Persistent Elevated Mortality in salmon farming in Scotland - the Scottish Government's Methodological Approach

Summary

It is important to understand whether some salmon farms have recurring, persistently high rates of mortality, due to their unhealthy locations or poor management. The Scottish Government has promised to test this by analysing mortality data, but it seems that the results are not yet available. The Coastal Communities Network (CCN) has worked with a data analyst to mirror the Scottish Government's methodology, giving an insight into the likely results of the Government's analysis and revealing some serious flaws.

CCN believes that the Scottish Government's methodology is not fit for the purpose of reducing the very high toll of deaths and poor animal welfare that exist in Scotland's fish farms. We urge the Rural Affairs and Islands Committee to challenge this methodology and to recommend a "three strikes and you are out" approach, whereby any farm that experiences mass mortality three times must be reduced in size, closed or relocated (conditional on following the normal consenting process).

Main points:

- The Government's analysis only applies to the marine part of the production of salmon. The freshwater stage has massive mortality as well. It is wrong not to consider both.

- The Government's methodology only includes farms with monthly mortality rates in the worst 5%, sustained for at least two months, in two or more consecutive production cycles, and with the same cause of mortality. This filters out many farms with repeated mass mortality events. Even so, between 2018 and October 2025[1], **24 farms** did fit all these criteria and **five farms** triggered all of the criteria twice. This only begins to show the extent of the problem.

- CCN believes that the Government has set the bar much too high. We have explored the consequences of including farms with the worst 10% and 25% of mortality events. This has a significant impact on the number of problem farms.
  When the worst 10% are included, **79 farms** (38% of the total) satisfy all the Government's other criteria, instead of 24. Including the worst 25% puts well over half of all Scotland's salmon farms (**117 farms**) on the problem list.
  Including the worst ten percent of mortality events is an entirely reasonable definition of "elevated" mortality. Including the worst 25% of mortality is also reasonable – that is still well above the average in most years.

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[1] Using Salmon Scotland's monthly mortality data, as the Scottish Government is doing.

- The Government's methodology requires mortality events to have the same cause (Persistence) but this approach is flawed. Salmon Scotland and the Government have ten categories for the causes of mortality, following the Farmed Fish Health Framework. None of these is specifically for the fish killed by treatments administered by farmers, so treatment deaths are lumped with those caused by various diseases and sea lice, making it impossible to know how many fish die due to treatments, the most important non-infectious killer of farmed fish, according to Mowi.[2]

- Cleaner fish mortality seems to be excluded. Deaths of smolts in their first six weeks at sea may also be excluded, and, it seems, so are culls of moribund fish following mass mortality events.

- Many mass mortality events are multifactorial, triggered by gill disease and/or natural events that injury fishes' gills, then exacerbated by other diseases, by sea lice and by treatments administered on farms. Assigning cause(s) to these complex situations does not clarify how many fish died due to each. The way causes are assigned could bias which farms are filtered in or out.

- Dropping the need for the cause of mortality to be the same would put **36 farms** on the list[3]. Including the worst 10% of mortality puts **96 farms** on the list, and if you include the worst 25% of farm mortality figures, without the same cause, then **179 farms** would qualify.

- We have also looked further back, using SEPA's data from 2002 to Oct 2025, as the Government is doing. **76 farms** met its elevated (worst 5%), recurrent criteria, without the cause of death being the same (as SEPA does not record the causes of mortality).
  There is a rising trend of farms meeting the Government's other criteria each year.

- The Government's analysis depends on merging three datasets[4]. CCN's analysis shows that they do not match. For example, SEPA's and Salmon Scotland's 2018 - Oct 2025 data flag the same 26 farms that fit the Government's criteria except for the cause of mortality (which SEPA doesn't record), but each dataset also flags 10 other, different farms, so 46 farms in total. This shows that the record keeping for salmon farm mortality is inconsistent and inadequate. It must be overhauled.

- The fourth stage of the Government's analysis offers farmers a chance to explain any mitigating circumstances. Mortality rates have exceeded 80% in some farms. It is right to ask the sector why, but not to carry on allowing this to recur, as happens at present.

CCN also explored another approach to identifying farms with recurrent high mortality, by simply listing all the farms that completed production cycles each year, in order of cumulative mortality.[5]

To interpret the lists, it is necessary to have an acceptable maximum mortality rate - something the Government refuses to do. What should that threshold be?

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[2] According to Mowi's 2024 Integrated Annual Report 2024 (page 226)
[3] Using Salmon Scotland's data: 2018 - Oct 2025
[4] SEPA's, Salmon Scotland's and FHI's
[5] Using Salmon Scotland's data: 2018 - Oct 2025

In 2024, Mowi wrote to the REC Committee, saying that around 2011, its Scottish farms achieved 15% average mortality over an 18-month marine production cycle, and that about 7% mortality in 12 months has been achieved in marine salmon farms in the Faroes[6]. Perhaps this might equate to about 15% over a full cycle.

Mortality rates in Scotland's marine salmon farms have averaged far more than 15% for many years. In the Scottish Government's most recent figures, the rate averaged 38%.
Even 15% mortality would be considered high in any other type of livestock farming (and this is only for the marine phase). The union representing Norwegian fish farm vets recently threatened to strike unless annual mortality there was reduced to 5% per year, in line with other types of farming.

The annual lists show that a significant proportion of farms are contributing to the high mortality rates. For example, to have achieved an overall 15% average for the farms that completed their cycles in 2023, as many as 40 would have had to reduce their mortality to that level or be closed. Likewise with 47% of the farms that completed their cycles in 2024. In all years except 2021, fewer than half of farms managed to keep their overall mortality below 15%. There are not just a few farms biasing the results.

A summary of the Scottish Government's proposed methodology for assessing elevated, recurrent and persistent mortality in marine salmon farms. It will exclude many farms that have repeatedly high mortality, due to being sited in unhealthy locations, or to being poorly managed.
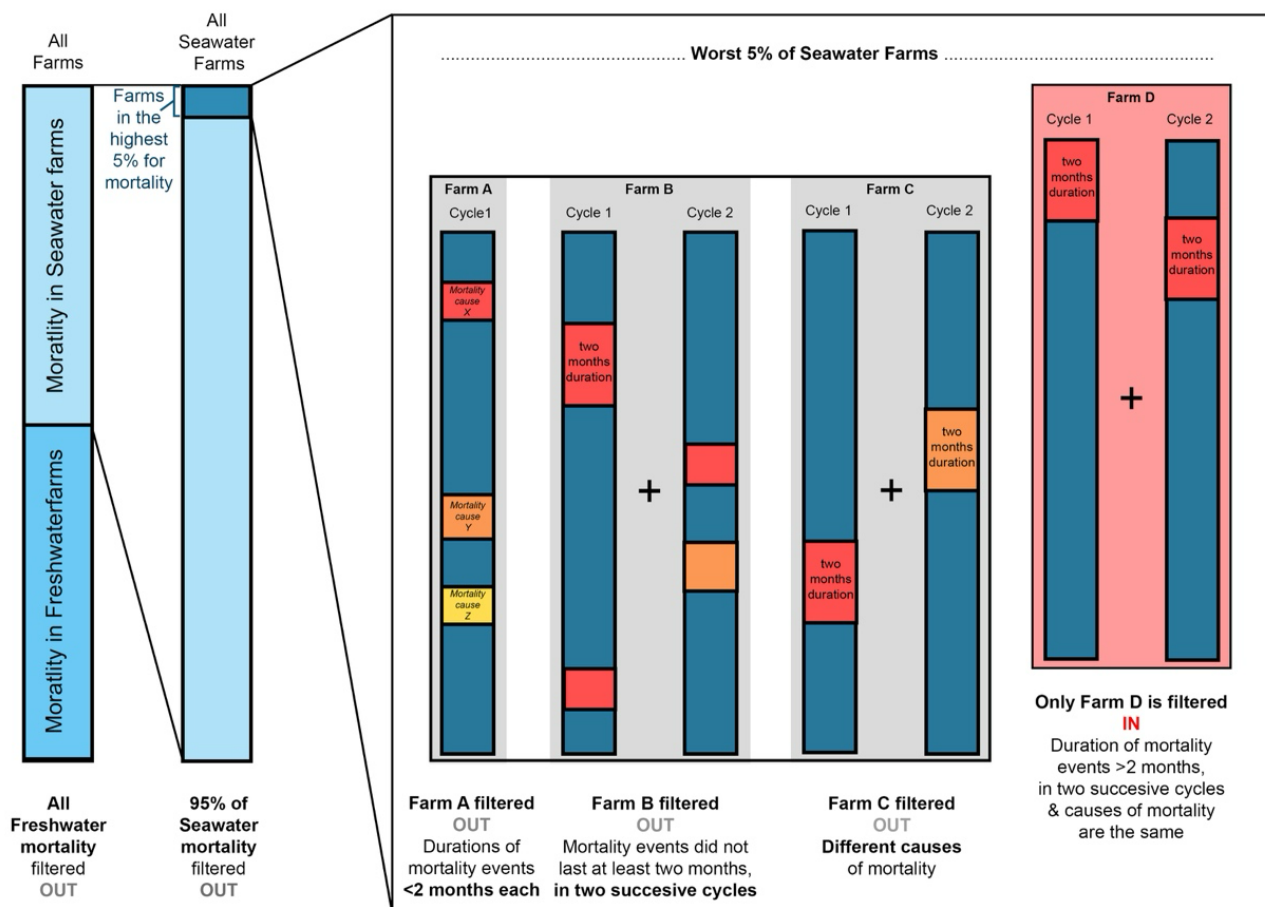
[6] Salmon farming in Scotland. Follow up information from the RECC evidence session on 2 October 2024 with Salmon Scotland. 25 November 2024.

