14 March 2022

Response to SEPA consultation:

Sea lice risk framework proposal

SEPA proposals for a risk-based, spatial framework for managing interaction between sea lice from marine finfish farm developments and wild salmonid fish in Scotland

Executive summary of response

Scottish Sea Farms object to this consultation proposal which fails to meet the core principles of any proposal to implement a regulatory change – the delivery of a strong, credible, and robust evidential platform which has dealt with the uncertainties, incorporated expert judgement, and been inclusive in its knowledge gathering.

The consultation, whilst meeting the Scottish Government (SG) Programme for Government (PfG) 2021 commitment to consult on a spatially adaptive sea lice risk assessment framework for fish farms by the end of the year, also fails to meet the core regulatory principles that regulatory functions should be exercised in a way that is transparent, accountable, proportionate, and consistent, and targeted only where action is needed.

We understand that the origins of this proposed framework were to aid decision makers in determining planning applications for the sighting of finfish farm developments in undertaking their wild salmon conservation considerations. We agree that action is required to aid decision makers in completing consenting determinations. It is important to reduce the level of uncertainty for business and address the generic misrepresentation of the scale of impacts posed by marine fish farming which the sector has experienced in recent and current consenting consultations. However, the proposal is not the appropriate tool to accomplish this.

The rhetoric in the consultation and the details of the framework proposed are not informed by an assessment of the potential risk or underpinned by robust empirical or scientific evidence.

The proposal fails to recognise the management of sea lice at marine finfish farms through existing regulatory and voluntary measure controls. Performance of the sector under these controls has not highlighted any deficiencies in mitigating the potential risk which would warrant this further

regulatory intervention. There is also no account of existing locational controls or of existing ecological water classification status, with most marine farms operating in high or good ecological status waterbodies.

Scotland's finfish farming sector already operates within an established risk-based management system for the interactions between marine finfish developments and wild salmonid fish which delivers locational and operational control. The presumption against marine finfish farm developments on the North and East coasts of Scotland firmly establishes the precautionary approach taken by Scotland in ensuring that c.80% of the Scottish salmon population migrate to the sea without any interaction with marine finfish farms. In addition, the relatively small fraction of the remaining population within the farmed area are mostly associated with rivers identified as having an insignificant role in terms of the wider conservation of the species and are rivers with other wild salmonid pressures accepted as occurring with no action required to be taken to address them e.g., poor water quantity as a consequence of hydropower or accepted mortality from recreational angling of wild salmon returning to spawn. The limited proportion and conservation value of the wild salmon population which occurs within the farmed area has not been considered when determining the risk and subsequent apparent need for further regulatory intervention.

The consultation document boldly claims, with little or no justification, that sea lice from marine fish farms pose a demonstrated substantial and significant risk to wild salmon. There is a lack of unambiguous scientific and empirical data to document and quantify the actual impact. Whilst it is accepted that sea lice are one of 43 expanded pressures faced by wild salmon[1] it is not a determining pressure as evidenced by the decline in salmon numbers across their global distribution range. This decline occurs in both farming and non-farming countries and is mirrored across their Scottish distribution range including in all areas where no marine finfish farming takes place.

The adoption of a 'no increased risk' or 'no impact' approach is inconsistent and disproportionate with the actions taken or proposed to manage other pressures, and with the approach taken to deliver environmental protection under all SEPAs (Scottish Environment Protection Agency) regulatory remits. Such an adoption being proposed because of reduced smolt numbers migrating into the marine environment due to a failure to address, combined with a willingness to accept, hazards posed

1 [online]: https://www.gov.scot/publications/conservation-of-wild-salmon/pages/high-level-pressures-on-atlantic-salmon/ accessed 14 March 2022.

by identified freshwater pressures. It is not acceptable to impose restrictions on the development and operations of one sector to compensate for the adverse impacts of others.

SEPA are legally required to balance the need for protection of the water environment with Scotland's social and economic needs. The proposal fails to reference a Business and Regulatory Impact Assessment or that any proportionate quantitative costs and benefits analysis of the proposal has been done. The words social, economic, financial, cost, health, welfare, wellbeing, people and business do not feature in this document.

Such disregard of a statutory duty is a damning failure in process and evidence led decision making in the exercise of a regulatory function. The proposal has been made without a demonstrated understanding of the consequences on farmed fish health and welfare, the social and economic wellbeing of the people and communities salmon farming are members of, the impact on responsible farming operations or on the sustainable development of fish farming and our supply chain in Scotland.

Additionally, given the SG vision to be a wellbeing economy the proposal fails to consider the role finfish farming has in the national endeavour to transform Scotland's economy.

Scottish Sea Farms operate as a contributing member of society and our business decisions are made with full consideration across economic, social, and environmental dimensions, to ensure that our actions deliver prosperity for our people, our communities, and our places. This proposal will place additional financial costs on our business which is already undermined globally by the recognised disproportionate regulatory burden in Scotland. Such regulatory burden resulting in a higher farming cost per tonne of salmon than other Atlantic Salmon farming nations.

Globally, the salmon market is increasing by c.8% per annum whilst here, Scottish salmon farming is growing at c. 1.4% per annum. Consequently, Scotland's sector share of the global market has fallen from a previous high of c.10% to c.6.6%, at a time where opportunity, appetite and need for aquaculture products are increasing[2.] This proposal will increase this decline and that of the related social and economic wellbeing which a thriving Scottish salmon food production sector can bring to Scotland.

We strongly object to the restrictions on development of fish farming and imposition of operational controls on existing farms, whilst SG and its public agencies simultaneously ignore the available data

2 [online]: Kontali Salmon market figures - Yearly publications from the world of seafood · Kontali accessed 14 March 2022.

of parallel decline in non-fish farming areas, ignore existing regulatory controls available for use, ignore operational sea lice management performance, contradict animal welfare objectives for farmed fish and fail to take a no increased risk control to all freshwater pressures on wild salmon.

Finally, the timing of this consultation is not conducive to delivering a cohesive policy and regulatory framework for finfish farming as set out by SG in the PfG work associated with the development of the SG Blue Economy Strategy to promote sustainable growth of the blue economy underpinned by environmental protection.

