



SEPA SEA LICE RISK ASSESSMENT FRAMEWORK – THE SCOTTISH SALMON COMPANY RESPONSE

The Scottish Salmon Company (SSC) welcomes the opportunity to comment on the proposed framework.

This SSC consultation response aims to answer the questions asked in the interest of working constructively with SEPA and to provide the regulator with a deeper understanding of the sectoral implications of the proposed framework. However, for the avoidance of doubt, in its currently proposed format **SSC does not believe that the Sea Lice Risk Assessment Framework is appropriate or fit-for-purpose**. SSC has provided feedback to the specific questions SEPA have outlined in the consultation and additional feedback in the final question of the consultation. These sections detail the key elements of the response, and the knowledge gaps/uncertainties of the proposed framework. These can be broadly summarized by the following points:

- **SSC consider the proposal presented outlines an untenable basis for regulation.** Whilst the consultation document is presented as a complete framework, ready for implementation, significant modification, clarification and detail is required before the framework can be successfully enacted. This should be achieved through further consultation and collaboration;
- There has been no assessment of economic impact on the finfish aquaculture sector and its supply chain, in both its current capacity, or in consideration of industry growth prospects looking forward;
- **The proposed framework is disproportionate in its regulation** on the finfish aquaculture sector, compared to other sectors which have known, direct impacts on wild salmonid stocks;
- **The consultation has continued despite the proposal conflicting with recommendations made in the recent ‘Review of the Aquaculture Regulatory Process in Scotland’, undertaken by Professor Russel Griggs and published in February 2022 (hereafter, the ‘Griggs Review’);**
- **The consultation has been launched prior to the publication of the Scottish Government’s ‘Vision for Aquaculture’ (to be published 2022), presenting risks of the framework undermining any forthcoming strategy or overarching regulatory reform;**
- **The potential conflict with the Scottish Regulators Strategic Code of Good Practice in aspects of both the consultation and the proposed framework;**
- **The science used to justify the need for the framework and the mechanisms underpinning the framework, are not agreed, often misrepresented, and do not present a solid empirical basis for the proposals.** The requirement for the framework therefore remains unestablished;
- The framework relies heavily on a Norwegian modelling approach which remains unvalidated in Scotland. Extrapolation of this approach to the Scottish west coast, coupled with the inherent uncertainty in model application results in unbounded uncertainty surrounding the basis for decision making. Quantification of this uncertainty and validation of this approach in Scotland is required before application as the foundation for regulation;



- The inclusion of a 'low impact' simulated threshold value for impacts to wild fish, is not justified within the consultation, or the literature referenced. This is considered baseless and unjustifiably conservative;
- **The current impact of salmon lice on wild fish populations in Scotland is undefined and so empirically quantifying the impact of the framework is not possible.** Establishment of current, 'baseline' conditions is required for appropriate future comparison and to establish 'success' of the framework;
- **The proposed framework presents a clear risk of duplication in the monitoring and regulation of sea lice on both farmed fish and wild salmonids,** as the consultation document fails to distinguish the remit of the framework, in relation to other regimes under control of different organisations (Fish Health Inspectorate (FHI), local government). This directly conflicts with the Scottish Government aim to streamline regulation, because of the potential for regulatory overlap and remit creep to occur.
- The consultation document does not include enough information to enable a comprehensive technical response to be given, such that further sub-consultation is essential for all framework components. No programme for further consultation has been outlined by SEPA in this initial consultation.

Notwithstanding SSC's reservations with the proposed framework as currently constituted, the following text aims to answer the questions of the consultation.

YOUR DETAILS

- 1. What is your name?**

[REDACTED]

- 2. What is your email address?**

[REDACTED]

- 3. What is your organisation? (if applicable)**

The Scottish Salmon Company

WILD SALMON PROTECTION ZONES

- 4. Do you think that there are important areas for wild salmon post-smolt migration that we have not identified as wild salmon protection zones? (Y/N/UNSURE)**

No

- 5. If yes, please identify these areas, explaining why they should be protection zones and the evidence to support this**
- 6. Do you think that any of areas we are proposing as wild salmon protection zones should not be so identified? (Y/N/UNSURE)**



Yes

7. If yes, please identify these areas, explaining why they are not important for wild salmon post-smolt migration and the evidence to support this.

Annex A states that Salmon Protection Zones (SPZ) will be proposed in relation to rivers where there is evidence that they are locally or nationally important (defined as having a grading under Conservation of Salmon (Scotland) Regulations 2016 or designated as a Special Area of Conservation (SAC)/Site of Special Scientific Interest (SSSI) for Atlantic salmon or freshwater pearl mussel (only where host species is salmon). SPZ are proposed in sea lochs into which locally or nationally important salmon rivers flow, and sounds.

The inclusion of all sounds is not justified in the supporting documentation. Knowing that salmon migrate quickly and actively to open sea¹ to reach feeding grounds in the north Atlantic, the following areas categorised as sounds do not represent the most realistic route of salmon migration in this area, as there would be no apparent ecological benefits to choosing these bodies of water over more obvious, shorter and accessible swim paths.

- **Grimsay and Ronay:** Salmon originating from the Horisay River would most likely follow the natural channels of the river which discharge immediately into open water in the Sound of Monach. This is considered the most probable migratory route for this population rather than migrating south eastwards into the Grimsay and Ronay SPZ, thereby prolonging residency time in shallow, nearshore habitats. Additionally, the shortest post smolt swim paths in the Grimsay and Ronay SPZ detailed in the supporting interactive map originate from no salmon population designated for inclusion in the framework's selection criteria.
- **Sound of Gigha:** There is no obvious ecological advantage to be gained for salmon exiting the Barr Water in entering the Sound of Gigha. This would increase transit time in nearshore habitats, rather than migrating between Islay and Gigha or due west into more open water.
- **Loch Tuath:** Salmon migrating out of the River Ba would most likely exit directly from Loch na Keal into Sea of the Hebrides, rather than actively navigating the more complex route into Loch Tuath. This is supported by the illustration of the shortest swim path in the Loch na Keal SPZ which shows a direct migration into outer Loch na Keal.

If the aforementioned sounds are to remain included as SPZs, full justification for their inclusion must be provided, beyond the generic criteria used to encompass all sounds regardless of their likelihood of use by migrating post-smolt Atlantic salmon.

PROPOSED SEA LICE EXPOSURE THRESHOLD

¹ Thorstad, E. B., Whoriskey, F., Uglem, I., Moore, A., Rikardsen, A. H., & Finstad, B. (2012). A critical life stage of the Atlantic salmon *Salmo salar*: behaviour and survival during the smolt and initial post-smolt migration. *Journal of fish biology*, 81(2), 500-542.



8. Do you have any scientific evidence that should be considered to ensure the sea lice exposure threshold is effective in protecting wild salmon populations? This includes any evidence for a refinement of the threshold. If so please provide that evidence below

SSC does not believe that the framework consultation and implementation period should proceed in its current format, however supports the view that any proposal for a sea lice exposure threshold (and all other aspects of the proposed framework) must be supported by the best available scientific evidence. Defining what constitutes 'best available' must be done by following a proper literary review process, with consensus from both industry and regulator.

This view is supported in the Griggs Review which recommends:

“the science and other evidence that is currently being used by all parties involved in the sector is reviewed independently to ensure it is the best and most up to date available”

The consultation document cites multiple scientific papers, supporting the proposed framework. Thorough review of the referenced literature, SSC has identified a number of areas, and recurring themes of concern. The points below are not exclusive to the literature used in support of the proposed sea lice exposure threshold, and further comments on the supporting science are made elsewhere in the SSC consultation response, notably in regard to the overall framework proposal.

Overarching observations on supporting science:

- The literature review process undertaken is unclear, with no rationale provided for the inclusion of some science and, equally, the exclusion of others;
- Relevance of research in a geographical context, and questions over the applicability of the results of Norwegian studies to Scotland;
- Misrepresentation of scientific literature, where the outcomes of the referenced literature conflict with points made in the consultation document.

In relation to the proposed threshold specifically, the thresholds included in the proposed framework for individual salmon post-smolt are largely derived from scientific studies which are typically:

- Of Norwegian origin;
- Laboratory experiments rather than empirical studies;
- Studies using hatchery-reared smolts (in lab conditions or sentinel cages).

It is important that the suitability and applicability of these types of studies is agreed upon when using the respective results to derive threshold levels upon which sea lice are to be regulated.



Literature cited in the consultation document recognises that susceptibility to lice infestation, and the effects of subsequent infestation, are variable at the genetic or population level of the host salmon^{2,3}, therefore it cannot be assumed that any results of Norwegian origin are directly applicable in a Scottish context.

The reference to work undertaken by Murray and Moriarty (2021)⁴ in the consultation document (Section B8) attempts to establish a relevance to Scotland. The authors constructed a “first principles” biological model to establish relevance of the 0.7 lice days threshold to an infestation pressure of 0.1 lice per smolt in a Scottish context. The authors work has leaned heavily on parameters extracted from Norwegian research (Stein et al, 2005⁵, Taranger et al. 2015⁹, Myksvoll et al, 2020¹⁵, Sandvik et al 2020¹⁴ Kristoffersen et al., 2020⁸) and no empirical validation of these parameters in Scotland has been undertaken. Consequently the relevance of these thresholds to Scotland are undefined and require review by relevant, agreed parties before application in regulation.

Similarly, literature cited in the consultation document recognises that survivability of hatchery-reared smolts released in the wild for scientific studies is generally low and approximately one half of that experienced by wild salmon smolts⁶. Selection pressures in hatcheries differ from those in natural environments, therefore studies observing the effect of lice infestation on hatchery-reared, rather than wild smolts are likely to produce lower critical thresholds for adverse effects of lice on a host. Additionally, experiments undertaken in artificial conditions (laboratory or sentinel cages) present additional stressors that are not experienced by wild fish, which are likely to confound any observed effects such as stress, condition loss, mortality etc, and contributing to overall susceptibility to lice challenges.

Literature^{7,8,9,10} referenced in the consultation document to support the proposed threshold, frequently cite the Taranger¹¹ mortality threshold estimates as the means of scaling the lice thresholds identified for effects on individual smolts, to a population level. The Taranger estimates are also a large underpinning component of the Traffic Light

² Skilbrei, O. T., & Wennevik, V. (2006). Survival and growth of sea-ranched Atlantic salmon, *Salmo salar* L., treated against sea lice before release. *ICES Journal of Marine Science*, 63(7), 1317-1325.

³ Jackson, D., Cotter, D., ÓMaoiléidigh, N., O'Donohoe, P., White, J., Kane, F., ... & Rogan, G. (2011). An evaluation of the impact of early infestation with the salmon louse *Lepeophtheirus salmonis* on the subsequent survival of outwardly migrating Atlantic salmon, *Salmo salar* L., smolts. *Aquaculture*, 320(3-4), 159-163.

⁴ Murray A. G. and Moriarty M. (2021). A simple modelling tool for assessing interaction with host and local infestation of sea lice from salmonid farms on wild salmonids based on processes operating at multiple scales in space and time. *Ecological Modelling*, Volume 443, 109459.

