock mortality", but this is not true of its farmed salmon, which has the worst KPI for mortality of all the livestock sold by Waitrose. In 2023, it was 26.4%, the highest ever (55% higher than in 2018). Note that this figure is just for the seawater stage of salmon farming and that it also excludes mortality during the fishes' first 90 days at sea.

The company blames this very high mortality on "record sea temperatures and a rise in novel planktonic risk factors leading to severe gill health challenges across the sector". It gives the same explanation for the 19.13% mortality of sea grown rainbow trout. These very high mortality rate did not stop Waitrose from selling either of these fish.

For comparison, the mortality of Waitrose's other marine fish was between a quarter and a half of the farmed salmon mortality at sea, with sea bass: 7%, sea bream: 8% and halibut: 12.4%. Its UK lamb mortality rate was 8.1%, chicken: 3.58% and laying hens: 11.8%.

Fish farming companies should be required by law to lower mortality each cycle, achieving a humane level within five years, as the Norwegian fish health workers' union has said.

⁹³ <https://www.bva.co.uk/media/5048/bva-policy-position-on-sustainable-finfish-aquaculture.pdf>

⁹⁴ <https://www.fishfarmingexpert.com/fish-mortality-norway-tekna/fish-health-experts-union-calls-for-5-mortality-limit-on-salmon-farms/1741307>

⁹⁵ <https://www.johnlewispartnership.co.uk/content/dam/cws/pdfs/Juniper/ethics-and-sustainability/Our-Approach-to-Animal-Welfare-and-Livestock-KPIs.pdf>

One-off events versus repeated high mortality

Rachel Shucksmith (UHI) told the RAI Committee that farms with an otherwise good mortality record can suddenly be hit by micro-jellyfish, killing many fish⁹⁶, an event that may not be repeated.

However, on a significant number of farms the mortality rates have been increasing year on year, which cannot be due to one-off events. These farms are readily identifiable. They are often too large for the unhealthy, slow-flushing sea lochs in which they are sited.

The Scottish Government should identify these farms and limit their production, or remove their operating licences, if they cannot reduce their mortality percentage. This should happen regardless of whether alternative sites have been consented beforehand.

“Meaningful action” on fish health?

The REC Committee called for meaningful action to tackle fish health. Salmon Scotland’s letter to the RAI Committee says that the industry has, “invested c. £975million over the last 5 years to support improved fish health and welfare”.⁹⁷ In addition to innovations such as freshwater treatments, this sum includes the enormous cost of physical sea lice treatment vessels, pesticides and cleaner fish.

It is unreasonable for the industry to frame much of this spending as a positive action, given the fish welfare problems that are being caused by it treating fish for sea lice, gill disease and for the effects of planktonic and micro-jellyfish blooms - all consequences of the intractable problems of farming salmon in increasingly unsuitable areas.

Fish mortality data reporting

REC Committee recommendations on providing better data on fish mortality

11 Information provided in future should **provide an accurate, detailed and timely reflection of mortality levels including their underlying causes across the whole sector**. It should also incorporate a mechanism for **reporting where early harvesting has been carried out because of a disease outbreak**.

13 There should be coordination with the data that is to be provided on sea lice infestation levels to ensure that **a package of data is available which provides an up-to-date and comprehensive overview of all fish health, welfare and treatment issues across the sector**.

This is consistent with the Committee’s other recommendations (22, 23, 24 & 33) that the data on fish farming in Scotland should be better and more transparently displayed, in a single location.

This should be done in such a way that makes analysis possible across the industry and at the farm and regional level. Norway’s excellent Barentswatch website displays much of the country’s aquaculture data in one place. The annual fish health reports of the national Veterinary Institute¹² are also a model of transparency, based on which the industry’s regulators can make sensible strategic decisions to improve fish health and welfare. There is no reason why this cannot be done in Scotland.

Professor Griggs’ review and the SSAC report both call for greater transparency. The lack of transparency around mortality and other impacts of salmon farming, breeds distrust in the industry and its regulators. Publishing comprehensive, consistent and transparent mortality assessments and welfare assessments is in the industry’s and the nation’s interest.

⁹⁶ <https://www.parliament.scot/chamber-and-committees/official-report/search-what-was-said-in-parliament/RAI-18-09-2024?meeting=16000>

⁹⁷ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-farming-from-salmon-scotland-4-june.pdf>

Mr Allan told the RAIC that, “all the data that is collected by the inspectorate is reasonably presented in the public domain”. The FHI does publish this data but it is scattered, incoherent and it contains large gaps (e.g. cleaner fish and salmon deaths per year). He added: “[The data] does not necessarily all sit in one place... If more resource to produce a different information technology system were available, we - by which I mean the regulators of aquaculture - could make that data more accessible.”⁷²

This should happen, funded by a sector-wide levy (rec. 24).

