Summary

Bakkafrost Scotland (BFS) is strongly opposed to implementation of the revised Environmental Quality Standard (EQS) for Emamectin Benzoate (EmBz), as it does not believe that it is proportionate or necessary. However, if the revised EQS is to be implemented, a significant number of concerns must be addressed in advance of progression:

- Potential issues arising from conflicting regulatory frameworks;
- Inconsistency between regulation of pesticide users across all sectors;
- Consideration for farmed fish health and welfare (including the need for an alternative to EmBz); and
- Consideration of a risk-based approach for the revised EQS.

The following points are also discussed, and form an additional basis on which BFS is opposed in principle to the implementation of the revised EQS.

- Lack of empirical evidence of impact despite historic use of EmBz;
- Lack of scientific justification for the proposed EQS;
- Irrational and ubiquitous application of over-precautionary EQS with failure to acknowledge site-specific interactions with the environment;

The consultation asks for views on the implementation timescale, however until there is a suitable alternative available which provides the same levels of benefit as EmBz the proposed EQS must not be implemented. Detail is provided in the following text to outline the primary concerns related to the proposed implementation of a revised EQS.

Regulatory inconsistencies and conflicts

We believe that the proposed implementation of the revised EQS is in direct conflict with the current proposals made by SEPA (Scottish Environment Protection Agency) under the Sea Lice Risk Framework, highlighting significant regulatory inconsistencies. SEPA have made clear throughout consultation on SLRF that its proposals are aligned with recommendations made in the Salmon Interactions Working Group (SIWG) Report[1]. Similarly, the Scottish Government's response to the SIWG Report welcomed the recommendations and recognised the powers afforded to SEPA to ensure 'Good Ecological Status' of the water environment, appointing SEPA as "*the lead body responsible for managing the risk to wild salmonids from sea lice emitted from fish farms in Scotland."* If the SIWG Report recommendations are a basis for implementing regulatory reform, then the current proposals are in direct conflict with recommendation 1.3 of the SIWG report, which states: '…*The Scottish Government should holistically assess and review the approach to sea lice treatment, including access to medicines and the use of controls in their use.'* If the revised EQS is to be implemented, it should not be progressed until such a review has been undertaken, considering all sea-lice interventions available.

The Scottish Regulators Strategic Code of Practice[2] describes the principles of better regulation stating that "…*regulatory functions should be exercised in a way that is transparent, accountable, proportionate, consistent and targeted only where necessary*.." It is our view that the proposed implementation of a revised EQS is not proportionate or consistent and is unnecessarily targeted towards EmBz.

The need for a regulatory mechanism to control EmBz in the environment is largely recognised and accepted, and Bakkafrost Scotland continue to engage and comply with the existing framework. However, the application of an overly constraining EQS for the only in-feed medicine available to

[1] https://www.gov.scot/publications/report-salmon-interactions-working-group/
[2] https://www.gov.scot/publications/scottish-regulators-strategic-code-of-practice/

aquaculture operators is entirely disproportionate when contextualised against both the scientific justification and evidence base as discussed in Section: Evidence of Impact and Scientific Justification, and the multiple other, lesser regulated sources of pesticide entering the water environment both from commercial and domestic applications**.** Further, we believe that a blanket application of the revised EQS is disproportionate to the actual risk presented by EmBz deposition, and if implementation of the revised EQS is to progress, then this must be done using a targeted, risk-based approach at sites identified as being at higher risk of interaction with sensitive receptors.

In 2022 only 42.3kg of EmBz was used by the Scottish marine fish farming sector. Furthermore, there has been a general decline in use of EmBz since a high in 2012 (71.6kg), as the sector has evolved its overall fish health management strategy, having access to a wider suite of control measures for sea lice.

Statistics and data on pesticide use in terrestrial agriculture are published following surveys of representative samples which are used to provide estimates of sector wide pesticide use[3]. Depending on the production/crop type, these surveys are undertaken every 2 or 4 years. The latest published statistics for each crop type are detailed in **Error! Reference source not found.**, with the total being indicative of any given year. However it must be noted that this list is not exhaustive, as there remains applications unaccounted for in amenity pesticide usage outwith the use of herbicides by local authorities (e.g. golf courses, private application, domestic use), and the table also excludes pesticide use in orchards, plant nurseries, mushroom farming, protected edible crops and any pesticide use in treatment of terrestrial livestock or pets. The table includes data for multiple types of pesticide, as it is relevant to consider EmBz use against not only insecticide use, but also other pesticides that will enter the water environment and potentially affect non-target plant and animal species.