The publication on 10 February 2022 of the independent Griggs review delivers a set of valuable recommendations – a path to follow to enable resolution and establishment of a modern regulatory framework for delivering SG ambitions for the sector. We fully embrace and support the Griggs recommendations, recognising the actions we must take ourselves to successfully deliver the recommendations he has made. We strongly recommend that collectively we follow the path laid out by Griggs with no shortcuts or deviations such that all can benefit from sustainable aquaculture in Scotland.

Detailed comments

We have chosen not to directly answer the specific consultation questions identified by SEPA.

We find the consultation structure is not neutral, being predicated on a presumption in favour of the need for such a framework and evidenced by the presentation of leading questions on which responses are sought.

Our response therefore focuses on the following key areas, where we provide our broad view and discussion on each aspect, before identifying key issues which must be addressed.

- Rationale and aim of the framework
- Scientific basis
- Proportionality
- Implementation
- Reviewing effectiveness
- Additional consequences and considerations

Rationale and aim of the framework

The consultation document does not provide any rationale for the proposed framework. Understanding the rationale for SG intervention and their policy intention is crucial to be able to effectively formulate the proposed framework's aim and objectives. In addition, the real-world aims and objectives of the proposed framework have not been defined. This issue suffers from the lack of context, in the absence of a rationale.

In considering the legal rationale associated with this proposed framework The Regulatory Reform (Scotland) Act 2014 includes provisions on promoting regulatory consistency, improving environmental regulation and a duty on regulators to contribute to achieving sustainable economic growth. The Scottish Regulators' Strategic Code of Practice has been published to support this. Section 5 (5) of the Act requires regulators to whom the code applies to have regard to the code. This duty to "have regard to" the Code means that the regulator must take into account the Code's provisions and give them due weight in developing their policies, principles and in setting standards or giving guidance. The Better Regulation requirements outlined in the code of practice dictate risk should be considered at every stage of their policy planning and decision-making processes, that regulation should be **risk and evidence based** with regulators taking informed decisions on where and how to focus effort – targeting action **only where necessary**.

The consultation document claims that sea lice from fish farms pose a demonstrated substantial and significant risk to wild salmon, and therefore requires regulation. However, it does not include a detailed assessment of potential risk, or robust scientific evidence or empirical data to support the necessity for this proposed framework. It also omits a review of the current regulatory and voluntary sea lice management regimes which are in place. These collective omissions are a direct failure to discharge the regulatory legal duties established under the 2014 Act.

The proposal refers to applying this framework through the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). It is not clear in the consultation which sub-section of Section 3 of the Regulations is being applied such that regulatory controls can be set.

In considering the Regulations Section 3(1)(a) *activities liable to cause pollution of the water environment* and Section 3(1)(g) *any other activity which directly or indirectly has or is likely to have a significant adverse impact on the water environment* would appear to be the only relevant subsections available for application of these requirements under CAR.

Section 2(1) of the Regulations defines pollutant to be '*any substance or heat liable to cause pollution, including those listed in Schedule 1, and for the purposes of this definition "substance" includes bacteria and other pathogens '*. Sea lice are not a bacteria or a pathogen, as defined by the Oxford English dictionary. They are also not a substance listed in Schedule 1 of the 2011 Regulations, sea lice are copepods - small crustaceans. Consequently, they are not a pollution which arises from an activity and therefore Section 3 (1)(a) is not applicable.

Under Section 3(1)(g) the premise that sea lice from fish farming have or is likely to have a significant adverse impact would appear to be the only grounds for introducing this proposal. As is discussed in detail to follow in our response there is a lack of unambiguous scientific and empirical data to document and quantify the actual impact likely from fish farm activity and the performance of the sector under the existing regulatory and voluntary measures has not highlighted any deficiencies in mitigating the potential risk which would warrant this further regulatory intervention and disregard of the 'targeted action only where necessary' requirements established under the 2014 Act.

In considering the base requirements of the Water Framework Directive (WFD), the proposal does not provide any evidence which disproves the high and good ecological status of the waters in which marine fish farms operate established through the River Basin Management Plan (RBMP). Rather, in the false assertion made in the proposal document that sea lice from fish farms pose a demonstrated substantial and significant risk to wild salmon, there is a direct contradiction with the criteria, guidance, and requirements of the WFD being made. Noting that WFD states that coastal waters, where all marine fish farms are located, do not have a biological element (value) which includes fish fauna in its determination of ecological status.

Placing that aspect of validity aside, in Annex V of the WFD when determining ecological status, the terminology *'values show low levels of distortion resulting from human activity but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'* is used to determine Good ecological status.

Given the commonality of decline in wild salmon experienced across non-farming and farming areas it is therefore reasonable to state that from a Scotland perspective the undisturbed conditions (in respect to fish farming human activity) of Scotland's North and East coasts salmon rivers are an ideal reference state to determine deviations arising from the human activity of fish farming from within the aquaculture region.

The omission of any evidence which supports the premise that '*values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status'* means it is reasonable to state that it is irrational to single out fish farming in the decline of wild salmon in the West coast such that the regulatory controls under this proposal are necessary for the purposes of protection of the water environment.

Further, contradiction in the intent and objectives for regulation of the water environment is demonstrated in the December 2021 SEPA publication of The RBMP for Scotland 2021 – 2027 and its related datasets. These documents and web-based datasets confirmed the high and good ecological status of most of the West coast marine farm locations and therefore the majority of the waterbody areas covered in this proposal. The related datasets identify the minor role aquaculture has in delivering improvements to waterbodies to meet good status, said improvements being associated with the freshwater environment only.

Risk

The consultation document vaguely mentions that the purpose of the proposed framework is to "help ensure Scotland's environment is protected and improving," in this case relating to protection of wild salmon. However, this cannot be effectively achieved without specifying high-level conservation objectives or targets or characterising the current status of the species. The potential risk must be contextualised not only to determine the necessity for further regulatory intervention, but also the proportionality of that intervention.

