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Scottish Government
Riaghaltas na h-Alba

Finlay Carson MSP
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5 March 2026

Dear Finlay,

Scottish Government report on persistent elevated mortality in salmon farming in Scotland and finfish survival data topic sheet.

I look forward to providing evidence to the Rural Affairs and Island's Committee on 11 March on the progress made towards our commitments set out in the Scottish Government's response to the Committee's follow-up enquiry which concluded in January 2025.

Following a commitment in the subsequent September 2025 delivery update, I am providing a full project report in relation to the work undertaken to analyse existing farmed salmon mortality data, exploring thresholds for 'persistently high mortality' and whether fish farms with 'persistently high mortality' exist (Annex A).

To support Committee deliberations on farmed fish mortality we have provided a mortality dataset topic sheet 'explainer', which will shortly be published on Scotland's Aquaculture Website as a public facing-document (Annex B).

MAIRI GOUGEON

ANNEX A

Persistent elevated mortality in salmon farming in Scotland – Update to methodological approach and preliminary findings

Introduction and background

Scottish aquaculture takes place within a robust legislative framework that regulates the way fish are farmed, their health and welfare, and the impact on the environment. The regulatory oversight of the Fish Health Inspectorate (FHI), the Scottish Environment Protection Agency (SEPA) and the Animal and Plant Health Agency (APHA), among others, already provides strong reassurance that farms act promptly and responsibly to avert the harms that could lead to mortality before the fact and in response to unforeseen incidences. However, recognising the desire for greater understanding of this area expressed as part of the Rural Affairs and Islands Committee's follow up enquiry into salmon farming, the Scottish Government committed (13 March 2025)[1] to undertaking analysis of the issue of 'persistently high mortality', setting out the methodology to explore whether such mortality exists as part of the delivery update (23 September 2025)[2]. The development of a robust methodological framework included the Scottish Government's engagement with salmon producers to 'ground truth' preliminary results and gain specific insights into actions that producers have taken in response to elevated mortality incidences.

This report provides the RAIC with a substantive update on this work and findings. It supports the Scottish Government's approach to ensuring Scotland has a sustainable, resilient, and thriving aquaculture sector. This paper discusses the preliminary results generated by the method set out, prior to scientific peer review. While it should not be regarded as final report or formal scientific paper, the rigorous and expert analysis to date, as set out in this document, can be used to draw indicative conclusions. Some final verification work is ongoing, and the peer review process could result in suggestions for amendments.

Based on the analytical approach and preliminary results set out below, we initially conclude that persistently elevated mortality – that is, elevated mortality with the same cause recurring across two or more consecutive stocking cycles – is not a systemic problem for Scottish marine salmon farms. We do not propose that further regulatory action is therefore warranted at this stage. This conclusion will be revisited once peer review is complete.

Summary of methodological approach and framework

A robust and innovative analytical framework has been developed to explore evidence of mortality occurring at Scottish marine salmon production sites to determine whether and to what extent fish farms have experienced "persistently elevated mortality" (Figure 1). Further

[1] Salmon farming in Scotland: Scottish Governments response to Salmon farming report. 13 March 2025. https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2025/salmon-farming-cabinet-secretary-response.pdf

[2] Salmon farming in Scotland: Scottish Government interim update. 29 September 2025. https://www.parliament.scot/-/media/files/committees/rural-affairs-and-islands-committee/correspondence/2025/salmon-farming-in-scotland-23-september-2025.pdf

methodological detail was provided in Scottish Government's written update to RAIC on 23 September 2025[2].

The framework encompasses three essential stages. Firstly, an analytical model has been designed to examine publicly available datasets and categorise reported mortality causes to prioritise mortality events for further investigation. Secondly, the detailed records for these screened sites are examined by inspectors from the FHI using their objective expertise. Finally, the sector is invited to present detailed site-level records to help understand the specific health management scenarios and what measures have been taken to curtail mortality. Each stage of this framework provides an opportunity for reflection and validation of the approach, which is vital to understand the complexities of the fish health scenario on the site. Conclusions on whether marine salmon farming sites experienced persistent elevated mortality can only be considered once all available evidence and all framework stages are complete.

