

RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SALMON FARMING IN SCOTLAND

SUBMISSION FROM PROFESSOR JAMES BRON

Dear members of the Rural Economy and Connectivity Committee,

I write to provide supporting evidence for comments which I made during the REC Committee evidence session convened on 7th March 2018 and to respond to alternative views which have been put forward.

In a recent communication to the REC Committee, Mr Linley-Adams referred to the following statement, which I made during the evidence session:

“...mostly sea lice are under control in Scotland and, as I said, if you look at the data that has been produced there has been no rise in sea lice. So I think there is an impression that there has been a sort of skyrocketing of sea louse numbers but actually, if you look at the average, that’s remained relatively static there...”

The above comment referred back to a statement that I had provided earlier in the same session, in which I indicated that:

“...if you look at the actual figures, and there is a recent paper by Hall and Murray, we can see that actually the numbers of sea lice have not been increasing, and the reason they are not increasing is that we have a lot more tools at our disposal to help us control these pathogens.....”

Mr Linley-Adams questions this in his communication to the Committee, saying that *“...as farm-specific sea lice data is not publicly available, it is not clear what the basis can be for Professor Bron’s statement.”* and asserting that

“what published data there is does not support Professor Bron’s evidence that “mostly sea lice are under control in Scotland””.

Mr Linley-Adams is incorrect. The statements to the Committee which Mr Linley-Adams contests are based on the reported findings of a recent study. This publication is in the public domain and employs data that are also in the public domain, and indeed are used by Mr Linley-Adams in his communication.

My statements to the Committee were informed by:

Hall L.M. and Murray A.G. (2018). Describing temporal change in adult female *Lepeophtheirus salmonis* abundance on Scottish farmed Atlantic salmon at the

national and regional levels. *Aquaculture*, Volume **489**, Pages 148-153 (<http://www.sciencedirect.com/science/article/pii/S0044848617318367>).

The authors of this paper work at Marine Scotland Science (MSS) which is the scientific Division of Marine Scotland, a Directorate of the Scottish Government responsible for the integrated management of Scotland's seas. The authors of the paper are internationally regarded leading statisticians / modellers in their field, and the paper is published in a respected peer-reviewed scientific journal. Having analysed data available at national and regional levels, the authors of this paper concluded in the abstract to their paper that, with regard to sea lice abundance between Dec 2010 and Sept 2017:

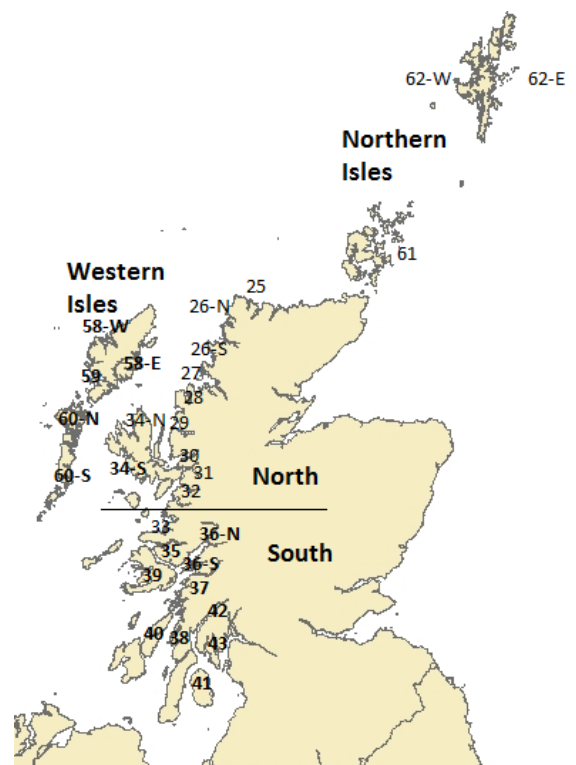
*“...longer-term changes at the national level and for two regions were also detected with **no apparent overall increase occurring over the period.**”* (bolding added).

Which is what I stated to the Committee in evidence.

I would now like to draw the Committee’s attention to other aspects of the analysis presented in this paper, something I did not do in the evidence session due to time constraints.

It can be observed in Figure 2b. (highlighted for the committee in the marked-up copy of the paper accompanying this commentary) that there is an apparent decline in sea lice abundance at the Scottish national level, running from mid-2015 to the last data point in September 2017. I contend that this demonstrates improvement in sea lice control, despite complicating factors such as complex gill disease, and I would argue that this has been achieved through increasingly successful use of a range of non-medicinal management tools e.g. cleaner fish and physical removal methods in addition to use of veterinary medicines.