Since 1999 there has been a presumption against marine finfish farm developments on the North and East coasts of Scotland (where Scotland's largest salmon river catchments drain into the North Sea), [3] ensuring that c.80% of the Scottish salmon population migrate to the sea without any interaction with marine finfish farms.[4] SG intend to maintain this presumption[5] which serves as a firm approach taken by SG to effectively implement the precautionary principle to protect wild salmon from any risks posed by marine finfish farms. Analysis by Marine Scotland using catch data to examine the potential impact

3 Marine Scotland (2016) Response to petition 1598 : Salmon and Trout Conservation Scotland [online]: PE159820160801MarineScotlandResponse.pdf (parliament.scot) accessed 25 February 2022.

4 Marine Scotland (2016) Response to petition 1598 : Salmon and Trout Conservation Scotland [online]: PE159820160801MarineScotlandResponse.pdf (parliament.scot) accessed 25 February 2022.

5 Scottish Government (2022) Scottish Wild Salmon Strategy [online]: Scottish Wild Salmon Strategy - gov.scot (www.gov.scot) accessed 25 February 2022.

of aquaculture on salmon and sea trout[6] highlights that the farmed area of Scotland represents only 5-19% of the rod catch for salmon in Scotland, indicating the limited scale of the potential risk.

The consultation document states that "salmon populations are in poor conservation status in nearly 60 percent of salmon rivers across Scotland". This is a disingenuous statement given that the latest annual NASCO report[7] states that 82% of the Scottish salmon stock is associated with Grade 1 areas. Grade 1 areas are areas with good conservation status, where the retention of salmon caught is allowed. This information indicates that the vast majority of the Scottish salmon population is considered sustainable to allow exploitation through recreational fishing. Most rivers in the farmed area are Grade 3 (that is, poor conservation status with mandatory catch and release), which in total represent only 7% of the wild stock. Approximately 50+ rivers/lochs within the farmed area as noted in this proposal have been accepted by SEPA to remain in poor or moderate status by the end of 2027[8] with either fish barriers, water quantity and overall ecology impacted on most of these rivers as a consequence of hydroelectricity generation.

There are 17 Special Areas of Conservation (SAC) for Atlantic salmon in Scotland. Of these, only four are located within the farmed area. Site selection for the SACs specifically targeted rivers which hold large salmon populations, across the geographical range of the species in the UK. Site selection also considered the variation in the ecological and hydrological characteristics of rivers, and in the life-cycle strategies adopted by the fish within them. **Most of the salmon rivers located within the farmed area were categorised as Grade D as part of the SAC site selection process which indicates a non-significant presence in terms of securing favourable conservation status for Atlantic salmon in the UK.**[9] Therefore, the conservation role of most rivers in the farmed area is considered insignificant.

In summary, it follows that the potential risk posed by farm-derived sea lice to wild salmon in Scotland is not significant in terms of wider conservation of the species.

6 Middlemas SJ, Smith GW, Armstrong JD (2017) Using Catch Data to Examine the Potential Impact of Aquaculture on Salmon and Sea Trout [online]: catch+data.pdf (www.gov.scot) accessed 25 February 2022.

7 Scottish Government (2021) NASCO Annual Progress Report on Actions taken under the Implementation Plan for the Calendar Year 2020 – UK – Scotland [online]: CNL2130rev_Annual-Progress-Report_UK-Scotland.pdf (nasco.int) accessed 25 February 2022.

8 The River Basin Management Plan for Scotland 2021 - 2027 published December 2021 [online]: 211222-final-rbmp3-scotland.pdf (sepa.org.uk) accessed 13 March 2022.

9 Joint Nature Conservation Committee 1106 Atlantic salmon *Salmo salar* [online]: Atlantic salmon (Salmo salar) - Special Areas of Conservation (jncc.gov.uk) accessed 25 February 2022.

Evidence

The claim that sea lice from fish farms pose a demonstrated substantial and significant risk to wild salmon requires substantiation.

The assertion is heavily reliant on the results of randomised control trials (RCTs) of salmon smolts treated with anti-lice medicines. Most of the references cited in the consultation document however do not support this, with these studies reporting very variable risks, and some even concluding the contrary:

- "Neither salmon lice infection nor pharmaceutical prophylaxis had any effect on survival or migration of Atlantic salmon post-smolts."[10]
- "Against a backdrop of a declining trend in survival rates of Atlantic salmon many studies are attempting to elucidate potential causes for this decline. Results from this study over a period of 9 years point to infestation with the salmon louse (*L. salmonis*) as being a minor component of marine mortality in the stocks studied."[11]

Vollset (2019) (not cited in the consultation document) states: "Studying the fate of treated and untreated Atlantic salmon smolts released from hatcheries has been conducted since 1996 in Norway and Ireland (and in later years also in other countries). These studies demonstrated that parasites (most likely salmon lice) reduced survival and growth and increased the age of returning adult salmon. However, **the average effects were relatively small and strongly variable**."[12]

It should also be noted that these studies do not distinguish between naturally derived and farm derived sea lice. Therefore, the studies assess the general risk posed by sea lice, not, as is implied by this proposal - the risk solely posed by finfish farms.

We would reiterate that any potential risk is highly variable, as it is dependent on many interacting factors. In particular: i) production of larval lice from adult female lice on farms; ii) distribution of farm-derived sea lice by currents; iii) exposure of wild salmon based on migration routes and swim speed; and iv) presumed mortality thresholds and extrapolated population level effects.

10 Sustainable Management of interactions Between Aquaculture and Wild Salmonids (2006) Report prepared for contract number Q5RS-2002-00730 [online]: SUMBAWS Report 1 Oct 2002 - 31 Dec 2005 by Inshore Ireland Publishing - Issuu accessed 25 February 2022.

11 Jackson D, Cotter D, O´ Maoileidigh N, O'Donohoe P, White J, Kane F, Kelly S, *et al.* (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 [online]: https://doi.org/10.1016/j.aquaculture.2011.03.029. accessed 25 February 2022.