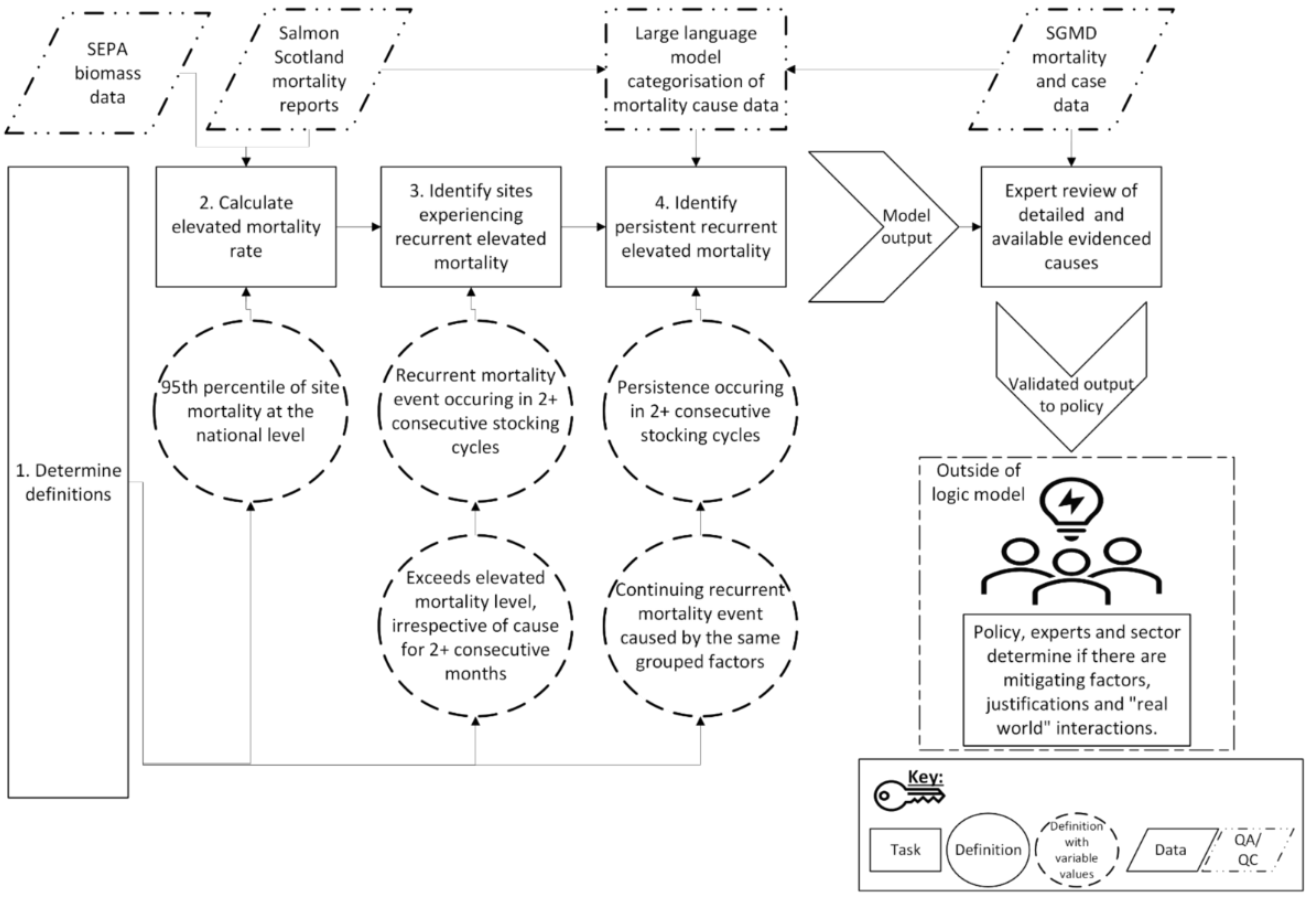

Figure 1. Taken from Moriarty et al. 2026[3]. Flow chart of persistent elevated mortality logic model and framework, including different data sources, proposed definitions, through analysis, to expert review and final policy advice.

Analytical Approach

To develop a robust evidence-based analysis framework it was necessary to define what "persistently high mortality" looks like. Our parameters for 'elevated', 'recurrent' and 'persistent' mortality clarified this (Figure 1). With this framework in place, the Scottish Government has been able to engage constructively with the sector and report to RAIC on both the challenges that may contribute to persistently elevated mortality, and the actions being taken to address

[3] Moriarty M., Parker SJ., Murphy JM., Duguid SJ and Murray AG., (2026) Model development towards understanding persistent elevated mortality in seawater phase of Scottish Atlantic salmon aquaculture Conference: Proceedings of the Society for Veterinary Epidemiology and Preventative Medicine. London, March 25-27, 2026.

them. Defining these parameters is a matter of judgement, which in this case has been informed by the professional expertise of Marine Directorate scientists and fish health inspectors, as well as the limitations of both the available data and the need for timely reporting; these are considered both fair and pragmatic for assessing long term trends of mortality in an animal production sector.