Background

The RAIC's recommendation

In the Rural Affairs and Islands Committee's 2024 report on Progress on the 2018 Rural Economy and Connectivity Committee Inquiry's recommendations, the RAIC notes:

> "…the REC Committee recommendations for no expansion at sites with high mortality and for 'robust intervention' when serious mortality events occur have not been implemented."

> "The Committee also notes the Cabinet Secretary's view that a threshold for intervention precipitated by a high mortality event would fail to recognise the wider context or that some are caused by factors outwith the fish farm's control. At the same time, however, the Committee believes further action is needed to improve the governance of fish health and welfare on farms to address gaps in accountability and enforcement around mortality."

> "The Committee recommends, therefore, the Scottish Government provide powers to the Fish Health Inspectorate (or another appropriate body) to limit or halt production at sites which record persistent high mortality rates. The Scottish Government should work with industry and regulators to agree appropriate criteria and mortality thresholds for the use of these powers."

The Scottish Government's response

The Scottish Government's September 2025 Interim update on activities in response to the Rural Affairs and Islands Committee report on 'Salmon Farming in Scotland'[7], includes:

Mortality analysis
• We will work to analyse mortality data, exploring thresholds for 'persistently high mortality' and whether fish farms with 'persistently high mortality' exist [2025/2026].

Progress update:
• We have developed a robust analytical framework to determine whether there is 'persistently high mortality' at Scottish production sites. The framework employs 3 qualified parameters for 'elevated', 'recurrent' and 'persistent' mortality to design a modelling approach that can help identify sites that potentially show 'persistent elevated mortality'. Annex A provides further information on the approach to the analysis.

• Quality assurance is being undertaken on the preliminary analytical model with a view to generating initial results later this year. Where there are sites screened as having 'persistent elevated mortality' under the analytical framework, we will engage with those operators to explore what actions are already taken by producers to prevent issues causing mortality persisting from year to year.

• By Spring 2026 we will provide a project report the Rural Affairs and Islands Committee detailing both the finalised methods, the results of analysis, and the planned Scottish Government response to these.

The methodology mentioned (Annex A) is included at the end of this letter.

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7 https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2025/salmon-farming-in-scotland-23-september-2025.pdf

Why this matters

This issue is important because enormous numbers of farmed salmon are suffering and dying. According to the Scottish Government's latest (2024) Fish Farm Production Survey[8], 21,109,702 of the most recent cohort of farmed salmon (2022) died at sea, before harvest, and close to a third of a billion (329,062,000 fish) farmed salmon have died at sea since 1984.[9]

These figures exclude the very large number of deaths in the freshwater stage of salmon farming, which reached record levels in 2024.

Clearly this industry has a massive problem with mortality and fish welfare, on a wholly different scale to any other type of livestock farming, in terms of both the numbers and proportions of animals dying.

CCN believes that this situation is partly due to some farms being sited in inappropriate locations which are poor for fish health, or where farm management is routinely poor. These farms ought to be reduced in size or closed, but farms where mass mortality occurs regularly are usually restocked. These fishes' deaths must have been preceded by unnecessary suffering but no fish farm operator has ever faced any sanctions for having allowed that suffering to occur, even though repeatedly restocking a farm with a history of high mortality, and therefore a high likelihood of animal suffering in future, seems contrary to the 2006 Animal Health and Welfare Act (Scotland).

It is reasonable to expect that the Government's methodology for assessing recurring, persistently high mortality would be designed to reveal every occasion in which the 2006 Act might have been breached. CCN believes that the chosen methodology is too conservative to achieve this, in particular in how it defines "elevated", "recurrent" and "persistent" mortality. As a result, many problematic farms are likely to have been filtered out before the findings are reported to the RAIC.

This analysis is only being applied to seawater farms, even though mortality in the freshwater stage of salmon farming has reached an unprecedented level. According to the 2024 Fish Farm Production Survey, one in two of the salmon ova laid down to hatch, failed to result in a smolt that could be put to sea. The five worst mortality events reported to the FHI in 2025 were all in freshwater hatcheries, totalling more than 1.7 million dead fish.

FHI - Worst weekly mortality events 2025
1. Applecross Smolt Unit **522,145 deaths** (16/06/25) ▼
2. Inverkerry Smolt Unit **343,184 deaths** (01/09/25) ▼
3. Lochailort Recirculation Hatchery **314,759 deaths** (18/08/25) ▼
4. Inverkerry Smolt Unit **303,075 deaths** (08/09/25) ▼
5. Lochailort Recirculation Hatchery **290,074 deaths** (11/08/25) ▼
6. Gob na Hoe **247,000 deaths** (27/10/25) ▼
7. Inchmore **210,135 deaths** (05/05/25) ▼
8. Applecross Smolt Unit 2 **196,563 deaths** (09/06/25) ▼
9. Inverpolly **189,736 deaths** (14/07/25) ▼
10. Applecross Smolt Unit **182,967 deaths** (12/05/25) ▼

Graphic: FreeSalmon; Source: FHI

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[8] https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2025/10/scottish-fish-farm-production-survey-2024/documents/scottish-fish-farm-production-survey-2024/scottish-fish-farm-production-survey-2024/govscot%3Adocument/scottish-fis

[9] Supplementary Tables https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2025/10/scottish-fish-farm-production-survey-2024/documents/scottish-fish-farm-production-survey-2024-supplementary-tables/scottish-fish-farm-production-survey-2024-supplement

CCN's analysis

Mirroring the Scottish Government's methodology

CCN has commissioned a data analyst to mirror the Government's proposed methodology.
This allows us to see how many farms are likely to appear in the Government's list.
It also lets us test the consequences of making different choices to the Government, by altering the thresholds that define "elevated" mortality, as well as "persistence". The results are discussed below.

The Scottish Government's methodology has four stages:

Stage 1: Filtering farms for **elevated mortality** (above the 95th centile, i.e. the worst 5%),

Stage 2: Filtering farms with elevated mortality, to see which experienced it **recurrently** (i.e. an "elevated" incident lasting at least two months, in two or more successive production cycles),

Stage 3: Determining **persistence**, by filtering out farms with elevated, recurrent mortality, if their mortality events had **different causes,**

Stage 4: **Asking the industry** to justify the high mortality in any farms that have not been filtered out already.

The bar has been set so high at each of these stages that CCN believes few farms will reach Stage 4. The diagram at the start of this document shows the high proportion of farms that will be excluded.

Mortality datasets that do not match

SEPA has collected mortality data from the industry since 2002, which it gives as the percentage of the total *weight* of fish in the farm. Salmon Scotland has reported monthly mortality for every marine farm since 2018, given as a percentage of the total *number* of fish in the farm. Their reporting dates do not match. These differences cause discrepancies between the datasets. We have not included FHI's dataset which is different again, due to its mortality reporting exemptions.