⁵ Stein, A., Bjørn, P. A., Heuch, P. A., and Elston, D. A. 2005. Population dynamics of salmon lice *Lepeophtheirus salmonis* on Atlantic salmon and sea trout. *Marine Ecology Progress Series*, 290: 263–275.

⁶ Finstad, B. E. N. G. T., & Jonsson, N. (2001). Factors influencing the yield of smolt releases in Norway. *Nordic Journal of Freshwater Research*, 37-55.

⁷ Johnsen I. A., Harvey A., Sævik P. N., Sandvik A. D., Ugedal O., Adlandsvik B., Wennevik V., Glover K. A. and Karlsen O. (2020). Salmon lice-induced mortality of Atlantic salmon during post-smolt migration in Norway. *ICES Journal of Marine Science*, Vol 78, Issue 1, 142 – 154. <https://doi.org/10.1093/icesjms/fsaa202>.

⁸ Kristoffersen, A. B., Qviller, L., Helgesen, K. O., Vollset, K. W., Viljugrein, H., and Jansen, P. A. (2018) Quantitative risk assessment of salmon louse-induced mortality of seaward migrating post-smolt Atlantic salmon. *Epidemics*, Volume 23: 19-33. <https://doi.org/10.1016/j.epidem.2017.11.001>

⁹ Taranger, G. L., Karlsen, O., Bannister, R. J., Glover, K. A., Husa, V., Karlsbakk, E., Kvamme, B. O., et al (2015). Risk assessment of the environmental impact of Norwegian Atlantic salmon farming. *ICES Journal of Marine Science*, 72, Issue 3, 997 - 1021. <https://doi.org/10.1093/icesjms/fsu132>

¹⁰ Murray A. G. and Moriarty M. (2021). A simple modelling tool for assessing interaction with host and local infestation of sea lice from salmonid farms on wild salmonids based on processes operating at multiple scales in space and time. *Ecological Modelling*, Volume 443, 109459. <https://doi.org/10.1016/j.ecolmodel.2021.109459>

¹¹ Taranger, G. L., Karlsen, Ø., Bannister, R. J., Glover, K. A., Husa, V., Karlsbakk, E., ... & Svåsand, T. (2015). Risk assessment of the environmental impact of Norwegian Atlantic salmon farming. *ICES Journal of Marine Science*, 72(3), 997-1021.



System (TLS) used to regulate lice in Norwegian aquaculture, which appears to be a benchmark against which the framework is being developed.

Taranger et al⁹ state limitations of the mortality threshold estimates:

“Despite large field effort the geographical coverage is insufficient in terms of the distribution of salmon farms and wild salmonid populations along the Norwegian coast. There are also problems considering How well the different sampling methods are representative for the different anadromous populations in that area. We have limited data on salmon lice infections in migrating Atlantic salmon smolts, so the risk assessment for salmon is mainly conducted by the use data on salmon lice infections on sea trout caught in traps and gillnets in Period 1 as proxy for the risk to Atlantic salmon post-smolts. Lice infections on trout may not be directly proportional to lice infections on migrating salmon smolt. It is likely that differences in, for example, migratory behaviour and marine ecology exposes salmon and sea trout smolts for different sea lice infection risk, even within the same fjord system”

Additionally,

“The link between individual lice infections and population effects is also very uncertain. There is therefore uncertainty of the current risk assessment both for Atlantic salmon, and for sea trout and Arctic charr. Moreover, the current data are presented without any estimates of uncertainty, which must be included in future analyses”

This is supported by Thorstad et al (2015)¹², which comments on Taranger: *“Values should therefore perhaps be considered indicative, and not absolute, and require further verification and validation, especially if the objective is to determine critical parasite burdens to guide conservation and management criteria. For example, density dependent mortality of salmon lice developing on a fish may affect estimates of threshold values, and the assumption of a simple linear relationship between lice numbers and lice mortality may not be correct.”*

Moreover, an independent Evaluation Committee (EvalComm) established in 2021 to evaluate the scientific basis of the Norwegian Traffic Light System (TLS), states in its review¹³, specifically in relation to the mortality threshold estimates proposed by Taranger et al:

‘The EvalComm is of the view that a solid empirical basis for the thresholds has not been provided to date and that such is required to underwrite key assessments arising from the TLS’.

It is clear that multiple, independent sources (including the author) believe that the mortality threshold estimates proposed by Taranger et al require further refinement and validation. It is therefore entirely inappropriate to use literature which relies so heavily on the Taranger estimates to justify the proposed framework threshold, until such validation and verification has been undertaken.

¹² Thorstad EB, Todd CD, Uglem I, Bjørn PA and others (2015) Effects of salmon lice *Lepeophtheirus salmonis* on wild sea trout *Salmo trutta*—a literature review. *Aquacult Environ Interact* 7:91-113. <https://doi.org/10.3354/aei00142>

¹³ <https://www.forskningsradet.no/siteassets/publikasjoner/2021/an-evaluation-of-the-scientific-basis-of-the-traffic-light-system-for-norwegian-salmonid-aquaculture.pdf>



The simulated lice threshold within an area is proposed to be factored by the swim time of a 12.5cm smolt, to determine exposure characteristics relevant to the work undertaken and exposure thresholds outlined by Sandvik et al. (2020)¹⁴. This work reviewed the impact against Norwegian 20cm smolts in sheltered fjords therefore, the relevance of the thresholds defined in this work to smaller, Scottish smolts in exposed fjord-like systems or the coastal environment is undefined and ambiguous. SSC suggest the assumed smolt size remain consistent throughout the proposed framework and it is imperative that this be supported by relevant and peer-reviewed science.

SSC have engaged extensively with SEPA and Marine Scotland since 01/10/2019. All previous discussion on the application of a model framework has outlined 2 lice/m² based on as a critical threshold limiting development. Immediately preceding the launch of the consultation, SEPA reduced this threshold to 0.7 lice/m² and have provided no justification for the significant (65%) reduction in threshold limit. This unsubstantiated modification of threshold is of great consequence to the implementation of the framework and the restrictions it applies on operators and requires clarification.

The current threshold of 0.7 simulated lice per m² has been defined as an infection pressure of 1 lice/fish, gained over a three-week period¹⁴. This has been defined as a “low” infestation pressure¹⁵ and is lower than the “Low Limit” threshold in the Norwegian TLF¹⁵. Additionally scientific experimentation has outlined that lice concentrations less than 2 lice/fish have been associated with no mortality^{8 & 9}, with infection pressures of 0.08 lice/g⁻¹/fish associated with impaired swimming ability¹⁶ and 0.04 lice/g⁻¹/fish eliciting a stress response¹⁷. If a mean smolt size of 30g is assumed¹⁸, this equates to an infestation pressure of 2.4 lice/fish for impaired swimming and 1.2 lice/fish for a laboratory observed stress response. The 0.7 lice/m²/year threshold is therefore considered excessively conservative and not supported by physiological studies into smolt response to lice attachment. SSC request that an uplifted threshold supported by modelling and physiological studies in a Scottish context is agreed with industry.

To establish applicable threshold criteria, relevant empirical research must be undertaken in a Scottish context to ensure that the critical thresholds underpinning the framework are accurate and relevant to Scottish populations of smolt and lice. These types of studies must aim to establish:

- The naturally occurring baseline levels of infectious lice in Scottish waters;
- The relationship between lice numbers on farmed-fish and to what (if any) increase above the baseline levels of infectious lice is observed in Scottish waters;
- The relationship between planktonic, infectious lice in the water and lice burden on individual fish; and

¹⁴ Sandvik, A. D., Johnsen, I. A., Myksovoll, M. S., Sævik, P. N., & Skogen, M. D. (2020). Prediction of the salmon lice infestation pressure in a Norwegian fjord. *ICES Journal of Marine Science*, 77(2), 746-756.

¹⁵ Myksovoll, M. S., Sandvik, A. D., Johnsen, I. A., Skarðhamar, J., & Albretsen, J. (2020). Impact of variable physical conditions and future increased aquaculture production on lice infestation pressure and its sustainability in Norway. *Aquaculture Environment Interactions*, 12, 193-204.

¹⁶ Nolan, D.T. et al. (1999) Infection with low numbers of the sea louse *Lepeophtheirus salmonis* induces stress-related effects in post-smolt Atlantic salmon (*Salmo salar*). *Can. J. Fish. Aquat. Sci.* 56, 947–959

¹⁷ Wagner, G. N., Fast, M. D. and Johnson, S. C. (2008). Physiology and immunology of *Lepeophtheirus salmonis* infections of salmonids. *Trends in Parasitology*. 24, Issue 4, 176–183. <https://doi.org/10.1016/j.pt.2007.12.010>.

¹⁸ Kenneth, R. A. (2002) Migration of Atlantic salmon (*Salmo salar*) smolts and post-smolts from a Scottish east coast river. MSc(R) thesis. University of Glasgow. [Available online 18/02/2022: <https://theses.gla.ac.uk/82089/>]



- The critical lice burden thresholds at which population level effects for outward migrating Atlantic salmon post-smolts are observed.

The literature review process undertaken by SEPA has not been made clear. There are established, systematic methods for undertaking literature reviews, with consideration given to independence, defined inclusion criteria, biases, weighting, significance of results etc. Whether or not this process has been followed is unclear and, based on the information provided in the consultation document, the literature selection appears to be largely based on a judgement/opinion/irrational basis, and is inclusive of literature authored by representatives of organisations that consistently oppose aquaculture development¹⁹.

SSC considers it essential that a central library of scientific information and evidence be established. The library must be mutually agreed by industry, regulators and relevant academic institutes to represent best practice, in terms of establishing an appropriate base from which science-led and evidence-led decisions can be made (including agreeing relevant gaps in information that need addressed). Pre-consultation meetings between industry and SEPA have included lengthy discussions on the appropriateness of the scientific evidence and it is clear that not all parties agree that the scientific studies proposed to underpin this framework are relevant. A central library that is agreed upon by all parties would also enable a more streamlined consultation and adaptation processes.

Please upload any documents you would like us to consider.

Please see reference list available in Footnotes referenced in text (1-19)

IMPLEMENTATION

9. Which groups and organisations do you think we should include on technical advisory groups to assist us with the development of the detailed working arrangements and methods needed to implement the framework?

SSC does not consider it appropriate to develop a technical advisory group, at this stage, for implementation of the framework in its current form. The proposed framework currently requires significant further consultation on all components, with contributions from a wider stakeholder group including clear direction from the Scottish Government at a strategic level.

The Griggs Review recommends that the Scottish Government works with key stakeholders through a nominated Project Board with an independent chair to produce a 10-year framework for finfish aquaculture. The Griggs Review proposes that the Project Board '*...should contain representatives from industry, regulators, Local Authorities, and other interested parties including someone to represent the communities involved*', and that this should take place over the next 12 months. At least part of this would coincide with the proposed implementation period SEPA propose for the framework.

¹⁹ Shephard, S., MacIntyre, C., & Gargan, P. (2016). Aquaculture and environmental drivers of salmon lice infestation and body condition in sea trout. *Aquaculture Environment Interactions*, 8, 597-610.



In the interests of avoiding duplication of effort and ensuring consistency in development of new regulatory frameworks, the establishment of a technical advisory group is not appropriate given the potential development of a Government-led Project Board.