There have been a few improvements in reporting (Scotland’s Aquaculture website now gives weekly sea lice counts, hydrogen peroxide discharges and antibiotic use, and Salmon Scotland publish monthly and cumulative mortality percentages) but there is still a long way to go to fulfil the RECC’s recommendations on transparent reporting and the presentation of data in one place (11-13 & 3).

The Scottish Government should report mortality in the same place as all other fish farm data, to allow it to be cross-referenced with the total number of salmon, wrasse and lumpsuckers dying in freshwater mortality and seawater farms, per facility, per week, and with the cumulative mortality totals for each cycle, per farm, and across the whole industry.

There should be full transparency about the losses of each group of fish, from when they are ova until they are smolts, and from them being put to sea as smolts until harvest, regardless of whether the fish have been moved between farms. When fish are moved between farms, some companies may restart their production cycle reporting “clocks” at zero, which can conceal the full extent of mortality for each cohort of salmon.

As in Norway, the Scottish Government should publish annual farmed salmon and cleaner fish mortality statistics, with analysis to inform strategic and local planning.

It cannot hope to set strategic targets for reducing fish farm mortality if it will not publish the most basic metric - the number of fish dying each year.

Six years have elapsed since the RECC inquiry called for full transparency in reporting mortality.

The slow progress suggests that the Scottish Government and the industry prefer the status quo, rather than exposing these deaths to greater public scrutiny.

Third-party certification schemes

The Scottish Government is over-reliant on farm inspections by third-party welfare certification bodies, such as RSPCA Assured and the Aquaculture Stewardship Council.

These paid-for schemes suffer from conflicts of interests, with advisory boards filled by industry representatives. They cannot be a substitute for an effective, independent, state-run welfare inspection regime. For instance, it is exceptionally rare for RSPCA Assured to expel farms, even when their mortality rates exceed 80%. It does not set a maximum mortality rate for the fish farms that it certifies.

The Scottish Government says that RSPCA Assured’s inspections help to ensure good welfare for farmed salmon and cleaner fish. To be certain of this, it should instigate a review of the enforcement/de-certification actions taken by all third-party schemes.

III. Economic and social benefit

In summary

- The 2023 Fish Farm Production Survey shows an industry with severe problems. Total production fell by 18% between 2021 and 2022. It fell again, by 11%, between 2022 and 2023, with 2023 production lower than at any time since 2009, and 25% lower than in 2018.
- All jobs matter in Scotland's coastal communities, but there would be just as many, and probably more, if salmon farming companies would commit to being better neighbours, reducing their impacts on the environment and on other users of the sea, and farming fish humanely, with far lower levels of mortality and much higher standards of animal welfare.
The current model is failing. The falling numbers of direct job on fish farms reflect this.
- The latest Scottish Government figures show that, in 2023, the number of people (F/T & P/T) employed directly in salmon production (excluding processing or marketing) fell to 1,480, the lowest since 2018. 305 people (F/T & P/T) were also employed directly in salmon smolt production. Between 2018 and 2022, the number of direct jobs on farms fell or was stagnant in all regions except the Northern Isles, due to company buy-outs, site consolidation, automation and having to keep farms empty due to the high risk of mortalities. In 2023, just four companies accounted for 94% of Scotland's farmed Atlantic salmon production. Total production has fallen for two years in a row, by more than a quarter (a total of 54,444t) from 2021 to 2022, according to the Scottish Government's Fish Farm Production Survey – the lowest production since 2009.
- Salmon farming is highly profitable but its economic value has been inflated because only the benefits have ever been assessed, never the costs imposed on other users of the sea. Local communities bear their brunt. A full cost-benefit analysis is essential before further expansion.
- The economic benefits are also inflated because the benefits of the indirect and induced jobs and GVA due to fish farming, are double-counted with the benefits of other industries, according to a 2020 report, commissioned by the Scottish Government¹⁰⁰. When referring to the aquaculture sector's direct contribution to Scottish GDP, that report said the correct figures at that time were 6,260 people directly employed across Scotland and £468 million direct GVA.
- The global head of seafood at the main bank that lends to Norway's salmon farmers (DNB) has concluded that the industry globally has "hit its biological ceiling", as farmers contend with climate risk and rising sea lice levels, and is losing its social licence as a result.⁹⁸ Anne Hvistendahl said: "There's a biological ceiling to how much we can produce, and we are hitting that ceiling now. You have to grow in a sustainable way; otherwise, politicians will not allow you to grow 10 years from now"; "[salmon farming] needs to concentrate on cultivating this 'social license' to operate in order to move forward."
- The industry should follow its own Community Engagement Charter and respect the majority opinion of communities on whether they want a local salmon farm. Only Mowi has withdrawn farm proposals and only a handful of times.
- "Community benefits" promised in advance of planning decisions are bribes.