Salmon Scotland sometimes fails to report culls of moribund fish as mortalities.
For example, an FHI inspection of the Vuia Mor salmon farm[10] found that: "Between 17th and 19th of April [2025], immediately post transfer a total of 155,500 fish were culled (55.3%). The following week a further 39,893 fish were culled which were removed by hand from the pens as they presented as moribunds".
However, Salmon Scotland's mortality report for Vuia Mor, for April 2025[11] (below) shows only 0.1% mortality, which is far too low to truly reflect the numbers of culled fish.

Company	Farm	Monthly mortality (%)	Notes	Cumulative mortality over full production cycle (%)
Bakkafrost Scotland	Vuia Mor	0.1		In Production

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[10] https://storage.googleapis.com/inspection_case_information/2025-0160_FS1103.pdf
[11] https://www.salmonscotland.co.uk/reports/monthly-mortality-rate-april-2025

SEPA's biomass data[12] also failed to include this mortality. SEPA's records for April 2025, show that there were 60,000kg of fish on site with only 395.3kg of mortalities, a 0.7% mortality rate.

Another example is Bakkafrost's Portree farm, where the company reported to its shareholders that, "the input mortality was 19% within the first 90 days".[13] This very large mortality was not included in Salmon Scotland's monthly report, although SEPA's data does include it.

In general, the Salmon Scotland and SEPA datasets show similar patterns but do not match exactly. This results in discrepancies between the lists of problem farms produced using each dataset.

SEPA also does not collect data on the causes of mortality, and FHI's data on causes before 2018 is inconsistent with Salmon Scotland's since then. The Scottish Government has resorted to using AI to try to integrate FHI's dataset with the other two, in order to extend Stage 3 of its analysis earlier than 2018. CCN has not attempted to do this, as the AI filtering would inevitably be different from the Scottish Government's.
Below you will see that CCN believes Stage 3 (same cause of mortality) should be dropped altogether.

The results of CCN's analysis

1. Farms in the Salmon Scotland dataset (since 2018), that would trigger the Scottish Government's criteria for elevated, recurrent and persistent mortality

24 farms in the Salmon Scotland dataset met all the Scottish Government's criteria for elevated, recurrent, persistent mortality, at least once during the period Jan. 2018 to Oct. 2025.
Five of these farms triggered all the Scottish Government's criteria twice.

The total number of months during which some of these farms experienced elevated monthly mortality was considerably longer than the two months minimum criterion per production cycle. The worst had elevated mortality for 12 months in total, across two or more successive cycles.

2. Comparing the farms in the Salmon Scotland dataset, since 2018, to those in the SEPA dataset, since 2018, that would meet the same criteria

This analysis only examines which farms meet the elevated and recurrent criteria, as the SEPA dataset does not record the causes of mortality that enables the persistent criteria to be defined.

Requiring each cause of mortality to be the same is spurious, given that mass mortality is caused by a cascade of multiple causes, triggered by disease and/or a natural event, such as a harmful planktonic bloom or a micro-jellyfish swarm, killing many fish and compromising the gills of others.

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[12] https://aquaculture.scotland.gov.uk/Data/FishFarmMonthlyBiomassAndTreatmentReports
[13] https://www.investing.com/news/transcripts/earnings-call-transcript-bakkafrost-q3-2025-sees-stock-rise-amid-operational-gains-93CH-4329239

Afterwards, treating these sick fish for sea lice will cause many more to die, or make them more susceptible to diseases. It is very hard to prevent mass mortality once this downward spiral sets in.

Table 1., below, shows the farms that met the elevated, recurrent criteria in the Salmon Scotland dataset (2018 - Oct 2025), and in the SEPA dataset (2018 - Oct 2025), without the additional criterion for the cause to be the same (i.e. Persistent).

Salmon Scotland dataset	SEPA dataset
Djubawick	Djuba Wick
Druimyeon Bay	Druimyeon Bay
East Tarbert Bay	East Tarbert Bay
Fada	Eilean Fada Mor
Geasgill	Geasgill
Gometra	Gometra
Gravir Outer	Gravir Outer
Grimsay	Bagh Clann Neill (Grimsay)
Invertote	Invertote
Kishorn B (North)	Allt a Chois (Kishorn North Shore)
Kishorn C (West)	Kishorn Outer (Kishorn West)
Kyles Vuia	Kyles Vuia East
Lamlash	St Molios
Maaey	Maaey (East of Loch Uiskevagh)
Meall Mhor	Meall Mhor
North Shore East	Erisort, North Shore East
Oldany	Oldany
Plocrapool	Plocrapol
Portree	Loch Portree (Torvaig)
Reibinish	Reibinish
Rubha Stillaig	Rubha Stillaig
Sound of Harris	Sound of Harris (Groay-Lingay)
Tanera	Tanera 1+2
Taranaish	Taranaish
Vacasay	Vacasay, Roag
Vuia Mor	Vuia Mor South
Ardessie A	Ardintoul
Camas Glas	Bight of Foraness
Caolas a Deas West	Culnacnoc
Groatay	Lippie Geo (Site 2)
Hellisay	Port nan Ledaig (Lismore B)
Loch Alsh	Scallastle Bay
Loch Creran (B)	Spelve B
Noster	Strondoir Bay
Portree Outer	Taing of Railsborough
Rum	Teisti Geo

Key:		
Meets criteria in both datasets		
Meets criteria only in Salmon Scotland dataset		
Meets criteria only in SEPA dataset		

Table 1: Comparison of sites meeting the elevated, recurrent criteria from 2018 – PY 2025.
Note that Salmon Scotland and SEPA frequently use different names to identify farms - the farms named in the left and right columns of the green section of Table 1 are the same.

A total of **36 farms** met the elevated, recurrent criteria in the Salmon Scotland dataset (2018 - Oct 2025), without the additional criterion for the cause to be the same (Persistent) – the green and pink sections above.
A total of **36 farms** also met the elevated, recurrent criteria in the SEPA dataset (2018 - Oct 2025), without the additional criterion for the cause to be the same (Persistent) – the green and blue sections above.
However, the two lists of farms do not match entirely.
Of the farms meeting these criteria, 26 of the 36 farms are common between the two lists, so each list has 10 additional farms which trigger the criteria in only one of the Salmon Scotland and SEPA datasets – the pink and blue sections above.

Typically, the mortality pattern in the two datasets is similar but the exact values per month are different, creating the difference in the two farm lists.
This is symptomatic of any analysis that relies on official and industry data in Scotland. As flagged up by the RAI Committee, mortality data recording is inadequate, opaque and not sufficiently joined up between agencies, or with industry. An overhaul is urgently needed, given the severity of the problem and the lack of improvement.

These results show that at least **46 farms** either satisfy, or are very close to satisfying, the Scottish Government's criteria for elevated and recurrent mortality; **22% of active farms**.

3. Using the SEPA dataset to look back to 2002, at farms that satisfy the Scottish Government's elevated and recurrent mortality criteria

76 farms met the elevated, recurrent criteria in the SEPA dataset (2002 - Oct 2025), without including the additional criterion to ensure that the cause was the same (Persistent). SEPA does not record the causes of mortality.

Figure 1, below, shows that there is a rising trend in the percentage of farms meeting the elevated, recurrent criteria each year. Further confirmation that this problem is getting worse.
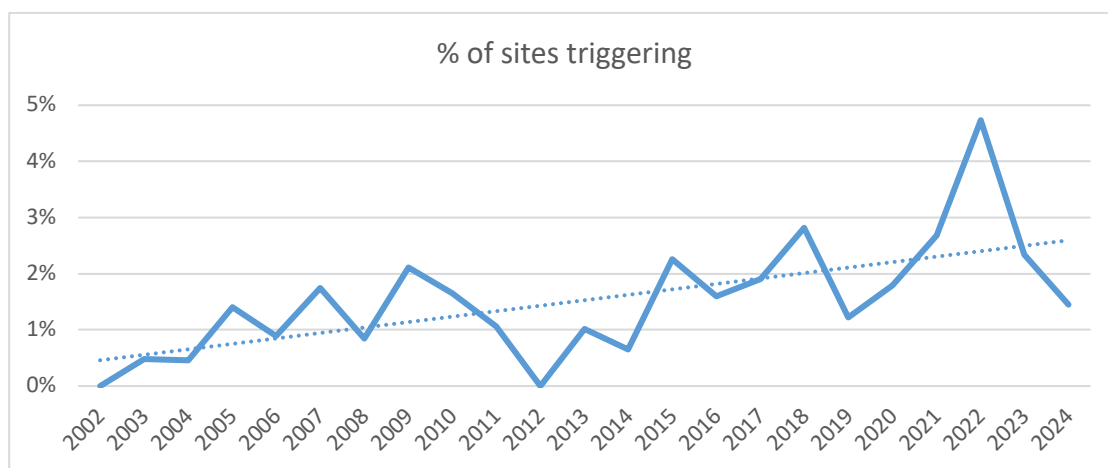
Figure 1: Percent of sites meeting elevated, recurrent criteria per year (SEPA 2002 - Oct 2025)

4. **Adjusting the thresholds for the elevated and recurrent criteria, to examine how many farms would have triggered the criteria under these conditions**

The Scottish Government's methodology sets a high bar for including farms in the list of those with elevated and recurrent mortality. This section examines the effect of altering these criteria within more reasonable bounds.