It is recognised that eventually the requirement for a technical advisory group tasked specifically with implementation of a regulatory framework may be required, and this must include appropriate representation from the finfish aquaculture industry, Scottish Government, Local Authorities and SEPA.

MODELLING

10. Do you have relevant expertise or experience that you would be happy to share with us during implementation planning to help us develop modelling protocols? (YES/NO/POSSIBLY)

Yes

11. If yes, please tell us about your area of expertise

SSC has an in-house team of highly-skilled modellers who have experience simulating lice dispersal and connectivity between sites across the west coast and islands of Scotland. SSC's modellers have already shared an approved methodology for NewDepomod calibration with SEPA and with other companies, following operator requests and direction from SEPA. This, already established expertise, extends to the modelling methodologies presented in the proposal and those used by Sandvik et al (2020) and Johansen et al (2021). This expertise in modelling methodologies and their application are integral to the development of modelling protocols relevant to Scotland.

Presently, the relevance of marine modelling to actual lice pressures on smolts is generally poorly understood and sampling techniques and their implementation into the framework currently requires significant review. In addition, SSC has an effective history in the management of sea lice populations within farm settings, reviewing the wider interactions between wild and farmed fish by sampling the marine conditions. SSC actively supports multiple initiatives to help improve understanding of aquaculture interactions with wild fish and improving knowledge on wild fish ecology. Examples of such initiatives include the funding of wild salmonid monitoring in marine and freshwater habitats through Environmental Management Plan (EMP) frameworks, contribution to the wild salmonid support fund, support for the west coast tracking project, and support for multiple restocking projects prior to policy changes restricting such work. SSC's involvement with such projects, in combination with our modelling and lice management capabilities, provides us with the expertise to support the development of modelling protocols.

12. If you would like to be involved, are you happy for us to contact you by the email address you have provided? (Y/N)

Yes

PERMITTING & SITE REGULATION



13. Do you have any suggestions for how SEPA could most efficiently and effectively assess compliance?

Compliance should be clear, concise, and logical to assess. The current regime under which SEPA assess aquaculture related discharges is considered largely adequate and fit for purpose. Any modification to this framework to integrate sea lice conditions should be kept to a minimum.

Regarding the current discharge regime – governed by the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) - the Scottish Government intimated in the response in October 2021 to the Salmon Interactions Working Group Report that a sea lice assessment framework will be applied through the CAR regime. SSC would question whether this regime is the most appropriate for the introduction and assessment of the framework. The CAR regime governs the following: activities liable to cause pollution of the water environment; abstraction of water; impounding works; building or engineering work in inland water or wetlands; artificial recharge or augmentation of groundwater; discharge into groundwater of any hazardous substance or other pollutant; and any other activity which has or is likely to have a significant adverse impact on the water environment. Sea lice occur naturally, they are neither a pollutant, a hazardous substance and nor do they cause pollution. Also, the 'water environment' is defined in the Water Environment and Water Services (Scotland) Act 2003 as "all surface water, groundwater and wetlands" but does not include the species that are supported by those environments (i.e. this framework is proposed to prevent deterioration of Atlantic salmon stocks, a species supported by the water environment). SEPA have not outlined why the CAR regime is an appropriate statute for the framework to be implemented through as there is no explanation of this in the consultation document. "Surface water" under the CAR regime also only includes coastal water extending landward for 3 nautical miles, therefore clarity is required on how the CAR regulations apply where connectivity between inshore areas is via pathways occurring beyond 3 nautical miles from shore.

It is understood, from consultation with SEPA, that the proposed approach to assess compliance is to monitor (parameters to be determined) against defined environmental standards (to be determined), under an overarching compliance assessment scheme (i.e. CAS). It is understood that SEPA will consult widely in 2022 on a new, publicly accessible compliance assessment approach. It is not stated explicitly in the consultation documents if the proposed framework will be adopted under the same compliance assessment approach/scheme as other controlled activities. The compliance assessment for the proposed framework must align with the current assessment approach, to ensure consistency across all regulation under CAR.

With regard to the establishment of appropriate environmental standards, SEPA must engage the industry in further dialogue and engagement to identify and develop these standards.

Sea lice is not the only pressure on smolt and salmon populations in Scottish waters as outlined in the Wild Salmon Strategy²¹. If the aim of this framework is to prevent deterioration of salmon populations and encourage their growth, efforts to increase capacity (improving breeding grounds, removing barriers to fish passages) should be recognised formally within any framework, recognising the aquaculture industry is not a sole stressor to wild salmon populations. Therefore, efforts to build and maintain these populations should be formally integrated into the framework to



neutralise or elicit a net gain impact from proposed development, in the acknowledgement that even 100% framework compliance cannot guarantee no deterioration of wild salmon populations.

With regards to the consultation document, SSC wishes to note the following specific points;

- Section 5.2 notes that *'All proposals for new marine finfish farms or increases in fish numbers at existing farms would be subject to an assessment of the risk posed to wild salmon post-smolts'*. This represents a change from the current regulatory system, in which permits are granted for biomass held at a site. It is not clear how fish numbers will be derived, or whether SEPA propose to include this as an additional condition or a replacement condition to biomass, as biomass is still relevant to other factors covered by the CAR licence e.g. medicine amount.
- Section 5.5 states that *'Any proposal where expected contribution of sea lice into the environment could not be accommodated within the sea lice exposure threshold would not be granted authorisation'*. However, SSC is of the understanding, through pre-consultation dialogue with SEPA, that such a proposal would be granted authorisation if appropriate measures are proposed to lower risk to below threshold.
- Section 5.7 states that *'Permits for approved farm developments would include such conditions as necessary to ensure the number of sea lice emanating from the developments is kept low enough to protect wild salmon post-smolts as they pass through wild salmon protection zones. The detail of these conditions will be developed during the implementation process'*. It is important that any condition notes the temporal aspect of the proposed protection as well i.e. that the exposure threshold applies to SPZ's during April and May only. SEPA propose that conditions relating to fish number and lice numbers would be necessary to achieve this, however this is not necessary, and will impose restrictions on how companies can operate sites, limiting the ability for adaptive and strategic stocking. The aim of such conditions could be met by a lice emission limit for a farm and continued use of a biomass condition. Successful lice management on a site is not relative to number of fish held on the site, rather an effective treatment strategy (see also Q21 response for further detail).

MONITORING THE EFFECTIVENESS

14. Do you have any suggestions on how we should develop a monitoring plan to assess the effectiveness of the framework and what it should include? (YES/NO/UNSURE)

Yes

If yes, please outline these suggestions?

The proportion of the decline in wild salmon populations that is attributable to salmon aquaculture is not well understood, therefore the highly precautionary approach proposed in this framework by SEPA cannot be justified. Monitoring for this framework must contribute to an overall holistic assessment and this is only possible if appropriate monitoring is also undertaken of other relevant factors e.g. other pressures on salmon populations in both freshwater and marine environments.



SEPA have suggested in pre-consultation discussions that the aim is to ‘prevent deterioration’, however details on what measurable objective is being proposed to achieve this have not been provided in the consultation document. Section 2.3 of the consultation document describes in strong language the risk posed to Atlantic salmon by sea lice from open-net fish farms, however also acknowledges this risk is subject to various factors. The consultation documentation does not detail how these other factors will be accounted for when assessing performance of the framework against its objectives, this must be clarified in order to better understand the proposed framework.

SSC does support the proposal to develop a monitoring plan to assess the effectiveness of the framework, recognising that a comprehensive monitoring and review process is essential to facilitate the ambition of the framework to maintain an adaptive approach based on credible evidence; an objective also advocated in the Griggs Review.

From consultation with SEPA it is understood that monitoring is likely to be a framework component subject to further consultation, with SEPA, Scottish Government and Industry. SSC welcomes the opportunity to participate in these technical discussions in full and has suggested higher level principles to be included in any monitoring plan in the following text.

It is essential that a clearly defined baseline is agreed and that defined metrics are established and agreed in consultation with the above stakeholders, to ensure that what constitutes ‘success’ and ‘effectiveness’ are mutually agreed by both industry and regulator. In support of this approach, it is critical to have well defined targets against which to measure the success of the framework, developed in accordance with the key principles of Scottish Regulators Strategic Code of Good Practice²⁰ (see also additional feedback on Q21: Overall Framework Proposal). Any plan to review the success and effectiveness of a framework must have an appropriate baseline condition agreed, against which the impact can be measured.

In January 2022, the Scottish Government published the ‘Scottish Wild Salmon Strategy’²¹ in which multiple pressures potentially impacting wild Atlantic salmon populations are detailed. It is essential that forethought is applied to assessing the proposed Framework’s effectiveness, in the context of these potentially confounding factors which may limit the ability of the framework to achieve and deliver its key objectives. It is not clear in the consultation documentation how SEPA proposes to pinpoint deterioration of salmon stocks sufficiently to impacts directly associated with aquaculture. For example, if assessing the framework’s success in an area where waterbodies are failing to achieve good ecological status (GES) for salmonids, a holistic approach must be adopted to consider the proportionate and relative contribution of all local pressures (i.e. forestry, exploitation, infrastructure) on a given receptor, and use this to inform adaptive management of the appropriate sector.

²⁰ <https://www.gov.scot/binaries/content/documents/govscot/publications/agreement/2015/01/scottish-regulators-strategic-code-of-practice/documents/scottish-regulators-strategic-code-practice-pdf/scottish-regulators-strategic-code-practice-pdf/govscot%3Adocument/Scottish%2Bregulators%2527%2Bstrategic%2Bcode%2Bof%2Bpractice.pdf>

²¹ <https://www.gov.scot/publications/scottish-wild-salmon-strategy/pages/4/>



The establishment of a monitoring plan must be entirely inclusive of representatives from the finfish aquaculture sector, and aim to measure the success of the framework's processes and procedures **in addition** to the framework's ability to achieve its environmental aims and technical objectives; both facets are required to ensure an effective framework is developed. The consultation document does not provide enough information to enable a detailed technical response on what should be included in a monitoring plan, however it is essential that the following principles are adhered to during its establishment:

- Inclusive of quantified baseline conditions;
- Collaborative with industry;
- Measurable with well-defined parameters that are relevant to the application;
- Relevant and proportionate to risk;
- Follows best practice, using recognised, validated methods; and
- Timebound to ensure clearly defined timescales for monitoring, reporting and subsequent review are adhered to.

Environmental monitoring components should be coordinated and undertaken by regulators/Government to minimise duplication and ensure consistency, impartiality in collection and delivery, as is done in Norway i.e. operators should not be collecting different environmental data and no wild fish bodies should be tasked with collecting these data either. It is unclear how this would be financed, however these types of exercises should supersede existing Environmental Management Plans (EMPs) (subject to decisions over EMP and sea trout exclusion from this framework).

The current mechanism for Operators to undertake environmental monitoring (e.g. wild fish monitoring, plankton trawls etc) is primarily through frameworks developed in EMPs, with the commitment secured by means of an appropriate planning condition. The SIWG report, and the Scottish Government's respective response, recognise that EMPs are an interim measure to manage interactions at a local level, pending the wider reform of the finfish aquaculture regulatory system. While many aspects of EMPs work well and have improved collaborative initiatives at a local level in some areas, the general application of EMPs is inconsistent between Farm Management Areas (FMAs), operators, and fisheries districts. EMPs (and supporting monitoring strategies) are typically subject to high levels of negotiation between operators and statutory consultees, over what is considered appropriate and proportionate for a particular development in any given area, resulting in delays to applications and commencement of monitoring strategies. The Griggs review clearly identified a high degree of "*mistrust, dislike, and vitriol*" between key stakeholders, which generally does not support effective EMP negotiations.