⁹⁸ <https://www.undercurrentnews.com/2024/03/20/dnb-salmon-farming-at-biological-ceiling-risks-losing-social-license/>

Industry growth

REC Committee recommendations on industry growth:

4 The impact of expansion plans on other sectors which share the marine environment needs to be recognised and the impact reduced. The Scottish Government, SEPA and all other responsible authorities should therefore **ensure that the needs of other industries are fully considered in setting the strategic context for the sector.**

Branding and accreditation: The Committee notes that the challenges referred to elsewhere in this report could and may be affecting consumer's perceptions of the product. **To maintain the Scottish brand, Scotland's salmon farmers must excel in responsible and sustainable production methods ...**

The economic benefits of salmon farming to Scotland – costs as well as benefits

At the RAIC session on 5th June 2024, the Convenor stated that “it has been estimated that salmon farming was worth approximately £760 million to the Scottish economy in 2021”.

Salmon Scotland's website⁹⁹ cites a 2022 economic report which seems to be the source of this figure but which appears not to have been published. It is said to show that the direct economic contribution of salmon farming to Scotland, in 2021, was £303m GVA, with a further £397m GVA generated indirectly through the supply chain and £66m more as “positive impact in employment costs, benefitting local communities and companies like accommodation providers and retailers ... taking the combined total to £766m”.

In the session on 20th October 2024, Tavish Scott (Salmon Scotland) referred to the “sector that employs 12,000 people” and said that “2,500 people” are directly employed by salmon farming companies, which are “sustaining a further 10,000 directly-dependent jobs across Scotland.”

There is no doubt that farming salmon is very profitable - an economic report commissioned by the Scottish Government from BiGGAR Economics in 2020¹⁰⁰ said that in 2018 the aquaculture sector contributed around £885 million GVA and 11,700 jobs to the Scottish economy - mostly due to salmon farming – but it warned about over-stating the benefits, pointing out that, “the aquaculture sector directly employed 6,260 people across Scotland and contributed around £468 million direct Gross Value Added (GVA). These impacts can be exclusively attributed to the sector. **As a result, when referring to the direct contribution that the aquaculture sector makes to Scottish Gross Domestic Product (GDP), this is the figure which should be referenced.**”

The BiGGAR Economics report also states that, “it should be acknowledged that the Gross Value Added (GVA), which is estimated in this study is different from the Gross National Income (GNI).

The latter considers the value of production that is generated by companies and workers from Scotland ... **When there is foreign ownership of an activity, the difference between the two measures is mostly dependent on the relative split of direct GVA between staff costs (mostly taking place in Scotland) and the returns accruing to capital (going abroad to the owners of this capital).** These shares in turn depend on how capital intensive a sector is ... **The share of staff costs as a proportion of Direct GVA ranged from 31% in salmon production to 72% in shellfish production.**”

The same report cautioned that “counting indirect and induced impacts for each industry across the economy would lead to double-counting and an overestimate of GDP”.

⁹⁹ <https://salmonscotland.nbcom.co.uk/news/scottish-salmon-hands-economy-ps760million-boost>

¹⁰⁰ BiGGAR Economics. 2020. Estimation of the Wider Economic Impacts of the Aquaculture Sector in Scotland <https://www.gov.scot/publications/estimation-wider-economic-impacts-aquaculture-sector-scotland/>

The REC Committee's report also noted similar, very large economic benefits, saying that, "the Cabinet Secretary for the Rural Economy told the Committee that [aquaculture] ... supports more than 12,000 jobs and contributes £620 million a year to the economy. This value to the Scottish economy was established in the 2017 Highlands and Islands Enterprise research report on the "Value of Scottish Aquaculture".¹⁰¹

The figures in that HIE report were disputed by some of Scotland's top economists.¹⁰²

They concluded that the report had failed to offset the claimed increases in income and job creation against the costs to other users of the sea, saying, "the reality is that the consequential damage to the marine environment will result in many other stakeholder groups being worse off", and that "the actual income and employment evidence cited by the Scottish Government does not describe the net impact on income and employment for Scotland as a whole".

Riddington et al. pointed out that, "a doubling of production does not necessarily mean a doubling of GVA and employment. The case for expansion has to focus explicitly on the additional benefits and costs that the expansion will deliver. No such analysis has been undertaken."

They concluded that, "the reality is that net expansion of income and employment is completely unknown", and that, "in public debate, estimates of income and employment are being used inappropriately to justify salmon aquaculture expansion."

The authors did not believe that the Scottish Government had "demonstrably considered the best interests of Scotland as a whole", in supporting this expansion so uncritically.

A peer-review¹⁰³ of Riddington et al. agreed that the evidence on which the Scottish Government relies is, "partial, incomplete and inappropriate for use in assisting public sector decision making", and that, "if the Scottish Government does propose to support expansion of the Scottish aquaculture sector then a proper assessment needs to be made". This is still the case.

Impacts on other users of the sea

Fishermen are clearly worse off due to salmon farms, losing valuable fishing grounds and safe places to work in winter, as the Clyde Fishermen's Association and Scottish Creel Fishermen's Federation regularly point out. Both organisations are deeply concerned that fish farm pesticides are reducing their members' ability to catch crustaceans (citing SEPA's study showing the impact of emamectin benzoate in Shetland). SEPA ignores their calls for this impact to be assessed in other areas.