Stage 1: Elevated mortality

The Government's methodology includes only the farms where mortality was in the worst 5% (the 95th centile) – when mortality exceeded 5.68% per month, a figure apparently derived from data collected by SEPA since 2002. There is no justification for choosing such a high mortality rate. As a result, Stage 1 will filter out many farms with mortality that is far above average.

The analysis uses only a relative measure of mortality (centiles). This will allow the overall number of fish dying to rise in future, without increasing the number of farms defined as having elevated mortality. This is of a piece with the Scottish Government's refuse to define an absolute level of mortality that is unacceptable on fish farms, even though the typical level of mortality across the industry is already far higher than in any other livestock sector, such as beef production, which grows animals for a similar length of time.

In the absence of an absolute cap on mortality, CCN has examined the effect of lowering the threshold for percentage monthly mortality, to including the farms with the worst 10 percent of mortality rates (the 90th centile), and the worst 25% (the 75th centile).
As the Salmon Scotland and SEPA datasets differ, we have shown this for each dataset, in Tables 2a and 2b below.
Note that the SEPA dataset covers the full range of dates, back to 2002. More farms have existed during this time than are active now.

a) **Salmon Scotland** dataset (**2018** – Oct 2025)

Elevated mortality definition	Elevated, recurring, persistent – i.e. with requirement for same cause code	Elevated, recurring – i.e. without requirement for same cause code
95th centile (worst 5% only)	24 farms	36 farms
90th centile (worst 10% only)	79 farms	96 farms
75th centile (worst 25% only)	117 farms	179 farms

b) **SEPA** dataset (**2002** – Oct 2025)

Elevated mortality definition	Elevated, recurring, persistent – i.e. with requirement for same cause code	Elevated, recurring – i.e. without requirement for same cause code
95th centile (worst 5% only)	Not available	76 farms
90th centile (worst 10% only)	Not available	155 farms
75th centile (worst 25% only)	Not available	259 farms

Lowering the threshold for percentage monthly mortality has a significant impact on the number of problem farms, while still applying all the other Scottish Government criteria.

For example, Table 2a shows that by including the worst 10% of mortality events, **79 farms** in the Salmon Scotland dataset since 2018 would be on the problem list, rather than 24 farms, at the Government's 95th centile threshold (only the worst 5%).
Including the worst 10% of farms and dropping the spurious need for the causes of mortality to be the same (Persistent), would put **96 farms** on the list. That is almost half of Scotland's total

This is a more realistic starting point for making decisions about how to reduce overall mortality in the sector. Including the worst ten percent of mortality events is entirely reasonable. Doing so shows that the number of problem farms is at least three times higher than would otherwise be included, and four times higher if the causes of mortality are not the same.

If the worst 25% of mortality events are included, 117 farms in the Salmon Scotland dataset since 2018 would satisfy the Government's criteria for recurrent <u>and</u> persistent mortality. This is well over half of Scotland's active salmon farms.

Stage 2: Recurrent mortality

The Government has defined "recurrent" as elevated mortality occuring in two or more consecutive production cycles, lasting for at least two months each time. Again, this is a high bar.

High mortality can also be caused by short-lived events, such as storms, jellyfish swarms or human error. Poorly-sited or poorly-managed farms may experience elevated mortality many times, but with occasional better years in between. In neither case would those farms pass through to Stage 3.

The Government's analysts ought to check how many recurring high mortality events last less than two months, in case severe events are being filtered out unreasonably.

Stage 3: Persistence of mortality, due to the same causes in successive years

Stage 3 of the Government's analysis will filter out all farms where elevated and persistent mortality has occurred but where the causes were different in different cycles.
This approach has several flaws:

- It is wrong to exclude farms because the causes of mortality are not always the same. Farmed salmon can die for several reasons, all of which could be consequences of farms being poorly-sited or consistently poorly-managed, so high mortality may happen repeatedly but not always for the same reasons.

- The records of deaths caused by treatments administered by farmers are merged with those caused by the conditions being treated. As a result, the mortality data conceal the very large number of fish that die during and after physical, chemical and freshwater treatments, making it impossible to total all the deaths that are due to treatments.

- This approach seems to exclude some or all of the deaths that happen during the smolts' first six weeks at sea, as FHI exempts these from its mortality reporting requirements.[14] In 2018, "smolt and transfer" made up more than 14% of all farmed salmon deaths at sea, according to a one-off analysis by the Farmed Fish Health Framework.[15]

- The mass mortality of cleaner fish does not feature in the FFHF's ten mortality cause categories. It is unclear whether they will be included in the Scottish Government's mortality analysis, even though at least seven million have died prematurely, mostly due to unknown causes, in Scotland's salmon farms since 2020.[16]

- Analysing the data in this way is prone to bias because of the ways that farmers and analysists can choose to assign different causes to complex, multifactorial mortality events.

Mass mortality is often due to a combination of reasons. If these were classed as different causes, then many farms would be filtered out at Stage 3.
It would be more realistic to class the cause of many (even most) multifactorial mass mortality events as "poor gill health leading to subsequent disease and treatment-related deaths". Assigning this umbrella cause would filter out far fewer farms.

The Government's methodology for Stage 3 is based on the ten mortality cause categories defined by the Government's Farmed Fish Health Framework (FFHF). These have been used by Salmon Scotland since 2018, in its monthly mortality reports. The Scottish Government's own records (kept by SEPA and FHI) go back to 2002 but they lack consistent reporting of causes of mortality.
The methodology statement says that AI has been used to retrospectively assign descriptions of the causes of mortality in the FHI data, to match the Government's Farmed Fish Health Framework and

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[14] https://www.gov.scot/publications/fish-health-inspectorate-mortality-information/
[15] An Analysis of the Causes of Mortality: Scottish Salmon Sector 2018-2020 Scottish Government FOI release. 9 Apr 2021
[16] https://www.theferret.scot/million-lice-eating-fish-died-at-salmon-farms/

Salmon Scotland categories to these earlier records. This is prone to error, as the earlier FHI reports often give several causes for mortality events, without suggesting what proportion is due to each of them.

CCN believes that this third stage of the Government's methodology is too messy and too prone to bias, so it should be omitted altogether. Causes of death should not be used to filter out farms from the list of those that have recurrent high mortality. Instead, they should be analysed separately, with the results published annually, as happens in Norway.[17]

Stage 4: Giving farm operators a chance to explain why some farms have elevated persistent mortality

This will be informative but it should not be used to excuse the restocking of farms where many fish routinely die. For instance, some farmers are likely to argue that repeated, high levels of deaths due to sea lice and treatments are not their fault, after disease and jellyfish have harmed their fishes' gills. The alternative explanation is that persistent high levels of death under these quite common circumstances could be due to poor husbandry - a consequence of choosing to continue to farm fish in locations that are unhealthy.

Are there other ways to approach this?

Table 3, below, shows that simply listing farms in order of their production cycle mortality percentage can be used to show which have performed the worst, in particular those farms that appear towards the top of the lists in multiple years but which are rarely or never in the lower, healthier, sections of the lists.

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[17] For example - Norwegian Fish Health Report 2024. Norwegian Veterinary Institute Report no 1b/2025

Table 3 — Farms that completed their production cycles in each year, listed in order of overall mortality percentage.