Table 1: Terrestrial Pesticide Use

Crop Type	Weight of pesticide active ingredient used (kg)	Pesticide Type	Year surveyed
Grassland/Fodder	6.45	Rodenticide only	2021
Grassland/Fodder	77,000	Pesticides inc. herbicides, fungicide, insecticide, molluscicide, seed treatment.	2021
Outdoor Vegetables	53,632	Pesticides inc. herbicides, fungicide, insecticide, molluscicide, seed treatment.	2021
Arable	62,000	Rodenticide only	2020
Arable Crop and Potato Store	1,372,000	Pesticides inc. herbicides, fungicide, insecticide, molluscicide, seed treatment.	2020
Soft Fruit	17,175	Pesticides inc. herbicides, fungicide, insecticide,	2020

[3] https://www.sasa.gov.uk/pesticides/pesticide-usage/pesticide-usage-survey-reports

Crop Type	Weight of pesticide active ingredient used (kg)	Pesticide Type	Year surveyed
		molluscicide, seed treatment.	
Amenity Usage (Local Authority Only)	15,238	Herbicides only	2019
Total (indicative annual usage)	**1,520,051**		

Although it may be argued that agricultural insecticides are applied to the land and not directly to aquatic environments it is noteworthy that CAR regulations permitting agricultural pesticide use prevent application a mere 1 metre from any water environment[4]. This raises the considerable risk of run-off into freshwater systems, with impacts on highly sensitive freshwater insects, and thereafter subsequent discharge into the intertidal and marine environments, with the potential for significant impacts on crustaceans (and, of course, the extremely rare intertidal insects). We must also acknowledge the half-life of some insecticide products, and their potential to eventually end up within Scotland's watercourses, through the natural water cycle.

The salmon aquaculture sectoral use of 42.3kg of EmBz equates to a maximum of 0.003% of the total quantity of pesticides used in terrestrial agriculture in Scotland per year. The relative risk of EmBz residues to non-target species, is therefore clearly negligible when contextualised relative to wider pesticide use. We maintain that the implementation of the revised EQS is entirely disproportionate and inconsistent when considering pesticide use as a whole. Clearly, the perceived environmental benefit of such a revision will be equally negligible as any improvement in environmental condition will be significantly outweighed by the continued application of lesser regulated pesticides entering the water environment.

The timescales to implement the revised EQS must reflect the need to urgently consider the adoption of a risk-based approach for EmBz, in order to best achieve a balance of robust regulation with minimal impacts on farmed fish health and welfare, and socio-economic impact. Similarly, implementation timescales must permit the development and publication of a policy statement to address all existing regulatory conflicts, to ensure that all stakeholders are clear on what constitutes compliance in conflicting regulatory frameworks. Furthermore, the revised EQS should not be implemented until all sources of pesticide in the water environment are regulated to the same standard to ensure regulatory consistency between sectors and to maximise any potential environmental benefit gained from such frameworks.

Farmed Fish Health and Welfare

In-feed EmBz is a unique treatment for line in both its application, duration and efficacy. There is currently no suitable alternative to in-feed EmBz. EmBz is used strategically in the first year of production, to manage and control sea lice (*Lepeophtheirus salmonis* and *Caligus elongatus),* in particular on small fish. The long duration of protection enables farms to minimise lice levels during the first year of production, particularly in advance of the typical lice settlement that occurs in spring, coincidental with the wild smolt migration period. In-feed EmBz is also used when it would generally be less appropriate to handle small fish through alternative interventions such as mechanical or medicinal bath treatments, both of which hold considerations for farmed fish health and welfare due the stresses of handling and exposure to topical medicines.