Following consultation with Industry and key stakeholders to establish appropriate monitoring protocols, any environmental monitoring components should be coordinated and undertaken by regulators (SEPA, in the case of the framework as currently proposed)/Government to ensure consistency and impartiality in collection and delivery. It is noted in the Griggs Review that in Norway there is a separate scientific body which advises Norwegian regulatory functions; a similar approach may be appropriate for the purposes of adopting ownership of environmental monitoring under the proposed Framework (dependant on Scottish Government's response to the Griggs Review).



Given that the basis of this framework is to inform and support a modelling framework based on a Norwegian design, all sampling must be relevant to, and readily applicable as, validation datasets within modelling exercises. Such high-quality spatial datasets will give reference to model outputs and frame uncertainties in the modelling undertaken.

It is outlined by Penston et al., (2008)²² that surveys of sea lice numbers to date in Scotland have proven difficult to gain a comprehensive impression of sea lice populations, with low numbers of lice <3 lice/sample observed. Additionally there is difficulty in gathering data that facilitates direct application to wild fish pressures with the application of sentinel cages the only method that has been successfully applied. If monitoring is to be closely tied to model outputs, it is imperative that sampling to support monitoring be relevant to the model framework applied.

15. Do you think there are components that should be included in an effectiveness monitoring programme that you would be able to help deliver? (Yes/No/Unsure)

Yes

If yes, please outline what these components are?

SSC welcomes the opportunity to engage with SEPA to help achieve the delivery of an effectiveness monitoring programme and supports the approach to develop collaborative initiatives as outlined in the Consultation document. The Consultation documents do not provide any information on form these initiatives may take, therefore, notwithstanding further consultation of the monitoring programme (including the establishment of appropriate baseline data) and formalisation of such initiatives, SSC expects to be able to contribute toward the suggested components.

- Contribution to the establishment of baselines and benchmarks relevant to Scotland, against which, compliance and the framework can be assessed.
- Regular feedback opportunities e.g. liaison meetings;
- At company or industry level through working groups and/or surveys inclusive of key metrics used to monitor the Frameworks performance, success and effectiveness.
- Industry contribution to a technical working group to assess the Framework's technical effectiveness and applicability; and
- Review of emerging science and data gained from both academia, site monitoring and environmental monitoring.

Beyond this, SSC does not believe that any proposed component that duplicates existing monitoring should be included, unless such existing monitoring is to be superseded and adopted formally under the proposed framework.

²² Penston MJ, Millar CP, Zuur A, Davies IM (2008) Spatial and temporal distribution of *Lepeophtheirus salmonis* (Krøyer) larvae in a sea loch containing Atlantic salmon, *Salmo salar* L., farms on the north-west coast of Scotland. *Journal of Fish Diseases* 31, 361-371



16. If you would like to be involved in the development of a monitoring plan, are you happy for us to contact you by the email address you have provided? (yes/no)

Yes. SSC considers that it is vital that the industry are involved with the development of monitoring plans.

ADAPTIVE APPROACH

17. Are there other types of information that you think could usefully inform the adaptive development of the proposed framework? (yes/no/not sure)

Yes

If yes, please outline how this information could be used.

SSC supports the ambition to regulate the framework using an adaptive approach and agree in principle with points (a) to (f) noted in Section 7.1 of the supporting consultation information.

Any new science or evidence to be used to adapt the framework must be independently reviewed, beyond that of journal peer review, and agreed upon to be the best evidence available at that time, as advocated in the Griggs Review. The application of emerging science in the framework must be assessed specifically against the aims and objectives of the framework and collated in a centralised library run between Industry and the Government.

This is supported in the Griggs Review, which recommends:

“The creation of a central science and evidence base should be put in place jointly run and managed by industry and the Scottish Government which gathers, collates and examines scientific and other evidence relating to this sector so decisions within the framework can be made in the most effective way.”

Further to maintaining an adaptive framework in the context of emerging science and data, it must also be recognised that developments and innovation will only be achieved by industry, if adequately enabled. The Framework must also maintain an adaptive approach with regard to new technology, proposed innovation, and trials of new lice intervention. In the context of innovation, the Griggs Review notes that all regulations and regulators should be ‘enabling’ and that innovation *“can be impacted by harsh application of the precautionary principle or a regulators lack of knowledge of a sector or issue that makes them ultra-cautious”*.

Examples of how this may be achieved under the Proposed Framework may include ensuring that:

- Permits granted under the Framework will facilitate and enable operators to manage lice adaptively i.e. implementation of emerging technologies without excessive administration/bureaucracy and need for permit variation;
- Permit conditions must not be overly restrictive; and



- Consideration to include derogations to permit conditions where an operator wishes to undertake controlled trials of emerging lice prevention/removal technologies.

The Griggs Review commends a change of culture within SEPA from 'enforcer' to 'enabler' in recent years which has facilitated improved regulation. It is trusted that SEPA will maintain this approach in the implementation of the framework to facilitate enablement of development and innovation and optimise regulation, and to align with the Regulators Code of Practice.

THE PROPOSED FRAMEWORK'S IMPLICATIONS FOR YOU

18. Do you think the design of the proposed framework, or how it is implemented, could affect your community or business interests? (Yes +/Yes -/Unsure/No)

Yes, in a negative way.

Please outline what you think the effects could be and why?

SSC is focused on responsible business growth and are passionately committed to the environmental, cultural, and economic growth and sustainability of rural Scotland. SSC employs more than 600 people across 60 sites along the remote and rural areas of the West Coast of Scotland and Hebrides; we are the largest private employer in the Outer Hebrides. Central to this is developing exports and retaining value and employment in the rural communities in which we operate.

The Scottish Salmon industry is crucial to the overall health of the Scottish economy, contributing £640 million annually. Scottish salmon is both Scotland's and the UK's largest food export, with overseas sales increasing by 36% to £614 million last year and exports shipped to 52 different markets, with growth across 10 of the top 20 markets. Overall, the sector supports more than 3,600 suppliers, with 10,000 jobs dependent on the industry. Going forward, future collaboration with regulators and wider stakeholders is of paramount importance to us. The industry as a whole is working towards the ambitions laid out in the sector's Aquaculture 2030 strategy to substantially increase the economic contribution of the industry by 2030.

SSC is committed to sourcing locally where possible and, in 2021, 61% of products and services were sourced locally in Scotland and indirect contribution to the local economy was continued with around 542 local suppliers, which made up 35% of SSC's total spend. SSC has invested significantly in housing to support recruitment opportunities in local areas where housing options are limited. SSC currently owns or leases 20 properties from Harris to Mull, including the recent opening of three new lodges at Loch Carron, and there plans for a further four properties in the West Highlands. Through SSC's Community Charter, the mission is to be an active part of the communities in which SSC staff live and work and, since the launch of the Community Fund in 2017, SSC has provided funding to more than 100 community groups to support local causes that not only improve health and wellbeing, but also to help promote stewardship of the natural environment or economic development.



There has been no assessment made by SEPA or Scottish Government, at any stage thus far, of the socio-economic impacts of the implementation and management of this framework.

The implementation of this framework as currently proposed will have significant financial implications for the aquaculture industry in various ways, including;

- Increased operating costs across sites;
- Loss of profit from individual sites (if removed or if they have to be operated in a different manner to allow other development in a waterbody);
- Indirect operational costs associated with the above points (e.g. increased treatment frequency (over and above SSC's treatment strategy)), increased treatment costs (associated with treatment type, resource availability);
- Influencing of development locations e.g. not operating in a specific area, impacts on supply chain due to geographical restrictions, and
- Impacts on supply chain associated with all of the above points.

As noted above, SSC contributes significantly to rural economies and supports rural communities. If our business cannot grow, and the framework as is currently proposed poses a real threat to this, this will result in knock-on effects for rural communities and economies in our operating areas etc, due to lack of investment. A similar effect will be felt across the industry and there is a tangible risk of Scotland becoming a less attractive place for aquaculture companies to invest and develop in.

It is imperative that a Business Regulatory Impact Assessment (BRIA) is undertaken at the earliest opportunity and the results of this must be made available for consultation, before any further work is undertaken.

The Regulators Strategic Code of Practice states that 'Regulators should consider the impact of their regulatory approach on those they regulate and any other relevant stakeholders' and 'Formal impact assessment for new or changing processes and policies are not mandatory across all regulators, but should be recognised as good practice, particularly when they feature dialogue with all relevant stakeholders and businesses' (both Section 4).

Any economic impact associated with the proposed framework, if deemed acceptable, must be proportionately balanced against the biological risk to the species in question. This risk is currently not defined i.e. the proportionate effect that sea lice have on population level decline of salmon is undefined, compared to other factors considered either through the Wild Salmon Strategy (i.e. the 12 pressures) or through WFD waterbody classification criteria.

As demonstrated above, there is a multitude of avenues by which economic impacts can be felt and undertaking a robust economic assessment on impacts on aquaculture companies, their supply chain, the sector as a whole, and local communities will be a complex task. SEPA must engage expert guidance from specialist contractors on this assessment and involve industry in all discussions pertaining to the assessment.



19. Do you have suggestions how any potential negative effects could be reduced or avoided without compromising the environmental protection purpose of the proposed framework? (Yes/No/Not sure)

Yes

If yes, please outline your suggestions:

It is essential for SEPA to both understand and consider the business and economic effects, as it is to deliver the framework's environmental objectives. This view is supported in the Scottish Regulators Strategic Code of Good Practice²⁶, which states:

'Good regulators seek to understand those they regulate, including taking economic and business factors appropriately into account in carrying out their regulatory activities'

It is not possible based on the information provided in the consultation document to outline suggestions of exactly how negative effects can be reduced or avoided, while ensuring the environmental objectives of the proposed framework are met. This reiterates the need for an urgent undertaking of a BRIA which will provide better definition of such negative effects.

The framework can, and should, be developed to ensure that any potential negative effects can be avoided without comprising the framework's environmental objectives. This may be achieved through adequately addressing all adverse economic effects and ensuring appropriate mitigants are included in the framework. However, pending the results of an economic assessment, the following guiding principles must be adhered to during framework development in the interim:

- Consideration of recommendations proposed in the Griggs Review, namely regulation demonstrably in accordance with Scottish Regulators Strategic Code of Good Practice²⁶ and recommendations in relation to establishing agreed science;
- Consideration of any lessons learned from historic CAR framework development; and
- Consideration of lessons learned and recommendations of reviews from other aquaculture regulatory frameworks i.e. what can be learned and adopted from the evaluation of the Norwegian TLS¹³.

'Good regulators seek to understand those they regulate, including taking economic and business factors appropriately into account in carrying out their regulatory activities.' (From Scottish Regulators Strategic Code of Good Practice)

The proposed framework aims to regulate specific aspects of aquaculture in relation to lice emissions and permitting. Regardless of the implementation of the proposed framework, there remains the need of an overarching reform of aquaculture regulation, notably in the context of consenting, that would likely afford a high proportion of the mitigation required to negate any adverse effects arising from the proposed framework.