2018

Farm	Mortality %
Inch Kenneth	58.2
Bay of Vady	48.8
Gravir Outer	47.6
North Voe	40.7
Vacasay	39.8
Calbha Bay	39.6
Taranaish	39.4
Loch Alsh	39.2
Greshornish	38.4
Djubawick	37.8
North Shore	35.3
Isle Ewe	34.8
Macleans Nose	34.6
Strone	34.6
Burkwell	34.3
Eughlam	34.2
Vuia Mor	33.3
Winna Ness	32.5
Treanay	32.0
Vuia Beag	31.3
North Shore East	31.3
Loch Carnan	28.0
Portree	27.9
Djubawick	26.7
Nevis C	26.7
Loura Voe	26.5
Kirkabister	26.2
Druimeon Bay	26.1
Ardintoul	26.0
Bow of Hascosay	25.7
Poll Na Gille	25.4
Uyea Isle	24.5
Bomlo	24.5
Invasion Bay	23.9
Bow of Hascosay	23.3
South of Linga	23.2
Vuia	23.1
North Sandwick	22.9
Wick of Vatsetter	22.6
Carness Bay	22.2
Bastaness	21.3
Vidlin	20.9
Swining 3	20.7
Badcall	20.6
Hellisay	17.8
Badcall	17.8
Duich	16.9
Turness	16.8
Eport Outer	16.7
Quanterness	16.7
Loch Hourn	16.4
Sgian Dubh	16.3
Noster	16.2
Bay of Cleat (South)	16.0
Camas Glas	16.0
Poseidon	15.2
East Tarbert Bay	14.7
Loch Spelve (B)	14.5
South West Shuna	13.7
Ouseness	13.7
Bagh Dail Nan Cean	13.6
Bringhead	13.5
Fara West	13.0
South Cava	13.0
Mangaster	12.7
Ormsary	12.6
Snizort East	12.2
Bay of Cleat (North)	12.2
Hellisay	11.9
Bloody Bay	11.8
Geasgill	11.4
Seaforth	11.3
Ardnish	11.1
Chalmers Hope	10.7
Seaforth	10.4
Fiunary	10.4
Noster	10.0
Vestness	9.6
Fishnish (B)	9.0
Slocka Ronas Voe	7.9
Strome	7.6
Trilleachan Mor	7.5
Scallastle	7.4
Gometra	6.6
Loch Laxford	6.5
Toyness	6.2
Fishnish (A)	5.6
Ardyne	5.5
Westerbister	5.3
Flaeshins	5.0
Corry Farm	4.3
Muck	2.6
Caolas a Deas West	2.4
Caolas a Deas East	1.1

2019

Farm	Mortality %
Ardessie A	65.7
Maaey	52.9
Ardessie B	50.5
Lismore North	41.2
Loura Voe	41.1
Nevis C	40.9
Bagh Dail Nan Cean	40.7
Loch Laxford	40.6
Loch Spelve (B)	40.6
Langa	37.2
Loch a Chairn Bhain	37.1
West of Burwick	35.8
North Papa	35.3
Grimsay	32.7
Treanay	32.6
Holms Geo	31.8
Kishorn B (North)	31.8
Tabhaigh	31.5
Djubawick	31.1
Groatay	29.7
Lamlash	29.6
Score Holms	29.5
Eport Outer	28.9
Grey Horse Channel	28.6
Scotasay	28.1
Teisti Geo	27.7
Lochmaddy	27.6
Fara West	27.2
Maragay Mor	27.1
Bight of Bellister	26.2
Colonsay	25.8
Carradale North	25.8
Burkwell	25.7
Nevis A	25.5
Plocrapool	25.3
Quarry Point	24.7
Poll Na Gille	24.3
Winna Ness	24.0
Bow of Hascosay	23.9
Linnhe	23.5
Maol Ban	23.4
Leinish	23.3
Grunna Voe	22.2
Loch Creran (B)	22.1
Vee Taing	21.2
Sconser	21.0
Olna South	20.7
Flaeshins	20.6
South West Shuna	20.5
Kishorn C (West)	20.3
Port Na Cro	20.2
Scadabay	20.0
Setter	19.9
Soay	19.7
MidTaing	19.2
Reibinish	18.9
Kempie Bay	18.6
Cairidh	18.3
Gorsten	17.8
Carradale	17.5
Gob na Hoe	17.0
Gob a Bharra	16.7
Torridon	16.7
Harport	16.6
East Tarbert Bay	16.4
Cloudin	16.3
South Cava	15.5
Sgeir Dughall	15.5
Glenan Bay	15.0
Bay of Vady	14.5
Kishorn A (South)	14.5
Kerrera B (Charlotte Bay)	14.3
Aird	14.3
Ness of Copister	13.8
Raineach	13.8
Chalmers Hope	13.6
Sian Bay	13.4
Corlarach	13.3
Dunstaffnage	13.1
Ardgadden	13.0
Tarbert South	12.8
North Voe	12.7
Kingairloch	12.3
Ardcastle Bay	11.9
Uyea Isle	11.9
Puldrite	11.1
Shapinsay	10.9
Lismore East (Walters)	10.9
Hellisay	10.9
Loch Carnan	10.8
Strone	10.4
Ornish	10.4
Tanera	10.1
Meall Mhor	9.5
Leven	9.3
Wyre	9.1
Rubha Stillaig	9.0
Bastaness	9.0
Strondoir Bay	8.2
Quanterness	7.3
Turness	7.2
Lismore West (B)	6.9
Shuna	6.5
Carness Bay	6.5
Stulaigh	6.4
Balta Isle	6.1
Ardmair	5.2
Burrastow	5.0
Ornish	5.0
Eday	4.4
Chalmers Hope	4.4
Marulaig Bay	4.2
Fada	2.8
Isle Ewe	2.7
Ouseness	2.2
Sconser Quarry	2.1
East Skelwick	1.3
Outer Bay	0.1

2020

Farm	Mortality %
Leinish	78.3
Corlarach	51.3
Strone	41.5
Calbha Bay	41.2
Coledeep	40.1
Sgian Dubh	39.4
Muck	39.0
Grimsay	38.9
Stulaigh	36.8
Lismore East (Walters)	36.6
Kyles Vuia	36.3
Lochmaddy	36.1
North Shore	35.2
North Shore East	35.2
North Voe	34.5
Taranaish	33.5
Vacasay	32.6
Carradale North	31.6
Caolas a Deas East	31.4
Groatay	30.3
Trilleachan Mor	28.9
Greshornish	28.7
Swining 3	28.7
Camas Glas	28.6
Isle Ewe	28.6
Portree	28.2
Caolas a Deas West	28.1
Mangaster	27.2
Ardintoul	27.0
Carradale	26.7
Vuia Mor	26.4
Setterness North	26.1
Snizort East	25.8
Druimeon Bay	25.6
Rum	25.6
Staid of Aithness	24.1
Soay	24.0
South of Linga	23.3
Wick of Belmont	23.3
Noster	23.2
Seaforth	23.2
Loch Alsh	21.4
Ardyne	20.5
Setterness South	20.1
Duich	19.3
Gometra	18.8
Vestness	18.4
Geasgill	18.4
Badcall	18.2
Foraness	17.8
Vidlin	17.3
Grey Horse Channel	17.1
North Sandwick	16.7
Macleans Nose	16.4
Slocka Ronas Voe	16.0
Greanem	15.8
Portree	14.9
East of Papa Little	14.8
Fiunary	14.8
Portree Outer	14.7
Vee Taing	14.4
West Strome	13.0
Bringhead	12.9
Bloody Bay	12.7
Ness of Copister	12.6
Eport Outer	12.3
Loch Hourn	11.4
Djubawick	11.3
Sound of Harris	10.4
Bow of Hascosay	10.3
Westerbister	10.2
Invasion Bay	10.0
Scallastle	9.9
Wick of Vatsetter	9.5
Fishnish (B)	9.0
Eughlam	9.0
Greanem	8.9
Grey Horse Channel	8.9
Meil Bay	8.6
Gravir Outer	8.5
Uyea Isle	8.3
Oldany	8.2
Toyness	8.0
Burkwell	7.8
Bastaness	7.4
Lyrawa Bay	7.0
Fishnish (A)	6.7
Ardnish	6.4
Corry Farm	6.3
Fada	5.5
Ardessie A	5.2
Quanterness	5.2
North Sandwick	4.0
South Cava	3.6
Tanera	3.6
Chalmers Hope	3.4
Outer Bay	3.1
East Skelwick	1.1
Ouseness	
Bay of Vady	0.7