[4] https://www.farmingandwaterscotland.org/wp-content/uploads/2022/11/KTR12Pesticides.pdf

The Animal Health and Welfare Scotland (Act) 2006 places a legal obligation on the person(s) responsible for animals to prevent unnecessary suffering[5]. The removal of a health management tool presents an elevated risk of unnecessary suffering either from increased exposure to sea lice, or through increased use of less benign interventions which require handling events of smaller fish. The decision to undertake any intervention on farmed fish is the expectation of a positive impact on health and welfare of the stock, balancing the benefits and risks of intervening in a given situation against a 'do nothing' scenario. The benefits and risks are weighed not only with regard to the acutely intended outcome of the intervention, but also considering the longer-term risks of stress induced complications, environmental interactions, and outcomes for production. Consequently, maintaining access to management tools of differing application, process and function is essential for Producers to ensure that *any* health challenge can be managed using the most appropriate means to optimise the outcomes of an intervention.

As the only permitted in-feed medicine, EmBz is a unique tool for lice management with several qualities over alternative interventions. These include:

1. Prolonged efficacy;
2. Suitable for treatment of small fish;
3. Strategic use can mitigate lice settlement;
4. Less impactful on the health and welfare of fish compared to alternative interventions (e.g., which require crowding and handling events); and
5. As part of a wider suite of tools, contributes to reducing lice resistance to intervention.

Question two of the consultation asks for "*any evidence on how long it might take to implement any adjustment to sea lice management which may be required as a result of these changes*". For the avoidance of doubt, **there is currently no suitable alternative or adjustment that could be made to directly replace in-feed EmBz.** Application of alternative interventions on fish that would otherwise be considered too small to handle will result in poorer outcomes for farmed fish health and welfare.

Unnecessary curtailment of this management tool will increase the risk of various negative outcomes such as; increased handling trauma and mortality, and chronically from repeated stress exposure (e.g., immunocompromisation, inappetence, secondary infections, presentation of comorbidities).

The proposed implementation of the revised EQS will render the use of in-feed EmBz at many sites to be unfeasible. It is an established principle of integrated pest management (IMP)[6] that control should be undertaken through numerous different methodologies in sequence to avoid the risk of resistance to any one measure within the pest population. Every sea lice intervention presents an alternative selection pressure on the lice population, i.e., if a mechanical intervention does not achieve the desired efficacy, then an alternative measure may be applied to eliminate the lice. The rotation and alternate exposure of a broad range of tools to manage sea lice, mitigates and minimises the risk of lice developing resistance to one particular intervention. The removal of a single tool (particularly one as unique in its process and action as EmBz) increases the risk of resistance developing to other intervention by creating a positive selection pressure for those lice which would otherwise be eliminated by EmBz. This has direct implications for farmed fish health and welfare, and negatively impacts on salmon producer's ability to operate with a 'risk minimisation' approach regarding migratory wild fish (see also Section: Regulatory inconsistencies and conflicts)

[5] https://www.legislation.gov.uk/asp/2006/11/contents
[6] https://ahdb.org.uk/integrated-pest-management-ipm-hub

We maintain that the impacts on farmed fish welfare must be central to any decision on implementation of a revised EQS for EmBz, and as such, we believe the timescales in which such implementation is progressed must allow the development and authorisation of a suitable alternative to in-feed EmBz to be established. There is no definitive period for how long this may take, but the Scottish Government should be supportive of this process as part of its commitment to holistically review sea lice management measures[1]. SEPA have made clear in its consultation for the Sea Lice Risk Framework that implementation will not occur until the framework is ready; an identical approach should be adopted here to allow for the development of a market-ready, suitable alternative to in-feed EmBz, regardless of how long this may take.

Evidence of Impact and Scientific Justification

We maintain that implementation of the revised EQS is not supported by sufficient evidence, either empirically or in published scientific literature.

The executive summary in the UKTAG report[7] notes that the sediment EQS is based on the '*lowest **relevant** and reliable study (28-day Chironomus riparius NOEC 2720 ng/kg dwt, normalised to default 5% organic carbon content).*' We do not consider the cited study to be at all relevant to the application of an EQS for marine fish farms, as *Chironomus riparius* is an insect species which is rarely found in the marine environment. Furthermore, where insects are found in the marine environment, this is generally in the intertidal zone, which typically has little to no interaction or effect from marine fish farm deposition due to disparities and disconnectivity between their respective locations, bathymetry and hydrography. We therefore believe it is disproportionate to base marine sediment EQS from insect studies, and that the marine sediment EQS must be based on those species that exist within habitats likely to experience depositional interaction with fish farms.