Angling for salmon and sea trout is another important industry, as FMS pointed out in its recent letter to the RAIC. In 2017, anglers spent around £135m, supporting 4,300 FTE jobs and £79.9m GVA.¹⁰⁴ It is widely accepted that salmon farming can affect wild salmon and sea trout populations.

Until the costs to other users of the sea have been factored in, as Riddington et al. pointed out, there can be no true assessment of the overall value of salmon farming to Scotland, in terms of jobs or the Gross National Income that is retained to benefit the nation.

¹⁰¹ <https://www.hie.co.uk/media/3035/valueplusofplusscottishplusaquacultureplus2017plus-plusreport.pdf>

¹⁰² Riddington, Radford and Gibson. 2020. The Economic Contribution of Open Cage Salmon Aquaculture to Scotland <https://www.sift-uk.org/wp-content/uploads/2020/04/Riddington-Radford-Gibson-Economic-Contribution-of-Salmon-Aquaculture-to-Scotland.pdf>

¹⁰³ Bridge Economics. 2021. Peer Review of the Economic Contribution of Salmon Aquaculture to Scotland <https://www.sift-uk.org/wp-content/uploads/2020/04/Peer-Review-Economic-Contribution-of-Salmon-Aquaculture-to-Scotland.pdf>

¹⁰⁴ <https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2024/salmon-inquiry-fms.pdf>

The number of direct jobs

Direct jobs on salmon farms are static or falling because of automation, the dwindling number of companies, due to buy-outs, and because farms are consolidating in fewer, larger sites.

Mowi's annual report says that it aims to cut its global workforce by 10% between 2020 and 2024.¹⁰⁵

According to the 2023 Fish Farm Production Survey, only 155 direct salmon production jobs have been added since 2014 (+11.7%). 1,480 people (62 of them part-time) were employed directly "in salmon production" (excluding processing or marketing), an increase of only 14 jobs from 2018.

305 people were employed in smolt production (20 of them part-time), up by 27 from 2018.

The Survey also shows that in 2023, the Western Isles had 25% fewer salmon production jobs than in 2018 (230 jobs), the North West (Highlands) had 20% fewer (378) and the South West (Argyll) had 4% fewer (378). Direct fish farm jobs in Orkney had almost doubled (to 182) and risen by 50% in Shetland (to 312).

Combining Fish Farm Survey data with population figures from the National Records Office shows that, in 2022, only 0.3% of all 16 - 64 year-olds in the North West (Highlands) were employed in the production of salmon at sea, with 0.7% in the South West, 1.4% in Orkney, 1.6% in the Western Isles and 2.1% in Shetland.

While every job does matter in Scotland's coastal communities (and there are valuable fish farm-related supply chain jobs there as well), salmon farming is not a very large employer in economically fragile rural areas. Fish processing is scattered all around the country. It employs larger numbers of lower-paid people. Poor fish health is also impacting some of these jobs, for instance in Stornoway.¹⁰⁶

Trust and social licence

In his review of aquaculture consenting, Prof Griggs said he had never seen such a lack of trust as there is around salmon farming. This loss of social licence is why so many proposals for new and expanded salmon farms are being contested by local residents. More of the communities closest to, and most affected by salmon farms are realising what is happening and that the situation is worsening. They believe it is time for this industry to become a good neighbour and clean up its act.

In order to restore some trust, Salmon Scotland's member companies should apply their own Community Engagement Charter¹⁰⁷ which says: "Consider putting the decision to a community vote - it is the ultimate test of whether the case has been made for a site and has the support of the wider population", and, "where relevant, we will engage communities in a vote to allow the local people to have a direct say in what is happening".

Mowi, to its credit, has respected the views of some communities when votes went against its proposed developments, but only with a few island communities and one recent mainland example. There are other cases when the company has not listened to community opinion, but as far as CCN is aware, it is the only company to do this at all. To give a current example, Bakkafrøst Scotland has not heeded the clearly expressed view of a majority of residents on Gigha, against its proposed new farm there.

The community engagement charter also contains this warning about bribing communities to approve new salmon farms, with promises of "community benefits", ahead of planning decisions:

¹⁰⁵ <https://www.calameo.com/read/00665208129e27ebb2ce9> (page 6)

¹⁰⁶ <https://www.bbc.co.uk/news/articles/cpd93j2znzno>

¹⁰⁷ https://www.salmonscotland.co.uk/site/assets/files/2691/community_charter_2016_digital_final.pdf

“[Have] Initial discussions on community benefits if appropriate. This is not a material planning consideration and developers must be careful what is discussed at this stage to balance engagement and being seen as trying to sway local opinion”. Not all companies abide by this advice.

Is farmed salmon a low carbon food?

There is a great deal of greenwashing, focused on the claim that farmed salmon has the lowest carbon footprint of any form of livestock farming.