The analysis has focused on recurring patterns of mortality to understand when and why elevated losses are being prolonged, and whether any intervention(s) can help reduce them. The concept of persistence inherently relates to trends that continue over time, rather than to discrete, short-lived events. The current framework parameters therefore prioritise patterns which are repeated and where mitigation or intervention is most likely to yield meaningful benefits for farmed fish. Mortality events of short duration, but possibly involving large quantities of fish, would not feature using these parameters.

Mortality is a complex, multifactorial issue, shaped by immediate effects and underlying or historical stresses. Influences such as genetics, environmental conditions, random events, and site management can all contribute. Therefore, mortality rates alone are not a reliable indicator of competence or site suitability, nor do they offer a pathway to effective management. Instead, by focusing analysis on cause of mortality, the framework provides clearer insight on specific challenges and appropriate interventions. Through this analysis of repetitive cause, the Scottish Government has sought insights which could indicate the need for, and value of, further intervention.

This analysis is reliant on publicly available datasets which have been carefully chosen and integrated to ensure that the dataset was sufficiently complete and consistent for robust assessment. SEPA's monthly biomass and treatment reports provide the longest and most comprehensive time series for site level mortality data, while the mortality information reported to Scottish Government offers the most detailed insight into health scenarios and mortality causes. In addition, Salmon Scotland's monthly mortality rate report provides valuable context for recent years, and a useful comparison of overall trends. Although these datasets may differ in scope, purpose, and method collection, resulting in some discrepancies, the Scottish Government's analytical team has been able to integrate the substantial information within SEPA and Scottish Government's records. This has enabled the identification and use of the most relevant and reliable evidence across the available sources.

The above method development, using an anonymised subset of the data as a proof of concept, has been submitted for peer review. Moriarty et al. (2026) has been accepted as a session presentation at the annual conference for the Society for Veterinary Epidemiology and Preventative Medicine (SVEPM). The presentation and associated conference paper will provide fuller detail on the method, analytical process, and validation.

Summary of the framework

The model functions as a screening tool designed to identify sites where publicly available data suggests that recurrent mortality may have occurred and where this is being persistently driven by the same single categorised cause. The subsequent stages of analysis involve the review by FHI experts of detailed causes based on their records, and contextualising of the mortality event at the site level, which requires updated input from the aquaculture businesses involved.

Engagement has been undertaken between Scottish Government officials, including FHI and scientific experts, and fish health and compliance professionals from each production company. Engagement with each producer followed a consistent semi- structured format for comparability, and all were asked to present further information on the mortality events flagged

in previous stages of the framework. The evidence presented included, but was not limited to, updated diagnoses based on extensive diagnostic results, clarification on prevalence and significance of multiple causes, and context on preceding health events for the stock. These more qualitative steps ensured that all available evidence in relation to each incident flagged by the model was scrutinised and fully considered.

Summary of preliminary findings

All stages of the framework are now complete and have delivered valuable insight into potential occurrences of persistent elevated mortality across the Scottish marine salmon production sector. The Scottish Government has confidence in the robustness of this analytical framework but considers the detailed results of a preliminary nature until the peer review process has concluded.

Model output and FHI expert review

The model analysed mortality data from 216 sites, incorporating over 5,500 free-text causes of mortality entries from 2018-2024. Of these, 188 sites showed no evidence of recurrent or persistent elevated mortality (Table 1). The remaining 28 sites were flagged for recurrent elevated mortality, of which 25 appeared from the model's analysis to have experienced mortality events meeting the definitions of persistent elevated mortality; these 25 were therefore assessed by the FHI (Table 1). During this review, the FHI experts cross-checked case records and the mortality cause reports to determine whether these events continued to meet the definition of persistent elevated mortality at this more detailed level. Subsequently, 5 sites were removed from further consideration because their underlying causes differed across the events. For example, mortality was attributed to distinct infectious diseases, or handling references were linked to treatment interventions, rather than true mortality drivers which the analytical model initially identified. This left 20 sites for assessment within the final stage of the framework; these represent approximately 9% of active Scottish marine sites (Table 1). Every currently active farmed salmon production business had at least one site flagged.