Regional level models are presented in Hall and Murray’s paper in their Figure 3. These ‘reporting regions’ are shown on map A below, which is taken from an earlier paper by Murray referred to on p149 of Hall and Murray’s paper. Looking at Figure 3 of Hall and Murray’s paper, it can be seen that in the Northern Isles, Western Isles and North Mainland reporting regions there is a trend for relatively little change or even a decline in sea louse abundance. In the South Mainland region there is a slight upward trend in abundance, though it should be noted that there are quite wide confidence bands (dark grey stripe) around the data at this end suggesting higher variability and a less predictable line (*i.e.* the actual abundance might



be higher or lower than that described by the model fit).

Map A. Map showing aquaculture regions in Scotland. From Murray (2016) 'A note on sea lice abundance on farmed Atlantic salmon in Scotland 2011–2013: significant regional and seasonal variation', *Aquaculture Research* [Volume 47, Issue 3](#), pages 961-968, 16 AUG 2014 DOI: 10.1111/are.12554 <http://onlinelibrary.wiley.com/doi/10.1111/are.12554/full#are12554-fig-0001>.

On the basis of the analysis presented by Hall and Murray (2018) I consider it correct to suggest, as stated in my evidence to the Committee, that from a national perspective sea lice are “mostly” under control.

As discussed in the Committee meeting, this control is exerted by the use and gradual improvement of integrated pest management strategies (IPMS) that employ a broad range of tools. The use of multi-component IPMS mean that sea lice control in Scottish fish farming is increasingly less dependent upon, though still requiring, the use of veterinary medicines. This is not to say that the mean numbers of lice per fish can not be improved in the future, or that every farm has been able to keep numbers to a satisfactory level, but overall I consider that the industry in Scotland is making real headway in control of lice.

I do not dispute Mr Linley-Adams’ suggestion that sea lice numbers on some sites exceed nominal “trigger thresholds”. As I indicated in evidence, however, nowhere have these thresholds been scientifically established and, where set very low, farm louse estimates can not easily be statistically validated. However, rather than automatically triggering specific treatments, these are in practice “decision thresholds” that prompt farm staff, health teams, responsible vets and others to make decisions about best management taking into account specific contextual factors (e.g. fish health and welfare state, site parameters, stage of production cycle, presence of other diseases, algal blooms, water temperature, weather considerations etc.). Treatment decisions should not be based simply on *estimated* numbers of adult female lice derived from a small sub-sample of fish.

Mr Linley-Adams included the following quote from the SAMS report in support of his contention that sea lice are not under control in Scotland:

“The main treatment methods used in Scotland are experiencing reduced efficacy in dealing with sea lice on farms. New techniques are being applied, although the long-term success of these is uncertain. The legislative and voluntary frameworks that underpin the management of lice levels on farms are not transparent. They appear neither to be succeeding in controlling sea lice, nor capable of addressing the environmental effects of the lice”

To be clear, in my opinion and based on my scientific knowledge and expertise in this area:

1. While some veterinary medicines show reduced efficacy in some regions / farms, the widespread use of IPMS means that they are rarely the only or main treatment method employed on Scottish fish farms.
2. The wide range of new non-medicinal techniques being applied, including cleaner fish, functional feeds, barrier methods and physical removal techniques, are **currently** proving successful at reducing louse numbers.
3. Whilst the contribution of individual components in IPMS is less clear, the currently-employed range of tools and techniques for the management of sea lice **is** “mostly” controlling sea lice numbers on Scottish fish farms.
4. Whilst it is not feasible that there is **no** environmental impact of sea lice, well-supported evidence for the existence of any significant environmental impact of lice in Scotland is largely lacking. In my view, the ability of existing frameworks to address any environmental impacts of sea lice cannot easily be assessed until that evidence is available

My apologies to the Committee for the lack of specific evidence brought to bear in the latter part of this discussion, which results from the short time allowed for a response to Mr Linley-Adams’ contentions rather than a lack of available evidence. I should nevertheless be happy to answer any further specific questions and to gather and to provide supporting evidence given sufficient time to do so.

Thank you for the opportunity to participate in these discussions.

Professor James Bron, University of Stirling’s Institute of Aquaculture
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