12 Vollset KW (2019) Parasite induced mortality is context dependent in Atlantic salmon: insights from an individual-based model. Sci Rep 9, 17377 [online]: https://doi.org/10.1038/s41598-019-53871-2 accessed 25 February 2022.

Although scientific consensus is that sea lice pose a risk to wild salmon under certain conditions, the impact of sea lice from marine finfish farms on the survival of wild salmon is a topical issue which is widely debated due to the lack of unambiguous data to document and quantify the impact.

Recent meticulous and in-depth research into the potential impacts of finfish farming on endangered species, including salmon, in the Puget Sound region in the United States by the National Oceanic and Atmospheric Administration has **found that the effects of farming are not likely to jeopardise the species**.[13] Peer reviewed studies by Canadian and American government scientists found that open-net aquaculture in the Discovery Islands region of British Columbia **poses less than a minimal threat to wild salmon stocks**.[14] Similar empirical research is lacking for Scotland.

The science-led review of the Aquaculture Stewardship Council (ASC) sea lice management standard has resulted in **ASC confirming a lack of scientific justification to support their previous precautionary on-farm sea lice threshold** and a Technical Group concluded there was **no globally agreed "silver bullet" level for precautionary maximum lice levels on farms**.[15]

Marine Scotland Science's latest 2021 summary of evidence[16] is also cited in the consultation to support the assertion that there is significant risk, but this does not seem to be qualified in that document.

Applying terms such as **demonstrated, significant** and **substantial** with poor justification shows a lack of scientific rigour in the interpretation of the evidence, resulting in leading and potentially damaging statements being included in a formal document.

Necessity

In Section 2 of the consultation document – requirement for regulation, the proposal fails to recognise the existing regulatory framework and voluntary measure controls or the resultant performance of the sector in the management of sea lice at marine finfish farms. The suite of legislation under the Aquaculture and Fisheries (Scotland) Act 2007 and Aquaculture and Fisheries (Scotland) Act 2013 added to by the voluntary measures through the Code of Good Practice for Scottish Finfish

13 NOAA (2022) Biological Opinion on the effects of marine finfish rearing facilities in Puget Sound [online]: https://drive.google.com/file/d/1mPef6Qw6hSIykZB3T5JrdfqHWSAfEPl3/view accessed 13 March 2022.

14 [online]: BCSFA_SeaLice-In_DI_FINAL.pdf (bcsalmonfarmers.ca) accessed 13 March 2022.

15 [online]: https://www.asc-aqua.org/wp-content/uploads/2022/02/Revised-Recommendations-for-Indicator-3.1.7-of-the-Salmon-Standard-after-public-consultation-March-April-2021.pdf accessed 13 March 2022.

16 [online]: Impacts of lice from fish farms on wild Scottish sea trout and salmon: summary of science - gov.scot (www.gov.scot) accessed 14 March 2022.

Aquaculture (CoGP) have resulted in rigorous effective maintenance and management of sea lice by the sector.

The performance of the sector in managing sea lice under the existing regulatory and voluntary regimes does not demonstrate a need for further regulation. Reporting data indicates that sea lice levels across the sector have generally been decreasing in recent years, with the sector experiencing the lowest annual sea lice averages in 2018 since detailed records were first published. Averages have remained consistently low since with a sector operational 3 year (2018-20) average female sea lice count of 0.34, and gravid female count of 0.13 over this period, which is below the CoGP thresholds. This general decreasing trend is a result of the sector increasing resources and capacity for sea lice management, and the introduction of new management measures.

From the 2014 Act regulators have a legal duty to follow the strategic code, targeting action only where needed. Clarification regarding the perceived shortcomings of the existing regulatory and voluntary regimes to adequately mitigate the potential risk of sea lice is therefore required to justify the need for further regulatory intervention and demonstrate public sector compliance with the 2014 Act.

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- The rationale behind SG intervention and SG's intended policy outcome has not informed the proposal.
- A policy options appraisal was not undertaken to assess whether alternatives to statutory regulation, such as a change to the industry-led approach, could deliver the intended policy outcome.
- The real-world aims and objectives of the proposed framework have not been defined.
- The potential risk to the wider Scottish salmon population from sea lice is not significant considering that the precautionary principle has already been effectively implemented through the presumption against finfish farming on the North and East coasts, protecting 80% of the Scottish salmon population (including the areas with the highest conservation value) against any potential impact from finfish farming. Therefore, further precautionary management is unwarranted.
- It has not been demonstrated that the sea lice infestation pressure in the farmed area of Scotland poses a significant risk to the conservation status of the Scottish salmon population.

- Performance of the sector under the current legislative and regulatory framework and CoGP has not highlighted any deficiencies in mitigating the potential risk which would warrant further regulatory intervention.

Scientific basis

As defined, the proposed framework depends upon a chain of factors which link farm lice loading through to a population-level effect. This chain is indicated below.

Via this chain, values may be inferred from one another using parameters, assumptions and modelling which are described in the proposal.

Each element relies on various assumptions. Links between these processes and factors are based either on model predictions, or parameter estimates involving a high level of uncertainty. In many cases they are **derived from work in other countries using other model systems, where it has been stated by the authors that there is no reason for assuming that specific values used should carry over to other systems.** Within the framework proposal such values have been used directly and assumed to be broadly applicable where they are unlikely to be.

It is noted that the chain of interlinked factors above omits any reference to lice in the environment which are present due to those hosted on wild fish themselves. Identification of a "natural baseline" would allow clearer interpretation of any calculation related to farm impacts on wild fish.

In particular:

- The link between farm lice load and lice density in the water column can be estimated by modelling. Model predictions may vary dramatically depending on the specific biological parameters applied, boundary forcing and the accuracy of the underlying physical model. Due to limited empirical observations for Scotland, present work is unlikely to provide a clear resolution to this.