In the model's initial mortality cause categorisation, gill health accounted for around 65% of potential persistent elevated mortality incidences. However, gill health is a highly complex challenge with multiple drivers, overlapping diagnosis and interactions with all the other mortality cause categorisations.

Full evidence gathering with sector engagement

The multiple causes which can be involved in gill health-related challenges can mean that patterns appearing to be 'persistent' in the model and in FHI records are not always consistent with producers' evidence and detailed insights. Engagement with producers is now complete for all the sites flagged for further review, enabling a fuller exploration and understanding of site-level records, diagnoses, and management responses. Mortality events can often stem from complex interactions, some of which are well-known, others newly recognised by both experts and the sector, and these interactions can be highly nuanced. Evidence was also presented of how producers have successfully mitigated or overcome persistent mortality challenges through targeted investment and innovation. As a result of greater understanding of the context in which mortality occurred, including diagnosis, several cases initially flagged as 'persistent' have been preliminarily re-categorised once these deeper insights were obtained.

In many cases, diagnoses have changed since the initial reporting to the Scottish Government, meaning the causes are no longer consistent across the recurrent mortality events. The initial reports to the Scottish Government are for the purpose of reactive surveillance of mortality

events and these are often preliminary and based on visual assessments at the site. Subsequent diagnostic testing and investigation by the producer may revise the original diagnosis, but there is no obligation for producers to retrospectively update their report unless a notifiable or emerging disease is suspected or confirmed. For these re-categorised events, the Scottish Government still examined the actions taken to address the mortality and verified appropriate measures had been implemented to reduce mortality or strengthen future health management practices.

As an example, an infectious disease has been reported based on previous pathogen detection, even without clinical disease. As the mortality event progresses, additional clinical signs or test results may indicate other leading causative agents. In other instances, early reports of generic gill health issues were later clarified or linked to damage caused by plankton blooms or evidenced that different causes were occurring across the events.

After more detailed information was provided through the sector meetings, it is understood that there are 9 sites which have experienced mortality events that meet the current definition of persistent elevated mortality (Table 1). Of these, all were 2023 or earlier and almost all events were followed up with improvement actions. Conclusive qualitative assessment of these events will take place once quality assurance of sector meeting notes and peer review of the methodology is completed.

Table 1. The number of the active sites identified as having recurrent or persistent elevated mortality at different stages of the analysis framework, and the percentage that this represents of total active marine salmon sites.

Framework Stage	Model recurrent elevated mortality	Model persistent elevated mortality	Persistent elevated mortality after FHI review	Persistent elevated mortality after framework completion
Number of sites	28	25	20	9
Percentage of total number of active sites	13.0%	11.6%	9.3%	4.2%

Interventions and mitigations implemented in response to recurrent or persistent elevated mortality

Access to detailed sector records confirmed that very few mortality events can be attributed to a single, easily identifiable cause. Evidence also showed that causes vary and change, with some following seasonal or annual trends, and others evolving more unpredictably. As a result, the sector must stay responsive, adaptable and ensure it is supported by a diverse diagnostic and intervention toolkit.

Gill health

Gill health emerged as the predominant high-level factor across many mortality events investigated. However, “gill health issue” is a broad term that encompasses a wide range of physiological processes, making it unsuitable as a single, uniform cause across events. Fish gills are highly specialised, multifunctional organs which integrate respiration, ion and osmotic regulation, excretion, and aspects of the immune response. This complexity makes them physiologically vulnerable, prone to damage from particles, pathogens, parasites, toxins and mechanical or osmotic stress. Gill pathology does not always occur in isolation, and existing or

concurrent health conditions can intensify gill disfunction. Interacting factors can intensify one another and elevate overall physiological stress that can result in mortality. Understanding this complex relationship is essential for identifying key issues to target in each case and determining the most effective combination of interventions to address them.

Amoebic gill disease

Persistent elevated mortality events caused by amoebic gill disease (AGD) have been experienced by several production companies. However, in direct response there has been clear strategic operational changes and investment in treatment options with many companies now better equipped to manage AGD and reduce handling. For example, based on better understanding of the disease through research, most companies have moved away from medicinal treatments in favour of freshwater baths. In direct response to mortality events, trends and their understanding of the disease, several companies have also invested in new generation, improved and biosecure well boats. These have greater freshwater treatment capacity and dual treatment options for both AGD and sea lice to reduce the number of occasions of potentially stressful handling.