2021

Farm	Mortality %
Druimeon Bay	82.1
Vacasay	66.2
Plocrapool	56.2
Sound of Harris	50.3
Reibinish	45.4
Kishorn B (North)	41.3
Eport Outer	36.8
Loch Creran (B)	34.6
Glenan Bay	33.6
Loch Spelve (B)	32.8
Sgeir Dughall	32.0
Maaey	30.0
Scadabay	29.9
Maragay Mor	29.5
Aird	27.7
Torridon	26.4
Bloody Bay	26.2
Sconser Quarry	25.8
Loch Laxford	25.6
Holms Geo	25.5
Ardgadden	25.2
Lippie Geo	25.0
Colonsay	24.8
Strondoir Bay	24.1
Stulaigh	22.2
Marulaig Bay	21.9
Teisti Geo	21.5
Loch Carnan	21.1
Oldany	20.7
Sconser Quarry	19.6
Maol Ban	19.0
Loch a Chairn Bhain	18.9
Tarbert South	18.1
Swarta Skerry	17.8
Lismore West (B)	17.7
Harport	17.3
South West Shuna	16.9
Cairidh	16.8
Ardcastle Bay	16.8
Furnace Quarry	16.8
Nevis B	16.8
Wyre	16.7
Chalmers Hope	16.6
Sian Bay	16.5
South Cava	16.1
Ornish	15.7
Lamlash	15.4
Bastaness	15.3
Rubha Stillaig	15.0
Djubawick	14.7
Marulaig Bay	14.4
Bight of Bellister	14.2
Gob na Hoe	14.1
West of Burwick	13.9
Hellisay	13.5
Bagh Dail Nan Cean	13.5
Wick of Vatsetter	13.5
Druimeon Bay	13.2
Hellisay	12.6
Meall Mhor	12.4
Uiskevagh	12.3
Ouseness	12.3
Flaeshins	11.9
Ardmair	11.8
North Papa	11.8
East Tarbert Bay	11.7
Cloudin	11.6
Langa	11.6
Greanamul	11.3
Caolas a Deas East	11.3
Winna Ness	10.9
Fara West	10.8
Kishorn A (South)	10.5
Meil Bay	10.4
Score Holms	10.0
Quanterness	10.0
Olna South	9.9
Scalpay	9.8
Poll Na Gille	9.7
Ardcastle Bay	9.6
Setter	9.4
Maol Ban	8.7
Gorsten	8.7
Kempie Bay	8.6
Kishorn C (West)	8.6
Kirk Noust	8.5
Linnhe	8.5
Outer Bay	8.3
Loch Hourn	8.3
Port Na Cro	8.0
Eday	7.8
Sconser	7.8
Lober Rock	7.8
Kerrera B (Charlotte B	7.8
Uyea Isle	7.6
Turness	7.5
Puldrite	7.4
Ness of Copister	7.1
East Skelwick	6.8
Ardessie A	6.6
Dunstaffnage	6.5
North Shore	6.2
Port Na Cro	5.7
Ardessie B	5.6
Soay	5.5
Carness Bay	5.3
Boisdale (An Camus)	5.3
Nevis A	5.2
Kingairloch	5.1
Shuna	5.0
Shapinsay	4.7
Nevis C	4.6
Leinish	4.5
Quarry Point	4.2
Kingairloch	4.2
Bay of Cleat (North)	4.1
Carradale	3.8
Gob a Bharra	3.7
Leven	3.3
Hogan	2.8

2022

Farm	Mortality %
East Tarbert Bay	80.2
Nevis B	64.3
Vuia Mor	61.4
Scadabay	59.8
Greshornish	59.5
Kyles Vuia	57.8
Greanem	55.9
Noster	52.9
Camas Glas	50.0
Nevis A	46.8
Grey Horse Channel	44.2
Gravir Outer	42.3
Swarta Skerry	41.5
Eughlam	41.2
West Strome	39.1
Foraness	38.9
Seaforth	38.1
Loch Creran (B)	36.7
Ardessie B	34.6
Loch Spelve (B)	34.3
Colonsay	34.2
Ardessie A	34.1
Ardnish	32.9
Toyness	32.1
Bay of Vady	30.6
Ardintoul	27.1
Caolas a Deas West	24.4
Geasgill	23.7
Westerbister	23.7
Gometra	23.3
Reibinish	23.2
Hellisay	23.0
Nevis C	22.9
Setterness North	22.8
Collafirth 3	22.6
Loch Alsh	22.1
Lismore East (Walters)	21.2
Ardcastle Bay	20.2
Swining 3	20.1
Loch Alsh	19.9
Mangaster	19.5
Vidlin	18.8
Setterness South	17.2
Rum	16.6
Reibinish	16.3
Tabhaigh	16.0
Bagh Dail Nan Cean	15.5
Ornish	15.4
Slocka Ronas Voe	15.1
North Sandwick	14.7
North Shore East	11.3
South of Linga	11.3
Gorsten	10.9
East Skelwick	10.6
East of Papa Little	10.3
Macleans Nose	10.3
Lee of Burrafirth	10.0
North Sandwick	10.0
Chalmers Hope	8.8
Fada	8.8
Duich	8.5
Tanera	8.3
Fishnish (A)	8.1
Vestness	7.7
Wick of Vatsetter	7.7
Sgian Dubh	7.5
Strone	7.4
Mill Bay	7.1
Uyea Isle	7.0
South Cava	6.8
Burkwell	5.4
Invasion Bay	5.3
Fishnish (B)	5.1
Bay of Vady	3.0
Trilleachan Mor	2.6
Muck	2.0

2023

Farm	Mortality %
Druimeon Bay	82.3
Loch Carnan	76.8
Score Holms	57.6
Dunstaffnage	56.5
Greanamul	56.4
Setter	51.9
Stulaigh	51.7
Hellisay	51.5
Lamlash	50.9
Poll Na Gille	50.4
Kerrera B (Charlotte Bay)	48.2
Sound of Harris	48.2
Loch Laxford	47.9
East Skelwick	47.3
Sian Bay	45.2
Gravir Outer	44.8
Strondoir Bay	44.5
Eday	43.2
North Papa	41.3
Bight of Bellister	41.0
Bow of Hascosay	40.6
Shuna	40.5
Kishorn A (South)	40.5
Invertote	40.1
Bay of Vady	39.5
Lismore West (B)	39.3
Ardcastle Bay	38.8
Teisti Geo	37.2
Chalmers Hope	37.1
West of Burwick	37.1
Oldany	35.3
Maaey	35.0
Loch Hourn	34.6
Maragay Mor	33.8
North Voe	32.6
South Cava	32.0
Wick of Belmont	31.0
Mangaster	30.7
Ardgadden	29.7
Scotasay	29.7
Boisdale (An Camus)	28.2
Gob a Bharra	27.9
Ornish	27.4
Kishorn C (West)	25.9
Furnace Quarry	25.7
Torridon	25.3
Mill Bay	25.3
Langa	24.6
Marulaig Bay	24.2
Meall Mhor	23.8
Kishorn B (North)	23.3
Linnhe	22.9
Holms Geo	22.6
Bow of Hascosay	22.2
Lippie Geo	22.0
Tarbert South	21.9
Flaeshins	21.5
Bastaness	21.2
Loch a Chairn Bhain	20.6
Greshornish	19.0
Glenan Bay	18.4
Gorsten	17.8
Lochmaddy	17.4
Ardessie B	16.1
Lober Rock	15.6
Burrastow	15.2
Quarry Point	15.1
Wick of Vatsetter	15.0
Vee Taing	14.7
South of Holm	14.6
Wick of Garth	14.6
Sgeir Dughall	14.6
Scalpay	13.8
Hogan	13.7
Mill Bay	13.5
Basta South	13.2
Bay of Holland	13.0
Ardyne	12.1
Aird	12.0
Kingairloch	11.8
Burkwell	11.8
Port Na Cro	11.8
Ardnish	11.6
Holm of Gruting	11.7
Cairidh	11.4
Greshornish	10.7
Carradale	10.4
Cloudin	10.1
Winna Ness	10.0
Carradale North	9.5
Groatay	9.4
Turness	9.4
Uyea Isle	8.2
Soay	8.1
Muck	8.1
Ardessie B	7.3
South West Shuna	6.9
Harport	6.5
South West Shuna	6.4
Rum	6.1
Wyre	5.9
Corry Farm	5.5
Shapinsay	4.2
Puldrite	3.6
Rubha Stillaig	2.9
Leven	1.6