- The link between lice density in the water and wild fish infestation pressure depends on physical and biological factors[17]. Work in Norway links modelled water column density with fish lice counts[18], but the authors state that their derived threshold is not absolute, relating only a) to the specific model, conditions and system under investigation, and b) to infestation pressure on sentinel fish only (not freely moving wild fish).
- The link between infestation pressure and mortality in wild fish is also weakly defined and lacks empirical evidence globally. In the Norwegian Traffic Light System (TLS), the present implemented thresholds for effect (upon which all assessments ultimately depend) are based on "expert opinion." This was a key point raised in a recent review of that system[19], which recommended additional empirical work to support (and regular review of) any thresholds implemented.
- The population level effect of specific lice infestation levels is also not well defined. There have been numerous RCTs of salmon smolts treated with anti-lice medicines (with limited studies available in Scotland with inconclusive results). While these studies generally appear to indicate a positive impact of medication, estimates of the impact vary dramatically, with a strong effect only being observed in populations where recapture in general was low[20].
- Attempts linking modelled lice larval density and fish movements with estimated mortality of fish released in RCTs have so far failed to find any correlation[21]. **This clearly warrants further investigation prior to any consideration of a framework based on this type of modelling.**

There is a significant gap in empirical work in Scotland relating to all ecological indicators described above. There are only a few studies (of limited spatial and temporal extent) providing limited insight into whether the suggested links are realised. The exception to this is farm lice loadings, which are already reported weekly across the entire region.

17 Murray AG, 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. Ecol Modell 443:109459.

18 Sandvik AD, Johnsen IA, Myksvoll MS, Sævik PN, Skogen MD (2020) Prediction of the salmon lice infestation pressure in a Norwegian fjord. ICES J Mar Sci 77:746–756.

19 Eliasen K, Jackson D, Koed A, Revie C, Swanson HA, Turnbull J, Vanhatalo J, Visser A (2021) An evaluation of the Scientific Basis of the Traffic Light System for Norwegian Salmonid Aquaculture. Oslo, Norway.

20 Vollset KW, Krontveit RI, Jansen PA, Finstad B, Barlaup BT, Skilbrei OT, Krkošek M, Romunstad P, Aunsmo A, Jensen AJ, Dohoo I (2016) Impacts of parasites on marine survival of Atlantic salmon: a meta-analysis. Fish 17:714–730.

21 Vollset KW, Dohoo I, Karlsen Ø, Halttunen E, Kvamme BO, Finstad B, Wennevik V, Diserud OH, Bateman A, Friedland KD, Mahlum S, Jørgensen C, Qviller L, Krkošek M, Åtland Å, Barlaup BT (2018) Disentangling the role of sea lice on the marine survival of Atlantic salmon. ICES J Mar Sci 75:50–60.

The Norwegian TLS has received considerable attention since its launch, including an ongoing legal challenge. The recent review of the scientific basis of the TLS, completed by a group of internationally renowned academic experts, identified some significant issues that needed to be considered. Findings of the review can be broadly categorised under i) dealing with uncertainty; ii) incorporating expert judgement; iii) knowledge inclusion; iv) external validation; and v) framing in an iterative framework. It is essential that the findings of this review are carefully considered by SEPA and SG with industry and relevant stakeholders, noting that this must be incorporated into the development of a cohesive and integrated regulatory framework as is proposed under the Griggs recommendations to SG.

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- Outputs and thresholds derived from studies elsewhere must not be blindly applied to a new framework for Scotland, as these are not considered to be universally applicable.
- A coordinated programme of modelling and empirical work covering the whole of Scotland must be undertaken to address uncertainties in the inter-linked elements of impact assessment.
- A sustained and coordinated programme of empirical work at a national scale must come prior to attempting to formulate any framework for regulation.
- Any attempt to formulate any framework for regulation, such as the one proposed, must be guided by experts in all the relevant disciplines, such as the expert group set up to review the Norwegian TLS. This would ensure that it is robust, fair, and transparent and that the shortcomings of the Norwegian TLS, as highlighted in the review, are not replicated in any Scottish model-based framework.

Proportionality

The proposed framework aims to manage the risk posed by sea lice to a level of no impact, no increased risk, and no mortality. This is overly precautionary when considering the minimal risk posed by farm-derived sea lice to the wider conservation status of wild salmon. This approach is also inconsistent with the regulation of other pressures faced by wild salmon and is inconsistent with the approach taken within other areas of environmental regulation.

Regulation of other pressures

Due to their large geographic ranges Atlantic salmon are subject to several pressures and disentangling the causes of changes in stocks is extremely challenging.[22] Total mortality reported during early marine migration of salmon post-smolts (up to 5–230 km from the river mouths) in the studies available to date varies between 8 and 71%. This is a life stage with high (and variable) mortality rates, due to both natural and human influences[23].

Evidence suggests that aquaculture is not a determining pressure in the declines in wild salmon populations, as declines have been noted in non-farming countries including USA, Russia, Sweden, Denmark, and Greenland[24], as well as in Scottish areas where there is no interaction with marine finfish farms, such as on the North and East coasts of Scotland[25,26]. The Moray Firth Tracking Project reported higher than expected losses of smolts, with 50% lost in freshwater before reaching the sea, and a further 15% loss in inshore waters.[27] This project indicates a 65% mortality in the outmigration stage alone – in an area where there are no marine finfish farm related pressures.

The current West Coast Tracking Project should provide comparable results for the farmed area. We question why the proposed framework was published in advance of the completion of this project, as well as other projects which aim to inform the potential risks of pressures faced by wild salmon.

The proposed highly precautionary management of the potential risk of farm derived sea lice on a relatively small fraction of the Scottish salmon population is also inconsistent with the management of other pressures. For example, annual salmon catch statistics released by Marine Scotland assume at least 10% release mortality from catch and release angling, a pressure which is accepted in most

22 Marine Scotland (2020) Scotland's Marine Assessment Salmon and Sea Trout [online]: Salmon and sea trout | Scotland's Marine Assessment 2020 accessed 25 February 2022.

23 Thorstad EB, Whoriskey F, Uglem I, Moore A, Rikardsen AH, 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 [online]: https://doi.org/10.1111/j.1095-8649.2012.03370.x accessed 25 February 2022.