Environmental insult (e.g. plankton and jellyfish)

Unpredictable plankton blooms, whether phytoplankton or micro-jellyfish, have also been contributing factors to the complex gill health of many of the persistent elevated mortality events. There is now a much clearer understanding of the relationship between gill inflammation, which can be reported as proliferative gill disease (PGD), and exposure to micro-jellyfish. It was noted during engagement that advances in their understanding of fish health and how fish respond to environmental conditions, led them to identify a correlation between historical PGD cases and what were likely undetected micro-jellyfish blooms at the time. In response to the threat from plankton blooms, producers discussed how they greatly increased and improved monitoring and identification capability, with more sites and staff able to monitor for blooms, with some having environmental monitoring on individual pens. Such surveillance not only increases their understanding of blooms, but can act as a warning system, which improves timing and choice of mitigations, which will reduce the impact of the detected impending bloom.

The sector has evidenced different intervention strategies including altered feeding regimes, use of 'functional feeds' specifically designed with ingredients to promote health or immune response, and installation of bubble upwelling systems. Whilst these interventions have shown to alleviate mortality after a harmful bloom, the sector is keen to explore options to further predict and mitigate impact caused by the blooms.

<u>Infectious disease</u>

Some elevated mortality events investigated through this framework have been shown to be due to infectious disease, such as pancreas disease, salmonid rickettsial septicaemia, or *Pasteurella skyensis*, which cause significant mortality. In direct response, companies experiencing some of these diseases have invested in vaccination development and deployment programmes across their sites, which include increased efficacy DNA vaccines or tailored autogenous vaccines. Alternatively, for general improved immunity and to increase physiological resistance, the use of 'functional feeds' has been implemented. Breeding programmes are also strategically focused to select stocks with specific traits that strengthen their resilience to challenges such as cardiomyopathy syndrome, AGD or broader health and performance pressures. Overall, these interventions have made substantial progress in addressing these disease challenges and have also alleviated some gill health issues.

Predation

Although there are no predation events that meet the definition of persistent elevated mortality, producers did emphasise the harms that seals cause in terms of direct mortality and stress beyond direct predation, which can exacerbate other challenges and lead to mortality. Where this was a particular issue, producers evidenced their response via investment in seal-resistant pen systems, with ongoing investment on design changes to directly respond to their learned behaviour to breach pens in swell, over handrails and at weak points. In addition, some sites allocate dedicated personnel to monitor pens, adjust rigging, and make real-time modifications during operations when seals are most likely to take advantage. Together, these measures demonstrate the increasingly proactive and adaptive approach required to mitigate predation risks in modern aquaculture.

Farming production strategies

To address some of the challenges seen in the analysis, several companies have already begun or are actively seeking to relocate portions of their production to locations with more favourable environment conditions, including more exposed and dynamic marine settings. Existing sites may become better suited for future innovative technologies (such as semi-enclosed pen systems), or repurposed for specialised functions, like broodstock management. There is also growing interest among producers experiencing specific health issues to transition to sites with fewer, but significantly larger, pens. Larger pen systems have been shown to enhance fish health and welfare by improving water dynamics and quality, supporting improved shoaling behaviour, reducing predation risks, and increasing operational efficiency, including for health treatments. Across the sector, producers emphasised the need for a more streamlined and responsive consenting process. Faster decision-making for new site applications has been requested to enable more proactive and strategic health management planning, helping the sector adapt more effectively to emerging environmental and biological pressures. Cognisant of this, the Scottish Government already has a significant consenting workstream to streamline the process without compromising on the necessary site-specific assessments which ensure robust environmental protection and community consultation is maintained.

Overall assessment

Nine events currently meet the definition of persistent elevated mortality, however, for nearly every instance[4] there has been clear intervention by the producer to limit mortality, and all producers have evidenced systemic improvements through change, innovation, and investment.

The framework has shown that occurrence of persistent elevated mortality cannot, at this time, be determined by analytical methods alone, with the model showing value as a screening tool, as it was intended, but that wider detail is needed for full consideration of an issue and whether actions were implemented to address the mortality. The reduction of sites meeting the definition of persistent elevated mortality through the framework process justifies the importance of expert validation and sector meetings to gain vital additional diagnoses and contextual information.