Producing intensively farmed salmon has a similar carbon footprint to intensively farmed chicken, produced in a conventional UK broiler unit.¹⁰⁸ However, this takes no account of two aspects of salmon farming that contribute much of its carbon footprint; the sourcing of feed ingredients and airfreighting farmed salmon to markets in the Far East and North America.

In 2015, farmed salmon was the heaviest cargo flown out from Heathrow (46,000t).¹⁰⁹

In the first half of 2024, 37% of Scottish salmon exports by value were outside the EU.¹¹⁰ All those fish would have been airfreighted because salmon is hardly ever transported frozen.

Taking Mowi as an example:

The company’s most recent annual report¹¹¹ shows that sourcing feed accounts for 39% of its global Scope 3 greenhouse gas emissions (the consequence of the activities of the company that occur from sources not owned or controlled by the company), with another 16% due to third-party feed.

24% of its Scope 3 greenhouse gas emissions were due to air freighting salmon to consumers.

In 2023, Mowi’s global Scope 3 emissions were 2,135,209 tonnes CO₂e, so the amount due to feed was (39+16% =55% of 2,135,209 tonnes CO₂e = 1,174,365 tonnes CO₂e).

In 2023, Mowi produced 11.57% of its salmon in Scotland.

Scotland’s contribution to the company’s Scope 3 emissions for feed sourcing is therefore likely to have been roughly 11.57% of 1,174,365 tonnes CO₂e, which is 135,874 tonnes CO₂e.

Air freight contributes another 24% of the company’s global Scope 3 emissions 2,135,209 tonnes CO₂e = 512,450 t CO₂e globally.

Scotland’s 11.57% share of that would be 59,290 tonnes CO₂e in 2023.

Intensively farmed salmon starts with a carbon footprint no lower than intensively farmed chicken and airfreighting it can then double its greenhouse gas emissions, as the Norwegian example below illustrates.

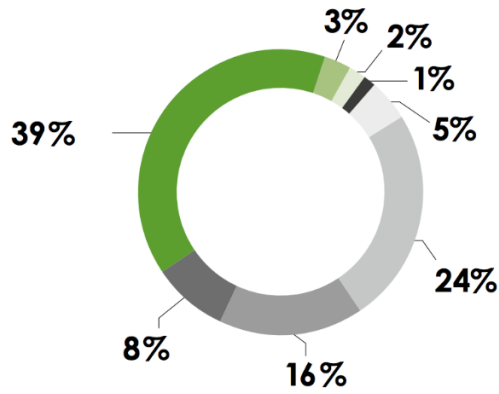
¹⁰⁸ <https://www.sruc.ac.uk/media/anhhtmv/rpc-research-briefing-quantifying-aquaculture-greenhouse-gas-emissions.pdf>

¹⁰⁹ <https://mediacentre.heathrow.com/pressrelease/detail/5289>

¹¹⁰ <https://www.fishfarmingexpert.com/douglas-alexander-salmon-scotland-scottish-salmon-exports/value-of-scottish-salmon-exports-rises-by-41/1808429>

¹¹¹ <https://www.calameo.com/read/00665208129e27ebb2ce9>

Scope 3 GHG emission in 2023



* Well-to-Tank

** Other includes: upstream transportation and distribution (0.3%), business travel (0.1%), employee commuting (0.2%), waste (0.2%), sea freight (0.1%), train freight (0.05%) and EoL treatment (0.4%)

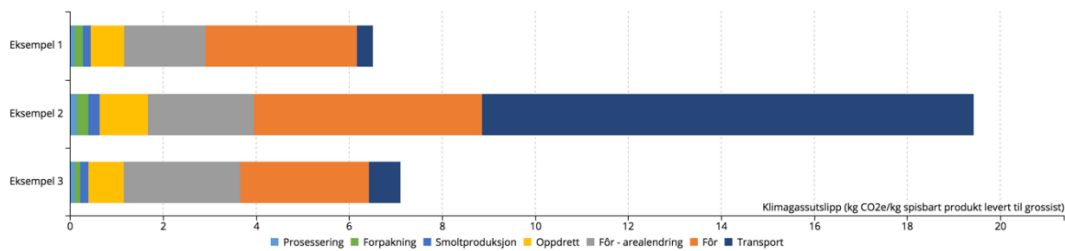
The example below, from the Norwegian Barentswatch website, shows that exporting farmed salmon from Norway to China by air, doubles the greenhouse gas emissions (dark blue) compared to using road transport from Norway to Paris.¹¹²

Climate footprint for Norwegian salmon products 2017

Example 1: Fresh gutted salmon with head to Paris by car and ferry. By-product use 80%.

Example 2: Fresh gutted salmon with head to Shanghai by car and plane. By-product use 20%.

Example 3: Frozen gutted salmon with head to Paris by car and boat. By-product use 70%.



Transportation	10,576
Before	4,905
Feed - area change	2,282
Breeding	1,038
Smolt production	0.24
Packaging	0.255
Processing	0.138

¹¹² Barentswatch climate impact reporting comparison for farmed salmon to Paris and Shanghai.