24 Torrissen O, Jones S , Asche F, Guttormsen A, Skilbrei OT, Nilsen FT, Horsberg TE, Jackson D (2013) Salmon lice – impact on wild salmonids and salmon aquaculture. Journal of Fish Diseases 36, 3:171-194 [online]: https://doi.org/10.1111/jfd.12061 accessed 25 February 2022.

25 Dadswell M, Spares A, Reader J, McLean M, McDermott T, Samways K, Lilly J (2021) The Decline and Impending Collapse of the Atlantic Salmon (Salmo salar) Population in the North Atlantic Ocean: A Review of Possible Causes. Reviews in Fisheries Science and Aquaculture [online]: https://doi.org/10.1080/23308249.2021.1937044 accessed 25 February 2022.

26 Jaffa M (2021) Merged Data Hides Differences in the Catch Trends of Scottish Salmon. *Aquac Fish Stud* Volume 3,3:1–6 [online]: https://doi.org/10.31038/AFS.2021334 accessed 25 February 2022.

27 Atlantic Salmon Trust (2021) Moray Firth Tracking Project Update [online]: The Moray Firth Tracking Project Update... - The Atlantic Salmon Trust accessed 25 February 2022.

poor conservation status rivers. In rivers with a good conservation status an additional level of mortality is accepted as retention of catches is permitted. In 2019 and 2020 a total of 92,881 fish were caught in the rod fishery with 6,804 fish retained - meaning a conservative estimated total of c.15,000 wild salmon were lost. It is also worth noting that these mortalities occur in the low percentage of the salmon population which have managed to reach maturation and return as wild broodstock (i.e., in many cases these fish are being removed from the rivers before they can breed, with direct implications for population sustainability). Papatheodoulou *et al.* (2022)[28] indicates that even catch and release angling could have adverse effects on reproductive success of salmon.

In the December 2021 RBMP document SEPA states 'Migratory fish are facing significant challenges from a number of pressures, including the effects of climate change, with droughts and higher temperatures threatening their survival. There is an urgent need to support these populations and build resilience where possible to counter these effects. Addressing man-made barriers to migration is a cost-effective, reliable and relatively fast way to achieve this.' Yet 16 years on from the commencement of the RBMP process retention of man-made fish barriers continues to remain an issue with c.20 fish barriers located within the proposal area.

There are also sectors such as hydro-electric power generation where water quantity classification derogations are often made to allow a direct impact on wild fish (e.g., 155km of freshwater habitat classed as high for fish passage remains at moderate status within the Linnhe area). Given the RBMP statements made regarding the effects of climate change on migratory fish there is an acknowledged and accepted negative impact to wild salmon habitat and therefore wild salmon conservation in these affected catchments.

In addition, there is willing acceptance of other pressures impacting on wild fish populations, through:

- non-management of predation species (bird, mammal, and fish). Scotland has continuing increased populations in salmon predator species, and it is notable that in the same year that this proposal is put forward to protect wild Atlantic salmon post-smolts during April and May 50+ applications made in early 2021 by Fisheries Boards and Trusts to permit seal shooting for the protection of wild salmon from predation were refused by SG, including applications made to protect West coast migrating salmon;

28 Papatheodoulou M, Závorka L, Koeck B, Metcalfe NB, Killen SS (2022) Simulated pre-spawning catch and release of wild Atlantic salmon (Salmo salar) results in faster fungal spread and opposing effects on female and male proxies of fecundity. Can. J. Fish. Aquat. Sci. 79: 267–276.

- limited habitat improvement directly within river corridors and within upland areas; and,
- Water quality impacts from extensive land application of fertilisers, pesticides, fungicides, and herbicides (e.g., greater than 1.4M kg of reportable pesticides)[29] continue to be applied on agricultural land with additional quantities non-reported by Forestry and Recreational Land Management sectors.

In conclusion, overregulating a single non-determining pressure is unlikely to result in a demonstrable positive effect on the Scottish salmon stock status, whilst having significant detrimental socio-economic impacts on the salmon farming industry and the communities it operates in (see "Additional consequences and considerations").

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- There has been no systematic study of pressures on wild salmon in Scotland to provide empirical data to inform proportionate regulatory intervention.
- The overly precautionary level of further regulation of sea lice proposed is disproportionate considering current regulation and voluntary measures already in place to mitigate the risk, the low significance of the potential risk to the wider conservation of the Scottish salmon population, and the level of regulation of other pressures faced by wild salmon.
- It is inappropriate to propose to include all marine coastal waterbodies in the farmed area of the west coast in the proposed framework considering that freshwater habitat pressures may be a limiting factor on wild fish populations in a number of freshwater catchments.
- Any risk assessment framework with the aim of protecting wild salmon must consider the full range of pressures if demonstrable outcomes are to be achieved.

Implementation

To discuss implementation of this proposal as it is described is inappropriate and pre-judges the outcome of this consultation. As detailed previously we find the consultation structure is not neutral, being predicated on a presumption in favour of the need for such a framework and evidenced by the presentation of leading questions on which responses are sought.

SEPA were directed by Scottish Government to consult on a spatially adaptive sea lice risk assessment framework for fish farms, not on the implementation of said framework. Despite repeated requests

29 [online]: Pesticide Usage | SASA (Science & Advice for Scottish Agriculture) accessed 13 March 2022.

by the sector to SEPA and Marine Scotland during the presentations given to the sector from May 2019 to November 2021 for a collaborative informed approach to be taken, which was inclusive of expertise held within the finfish sector, limited engagement and inclusion of knowledge was made. Likewise, to enable understanding of this work the sector requested examples of the practical result which would arise from use of the framework at real scenarios, said examples continue to be absent. To release a consultation which discusses implementation and incorporation of regulatory controls without providing any real examples of framework output and its effects is contrary to the regulatory behaviours required to be delivered under the 2014 Act.

Further, the consultation detail within Section 8 and Annex C, added to through recent engagement with SEPA personnel associated with this work indicates that substantial work will be required to be undertaken in respect to this proposal, including details pertinent to the framework and its implementation.