As recommended in the Griggs Review, SSC believes that such reform would result in a single consenting regime, managed by the Scottish Government, which would reduce the potential negative effects that SSC has highlighted in



this response. SSC considers the 'one stop shop' approach to offer the most benefits in terms of streamlining regulation and ensuring a fair and transparent determination and enforcement process.

20. Do you have any suggestions how potential positive effects can be delivered or enhanced without compromising the environmental protection purpose of the proposed framework? (Yes/No/Not Sure)

Yes

If yes, please outline your suggestions

The proposed framework currently only considers the impact of sea lice infestation to smolt populations and the mitigation of aquaculture impacts. In 2019, the Scottish Government outlined Sea Lice as one of 12 pressures to wild salmon populations in Scotland²³ some of which may have greater positive impacts on salmon populations with appropriate management. If the aim of the proposed framework is to prevent the deterioration of wild salmon populations, a holistic approach is required, acknowledging and incorporating these stressors into this regulatory framework, with the aim of increasing wild salmon numbers (such as increasing quality of spawning habitats or removal of migratory barriers). SSC are willing to work with SEPA and relevant stakeholders in on a waterbody specific scale to collaborate on, holistic management approaches, that recognise the multi-faceted nature of ecosystem management. Such collaboration would recognise that sea lice are not the only significant pressure on wild salmon populations and present opportunities to discuss mechanisms for offsetting potential impacts of a given development. More work is required to derive a formal, weighted, comparison, this should be balanced and appropriate, based on agreed science and lead by established frameworks to compare ecosystem services and biodiversity offsetting.

OVERALL FRAMEWORK PROPOSAL

21. Do you have any additional feedback on the proposed framework?

SSC welcomes the opportunity to provide comment on this proposed framework and acknowledges the efforts that have been made to engage in dialogue with the industry in the run-up to release of the consultation.

SSC recognizes the limitations with the current regulatory system, under which Local Planning Authorities monitor for impacts on wild salmonids under the mechanism of Environmental Management Plans and have enforcement powers. SSC recognizes that a risk assessment framework is a useful template on which to review the regulatory mechanism for impacts on wild salmonids. However, in its currently proposed format, **SSC does not believe that the Sea Lice Risk Assessment Framework is appropriate or fit-for-purpose**. SSC would be supportive of a framework that is based on agreed science and is proportionate to the pressure and the risk.

²³ Marine Scotland (2019) Conservation of Wild Salmon <https://www.gov.scot/publications/conservation-of-wild-salmon/pages/high-level-pressures-on-atlantic-salmon/>



Throughout this response, SSC has outlined the key areas of concern and whether it is considered that they can be overcome; if so, how this might be possible and, if not, what is considered as best alternative options. SSC's key areas of concern can be broadly summarized in the following points:

- SSC consider the proposal presented outlines an untenable basis for regulation. Whilst the consultation document is presented as a complete framework, ready for implementation, significant modification, clarification and detail is required before the framework can be successfully enacted. This should be achieved through further consultation and collaboration;
- There has been no assessment of economic impact on the finfish aquaculture sector and its supply chain, in both its current capacity, or in consideration of industry growth prospects looking forward;
- The proposed framework is disproportionate in its regulation on the finfish aquaculture sector, compared to other sectors which have known, direct impacts on wild salmonid stocks;
- The consultation has continued despite the proposal conflicting with recommendations made in the recent 'Review of the Aquaculture Regulatory Process in Scotland', undertaken by Professor Russel Griggs and published in February 2022 (hereafter, the 'Griggs Review');
- The consultation has been launched prior to the publication of the Scottish Government's 'Vision for Aquaculture' (to be published 2022), presenting risks of the framework undermining any forthcoming strategy or overarching regulatory reform;
- The potential conflict with the Scottish Regulators Strategic Code of Good Practice in aspects of both the consultation and the proposed framework;
- The science used to justify the need for the framework and the mechanisms underpinning the framework, are not agreed, often misrepresented, and do not present a solid empirical basis for the proposals. The requirement for the framework therefore remains unestablished;
- The framework relies heavily on a Norwegian modelling approach which remains unvalidated in Scotland. Extrapolation of this approach to the Scottish west coast, coupled with the inherent uncertainty in model application results in unbounded uncertainty surrounding the basis for decision making. Quantification of this uncertainty and validation of this approach in Scotland is required before application as the foundation for regulation;
- The inclusion of a 'low impact' simulated threshold value for impacts to wild fish, is not justified within the consultation, or the literature referenced. This is considered baseless and unjustifiably conservative;
- The current impact of salmon lice on wild fish populations in Scotland is undefined and so empirically quantifying the impact of the framework is not possible. Establishment of current, 'baseline' conditions is required for appropriate future comparison and to establish 'success' of the framework;
- The proposed framework presents a clear risk of duplication in the monitoring and regulation of sea lice on both farmed fish and wild salmonids, as the consultation document fails to distinguish the remit of the framework, in relation to other regimes under control of different organisations (Fish Health Inspectorate (FHI), local government). This directly conflicts with the Scottish Government aim to streamline regulation, because of the potential for regulatory overlap and remit creep to occur.



- The consultation document does not include enough information to enable a comprehensive technical response to be given, such that further sub-consultation is essential for all framework components. No programme for further consultation has been outlined by SEPA in this initial consultation.

SSC would like to highlight the following:-

I. Consultation procedure and the Gunning Principles

SEPA has obligations in carrying out consultations as set out in the Gunning Principles²⁴. These Principles provide that:-

- The consultation must be at a time when proposals are still at a formative stage.
- The proposer must give sufficient information for intelligent consideration.
- Adequate time must be given for consideration and response.
- The product of consultation must be conscientiously taken into account in finalising any statutory proposals.

SSC would not agree that the proposals are still at a formative stage given that the components of the framework have already been decided upon. As mentioned elsewhere in this response no information has been provided on the alternatives to the framework, or on alternatives to SEPA as the lead body, that were considered by the Scottish Government prior to this Consultation.

SSC would also question whether, given the comments made in this response undermining the literature that SEPA have relied on, sufficient information has been provided to explain and justify the proposed framework.

II. Need for regulatory reform

The marine salmon aquaculture sector was represented in the Salmon Interactions Working Group (SIWG). The SIWG Report²⁵ Recommendation 1.1 clearly demonstrates the desire from the group (including the farmed fish sector) that the existing regulatory regime be reformed:

Scotland's finfish aquaculture regulatory regime should be reformed to ensure that it is fit for purpose, comparable with the highest international and domestic regulatory standards and in line with the Scottish Regulators Strategic Code of Practice²⁶.

In its response to the SIWG report, The Scottish Government appointed SEPA as the lead body responsible for managing the risk to wild salmonids from sea lice from fish farms.

While regulatory reform is supported and SSC welcomes the pre-consultation engagement with the sector undertaken by SEPA, it has not been made clear what alternative approaches were considered and rejected, prior to the

²⁴ R v London Borough of Brent, ex p Gunning [1985] LGR 168

²⁵ <https://www.gov.scot/publications/report-salmon-interactions-working-group/documents/>

²⁶ [Scottish regulators' strategic code of practice - gov.scot \(www.gov.scot\)](http://www.gov.scot/publications/scottish-regulators-strategic-code-of-practice/documents/full-report/index.html)



development of the proposed framework, which relies significantly on a model which has not yet been trialled and tested in Scotland. There is no acknowledgement of the limitations of such an approach noted in the consultation documents. SSC requests that all other alternative options that were rejected prior to adoption of the proposed framework and the reasons for rejection be shared with all key stakeholders.

More pertinent, is the recently published Griggs Review, which details a clear recommendation that a Government-led Project Board be established to develop a framework to include (among other points):

- Where they want sites to be as part of a larger Marine Planning exercise. (The proposals outlined in the Fourth National Planning Framework recommends that local development plans should guide new aquaculture developments to locations that reflect industry needs and take account of environmental impact and wider marine planning. Local Authorities will be required to do this. Shetland already has this in place);
- Parameters for disease control and other issues such as sea lice within which the industry must operate;
- How interactions with other species and predators would be managed
- The licencing and consenting regime and how that will operate;
- Clear lines of responsibility in terms of who does what;
- The length and substance of each licence, and
- How it would be funded.

In addition to these points which require an all-encompassing framework to be adopted, the Griggs Review makes it clear that the Framework be owned by the Government and reiterates:

“it is key that it is Government which makes policy and the frameworks within which policy operates. Agencies and regulators implement, not create policy themselves. If they did there is a danger that Scottish Government outcomes are not met.”

Regardless of the technical detail of the proposed framework, the proposal being consulted on conflicts directly with the recommendations made in the Griggs Review. Clarity must be provided by SEPA or a suitable representative from the Scottish Government as to if and how the proposed framework aligns with the outcomes of the Griggs Review.

SEPA note in Section 9.1 that whilst wild sea trout can become infested with salmon lice, they are not proposing to define protection zones for sea trout, justified by noting that *‘Understanding of the interaction between sea trout and sea lice is improving but more science is needed before knowledge is sufficient to enable us to design a practical, risk-based regulatory framework’*. It is evident, through the pre-consultation dialogue between the industry, SEPA and Marine Scotland Science, that there is currently not agreement on the appropriateness of the scientific evidence on which this framework for salmon is based. The Griggs Review recommends *‘the creation of a central science and evidence base should be put in place jointly run and managed by industry and the Scottish Government which gathers, collates and examines scientific and other evidence relating to this sector so decisions within the framework can be made in the most effective way’*. SSC considers this approach to be best practice; implementation of the framework



in its current format cannot be progressed until the science base relevant to impacts on salmon populations in Scotland is agreed. It would not be rational or practical to carry on with framework implementation based on the science proposed in the consultation document, when SEPA themselves acknowledge that a practical, risk-based framework must be based on sufficient scientific knowledge.

III. Streamlining regulatory processes

There are a number of areas presented in the consultation document that are not aligned with the Scottish Government's aim of streamlining regulation. These can be summarized as:

- Added complexity associated with proposed consent conditions during the implementation phase (please also refer to 'one-stop-shop' approach detailed in response to Q19);
- The proposed framework will result in duplication of monitoring activities, which would be undertaken for CAR requirements (as per this consultation), in addition to activities undertaken by Local Planning Authorities (to fulfil duties under Town & Countryside Planning (Scotland) Act 1997), for example the enforcement of EMP planning conditions. Each regime will apply different enforcement action, assessed against different thresholds to the same pressure (sea lice).
- Similarly, the proposed framework presents potential overlap with existing on-farm sea lice monitoring regimes i.e. monitoring and reporting to Marine Scotland (Fish Health Inspectorate (FHI)). It is unclear from the consultation document whether obligations pertaining to reporting sea lice to FHI would cease following implementation of the proposed framework.
- The implementation of the proposed framework presents a potential risk of operators being required to comply with conflicting legislation. Typically, a holistic view of fish health is adopted prior to any intervention being undertaken, with treatments optimised to accommodate any co-morbidities, in addition to achieving the aim of a given intervention (e.g. lice reduction). The framework as currently proposed presents a real risk of companies not being able to follow this recognized best practice.
- It is understood that the proposed framework will stipulate permit conditions relating to sea lice control, the compliance with which may require operators to undertake lice interventions regardless of farmed fish health in order to achieve the required threshold to avoid enforcement action. This scenario may conflict directly with legal obligations under The Aquatic Animal Health (Scotland) Regulations 2009. Clarity should be provided from SEPA as to whether derogations will be afforded in permit conditions to enable operators to uphold their legal and ethical obligations with regard to fish health and welfare in circumstances where fish health dictates that further intervention is not appropriate. SEPA must consult with Marine Scotland and the Fish Health Inspectorate (FHI) specifically on this aspect to assess the risk of conflicting regulation being applied on the sector.