2024

Farm	Mortality %
Culnacnoc	86.3
Soay	76.1
Loch Alsh	65.6
Noster	58.7
Tanera	56.4
Geasgill	52.2
Meil Bay	47.3
Camas Glas	42.8
Colonsay	40.1
Gometra	39.4
Grey Horse Channel	39.4
Lochmaddy	36.2
Portree	34.7
Ardintoul	34.1
Loch Spelve (B)	33.1
Sgian Dubh	32.9
Groatay	32.9
Eughlam	32.4
Hunda	30.8
Torridon	30.1
Kyles Vuia	28.9
Vuia Mor	28.3
Slocka Ronas Voe	28.3
Bringhead	27.8
Vee Taing	26.3
Foraness	26.1
Portree Outer	25.5
West Strome	25.2
Tabhaigh	25.1
Fishnish (A)	24.9
Westerbister	24.6
Toyness	24.5
Setterness North	23.4
Macleans Nose	22.4
Plocrapool	22.3
Bastaness	22.0
East Skelwick	21.9
Chalmers Hope	20.5
South of Linga	20.4
Sconser Quarry	20.1
North Sandwick	19.2
Taranaish	19.1
Uyea Isle	18.5
Scotasay	17.7
South Cava	17.6
Scalpay	16.8
Staid of Aithness	16.8
Druimeon Bay	16.0
Coledeep	14.7
Fiunary	14.7
Fishnish (B)	14.1
Lee of Burrafirth	14.0
Olna South	13.6
Bagh Dail Nan Cean	13.5
Winna Ness	13.0
Sian Bay	12.4
Calbha Bay	11.8
Invasion Bay	11.7
Rum	10.7
Burkwell	10.1
Maol Ban	9.9
Greanem	9.9
Bloody Bay	9.5
Turness	9.1
Muck	9.0
East of Papa Little	6.0
Duich	6.0
Loch Hourn	3.2

to Nov 2025

Farm	Mortality %
East of Papa Little	58.2
Sgeir Dughall	48.8
Portree Outer	47.6
Bay of Holland	40.7
Meall Mhor	39.8
Muck	39.6
Lismore West (B)	39.4
Loch Hourn	39.2
Loch a Chairn Bhain	38.4
Portree	37.8
Djubawick	35.3
Etive 3	34.8
Turness	34.6
Greshornish	34.6
Kingairloch	34.3
Strondoir Bay	34.2
Strone	33.3
Dunstaffnage	32.5
Maol Ban	32.0
Hogan	31.8
Aird	31.3
Maaey	28.0
Stulaigh	27.9
Loch Laxford	26.7
Uyea Isle	26.7
Ardyne	26.5
Bight of Bellister	26.2
East Mochlett	26.1
Scalpay	26.0
Glenan Bay	25.7
Bagh Dail Nan Cean	25.4
Linnhe	24.5
Rum	24.5
Carness Bay	23.9
Quarry Point	23.3
Maragay Mor	23.2
Ardgadden	23.1
Soay	22.9
Ornish	22.6
Rubha Stillaig	22.2
Harport	21.3
Lober Rock	20.9
South West Shuna	20.7
Puldrite	20.6
Quanterness	17.8
North Kilbrannan	17.8
Port Na Cro	16.9
Shuna	16.8
Lamlash	16.7
South Cava	16.4
Gob a Bharra	16.4
Furnace Quarry	16.3
Gorsten	16.2
East Skelwick	16.0
North Sandwick	16.0
Kerrera B (Charlotte Bay)	15.2
Wick of Vatsetter	14.7
Sconser Quarry	14.5
Shapinsay	13.6
Wyre	13.6
Burrastow	13.6
Bastaness	13.6
Leven	13.0
Cloudin	13.0
Burkwell	12.7
Eday	12.6
Swarta Skerry	12.2
Vidlin	12.2
Nevis A	11.9
Score Holms	11.8
Vee Taing	11.4
Winna Ness	11.3
Flaeshins	11.1
Loch Carnan	10.7
North Voe	10.4
Poll Na Gille	10.4
Gletness	10.0
Carradale	9.6
Nevis B	9.0
Langa	7.9
Holms Geo	7.6

Table 3. Farms that completed their production cycles in each year are listed in order of their overall mortality percentage. *Source: Salmon Scotland mortality reports*

Key - for farms with production cycles ending in each year

- Above 25% cumulative mortality for production cycle
- Above average but below 25% cumulative mortality for production cycle
- Below average but above 15% cumulative mortality for production cycle
- Below 15% cumulative mortality for production cycle

Farms named in red had overall mortality above 25% in more than one production cycle.

In 2024, Ben Hadfield (COO Mowi Scotland) wrote to the REC Committee to confirm that Mowi believes that overall average mortality of 15% is possible in marine salmon farms. It achieved this in its Scottish farms around 2011.[18] Average mortality across the sector in Scotland has never been so low since then. For the 2022 smolt cohort it was 38%.

Table 4, below, shows the number and proportion of the farms completing their production cycle in a given year, that had production cycle mortality above 25%, above the average rate, and below 15%.

Year of completion of production cycle	2018	2019	2020	2021	2022	2023	2024	to Nov 2025
Total number of farms completing their cycle that year	94	119	99	120	89	107	73	81
Farms with over 25% of fish dying	31	36	34	21	26	48	32	14
% of farms with over 25% of fish dying	33%	30%	34%	18%	29%	45%	44%	17%
Farms above average mortality	44	55	43	45	34	45	29	33
% of farms above average mortality	47%	46%	43%	38%	38%	42%	40%	41%
Farms with under 15% of fish dying	38	49	44	71	40	39	21	33
% of farms with under 15% of fish dying	40%	41%	44%	59%	45%	36%	29%	41%

Table 4. Note that 2025's data is not for the complete year. Source: Salmon Scotland mortality reports

The number and percentage of farms with more than 25% of their fish dying is alarming, especially in marine heatwave years such as 2023.
In all years except 2021, fewer than half of farms managed to keep their overall mortality below 15%. There is a very long way to go before the industry could fulfil Mowi's hope that overall mortality at sea would again be as "low" as 15%.

In order to achieve an overall 15% mortality rate, Table 5, below, shows how many of the worst farms would have to be removed from each year's list, or would have to achieve 15% mortality themselves.

Year of completion of production cycle	2018	2019	2020	2021	2022	2023	2024	to Nov 2025
Number of farms removed to achieve 15% mortality over	22	24	19	2	20	40	34	11
Percentage of the farms completing prod. cycle that year	23%	20%	19%	2%	22%	37%	47%	14%

Table 5. Source: Salmon Scotland mortality reports

There are not just a few bad farms spoiling the good results of the others. Large numbers of farms, and a significant percentage, are contributing to the high mortality rates: as many as 40 of the farms that completed their cycles in 2023, and 47% of the farms that completed their cycles in 2024.

Combined with the earlier analysis of which farms repeatedly experience high mortality, this shows that it is possible and necessary to close or move the worst salmon farms.

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[18] Salmon farming in Scotland. Follow up information from the RECC evidence session on 2 October 2024 with Salmon Scotland. 25 November 2024.

Persistent Elevated Mortality in salmon farming in Scotland - Methodological approach

Introduction and background

In the RAIC's report on its follow-on enquiry (17 January 2025) it noted concerns on the levels of mortality in Scottish salmon production and made the following recommendation:

The Committee recommends, therefore, the Scottish Government provide powers to the Fish Health Inspectorate (or another appropriate body) to limit or halt production at sites which record persistent high mortality rates.

The Scottish Government committed to analyse existing mortality data in its response (13 March 2025), exploring thresholds for 'persistently high mortality' and to whether fish farms with 'persistently high mortality' exist. This annex provides an overview of the methodological development that has taken place over summer 2025 with a view to finalising the initial analysis later this year.

Methodological approach

To ascertain if any individual sites have experienced 'persistent high mortality' a robust, objective and reproducible analytical framework was developed to analyse available datasets.