Scottish Sea Farms would wish to be fully included in any such work to ensure as was recommended by those tasked by the Norwegian Government to review the Norwegian TLS that the logical key principles are delivered. That is dealing with uncertainty, incorporating expert judgement, knowledge inclusion, external validation, and framing in an iterative framework.

Reviewing effectiveness

The Better Regulation requirements under the 2014 Act dictate that regulation should ensure the **achievement of measurable outcomes**.

The consultation document does not define measurable outcomes against which the effectiveness of the proposed framework will be assessed.

The outcomes would be derived from the aim which in turn is dependent on the rationale behind SG intervention and their overarching policy intention which, as previously mentioned, are notably absent from the consultation document.

It is not possible to validate the proposed framework without measurable outcomes and it is not appropriate to propose regulation when the effectiveness of regulation cannot be determined.

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- The measurable outcomes against which the effectiveness of the proposed framework will be assessed have not been defined.
- The confidence level that the aim will be achieved has not been ascertained.

Additional consequences and considerations

A broad view of the potential consequences of the proposed framework must be taken to ensure that all relevant considerations are balanced. Relevant considerations include farmed fish health and welfare, veterinary ethics, responsible use of medicines, increased requirement for treatments, sea lice resistance, socio-economic consequences, and operational feasibility.

Farmed fish health and welfare

The proposed framework will result in the management of an unproven theoretical risk to wild fish being prioritised over actual foreseeable harm to farmed fish. This is a direct conflict with animal welfare legislation and one which cannot be condoned.

The proposed framework would result in the need to treat farmed stock for sea lice to comply with a regulatory threshold even when sea lice do not pose a risk of harm to those farmed fish. This threatens fish health and welfare. It also raises ethical concerns for veterinarians as they consider the balance of risks to fish under their care; prescribing an unnecessary treatment directly contradicts the ethical rule "first do no harm". The SEPA remit includes the consideration of wild fish welfare but not that of farmed fish which falls within the remit of the Fish Health Inspectorate (FHI) and the Animal and Plant Health Agency (APHA). The regulatory controls and guidance provided to FHI under the Aquaculture and Fisheries (Scotland) Act 2007 include the consideration of wild fish welfare in the management of sea lice on finfish farms, and as stated previously, the operational practices by finfish farms have led to significantly decreased levels of sea lice on farms.

The core principles of effective and responsible parasitology are rooted in the practices of sea lice management adopted by SSF. An increased requirement for intervention increases the risk of sea lice developing resistance to both medicinal and freshwater treatments which is a cause for concern in terms of both farmed and wild fish interests. Consideration of such damaging consequences of driving further sea lice interventions are omitted from the consultation text.

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- Balancing the protection of wild and farmed fish interests will be far from straight forward, as the SEPA remit includes the consideration of wild fish welfare but not that of farmed fish. In balancing these two priorities, due consideration must be given to the actual, quantifiable risks to both. It is unclear how the proposed framework will interact with the existing role of the FHI and APHA and consultation with these stakeholders is required.
- The proposed framework will result in the requirement for increased sea lice treatments, conflicting with SEPA's medicine minimisation strategy. It is unclear how SEPA intend to balance these two conflicting interests, or whether it has been considered.

Socio-economic

Aquaculture forms a significant and sustainable part of the Scottish economy, contributing to both exports and local communities in mainly vulnerable rural areas of Scotland. Scottish salmon is the UK's biggest food export and supports 2500 direct jobs in Scotland as well as thousands more indirectly. Economic wellbeing is a key national priority and the positive economic effects of the finfish sector on the Scottish economy is of national importance. Such economic wellbeing includes sustainable and responsible expansion of the sector which is crucial to realising Scotland's economic potential as the sector constitutes a significant element of both the "blue economy" and "food and drink" key industries outlined in Scotland's National Strategy for Economic Transformation. The economic transformation strategy also emphasises the aim to ensure that the Scottish economy is more prosperous, more productive, and more internationally competitive.

The National Performance Framework contains an overall purposes and vision for Scotland where public services are aligned, encouraging more effective partnership working. It is aligned with the Programme for Government 2021-2022 which states that the purpose of the Scottish Government is to focus on creating a more successful country with opportunities for all of Scotland to flourish through increased wellbeing, and sustainable and inclusive economic growth.

To help achieve its purpose, the National Performance Framework sets out 'National Outcomes' which describe the kind of Scotland it aims to create. In terms of the economy, the SG states "We have a strong, dynamic and productive economy which creates wealth and employment across Scotland. Our economy is competitive, and we have good international trade, investment and export networks. We are considered an attractive place to do business."

In 2010, Scotland's share of global salmon production was 10%, but by 2020 this had reduced to 6.6%. Some industry experts suggest that Scotland's share could sink as low as 2 or 3% in the next decade.

Even though the global salmon market is growing by 8% a year, Scotland is only managing modest growth of 1.4% per year. This is in contrast with Norway, Faroes and Iceland who have increased their market share, generating economic wellbeing for their nations. Scotland's loss is due, in no small part to the ever-increasing burden of regulation when compared with international competitors, and the significant challenges inherent in constantly trying to adapt and comply with inconsistent, overly precautionary, and often contradictory regulatory regimes.

Scotland has a higher cost of production than other salmon farming nations[30], and the costs attributable to regulatory activities are also higher. This already places considerable pressure on Scotland's salmon farmers, when operating within a global market. Added uncertainty and costs associated with the new framework will further increase uncertainty for external investors, including for those supply chain businesses that already operate within the sector, but also for potential new investors, including those bringing "green" investment and innovation to Scotland, which can support Scotland's goal of becoming net zero by 2045.

The Regulatory Reform (Scotland) Act 2014 requires regulatory functions to be exercised in a way that contributes to achieving sustainable economic growth, except to the extent that it would be inconsistent with the exercise of such functions to do so. The SG has also published statutory guidance for SEPA on its general purpose as introduced by the Regulatory Reform (Scotland) Act 2014, and its contribution towards sustainable development. The SEPA response to a recent FOI (Freedom of Information) request clearly indicates that no Business Regulatory Impact Assessment in respect to this proposal has been made ahead of placing this matter into the public domain. The content of this proposal is also not sufficiently detailed such that an appropriate detailed assessment of the economic impacts can be made by business. This aspect was raised in a meeting with the Sector in November 2021 where specific concerns were expressed at the lack of attention to this being made by SEPA with verbal confirmation by SEPA representatives of no economic impact considerations forming the decision-making processes in this area of regulatory control. It is therefore genuinely concerning that no attempt to address this was made prior to progressing to public consultation.

