Sea Lice Burdens of Sea Trout at Sound of Shuna, Argyll, 2025

For further information on this report please contact:

Argyll Fisheries Trust
Cherry Park
Inveraray
Argyll
PA32 8XE
Telephone: 01499 302322
E-mail: ak@argyllfisheriestrust.co.uk

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Background

Argyll Fisheries Trust undertook seine net and fyke net surveys in the Sound of Shuna Farm Management Area in summer 2025 to assess burdens of a parasite (Sea lice; *Lepeophtheirus salmonis*) found on sea trout (*Salmo trutta*).

Main findings

- A fixed fyke net sampled 26 seat trout over a period of two weeks, including one week in mid-June and one week in mid-August 2025.
- The survey assessed sea lice burdens on 20 trout under 150 grams (76.9 % of sample) and 6 trout over 150 grams (23.1 % of samples).
- The percentage of trout sampled that were infected by sea lice (prevalence) was 45.0 % for small trout (< 150 g) and 83.3 % for larger trout (> 150 g).
- The total lice-related risk index (Taranger et al., 2015) estimates a moderate sea lice-related risk of increased mortality or premature return to freshwater for smaller trout (19.5 %) and a high sea lice-related risk of increased marine mortality or compromised reproductive potential for larger trout (37.5 %) in 2025.
- The lower number of sea trout collected by the fyke net in 2025 due to reduced sampling effort. The technique provided limited data to estimate the total lice-related risk to sea trout in the Sound of Shuna Management Area.

Acknowledgements

Argyll Fisheries Trust thanks Mowi Scotland Limited and Kames Fish Farming Limited for their assistance and funding of the 2025 study.

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1. INTRODUCTION

Argyll Fisheries Trust conducted surveys of the sea lice burdens of sea trout by fishing a stationary fyke net at Craobh Haven located between Loch Craignish and Loch Melfort over a period of two weeks. One week in mid-June and one week in mid-August 2025. The aims of the surveys were to capture and assess the sea lice burdens of post-smolt sea trout in the Sound of Shuna Farm Management Area. This information is used to inform an Environment Management Plan (EMP) for fish farm operators in the area: Mowi Scotland Ltd. and Kames Fish Farming Ltd. This study will also inform on-going development of the suitability of the fixed net sampling technique in the management area.

Assessing the potential impacts of sea lice on wild migratory salmonids in the Sound of Shuna has been undertaken using a risk index developed within a wider a risk assessment framework for aquaculture in Norway (Taranger et al., 2015). This tool attempts to quantify any increase in sea lice-related marine mortality or return prematurely to freshwater of smaller sea trout and marine mortality or compromised reproductive potential for larger trout. Due to the behaviour of salmon smolts, which migrate rapidly out of the study area, this study concentrates on the sea trout that mostly reside in coastal waters.

The 2025 results have been compared to the results of seine and Fyke net sampling undertaken in five other years (2008, 2009, 2010, 2021, 2022, 2023, and 2024) to compare sea lice infection pressure between years in relation to the production of farm salmon in the Sound of Shuna.

2. METHODS

A coastal fyke net was employed to catch sea trout in the Sound of Shuna fish farm management area over a period of 16 days between the 8th and 13th of June and 12th and 21st of August, 2025.

2.1 Sampling location

The fyke net deployment and sampling of fish was undertaken using a Standard Operating Procedure developed specifically for this type of net (Lochaber Fisheries Trust, 2020). The coastal fyke net consists of a lead and two wing nets which guide fish into a series of funnels via a central area (known as the heart) before entering a residence area which was raised and checked at regular intervals (usually two days fishing time). Fish were removed via a trap door and then sea trout were processed as described in section 2.3. All by-catch was released at the site. The Fyke net was set in one location in 2025, at Traigh nam Musgan (near Craobh Haven) (Table 2.1 and Figure 2.1).