IV. Scottish Regulators Strategic Code of Good Practice

Scottish Regulators Strategic Code of Good Practice (CoGP) (hereafter 'Regulators' CoGP) requires that regulation should be;

- Transparent



- Accountable
- Consistent
- Proportionate
- Targeted only when needed

SSC notes the following concerns on the proposed regulatory framework and how it may or may not align with the Regulators' CoGP.

Transparent

- SSC welcomes the pre-consultation dialogue with SEPA however, as noted above, there are a number of areas in the consultation document where it is not clear how the approach taken by SEPA has been defined, or why different information has been presented from that previously discussed with Industry.
- It has not been made clear during the pre-consultation discussions, or in the consultation document, what alternative options were explored in terms of regulatory mechanism and the lead body, or why the CAR regime has been determined to be the most appropriate.

Accountable

- Regulators are required to justify their actions and decisions. As demonstrated in this response there are a number of areas where SSC question whether SEPA's proposals are justified due to, for example, the lack of clarity on alternative actions and lead body, the interpretation of the literature on which SEPA are relying; and SEPA's proposed 0.7 lice/m² threshold which is not considered appropriate or scientific.

Consistent

- SEPA has suggested, in pre-consultation discussions with industry, that this mechanism of regulation is also applied to other sectors regulated under the CAR regime and it is a way of regulating that SEPA are familiar and comfortable with. However, SSC are not aware of other sectors where such highly precautionary regulation with such potentially significant impact is being applied to one industry where SEPA themselves acknowledge the extent to which other activities are affecting the environment and so this approach is not understood. The River Basin Management Plan for Scotland (2021 – 2027) (RBMP)²⁷ describes how SEPA employs a flexible, adaptive and case-specific approach with activities where there is a recognition of limiting factors e.g. lack of information with which to adequately assign causality (e.g. during the second RBMP cycle where SEPA worked with hydropower operators to understand better the extent of the impacts associated with their schemes and gathered data to improve confidence in SEPA's assessment) and recognition of disproportionate/ excessive costs associated with mitigation (e.g. as inferred by SEPA in relation to removal of certain fish barriers). If sea lice associated with aquaculture are

²⁷ <https://www.sepa.org.uk/media/594088/211222-final-rbmp3-scotland.pdf>



to be regulated under Water Framework Directive derived regulation, the approaches applied should be consistent with other activities, as described in the RBMP.

Proportionate

- The Consultation acknowledges that *'the causes of the poor conservation status of wild salmon stocks are complex and believed to be due to a range of different factors rather than a single cause. The Scottish Government has identified 12 groups of high-level pressures on the status of salmon stocks, one of which includes sea lice from marine finfish farms'* (para 2.2). These are laid out in The Wild Salmon Strategy, published in January 2022, which notes that *'in most cases pressures do not operate independently of one another but act in conjunction to negatively impact salmon survival and can be amplified by climate change effects'*. In the consultation document, the information presented on action taken on the 11 other pressures is not detailed (or it is not clear if action is being taken at all). It is also not clear how SEPA will assign causality or proportionality to aquaculture, in terms of contributing to deterioration of waterbody status. This concept requires to be consulted on further with Industry, SEPA and Marine Scotland.

Targeted only when needed

- The proportion of aquacultures' contribution to the decline in Scottish salmon populations is currently undefined. It has been reported, from tracking studies on the Scottish east coast, that up to 50% smolt mortality can occur in freshwater²⁸. Given the impact to salmon populations is significant in freshwater and the extent to which other activities affect salmon populations in the marine environment is undefined, it cannot be justified why SEPA have determined that the targeted approach, outlined in this framework, is needed.

Furthermore, the evidence presented in this consultation does not suggest there is a need for such a highly precautionary approach, as much of the literature SEPA have cited in their consultation (Table 1) outlines the contribution of farm related lice releases to wild fish mortality as *"minor and irregular"*^{2,3,6, 29 & 30}.

In order for the Framework to prevent deterioration and ensure waterbodies achieve good ecological status (GES) for salmonids, a holistic approach must be adopted to consider the relative contribution of all local pressures (i.e. forestry, exploitation, infrastructure) on a given receptor, and use this to inform adaptive management of the appropriate sector.

²⁸ <https://atlanticsalmontrust.org/our-work/the-west-coast-tracking-project/>

²⁹ Jackson, D., Cotter, D., ÓMaoiléidigh, N., O'Donohoe, P., White, J., Kane, F., ... & Cullen, A. (2011). Impact of early infestation with the salmon louse *Lepeophtheirus salmonis* on the subsequent survival of outwardly migrating Atlantic salmon smolts from a number of rivers on Ireland's south and west coasts. *Aquaculture*, 319(1-2), 37-40.



V. Concerns on Modelling and Use of Science in the Framework

The proposed framework relies on a complex lice dispersal model, that informs on the potential lice loads in defined wild salmon protection zones, with new farm developments assessed against a highly precautionary threshold of 0.7 lice per m².

Whilst the sector supports the use of models for farm consenting and decision making, they should be used exactly in that manner – to support decision making. They should also only be used in regulatory decision making when they can properly be calibrated and validated with field data. At present, the proposed framework places undue reliance on the outcomes of modelling. These concerns are over and above any we have with regard to the detail of the model, which has not been provided in the consultation documentation and which appears to be the subject of a further consultation.

Models provide predictions or estimations. There is no “right” answer from a model, rather choices and defensible decisions that lead to a level of confidence in model outcomes. At present, the outcomes of the proposed model lead directly to decisions around consenting without any further assessment of risk, proportionality or balance regarding other factors that may be relevant (other pressures on wild salmon, current and historical lice management, current and emerging lice management tools).

It is also extremely concerning that SEPA have opted to use significant components of a modelling framework developed for Norway, within a Scottish context. How can this be relevant for operation in Scotland? For example, a maximum sea lice threshold of 0.7 lice per m² is proposed within the salmon protection zones. This, figure, taken from Sandvik et al. (2020)¹⁴, is a modelled figure, validated against field data collected within Norway. Aside from all the uncertainty within the modelling framework adopted and the fact that SEPA have chosen the most precautionary figures from Sandvik et al., this threshold will only hold as reliable in Scotland if the exact same model architecture is used, and we make the very significant assumption that the principles that apply for Norwegian fjordic systems also apply for Scotland. It is noteworthy that all work relating to this threshold was undertaken in Hardangerfjord, a fjordic system renowned for containing the highest density of salmon and trout farms, globally, and for being atypical of Scottish loch systems.

The consultation document outlines some information on the proposed approach that companies will need to take regarding modelling, including an expectation for companies to build their own hydrodynamic models. We will not make any detailed comments on the complexities of modelling, but instead refer SEPA to the consultation responses of individual salmon farming companies, as this is where modelling expertise resides. However, we do wish to note that ensuring alignment and consistency between models developed for different regions, sites and companies is a complex issue that will be required under the proposed framework. Such structure will ensure work packages can be appraised on a level-playing field. To establish such a framework it may be necessary to:

- Introduce a degree of standardisation by defining an accepted “standard” approach, including the hydrodynamics that are to be used to drive assessments.
- Undertake a centralised assessment of given areas compliance at defined intervals.



Enforcing individual companies to develop models independently for the purpose of area classification will be unworkable for the sector and regulator alike. It is also noted that development of high-quality regional scale models for Scotland has taken many years and is still incomplete. The timescale of 1 year for implementation will not be sufficient to develop and implement an appropriate modelling framework.

The proposed Scottish framework has similar objectives to that of the Norwegian Traffic Light System (NTS), although the NTS operates in a different way, setting area- rather than individual farm-based growth controls. The NTS has received considerable attention since its launch, including an ongoing legal challenge. A recent review of the scientific basis of the NTS has been completed by a group of internationally renowned academic experts¹⁰. Several of the key recommendations are relevant to the proposed Scottish framework. These were presented by the evaluation team, at a meeting with SEPA, Marine Scotland, FMS and the salmon and trout sectors on 1st Mar. 2022 (a recording of the meeting is available). Whilst we strongly advise SEPA to consider and take on board the findings of the review, we briefly cover some of the key findings, as relevant to Scotland, in the following paragraphs:

Dealing with uncertainty: Models inherently include uncertainty and as the complexity of a model increases, the level of uncertainty of the overall system multiplies. This in itself is not necessarily an issue but ensuring that uncertainty is properly characterised for each aspect of a model framework is vital, and it is also critical that the overall uncertainty of a model system is understood and informs how model outcomes are interpreted and used (i.e., informing the overall assessment of risk). The consultation document appears to acknowledge this but fails to provide a process by which uncertainty can be identified and how it will be handled in the wider framework. More concerning, however, is that despite what this the consultation document states, the framework appears to use the outcomes of the model without any assessment of their reliability. The outputs appear to be taken as definitive. This is not correct and represents a significant failing of the proposed system.

Incorporating expert judgement: The review of the NTS acknowledged the inclusion of expert judgement as a necessary part of the system. However, the review criticised the lack of any explanation of how expert judgement had been used and justified, noting that there are recognised approaches for incorporating expert views. Expert judgement is inherent in the proposed Scottish system, and there is also a lack of any clear explanation and justification for the inclusion of expert judgement and no evidence of a formal, structured approach. These failings must be addressed. By way of a examples, expert judgment seems to have been used in the below:

1. Wild salmon protection zones are narrow or constrained areas of sea that wild salmon post smolts have to pass through.
2. Salmon protection zones are identified taking account of advice from Marine Scotland and fisheries managers.
3. The protection zone for rivers entering the sea on open coastlines is arbitrarily set at 5km.

It is unacceptable to have significant aspects of the framework included through expert opinion, without any wider scientific scrutiny.



Knowledge inclusion: The review of the NTS recommended a clear framework for the inclusion or exclusion of sources of information and a more robust process associated with how knowledge is included within the framework. These are key requirements for any Scottish system and at present the sector is extremely concerned with the lack of any explanation as to how and why data sources and information have been included, and why others might not have been. It is critical that there is full transparency in decision making around this framework so that all stakeholders can be assured of objectivity in the process. At present, this is not the case. We would argue that the proposed system needs independent oversight, to ensure the most up to date and scientifically valid, information is being used.

External validation: This subject warrants its own specific section, below.

Framing in an iterative framework: The Evaluation group identified that within the NTS there was no mechanism for assessing the effectiveness of actions nor any ongoing assessment of the framework assumptions or for informing expert judgment. They proposed an iterative framework to support such assessments.

The current proposed framework offers no insight into how SEPA will assess the suitability of the framework, its core components and assumptions and whether they are “up to date”. For any system to work correctly, there requires to be a clear and transparent process by which SEPA will appraise the framework in its entirety, at regular intervals.