The focus of this work is on marine sites where there are existing datasets. The Scottish Environment Protection Agency's (SEPA) monthly biomass and mortality reports (2003 - 2024) were employed for the analysis given the volume of information available at site level. Salmon Scotland monthly survival rates (2018–2024) and reports provided to Scottish Government Marine Directorate's (SGMD) Fish Health Inspectorate (FHI) were also integrated with the SEPA data as they provide detail on mortality cause and also ensure appropriate verification of outputs.

The novel model is designed in two stages, first identifying instances of 'elevated' and 'recurrent' mortality in the dataset using analytical methods.
Secondly, applying an Artificial Intelligence (AI) based large language model to categorise causes in the data to allow the model, with input from the professional expertise of the FHI, to determine if the 'recurrent elevated mortality' events were due to related causes and, therefore, if they are regarded as 'persistent', based on the available data.

Defining terms and undertaking screening

This process required 'elevated', 'recurrent' and 'persistent' mortality to be defined and then analytically identified. These definitions are described below and form part of sequential screening process that excludes site mortality data out with the qualifying parameters and ultimately aims to highlight production sites that may have experienced 'persistent elevated mortality'. That is the basis of the preliminary method development described below to complete the analysis.
The full summarised process is noted in Figure 1.

Elevated mortality

Mortality is deemed to be '**Elevated**' when it exceeds levels widely observed by farming Atlantic Salmon in Scotland. By exploring trends and average levels of mortality within SEPA's mortality dataset, we adopted an analytical approach that focuses on elevated mortality levels that it could, in practice, point towards production challenges such as unfavourable environmental conditions.

Percentiles are measures used in statistics to show the position of a value within a dataset. The analysis focuses on the 95th centile (5.68% monthly mortality) of the (i.e. the largest 5% of monthly mortality values) as the boundary for screening out 'elevated' mortality events and associated production sites for further analysis. This screening is applied to mortality data between 2018 and 2024 where there is corresponding data on mortality cause.

Recurrent mortality

Recurrence of mortality is defined as repeated **elevated** mortality events on the same site, irrespective of cause. Mortality is recurrent at a site where it is 1) consecutively elevated over a 2-month period **and** 2) two or more consecutive stocking cycles[2].

Persistent mortality

Persistent mortality is defined as the reoccurrence of mortality through the **same causal factors**. Factors causing mortality may be out of the control of the site management, or controllable but continued despite attempts to improve conditions, mitigate or eliminate the issue.

Establishing and assuring 'persistence'

Sites showing **recurrent** mortality are analysed alongside the mortality cause to determine if mortality is persistent (i.e. assess if the cause is the same). To do this systematically, a Large Language Model[3] was developed to categorise mortality causes reported to SGMD. This analysed the free text information contained within SGMD returns to group mortality into cause categories. Mortality causes are wide ranging and complex and this novel approach aids standardisation of causes into several broad categories. The model can then robustly analyse the categories associated with the 'recurrent elevated' mortality and identify sites with related grouped causes. Where model outputs flag potential persistence based on grouped causes, these are then assessed by FHI to determine if the same individual cause(s) is the reason for the recurring mortality. Thus, the model identifies potential persistent mortality from the available data and serves as a tool to direct effort into exploring individual cases at the site level. This part of the process is currently being validated by the Fish Health Inspectorate (FHI) and Marine Directorate analysts.

Data Quality Assurance and Quality Control by the Scottish Government is needed and will aid the accuracy outputs and ensure integrity of the model outputs, prior to generating outputs.

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[2] A stocking cycle is when a site is stocked with fish and grown onto harvest or transfer
[3] A Large Language Model (LLM) is a type of computer programme that is trained on huge amounts of text so it can understand and generate human-like language

Understanding persistence under 'real world' conditions

To understand if sites screened as showing persistent elevated mortality through the quantitative approach described truly are persistent, discussions with site operators will be undertaken to provide additional context around the mortality experienced at these sites and mitigating actions taken by operators. Combined with the objective expertise of the Fish Health Inspectorate, this will enable a qualitative and consistent determination of whether a site truly has exhibited persistent elevated mortality.

Next steps

The Scottish Government will continue working at pace to deliver this analysis, including:
- Model validation and development with further Quality Assurance and Quality Control. Marine directorate scientists will submit a methods development paper through the peer review process this year, seeking to apply the highest academic scrutiny to the method.
- Upon completion of model validation, outputs will be generated and sites screened as potentially exhibiting persistent elevated mortality will be taken forward for 'ground truthing' with the FHI and producers.
- By Spring 2026 we will provide a full project report to the Rural Affairs and Islands Committee detailing both the finalised methods, the results of analysis, and the planned Scottish Government's response to these.
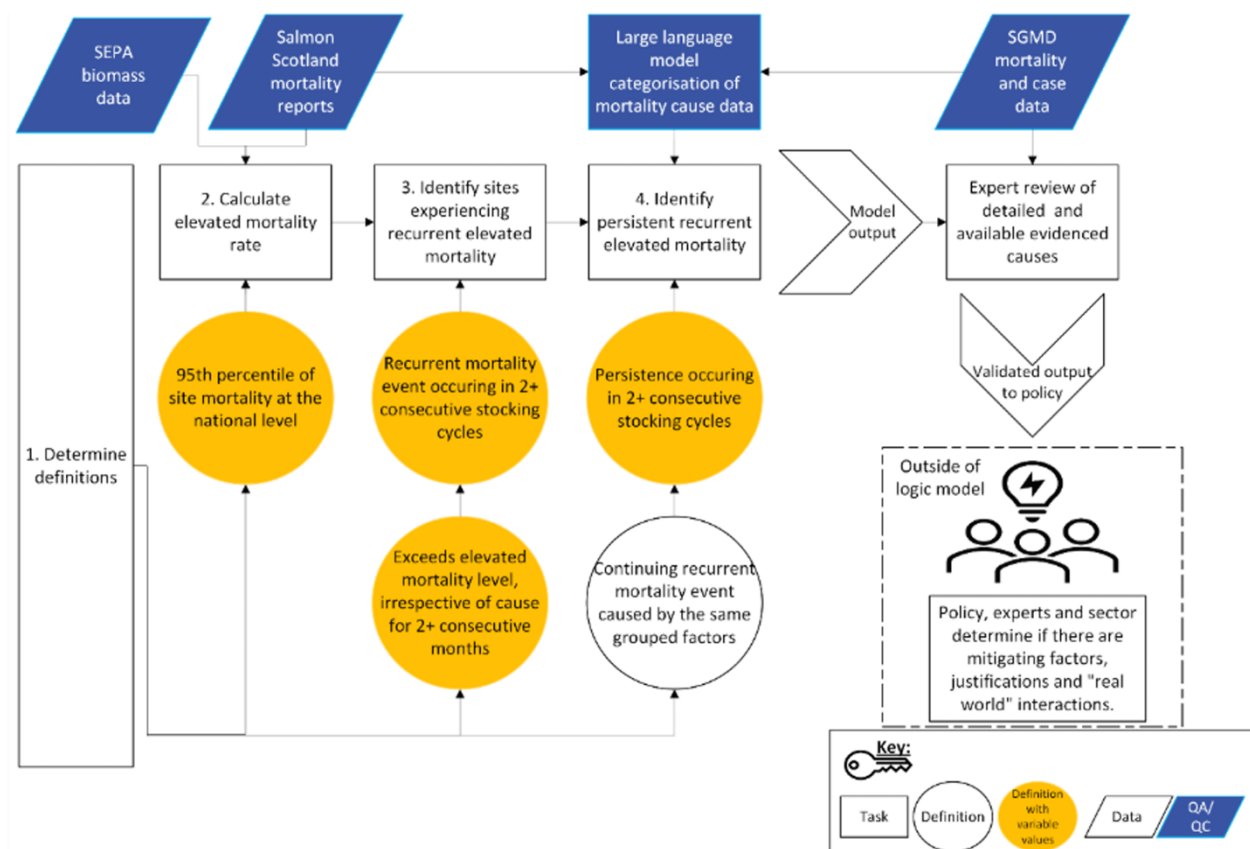

Figure 1. Process flow chart of persistent elevated mortality model, including different data sources, proposed definitions, through analysis to expert review and finally policy advice.