The revised EQS has been based on the toxicity effect on a species of *Insect*, which exists as a subphylum of *Arthropoda*, also including crustaceans. The rationale for the cross-application between phyla being that consumption and toxicity pathways are similar. However, it should not be assumed that the existence of a cladistic relationship, or indeed, the presence of superficial morphological similarity should equate to identical or similar physiological or metabolic process. By way of context and comparison, humans are of the phylum *Chordata*, which encompasses all other vertebrates (including fish and reptiles), in addition to tunicates (sea squirts) and lancelets.

The UKTAG report also relies heavily on two particular pieces of published literature (Wilding et al (2017) & Bloodworth et al (2019)). The following observations on these publications are made:

Wilding et al (2017)

- The Authors note that the results are only directly applicable to Shetland Local Authority. The regional bias also extends to the fact that the sites examined are operated by 1 or 2 producers, whose application and practical use of in-feed EmBz may differ significantly to other operators in different regions. Therefore, any observed effect is not necessarily transferable to other areas of Scotland.
- A meaningful relationship between crustaceans and EmBz could only be determined following removal of 'outliers' of high abundances of scavenging crustaceans, and the effect was limited to mobile crustaceans only. Of course, removal of mobile crustaceans from the dataset will add statistical power to the conclusion that a negative relationship exists between EmBz and mobile crustaceans. It is not appropriate to remove outliers from datasets where the outlier affects both the result and the assumptions of analysis.

[7] UKTAG Environmental Quality Standards Recommendation for Emamectin Benzoate (June 2022) Water Framework Directive - United Kingdom Technical Advisory Group (WFDUKTAG)

- The author also noted that significance does not equate to causation, as other environmental drivers (e.g. particle size) may be highly influential in benthic communities;
- There was also positive association observed between EmBz and crustaceans considered to be vulnerable due to their life history (sedentary and feeders of particulate organic matter).
- The perceived effect on crustacean abundance is clearly unfounded, and the narrative that EmBz indiscriminately kills crustaceans is false given some of the species considered most vulnerable, increased in abundance. Explanatory factors for the changes in abundance of mobile crustaceans may include more general changes in benthic habitat composition as a result of a fish farming operation, however this may equate to minor displacement, rather than ubiquitous toxicity effects on all crustaceans present.

Bloodworth et al (2019)

- The results are only applicable to Shetland. No other control or study sites were examined elsewhere in Scotland. Similarly, the sites are operated by 2 producers, and concerns around the comparability of in-feed EmBz usage remain valid for this study also.
- Similar to Wilding et al (2017), crustacean assemblage was positively correlated with particle size. The effect was such that '*evidence for an impact on benthic invertebrates could not be separated from the effect of particle size in this study*', Therefore, differentiating the effect of particle size from chemical influence must be explored as a priority, as there is a potentially confounding factor in that EmBz is more likely to bind to finer sediments, in which crustaceans diversity and abundance may be naturally low.

We continue to support the use of science in regulatory decision making, however given the potential burdens arising from regulatory change on socio-economic facets and farmed fish health and welfare, we maintain that the science used must be robust beyond any reasonable doubt. In the context of justifying any reduction in the marine sediment EQS, more research is required to actually evidence a negative impact from EmBz use at current/historic levels, and indeed to better understand the true toxicity levels of receptors that are likely to be impacted to inform a relevant EQS, rather than relying on studies of irrelevant taxa that are rare in the marine environment, and do not appropriately represent receptors of concern.

We strongly argue that **an EQS used in the regulation of salmon farms must be based on the site specific environments and species that are relevant and are at a higher risk of interaction with marine fish farms. The revised EQS should not be implemented until an appropriate body of research has been undertaken to establish an EQS based on relevant receptors.**

Environmental Implications

Any reduction in a farmer's ability to use EmBz will have unintended negative consequences on the environment, through a need to use alternative medicinal interventions.

CAR licences are issued to protect the environment and the species living around the farm from specific operational activities. Individual farm licences have consented limits which should be based upon the specific farm environmental conditions. We believe that the blanket adoption of a sediment EQS is not appropriate for use across all marine finish farms in Scotland and should be considered based upon the site specific environmental conditions and specific species relevant to the farm area and those likely to be impacted.