VI. Scientific evidence base/ Literature Review

Basis for regulation:

In Section 2 of the consultation document (“Requirement for regulation – protection of wild salmon”) it is claimed that “*Substantial impacts on the marine survival of wild Atlantic salmon resulting from sea lice from finfish farms have been demonstrated in Ireland and Norway*”, supported by citing research from 9 academic references.

The cited literature does not support the claim that demonstrable evidence exists of substantial impacts on marine survival of wild Atlantic salmon from sea lice from finfish farms. Table 1 details the academic papers referenced and observations from review of the literature that conflict with the claim made in the consultation document.

A common theme of the supporting literature is the use of prophylactic experimentation on released smolts which are then subsequently recaptured as returning adults.

One of the key limitations of prophylactic studies is that the release of treated and control groups of hatchery-reared salmon smolts into aquaculture bays allows assessment of the efficacy of an in-feed sea lice treatment to be tested³⁰, rather than demonstrating any difference in lice burden (and the risk of increased mortality effects) between areas of aquaculture production and naturally occurring baseline infestations.

³⁰ Hazon N., Todd C. D., Whelan B., Gargan P. G., Finstad B., Bjørn P. A. and Wendelar Bonga S. E., et al. (2006). Sustainable management of interactions between aquaculture and wild salmonid fish. Final report for the SUMBAWS EU project. pp. 1 –293. https://issuu.com/inshoreirelandpublishing/docs/4-ms-sumbaws_final_pdf_doc.



Additionally, when coupled with recapture attempts of returning adults, typically no consideration is made for returning fish which remain uncaptured, resulting in discrepancies in gathering catch statistics³¹. Where significant results are reported in cited literature, generally the difference between observed and expected cohorts applies to relatively, very few fish. Studies presenting results with such large potential for error, and in which ‘significance’ hinges on such narrow margins, must not be relied upon for establishing a regulatory framework. Additionally, this raises questions as to whether the proposed framework for aquaculture is disproportionate in its entirety compared to the respective regulation of other pressures (see also comments on proportionality and other pressures in response to Q14, Q18, Q20 and Q21).

Table 1: Review of literature: Cited literature supporting claim of demonstrable evidence of substantial impacts on wild salmon smolts

Consultation Reference #	Author	Comments
5	Finstad & Jonsson (2001) ⁶	<p>This paper is a literature review which assesses multiple factors affecting the yield of hatchery-reared smolts released in Norway. This paper presents no novel research on lice interactions.</p> <p>The paper refers to varying levels of recapture from different smolt releases, all in the context of multiple factors which may affect yield (production methods, density regulation, time of release, site of release, size and age, sexual maturation, water quality, discharge, seawater acclimatization, physical training, handling/transport/anaesthesia, seasonal return patterns, predation and parasites), and concludes ‘<i>Due to differences in production strategies in the hatcheries leading to a various smolt quality it is difficult to generalize a conclusion from these results</i>’.</p> <p>The only quantified effect on smolt yield explicitly from sea lice is a reference to a prophylactic study undertaken by Finstad et al (1999). This paper is not available for review.</p>

³¹ Hvidsten N. A., Finstad B., Kroglund F., Johnsen B. O., Strand R., Arnekleiv J. V., and Bjørn P. A. (2007). Does increased abundance of sea lice influence survival of wild Atlantic salmon post-smolt? *Journal of Fish Biology*, Volume 71, Issue 6, 1639–1648. <https://doi.org/10.1111/j.1095-8649.2007.01622.x>



Consultation Reference #	Author	Comments
6	Hazon, Todd, Whelan (Brendan), Gargan, Finstad, Bjorn, Wendelaar Bonga, Kristofferson, Martinsen (2006) ³⁰	<p>This is the report of the 'Sustainable management of interactions between aquaculture and wild salmonid fish'.</p> <p>On Page 4, 'Project's actual outcome', the report states: <i>"Neither salmon lice infection nor pharmaceutical prophylaxis had any effect on survival and migration of Atlantic salmon post-smolts."</i></p>
7	Skilbrei & Wennevik (2006) ²	<p>The study shows no difference between treatment and control groups from two releases of smolts during peak migration in May.</p> <p>This study only reports a significant difference between treatment and control groups for a single smolt release in June (after peak migration), however to contextualise this result further, the significant result only applies to a return difference of 34 individual fish (49 treated vs 15 control fish, recaptured). 34 individual fish equates to 0.3% of the 10,471 smolts released in total.</p>
8	Hvidsten, Finstad, Kroglund, Johnsen, Strand, Arnekleiv, Bjorn (2007) ³¹	<p>The research was conducted in Trondheimsfjord, a fjord system in Norway which according to the study is 'protected against the establishment of salmonid aquaculture'. It is therefore not appropriate for the results from this study to support the claim that lice from finfish farms have been demonstrated to impact substantially on marine survival of wild Atlantic salmon.</p> <p>To summarize, the sea-lice analysis in Trondheimsfjord indicated a non-significant influence on wild post-smolt year-class survival.</p>
9	Jackson, Cotter, O'amaileidigh, O'Donohue, White, Kane, Kelly, McDermott, McEvoy, Drumm, Cullen, Rogan (2011)	<p>This Irish study occurred over 9 years, and observed declining trend in survival rates of both treated and control groups, hinting to additional and greater marine pressures than sea lice infestation.</p>



Consultation Reference #	Author	Comments
		The study concludes: <i>infestation of outwardly migrating salmon smolts with the salmon louse (L. salmonis) as being a minor and irregular component of marine mortality in the stocks studied and not being implicated in the observed decline in survival rate.</i>
10	Jackson, Cotter, Newell, McEvoy, O'Donohoe, Kane, McDermott, Kelly, Drumm (2013) ³²	This Irish study concludes: <i>There is no evidence to suggest that this trend [long-term increasing marine mortality] is influenced by sea lice infestation levels of outwardly migrating smolts as treated and control fish are equally affected. Sea lice-induced mortality is significant in just under 40% of the releases in the study. The level of sea lice-induced mortality is small as a proportion of the overall marine mortality rate, which is in the region of 90%, and in absolute terms represents 1% (10 fish in a thousand).</i>
11	Gargan, Forde, Hazon, Russell, Todd (2012)	<p>Comments on this study have been made in other literature³², which states that the methods used by Gargan et al (2012) may have compromised the survival of the released smolts (reared in alkaline waters and released into acidic).</p> <p>The results presented by Gargan et al (2012) demonstrate a significant difference between treated and control groups in only 3 of 8 smolt releases. Of the 8 releases, there were no significant differences observed in the region with the highest estimated number of farmed fish present at the time of release (Invermore).</p> <p>As described previously, while a minority of results may be statistically significant, they actually only relate to a small proportion of released smolts.</p> <p>To better contextualise this, the significant differences of survival between treatment and control equate to</p>

³² Jackson D., Cotter D., Newell J., McEvoy S., O'Donohoe P., Kane F., McDermott T., et al. (2013). Impact of *Lepeophtheirus salmonis* infestations on migrating Atlantic salmon, *Salmo salar* L., smolts at eight locations in Ireland with an analysis of lice-induced marine mortality. Journal of Fish Diseases, Volume 36, Issue 3: 273 –281. <https://doi.org/10.1111/jfd.12054>



Consultation Reference #	Author	Comments
		<p>between 0.31% (29/9354 individuals, Owengowla 2004) and 0.37% (35/9348 individuals, Erriff 2005) of total smolts released in any given release.</p> <p>Additionally, the significant results only relate to unraised returns (i.e. tags actually retrieved from returning fish), however the author states that <i>“the unraised tag returns cannot be utilized in estimating percent marine mortality.”</i></p> <p>By comparison, the non-significant difference in the mean survival of the raised data (3.7% treatment vs 2.1% control) is 1.6%. This equates to only 16 fish in 1000.</p>
12	Krkosek, Revie, Gargan, Skilbrei, Finstad, Todd (2012)	<p>The data used to inform this meta-analysis is entirely based on literature already referenced within the SEPA Consultation Document (reference numbers 7, 8, 10 and 11), therefore its inclusion is a duplication of evidence to add weight to the impact claim.</p> <p>The paper also appears to misrepresent much of the original research, notably, in relation to Jackson et al (2011), which contributes a large majority of the overall data used. The declining survivability trends of both treatment and control groups identified by Jackson et al (2011), do not appear to be accounted for in the Krkosek et al (2012 paper).</p>
13	Krkosek, Revie, Finstad, Todd (2014)	<p>This paper offers a critique of the statistical methods used by Jackson et al (2013).</p> <p>The consultation documentation provided by SEPA makes no reference to the subsequent response by Jackson et al³³, which provides clear justification and clarity around the methods used.</p>

³³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4314703/pdf/jfd0037-0419.pdf>



Consultation Reference #	Author	Comments
		The Marine Institute of Ireland has also released a video explaining exactly why the Krkosek et al paper misrepresents its findings: https://vimeo.com/83845976

Basis for modelling/ thresholds (Annex C)

The modelling approach by SEPA has been established by a small group of Norwegian researchers which has been developed to support the implementation of an aquaculture regulation system in Norway. The literature cited to support the proposed modelling approach is reviewed in Table 2.

SEPA's citing of literature surrounding the potential modelling applications and the 0.7 threshold focuses on studies developed to support the implementation of the Norwegian Traffic Light System (TLS) and heavily on data presented by Sandvik et al (2020)¹⁴ whose sample was based on 18 discrete sentinel cages sampled throughout a single fjord south of Bergen over a three week period. The dataset used to define the 0.7 lice/m² was derived from approximately six of these sentinel cage deployments and approximates to observe lice loads of one lice per fish (0.02 lice/g) and was considered to be a "low" infestation pressure. SEPA's proposed extrapolation of this 0.7 lice/m² threshold to inform Scottish regulation is not considered appropriate and without significant scientific basis.

The selection of a threshold based on "low" exposure is not considered appropriate given the uncertainties surrounding the impact of Sea Lice on wild salmon stocks³² and the application of an unbounded Norwegian modelling study to Scottish waters is not considered appropriate. Further work by Johansen et al (2020)⁷, referenced in SEPA's consultation, is based on a similar modelling schema to Sandvik et al, identified a "low infestation pressure" of two lice per fish based on hypothetical smolt tracks.