Producers demonstrated that extensive diagnostics and analysis follow mortality events and at the end of a production cycle to inform changes required to address issues. Deployment of a

[4] One provisional persistent elevated mortality event did not show any related intervention actions to mitigate mortality during this event. However, the site has now closed for operational reasons.

wide range of techniques and expertise to assess the stock health, the environmental conditions, and evaluate the effectiveness of their health management strategies, with continued investment and training to enhance these capabilities further in ever changing situations were observed. In many cases, producers' investigations revealed complex diagnostic results with multiple contributing agents. While the primary focus was on identifying dominant drivers active at the time of each event, it was also clear that previous health challenges, though under control and not currently affecting the mortality of the stock, may have predisposed the stocks to higher mortality during subsequent stressors. Managing these multifactorial challenges often requires different layered and sequential interventions, each of which can introduce additional pressures if combined or poorly timed. Despite this complexity, the sector provided numerous examples of well-reasoned decision making informed by fish health and veterinary professionals and targeted actions taken to address mortality events, including high investment, companywide health management strategies, and collaboration into further research and development.

Conclusion and next steps

This work set out to understand how sites with persistent elevated mortality manifest, to determine if there are sites where such mortality exists, and to establish what actions are taken by producers to mitigate issues. The multi-stage analytical framework enabled us to conclude, based on the preliminary results, that there a small number of salmon farms which have experienced persistent elevated mortality. However, what is also clear is that overall, salmon farmers have taken, and continue to take, actions to curtail persistent elevated mortality to ensure the best fish health outcomes are achieved going forward. Therefore, our preliminary conclusion is that this analysis indicates that persistent elevated mortality is not a systemic issue for Scottish aquaculture businesses.

There is a high degree of transparency with information widely available and proactively shared by the Scottish Government and the sector regarding mortality and its causes. Based on this assessment, further legislative controls related to mortality such as site closure of Scottish marine salmon farms cannot be justified. Regulation should promote and encourage better practice and the detailed evidence presented by producers demonstrated that, following a mortality occurrence, immediate changes in approach were actioned, and that mitigations are being deployed without regulatory intervention.

However, this work provides further evidence for the importance of the actions producers take to address the issues that can lead to mortality. The work illustrates the complexity of the factors which can result in mortalities, indicating the ongoing necessity for producers to monitor, innovate and adapt to known challenges and to new ones as they arise via continued investment in innovation, farming strategies, and technologies. The Scottish Government's key existing workstreams act to support these efforts from producers. These include:

- Continuing work to streamline the aquaculture consenting system while maintaining high standards, enabling informed regulatory decisions to be taken as quickly as possible, helping producers to continually adapt their marine estate as is necessary and to apply new innovations and technology.
- Support the sector's development in more exposed and high dispersal waters, through the roll out of SEPA's marine fish farm regulatory framework and by clarifying the broader regulatory framework on developments to 12 nautical miles, enabling sites to be located in more dynamic locations.

- Investing in innovation and infrastructure development, for example through any future years of the Marine Fund Scotland which in past years has supported projects on infrastructure and R&D designed to support fish health.
- Delivering a new aquaculture innovation finance vehicle, to inherit the role of the Sustainable Aquaculture Innovation Centre (SAIC), supporting key science and innovation in areas such as genetics, disease management, treatment, mitigation, climate change adaptation etc.
- Maintaining effective connections between aquaculture science groups including Marine Alliance for Science and Technology for Scotland (MASTS), SAIC and others to enable more effective knowledge sharing, building on our existing work, including engagement on our Aquaculture Areas of Research Interests.

The framework and analysis can be used to support ongoing collaborative conversations between sector, researchers and regulators to better understand how mortality affects Scottish salmon farming and the way producers act to mitigate it. This work offers evidence-based insights to further promote consumer and stakeholder confidence in the future of the sustainable, resilient, and thriving aquaculture sector.

ANNEX B

Copy of topic sheet text in relation to information on the survival of farmed finfish (to be published on Scotland's Aquaculture Website)

Losses and survival information in Scottish farmed finfish production

This page provides detailed information on, and links to, data sources which report the survival of finfish in Scottish aquaculture.