<https://www.barentswatch.no/havbruk/klimagassutslipp>

ANNEX – Fish farm mortality calculations

FHI reporting exemptions

Salmon farm operators are not required to report any fish deaths during the first six weeks after stocking a marine site, a time during which mortalities are often especially high.

In theory, it would be possible for roughly half the fish in a farm to die gradually over 21 months at sea, without the operators having to report any deaths to FHI.

All farms have large numbers of fish deaths that are not reported - the routine removal of dead fish from the Dunstaffnage farm, before the RAI Committee members' visit, is an example of the daily salmon deaths which go unreported to FHI.

Table of mortality reporting thresholds, seawater farms:

Site Ave. Weight (g)	Max. weekly mortality (%)	Max. 5-week rolling mortality (%)
<i>Under 750</i>	<i>1.5</i>	<i>6</i>
<i>750+</i>	<i>1.0</i>	<i>4</i>

Source¹¹³

Table of mortality reporting thresholds, freshwater lochs:

- Egg to 1st feed – 10 weeks – 6% weekly
- 1st feed to 5g – 10 weeks – 3% weekly
- 5g to smolting – 20 weeks – 1.5% weekly

Source¹¹⁴

“Monthly survival”

The industry often says that it has “97% monthly survival”. This does not acknowledge that applying a monthly mortality rate of a few percent, over the 18-21 months that fish spend at sea, will result in a very high overall mortality percentage.

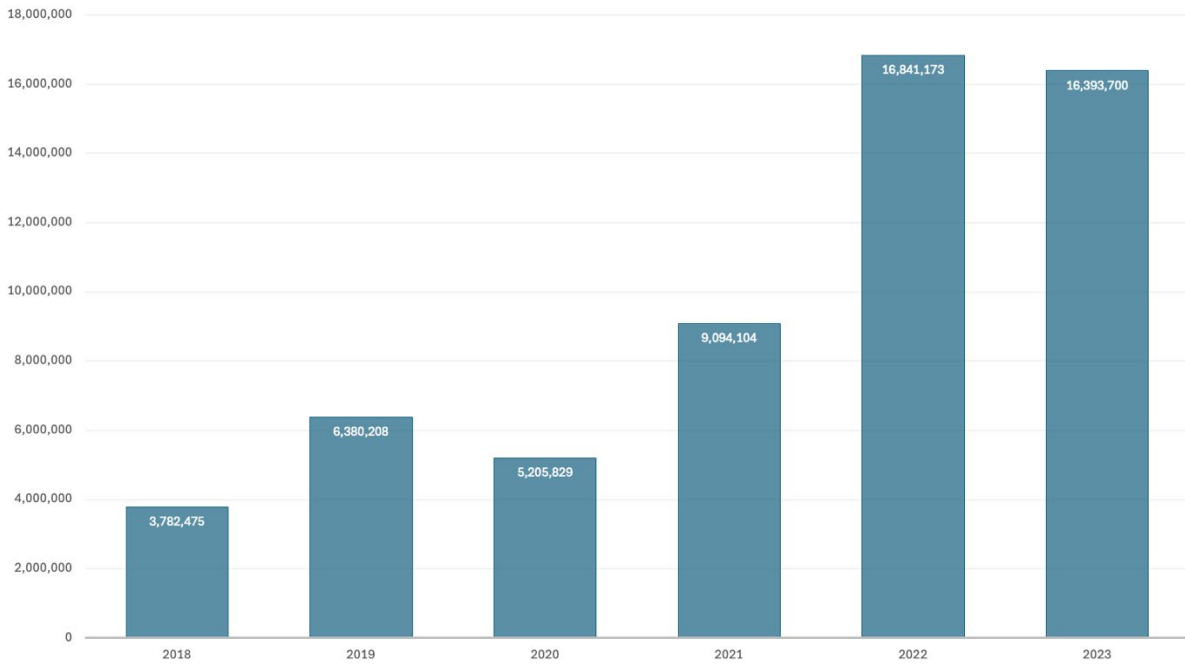
FHI Mortality figures

According to the Fish Health Inspectorate's figures (see chart below), over 16 million salmon died in Scottish freshwater and saltwater salmon farms in 2022 and in 2023, 430% more than FHI reported in 2018. This excludes all deaths that were below FHI's reporting threshold.

¹¹³ <https://thecodeofgoodpractice.co.uk/documents/chapter-4-seawater-lochs.pdf>

¹¹⁴ <https://thecodeofgoodpractice.co.uk/documents/chapter-3-freshwater-lochs.pdf>

Farmed salmon mortality (FHI data 2018 - 2023) - Freshwater and Seawater
Subject to FHI reporting thresholds



Source: FHI mortality reports¹¹⁵

How many deaths are not reported to / by the FHI?

This can be estimated by comparing SEPA’s and the FHI’s mortality figures.