Table 2: Literature review; Cited literature in support of modelling approach and thresholds applied

Consultation Reference #	Author	Comments
37 & 41	Johnsen I. A., Harvey A., Saevik P. N., Sandvik A. D., Ugedal O., Adlandsvik B., Wennevik V., Glover K. A. and Karlsen O. (2020)	This study reviews the Norwegian TLS and the application of a modelling methodology similar to Sandvik et al (2020) ¹⁴ to a set of hypothetical smolt tracks and is validated by smolt recapture. The aim of this study was to review the application of lice dispersal techniques to 400 rivers in Norway and to provide regulation "an objective measure of the influence salmon lice have on wild fish in a time period and area that the post-smolts are likely to migrate"



Consultation Reference #	Author	Comments
		<p>This paper is also used to establish a lice attachment pressure associated with impact. SEPA outline this to be 1 lice/ 20g smolt or 0.1 lice per fish interchangeably. The paper outlines a value of 2 lice per 20g smolt as a low infestation pressure and references Kristoffersen et al. (2018)⁸ and Taranger et al. (2015)⁹</p>
38	<p>Sandvik, A. D., Johnsen, I. A., Myksvoll, M. S., Sævik, P. N., & Skogen, M. D (2020)</p>	<p>This is the basis of SEPA’s proposed application of a 0.7lice/m² threshold as a basis for regulation.</p> <p>The basis of this modelling exercise is based on a small sample of 18 discrete sentinel cages samples throughout a single fjord south of Bergen over a three week period. The dataset used to define the 0.7 lice/m² was derived from approximately six of these sentinel cage deployments and approximates to observe lice loads of one lice per fish (0.02 lice/g). The authors consider this to be a “low” infestation pressure. SEPA’s proposed extrapolation of this 0.7 lice/m² threshold to inform Scottish regulation is not considered appropriate or scientific.</p> <p>It should also be noted that the authors quote a 20% false positive result for this lower threshold. This means the modelling predicted lice concentrations in excess of 0.7 lice/m² where observed lice concentrations were less than one lice per fish</p>
39	<p>Kristoffersen, A. B., Qviller, L., Helgesen, K. O., Vollset, K. W., Viljugrein, H., and Jansen, P. A. (2018)</p>	<p>The work outlined in this study is similar to that undertaken by Johansen et al (2020) however the authors used a population model based on stocked biomass and validated against sentinel cage data, achieving an R² value of 0.39.</p> <p>Similarly, to Johansen et al (2020), this paper referenced Taranger et al (2015) in its selection of infestation pressures and chose a low infestation pressure of <2 lice per fish as having 0% mortality for “Low” and “Normal” mortality, Table 5. This is double the level quoted in the consultation document (“0.1 mobile sea lice per gram of host fish”, B.8, pp 22)</p>



Consultation Reference #	Author	Comments
40	Taranger, G. L., Karlsen, O., Bannister, R. J., Glover, K. A., Husa, V., Karlsbakk, E., Kvamme, B. O., et al (2015)	<p>This investigation was undertaken by the authors to outline a risk assessment methodology for the support a risk assessment of the Norwegian wild salmon stocks, indicating 27/109 farms assessed had moderate-to-high risk to smolts from sea lice.</p> <p>The paper outlines infection rates between 0.1-0.2 lice/g⁻¹ fish are associated with 20% mortality and 0% mortality for lice infestation < 0.1 lice/g⁻¹ fish, referencing an earlier paper by Taranger et al. (2012)³⁴. This paper is concerned with a “conservative” (<i>konservativt</i>)²⁸ estimate of mortality for smolts of <150g weight. This statement is unreferenced and it is unclear how the sample used to derive this basis is relevant to the 20-30g smolts outlined in the consultation. Further work should be undertaken to review this relationship, specific smolt sizes typical of Scotland.</p>
42	Murray A. G. and Moriarty M. (2021) ³⁵	<p>The authors here develop a schematised model to review small scale processes in attachment success of lice to host salmonoids. The paper relies heavily on Norwegian research for lice life-cycle. The paper outlines a threshold of 0.75 lice/g as “high risk of mortality”</p> <p>This research uses a simplistic theoretical model framework and a link between this theoretical experiment and the application of a simulated threshold of 0.7lice/m² threshold outlined in the consultation is ambiguous.</p> <p>The consultation appears to present this research as evidence of Scottish lice populations. It should be highlighted that this is a theoretical review of lice-smolt connectivity, based on schematised kernels developed largely using Norwegian data on lice life cycles and does not establish relevance to Scottish lice populations.</p>

³⁴ Taranger G. L., Sva°sand T., Kvamme B. O., Kristiansen T. S., and Boxaspen K. K. (2012). Risk assessment of Norwegian aquaculture [Risikovurdering norsk fiskeoppdrett] (In Norwegian). Fisken og havet, særnummer 2-2012. 131 pp.

³⁵ Murray A. G. and Moriarty M. (2021). A simple modelling tool for assessing interaction with host and local infestation of sea lice from salmonid farms on wild salmonids based on processes operating at multiple scales in space and time. Ecological Modelling, Volume 443, 109459. <https://doi.org/10.1016/j.ecolmodel.2021.109459>



Consultation Reference #	Author	Comments
43	Urke H. A., Kristensen T., Ulvund J. B. and Alfredsen, J. A. (2013). ³⁶	<p>The authors here outline a schema for Norwegian smolt migratory behaviour. The authors retained a small sample size of 65 recaptured smolts and recorded swim-speeds as variable with a median swim-speed of ~1bl (body length)/s with the 75th percentile un excess of 2.5 bl/s in inner fjords. These speeds have been seen as independent of hydrographic flows.</p> <p>SEPA outline this supports an average swim speed of 1bl/s. It should be noted that the paper references only a median statistic which may be significantly lower than the mean.</p>
44	Middlemas S. J., Stewart D. C., Henry J. I., Wyndham M., Ballantyne L. and Baum D. (2017). ³⁷	<p>This document was not available for review and appears to be proceedings from a symposium. Given the implications of this reference, this should be made available to the industry</p>
45	Malcolm I. A., Millar C. P. and Millidine K. J. (2015) ³⁸	<p>The authors here review the physiological characteristics of migratory smolts and review a “sensitive window for smolt migration”. The authors present numbers of smolts >135mm and do not present a mean smolt size. The authors also avoid presenting a mean smolt size due to spatio-temporal variability.</p> <p>Given that the authors of this papers do not present a mean smolt size, it is unclear how this citation supports SEPA’s selection of 125mm as a mean smolt size for Scotland</p>

It appears there is an error in Table B1, corresponding to reference 37 (Johansen et al (2020)⁷). SEPA outline that for a 20g smolt the number of sea lice associated with <0.1 lice/g and “Impact unlikely”. Johansen et al., outline a minimum impact of <2 lice per fish have no assumed mortality under all scenarios (Table 1⁷) and not 1 lice per fish as the table outlines.

³⁶ Urke H. A., Kristensen T., Ulvund J. B. and Alfredsen, J. A. (2013). Riverine and fjord migration of wild and hatcheryreared Atlantic salmon smolts. Fisheries Management and Ecology, Volume 20, Issue 6: 544–552. <https://doi.org/10.1111/fme.12042>

³⁷ Middlemas S. J., Stewart D. C., Henry J. I., Wyndham M., Ballantyne L. and Baum D. (2017). Dispersal of post-smolt Atlantic salmon and sea trout within a Scottish sea loch system. In Harris G.S. (ed.) Sea trout: science and management. Proceedings of the second international sea trout symposium. Dundalk. Troubadour publishing. Pp. 339-353

³⁸ Malcolm I. A., Millar C. P. and Millidine K. J. (2015). Spatio-temporal variability in Scottish smolt emigration times and sizes. Scottish Marine and Freshwater Science, Volume 6, Number 2: 1 – 19. <https://www.gov.scot/publications/scottish-marine-freshwater-science-volume-6-number-2-spatio-temporal/>



VII. Principles of regulating something that occurs naturally

Sea lice are a natural occurring parasite. Their numbers can increase in certain environments e.g. increased number of hosts with inadequate mitigation employed. However, the release of sea lice from a farm is a release of something that occurs in the natural environment anyway and as mentioned above it is not a pollutant. As detailed in response to Question 9 in the context of permitting, the number of fish on a farm is not directly related to lice levels on the farm, rather this is dependent on how well lice levels are managed i.e. a farm with fewer fish could emit the same number of lice as a farm with more fish if it is not being managed effectively, or the environmental conditions promote a greater baseline level of lice in the environment. The focus of regulating lice on farms must be to ensure that good management practice is adhered to on farms, rather than limiting a farm's production capacity through permit conditions as a primary means of intervention. Sea lice pressure in a loch is affected by various external factors e.g. temperature and salinity, and so the baseline sea lice pressure in any given sea loch must also be assessed and established first.

Examples of other naturally occurring lice/insects which are managed by the law demonstrate that the focus is on appropriate mitigation and not on restricting the size or location of the activity in the first instance.

Varroa destructor, a parasitic mite which affects honey bees and can move between wild and managed bees. There are similarities with sea lice as Varroa weakens the bee by sucking out body fat. The point is that the presence of the parasite alone on managed bees is not a reason to require commencement of treatment. There is a legal obligation in the Bee Diseases and Pests Control (Scotland) Order 2007 to report the presence of the mite on managed bees but a notice ordering the destruction of the mite (not the bee) will only be issued if the presence of a notifiable pest (small hive beetle and any species of *Tropilaelaps* mite) for which Varroa is a vector, is confirmed. There is no requirement to move the managed bee hives or restrict their number.

Statutory nuisance also provides a useful example of how other pests' are managed. Any insects emanating from premises which are prejudicial to health or a nuisance are classed as a statutory nuisance (section 79 of the Environmental Protection Act 1990). The Act provides that an abatement notice may be served by the local authority where a statutory nuisance has been identified or is likely to recur. The guidance produced by the Scottish Government for insects is clear that the actions are not meant to be taken against most naturally occurring concentrations of insects acknowledging that they are in fact naturally occurring. It is a defence to an abatement notice to prove that the best practicable means are being used to prevent or counteract the effects of the nuisance. The guidance advises managing the nuisance and using chemical treatment. There are no requirements to restrict the size or location of the activity or to shut down a business due to increased numbers of insects emanating from the premises.

VIII. Timing of consultation release

The Griggs Review recommends that 'Governments produce frameworks for industry and regulators implement that policy' and notes that the Scottish Government will publish its Vision for Aquaculture in due course. The Review goes



on to note 'While the Vision for sector is being finalized I propose that the Government led Project Board take forward the initial work on a framework that will allow a timeous meld in with the Vision, once in place'. SSC does not consider it appropriate that the implementation of this SEPA Sea Lice Risk Assessment Framework continues, ahead of the Vision for Aquaculture being released by the Scottish Government, or indeed, the response of the Scottish Government to the output of the Griggs Review. It is more appropriate that further consultation and implementation should be paused until after the Vision is released/ decision on which Griggs recommendations are to be taken forward, to allow for any updates to direction from Scottish Government to be actioned.

IX. Resource and timescale for implementation

SSC notes concern over the proposed 12-month period for implementation. It is evident that there are a number of areas where further detailed discussions are required and areas that need strenuous review, as consistently requested by the industry throughout pre-application dialogue with SEPA. It is difficult to see how SEPA can implement its duty to take account of all consultation responses and also how discussions will progress to a point of mutual satisfaction after a refined time period. The implementation period should not be time-bound, rather the framework should only be launched formally when SEPA, Marine Scotland and the industry are satisfied with its format.

SSC requests that SEPA clarifies how it proposes to sufficiently and appropriately resource this framework implementation and management, in order to adequately assess applications subject to the framework, and to monitor and assess potential impacts. It is important that application determination times are not delayed as a result of this framework.

It is unclear how SEPA propose to support Local Planning Authorities (LPAs) during the implementation phase and ongoing beyond that, when LPAs will still be required to consider potential interactions on wild salmonids, in order to fulfil their biodiversity duties (under the Nature Conservation (Scotland) Act 2004) when considering planning applications.