Background

Finfish are produced in dynamic marine and freshwater environments – in net pens in the sea and freshwater lochs, tanks, ponds and raceways within on-land facilities. Like other animal production systems, Scottish finfish farmers can experience losses in livestock at any stage before animals are harvested for human consumption. Losses in production may occur when fish perish prematurely due to a variety of causes such as environmental challenges (e.g. jellyfish, or harmful algal blooms) or fish disease. Fish may, from time to time, be euthanised (culled) for a variety of reasons.

Understanding the reasons for losses within food production is an important part of responsible farming. Reporting information on losses, including mortality events – which may also be a regulatory requirement – is important to support decision making and to raise awareness of the various reasons fish are lost and to ensure public transparency. There are a range of relevant publicly available datasets which are maintained for different regulatory and transparency purposes. These datasets cannot be directly compared with one another because they are collected for different underpinning reasons and comprise different information, which is analysed and reported differently. Some datasets may only include information on particular species of farmed fish or production stages, or when prescribed thresholds are exceeded.

The main datasets which report on farmed fish losses, survival and mortality are:

1. Scottish Government: mortality information by production site, when exceeding defined thresholds (Source: Scottish Government's Marine Directorate Fish Health Inspectorate)
2. Monthly site biomass loss by weight of fish (Source: Scottish Environment Protection Agency (SEPA))
3. Scottish Government production survey – survival to harvest by year class (Source: Scottish Government's Marine Directorate)
4. Monthly survival at site and sector level, as percentage loss and by cause (Source: Salmon Scotland)

Some of these datasets apply to different phases of production or farmed species and this is indicated within the descriptors below.

1. Scottish Government: mortality information by production site, when exceeding defined thresholds (Source: Scottish Government's Marine Directorate Fish Health Inspectorate)

The Scottish Government's Fish Health Inspectorate operates an aquatic animal disease surveillance programme to prevent the introduction and spread of listed and emerging fish and shellfish diseases in Scotland.

The Aquatic Animal Health (Scotland) Regulations 2009 place a legal obligation for increased, unexplained mortality in aquaculture animals to be reported to the Fish Health Inspectorate or a veterinarian. This reporting requirement applies to all Aquaculture Production Businesses (APBs).

In addition, there is a voluntary agreement in place with finfish APBs to report incidences of mortality of farmed salmonids (e.g. Atlantic salmon and rainbow trout). The reporting of this information is intended to supplement the FHI's aquatic animal disease surveillance programme. Reporting is according to defined thresholds that were agreed as part of the Scottish Government's Ministerial Group on Sustainable Aquaculture and its "Healthier Fish and Shellfish" working group.

Dataset description

Mortality reported to the Marine Directorate's Fish Health Inspectorate (FHI) provides numbers and percentage information on fish that have died on a farm in a specified time period (1 week or 5 weeks), where the percentage is above specific reporting thresholds set in agreement with the Fish Health Inspectorate. These reporting thresholds are incorporated into the Code of Good Practice for Scottish Finfish Aquaculture, which applies to farmers who produce salmonid species.

Scottish Government publishes mortality information received through the voluntary mortality reporting commitment, as well as mortality information obtained through the aquatic animal health surveillance programme. It can be found here.

This dataset is not a comprehensive record of all mortality as reporting only includes mortality that has exceeded the predetermined thresholds. While the purpose of collecting this information is to support the FHI's surveillance programme, it is also proactively published. Data may be revised at any point, including after publication, as additional information can be provided by the site operators when mortality events are concluded, and following FHI surveillance where mortality records on site are checked during routine site inspections.

Mortality occurring at seawater salmon farms within the first six weeks post transfer from a freshwater rearing site is not part of the voluntary reporting requirements, although it is recorded on farm and is available for inspection by the FHI during health surveillance inspections.
The FHI publishes information on a monthly basis, one month in arrears, in the form of an excel spreadsheet download.

Understanding losses using this dataset

This data cannot be used as a comprehensive mortality dataset but can be used to better understand site-level mortality and its cause.

2. Monthly site biomass loss by weight of fish (Source: Scottish Environment Protection Agency (SEPA))

SEPA regulates the discharge of organic matter (e.g. fish faeces and uneaten food) from aquaculture sites as part of the Environmental Authorisations (Scotland) Regulations 2018 (EASR). SEPA uses biomass (i.e. the quantity of fish by weight) as a parameter to quantify levels of organic waste discharged, placing permit limits on the biomass that each site can carry. To help monitor and ensure compliance with a biomass limit, SEPA requires fish farms to report peak monthly biomass on each farm as well as the biomass of mortalities as a requirement of discharge permits.