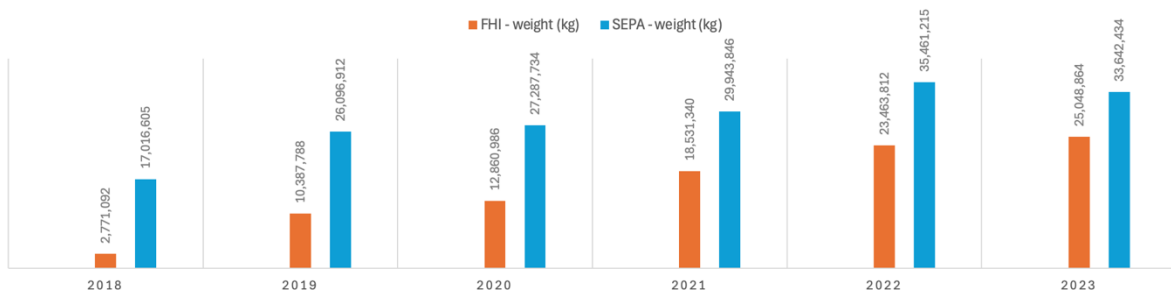
FHI publishes mortality figures both by weight and the number of dead fish. SEPA only publishes mortality figures by weight, but without the FHI’s reporting thresholds.

The weights of fish mortalities in seawater farms reported by FHI and by SEPA are compared in the first chart below. These include a small proportion (estimated to be about 6%) of marine farmed rainbow trout mortalities. The rest are farmed salmon. SEPA’s figures are always higher.

Farmed salmon & rainbow trout mortality at sea - by weight (kg)

FHI data is subject to reporting thresholds

SEPA data is not subject to FHI reporting thresholds



Sources: FHI seawater mortality figures.¹¹⁶ SEPA seawater mortality figures from Scotland’s Aquaculture.¹¹⁷

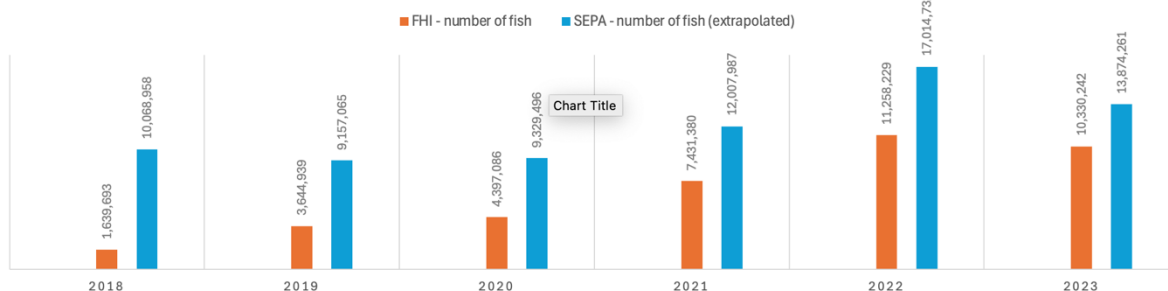
The second chart uses the ratio of FHI’s mortality weights to its fish mortality numbers, to extrapolate from SEPA’s mortality weights in order to estimate the number of dead salmon and rainbow trout in seawater farms.

¹¹⁵ <https://www.gov.scot/publications/fish-health-inspectorate-mortality-information>

¹¹⁶ <https://www.gov.scot/publications/fish-health-inspectorate-mortality-information/>

¹¹⁷ https://aquaculture.scotland.gov.uk/data/fish_farms_monthly_biomass_and_treatment_reports.aspx

Farmed salmon & rainbow trout mortality at sea - number of dead fish
 FHI number of dead fish is subject to reporting thresholds
 SEPA number of dead fish is extrapolated by the ratio of weight to number of fish in FHI data



Sources: FHI seawater mortality figures. SEPA numbers extrapolated from SEPA weights -Scotland's Aquaculture.

By this calculation, an estimated 17m salmon and rainbow trout died in Scotland's seawater farms alone, in 2022.

FHI reported 11,258,229 deaths in the same period, suggesting that its reporting thresholds excluded roughly a third of the deaths in that year (roughly 6m), almost all of them salmon.

The proportion of salmon dying prematurely in freshwater and seawater

The Scottish Government's Fish Farm Production Survey 2023 gives the ratios of ova laid down to smolts produced in Scotland. A small proportion of other smolts are produced elsewhere.

Assuming that the same ratios apply to all smolts put to sea in Scotland, then, 55,300,000 smolts were put to sea in 2022, so 77,420,000 ova must have been laid down two years earlier, in 2020. Therefore 22,120,000 fish must have died before the surviving smolts were put to sea, giving 29% mortality in the freshwater stage.

The average freshwater mortality for the five most recently reported ova year-classes (2016-2020) was 31%.

When this is combined with the average mortality rate for smolt year-classes at sea (roughly 24%, as the Scottish Government says), the average mortality in freshwater and seawater is almost 50%, across the salmon farming industry in Scotland. It would have been even higher for the most recent year-class.

How many farms routinely experience high mortality?