Any decisions made which will lower the consented limits on EmBz will potentially lead to an increase of pressure and use of other sea lice management options. Whilst our long-term intervention strategy is to move away from the use and discharge of other medicines, the reduction of EmBz levels will no doubt result in an increase of use of other consented medicines, at this time all of which are bath treatments. While the discharge of other medicines would be within the consented quantities, this highlights the need for the Scottish Government to undertake a holistic review of all sea lice

interventions **prior to the implementation of the revised EQS for a single medicinal treatment method.**

Socio-Economic

Question three of the consultation asks '*Where appropriate, please provide any available information about the socio-economic impacts of implementing the new EmBz EQS.'*

It is not currently possible to quantify the socio-economic impact from implementing the revised EmBz EQS, as the consultation paper does not state how the EQS will relate to site-specific permit conditions i.e., a scaled approach vs modelled.

Given the proposed EQS is to be applied ubiquitously across all salmon farms (rather than using a targeted, case-by-case approach for higher risk sites), we anticipate a significant reduction in the EmBz use across our sites including a complete loss of useable quantity at many sites. The consequences of such a reduction will include :

- Decrease in EmBz expenditure
    - This will create direct loss of value and jobs in the aquaculture supply chain.
- Increased expenditure and pressure on alternative intervention resource
    - Increased wellboat expenditure (ca.£10-40k/day)
    - Increased freshwater abstraction where Reverse Osmosis is not available
    - Increased pressure on cleanerfish supply chain
        - Farmed and wild sources
- Acute losses arising from increased handling related mortality;
    - This also presents increased reputational related challenges when measuring sustainability metrics.
- Losses arising from poorer health and welfare outcomes
    - Increased expenditure to manage secondary complications;
    - Secondary complications e.g. gill disease, bacterial infection
- Additional expenditure due to increased production cycle duration (as alternative interventions will result in lost growth to fish due to 'starve' days)
    - Loss of production/growth during alternative interventions;
    - Consequent increased risk of environmental interactions – more time at sea presents greater biological risk.
- Social impacts
    - Stakeholder confidence in the ability of producers to control sea lice.
    - Loss of supply chain jobs from the provision of EmBz.

The anticipated socio-economic impacts undermine and detract from the Scottish Government's Blue Economy vision in which it aims to ensure that the '***marine environment*** *supports ecosystem health,* ***improved livelihoods, economic prosperity, social inclusion and wellbeing'***. The socio-economic impacts will also conflict directly with the Scottish Government's policy position in support of sustainable sectoral growth by 2030 and beyond underpinned by a *'robust, proportionate and effective regulatory regime'*[8]. The socio-economic impacts must be balanced against anticipated benefit of implementation of the revised EQS. Given the lack of evidence that the revised EQS is either needed and/or appropriate, it is considered entirely disproportionate to apply a blanket EQS revision across the sector for negligible, if any, environmental benefit.

[8] https://www.gov.scot/policies/aquaculture/

Conclusion

Bakkafrost Scotland maintains its opposition to the implementation of the proposed EQS on any timescale. Whilst we support the development of a new EQS, it must be scientifically derived and suitable for regulatory use on Scottish marine fish farms. The reduction of EmBz as a sea lice management tool will increase reliance on other management tools. In the short to medium term it will not be possible to adapt our broader strategy for sealice control to an equivalent level of efficacy if the access to EMBz is curtailed to this extent and it will only be possible to achieve long term equivalance upon the development of a new zero-handling mitigation measure of equal merit. We maintain that the consequences and implications for farmed fish health and welfare must be central to any decision that will potentially eliminate the effective use of EmBz. There are also considerable wider implications and impacts, as detailed in this response that need to also be considered thoroughly before any implementation of the proposed EQS.

However if the policy decision to progress with the revised EQS has already been adopted despite lack of appropriate supporting evidence, we believe that the timescale for implementation cannot currently be defined, and must reflect the time needed to address several areas of concern:

- Potential issues arising from conflicting regulatory frameworks;
- Inconsistency between regulation of pesticide users across all sectors;
- Consideration for farmed fish health and welfare (including the need for an alternative to EmBz); and
- Consideration of a site specific risk-based approach for the revised EQS, including the demonstrable absence of intertidal species at marine farms

Addressing these issues must be prioritised to ensure that the revised EQS can be appropriately implemented in a clear, scientifically robust and transparent manner. In doing so, this will help to minimise impacts on farmed fish health and welfare and socio-economic impacts.