Dataset description

Peak monthly biomass on each farm is reported in tonnes and the weight of mortalities is reported in kilograms. Reporting is undertaken on a quarterly basis and applies to seawater sites. This dataset shows the biomass (mass of fish in tonnes) at each fish farm in active production for the main farmed species e.g. salmon or trout. While this dataset is collected for the purpose of environmental compliance, information is proactively published. Records for sites that have been closed are not available.

Biomass loss is available from 2002 to the present and is published in downloadable form on Scotland's Aquaculture Website.

Understanding losses using this dataset

This dataset can be used to understand seawater farm losses on a monthly basis and potentially over annual timescales. It cannot be used to estimate the total number of fish lost over a given time. This provides the total biomass, not the size of individual fish, which can vary.

3. Scottish Government production survey – survival to harvest by year class (Source: Scottish Government's Marine Directorate)

The Marine Directorate's annual production survey collates production data as part of Official Statistics from Scottish finfish farm sites operated by authorised aquaculture production businesses. It includes information on the number of farmed salmon that are harvested by year class.

Dataset description

A year class of farmed fish is a cohort of fish that are put to sea in a specific year. Survival to harvest by year class infers losses as the percentage of smolts put out to sea which do not reach harvest.

Fish are harvested over a number of years, and the data is only complete when all fish from an input year have been harvested. This is reflected in what is published. As salmon may take up to two years from being put to sea to be harvested, the figures in the survey refer to fish that entered the sea up to two years earlier. This means that the survey does not include more recent losses.

As well as mortality, losses (i.e. fish that do not reach harvest) also consist of fish which have escaped, been culled for production reasons, removed for sampling purposes, statutory

culls for disease control purposes or for fish selected for broodstock production. Escaped fish specifically are reported published differently and further information can be found here.

Survival to harvest is available by year class from 1984 to the most recent reporting period in PDF form, and in a downloadable data table.

Understanding losses using this dataset

Survival to harvest can be used to understand trends in losses over the longer term. The number of fish in a year class (i.e. the fish grown to harvest within a production cycle) varies between years, and therefore expresses losses as a percentage of input within a year class (i.e. survival to harvest) provides a basis for long term comparison of sector-level losses.

This dataset can also be used to understand the sector-level performance by complete production cycles. However, it cannot be used to understand more recent losses nor specific mortality events within production cycles.

4. Monthly survival at site and sector level, as percentage loss and by cause (Source: Salmon Scotland)

Salmon Scotland voluntarily reports survival rates as monthly losses of farmed salmon due to mortality in all active marine fish farms. This is for the purpose of transparency and to aid public understanding of the causes of mortality, which can be complex.

Dataset description

All mortality is provided by authorised APBs to Salmon Scotland for reporting. Reports show a percentage of farmed mortality losses each month, based on the number of fish on a farm at the start of the month. Mortality over the entire production cycle, again based on fish numbers, is provided when all fish have been harvested from a farm. A sector level monthly mortality is provided based on data from all farms, each month.

A description of the main cause(s) of mortality is provided, based on 10 categories. This is provided where mortality is higher than 3.4%. The 10 categories of mortality causes are those that were previously agreed within the Scottish Government's "Farmed Fish Health Framework". They were set to support alignment in reporting across the various public datasets.

Once a farm is fully harvested and empty, Salmon Scotland report the cumulative mortality for the whole production cycle. This is calculated using the initial input number when fish are first stocked onto the farm and the total mortalities over the production cycle. Each month, sector wide "monthly mortality" is reported, based on all data provided in that reporting month.

Salmon Scotland's sector mortality data are published monthly in arrears and are available in PDF. The data ranges from 2018 to the present.

Understanding losses using this dataset

This dataset can be used to provide complete records of mortality rates at sites and for the whole sector at monthly intervals.

Mortality cause can be understood at each site where mortality exceeds 3.4%.

Summary

Each data set provides a level of information relating to production losses and survival. However, they are each compiled for a distinct purpose and reported using different parameters. It is for this reason that no single dataset provides a complete picture across the entire production cycle, or for any single fish species or production phase (seawater or freshwater).

Datasets cannot be directly compared as they are each designed for a different purpose and report on different production phases.

As described, each dataset provides information that when used can help provide an understanding of mortality and associated causes – but their respective limitations should be understood and observed.