Since 2018, 34 seawater farms have suffered mortality of over 50%, according to Salmon Scotland data. This is becoming more common - just one of those incidents was in 2018, eight were in 2022 and ten in 2023.

High mortality is happening repeatedly at some farms. They are easy to identify and ought to be reduced in size, closed or moved.

Between 2018 and June 2023:

132 farms had at least one production cycle with mortality above 25%;

In 62 of these farms, production cycle mortality was above 25% at least twice;

In 10 of them, three production cycles had mortality above 25%, and;

In 3 of them, four production cycles had mortality above 25%.

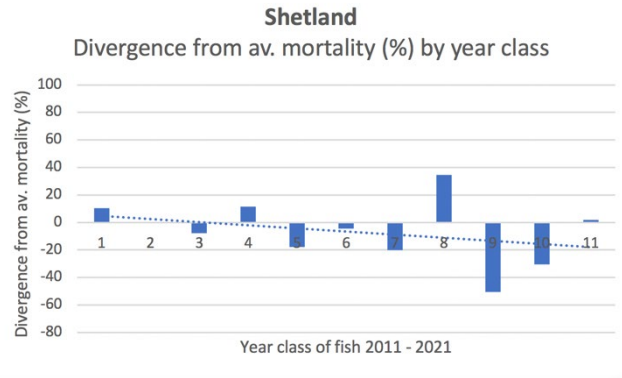
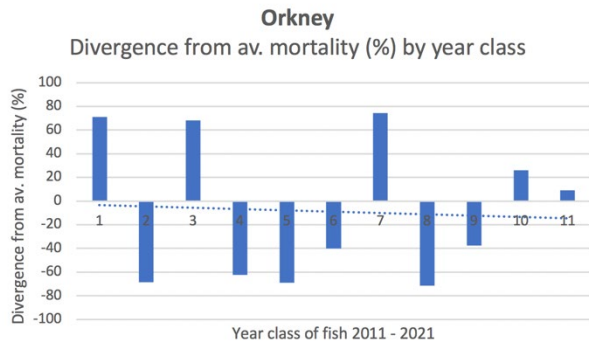
High mortality is a common problem. Between 2018 and June 2023:

Mortality exceeded 35% in 97 production cycles in seawater farms (14% of them);

Mortality exceeded the industry average of 24% in 210 cycles in seawater farms (31% of them);

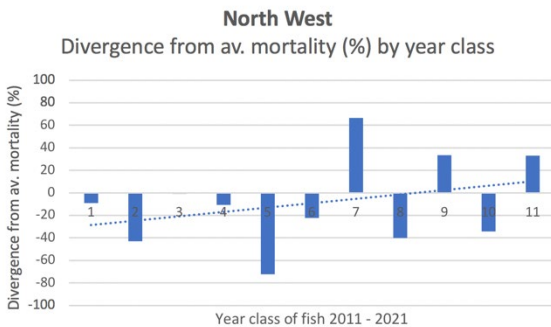
Mortality was below 10% in fewer than a quarter of cycles, and below 5% in only 6% of them.

Regional mortality in marine salmon farms



Source: Scottish Government Fish Farm Production Survey 2023. Table 30.

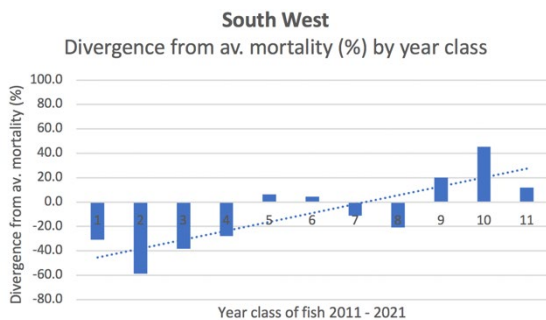
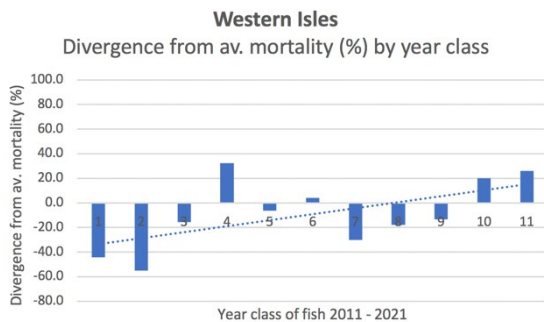
These charts show the trends in overall mortality for smolt year-classes put to sea between 2011 and 2021 (the latest data), in the five salmon farming production regions. Only in Shetland and Orkney have mortalities been falling slightly, compared to the Scottish industry average (dotted blue trend lines). No wonder jobs are only rising there.



The picture is very different in the North West, the South West (essentially Argyll) and the Western Isles, where there is a strong trend of increasing mortality, compared to the industry average.

This pattern correlates to the water temperature in all these areas.

Warmer water is making it much harder to farm salmon humanely in the south and west of Scotland, compared to the Northern Isles, where the water is colder.



Source: Scottish Government Fish Farm Production Survey 2023. Table 30.