Implementing a precautionary framework, which seeks no impact or no increased risk, over and above the existing precautionary presumption against marine fish farm developments on the North and East coasts of Scotland does not support the Better Regulation requirement of promoting sustainable

30[online]: Iversen et al. (2020) Production cost and competitiveness in major salmon farming countries 2003-2018. Aquaculture 522: 735089 accessed 13 March 2022

economic growth, and conflicts with the SG's green recovery and economic transformation objectives. Moreover, publication of the consultation document prior to SG finalising their vision for the sector is premature, as the vision should inform policy and regulation of the sector as highlighted in the recent independent regulatory review by Prof. R Griggs[31].

The operational feasibility of the requirement for increased intensive treatments to comply with the proposed framework including the implications thereof described under "Farmed fish health and welfare" as well as the associated financial costs need to be considered.

The WFD prescribes the use of economic principles, such as derogation on grounds of disproportionate costs of mitigation. SEPA have the responsibility to consider the disproportionality principle to ensure that proposed conditions are not disproportionately expensive. Tests to determine whether the costs associated with implementing the proposed framework will be disproportionately high should firstly include an assessment of the technical feasibility of the actions required to achieve the objectives and whether natural background conditions make the achievement of the objectives impossible. Secondly, a cost-benefit analysis must be undertaken to ensure the proportionate distribution of the costs associated with achieving the objectives.

We consider that the following statements are accurate in respect to this proposal and must be addressed:

- SEPA have not assessed whether the claimed benefits of implementing the proposed framework outweigh the inevitable adverse socio-economic consequences.
- SEPA have not assessed whether the claimed benefits of implementing the proposed framework will be disproportionately expensive.
- SG's vision for aquaculture, particularly in terms of the sector growth targets, must be considered.

Concluding remarks

For the avoidance of doubt, we are opposed to the introduction of the proposed framework for the reasons highlighted throughout this response.

There are significant fundamental issues with the underpinning principles of the proposal. The proposal does not align with the legal requirements of the Regulatory Reform (Scotland) Act 2014, nor

31 Griggs R (2022) A Review of the Aquaculture Regulatory Process in Scotland [online]: Aquaculture regulatory process: review - gov.scot (www.gov.scot) accessed 25 February 2022.

the Scottish Regulators' Strategic Code of Practice (of which SEPA is a signatory) as it is not representative of a targeted, proportionate, risk and evidence-based approach to regulation.

The publication of the consultation document prior to SG finalising their vision for the sector is premature. The SG's aspirations for the sector (Aquaculture Vision) must inform regulation of the sector to facilitate the effective delivery of these aspirations.

The review of aquaculture consenting by Prof. Griggs outlines a clear framework for significantly improving the consenting regime for Scottish aquaculture. The review recognises that regulation of aquaculture is not working effectively, and that policy and regulation have become intertwined and need to be separated. We would reiterate these conclusions; it is key that it is Government which makes policy and the sectoral frameworks within which policy operates. Agencies and regulators should then implement, not create policy as a by-product of regulation.

In the absence of the rationale behind SG intervention and SG's intended policy outcome in directing SEPA to formulate the proposed framework, the proposal lacks a clear foundation. The aim and objectives, in terms of the anticipated demonstrable real-world implications, of the proposed framework have not been defined, nor have the measurable outcomes against which the effectiveness of the proposed framework will be assessed.

It is clear from the document and from evidenced statements from the sector and other regulatory bodies we have spoken with that this framework has not been developed in a collegiate and co-operative way that considers and understands the views of others.

The inclusion of regulatory controls on the management of live animals by those without the expertise to understand the impacts on farmed fish is already an area of contradiction under the existing regulatory framework which governs finfish farming. This proposal will lead to further direct conflicting decisions being made by different parts of the regulatory process; this aspect of regulatory conflict is noted in the Griggs review report.

These omissions indicate a lack of critical thinking applied to the formulation of the proposal.

When considering the implementation of regulatory intervention, evidence-based decision making is crucial to ensure that the demonstrable benefits outweigh the consequences. Lack of data will tend to lead to an overly precautionary approach to management, such as the framework currently being proposed, which is in no way proportionate to the potential risk and could have considerable adverse farmed fish health and welfare as well as socio-economic consequences. Lessons from other

jurisdictions must be learned, and the cessation of opinion driven policy and regulatory action must occur.

The example of such opinion driven decisions, as made by Canadian politicians to end fish farming in British Columbia without a robust scientific evidence base is highly relevant to this proposal. Recent US and Canadian peer reviewed scientific studies evidence the less than minimal threat to wild salmon stocks presented by fish farming in BC waters. This is supported by other geographic studies undertaken by the US National Oceanic and Atmospheric Administration and in the recent confirmation of a lack of scientific justification to support the precautionary on-farm sea lice threshold made by the ASC.

As was noted by Prof. Griggs in his independent review into the current regulatory framework for aquaculture 'If you are making a decision or making a judgement on an issue that you do not understand fully, do not interact with often, or sometimes just have no experience of then the caution applied can go beyond what the science or other factors may say'.

We would suggest that the decisions and judgements made to propose this framework have been made on the basis of evidence that is flawed, not representative of the Scottish context and out of date.

The review of aquaculture consenting regulation by Prof. Griggs outlines a clear framework for significantly improving the consenting regime for Scottish aquaculture. All aspects relating to farmed and wild fish interactions, including sea lice, must be transferred into the process recommended by Prof. Griggs.

In the commencement of the aquaculture vision and regulatory review workstreams Scottish Government, SEPA and other regulatory partners have an opportunity to address this matter such that a cohesive and integrated framework for Scottish Finfish farming policy and regulation is delivered.