Table 2.1 Net survey site locations 2023

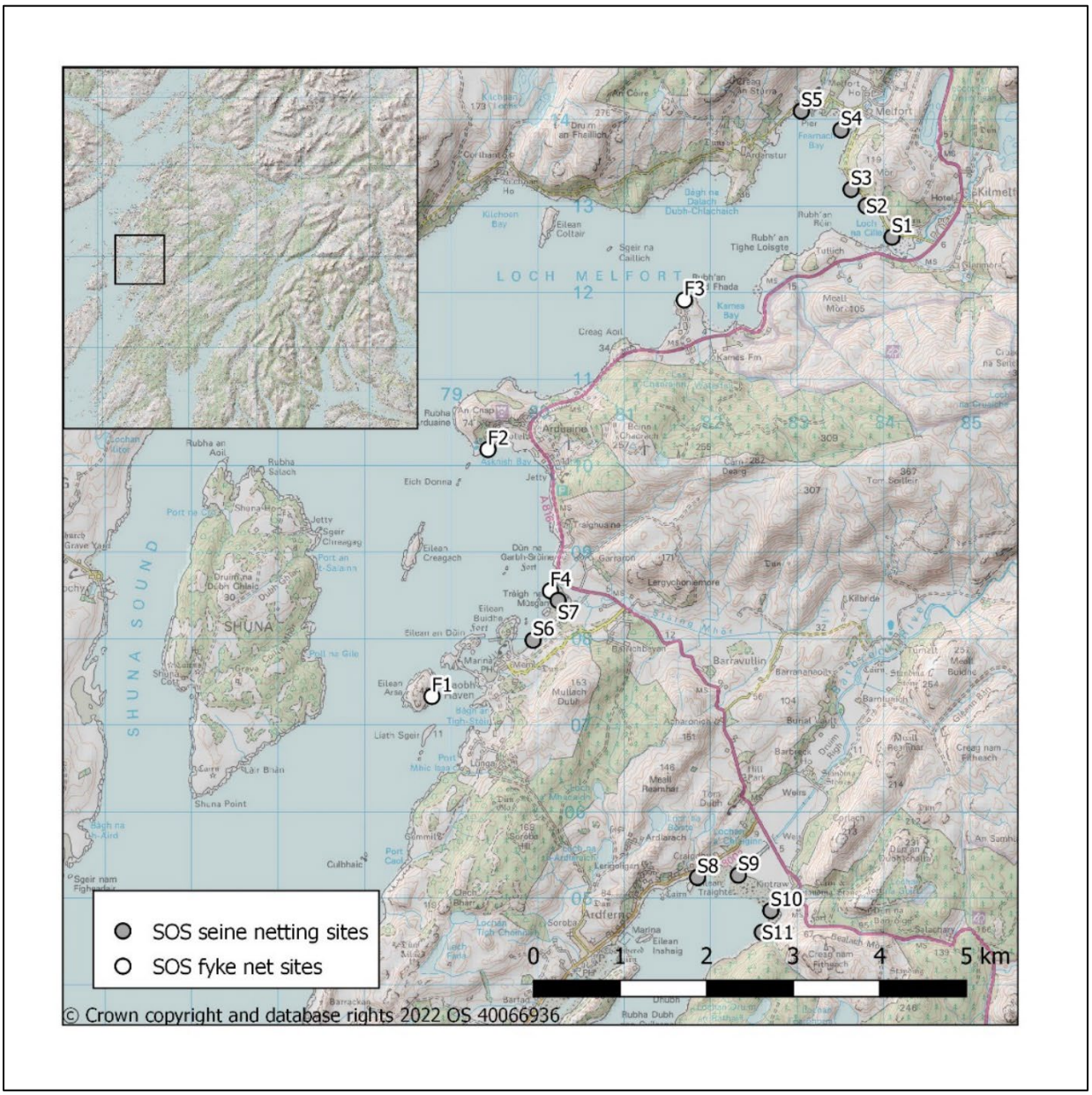
Method	Location	Grid ref	Start	End	No. days
Fyke	Traigh nam Musgan	NM 80145 08547	08/06/25	13/06/25	6
Fyke	Traigh nam Musgan	NM 80145 08547	12/08/25	21/08/25	10
Total					16

2.2 Data recording and analysis

Trout were anaesthetised prior to collection of length and weight information and counts of sea lice were undertaken according to the protocol prescribed by Scottish Fisheries Coordination Centre (SFCC, 2008). Data on the physical characteristics (length and weight) of the trout sampled and their sea lice burdens were recorded to calculate the following:

- Condition factor (K) – coefficient of the condition of the trout (Ricker, 1975).
- Prevalence of lice – number/percentage of trout sampled with a sea lice burden.
- Abundance of lice – the average (mean) number of sea lice per trout.
- Intensity of infection – the average (mean) number of lice per infected trout.
- The proportion of different life-stages of lice – Stage 1 attached (copepodids and chalimus), Stage 2 Mobile (sub-adults and adults excluding gravid females) and Stage 3 Gravid (adult females with eggs) lice stages.

Fig. 2.1 Location of the Sound of Shuna netting sites (2024 – F4)



Analysis was also carried out using the Norwegian risk assessment framework by Taranger et al. (2015) to categorise the increased lice-related risk of marine mortality or premature return to freshwater for individual trout according to the number of lice present in relation to the body weight of the fish (no. lice/g^{-1}).

The framework assumes that small sea trout post-smolts (<150 g body weight) will suffer 100% lice-related marine mortality or return prematurely to freshwater, if they are infected with >0.3 lice

g^{-1} fish weight. Furthermore, the lice-related marine mortality is estimated to be 50% if the infection is between 0.2 and 0.3 lice g^{-1} fish weight, 20% if the infection rate is between 0.1 and 0.2 lice g^{-1} fish weight, and finally 0% lice-related mortality if the salmon lice infection is <0.1 lice g^{-1} fish weight.

For larger sea trout (over 150 g) the risk analysis assumes that increased lice-related mortality or compromised reproduction will be 100% in the group if they have >0.15 lice g^{-1} fish weight, 75% for lice infections between 0.10 and 0.15 lice g^{-1} fish weight, 50% for lice infections between 0.05 and 0.10 lice g^{-1} fish weight, 20% for lice infections between 0.05 and 0.01 lice g^{-1} fish weight, and 0% if the salmon lice infection is <0.01 lice g^{-1} fish weight.

Total increased risk of marine mortality or return prematurely to freshwater or compromised reproduction are calculated as the sum of the increased mortalities separately for each of the different “infection classes” in the sample, reflecting the distribution of the intensity of salmon lice infections of the different individuals sampled. The total risk to each infection class was further scored according to the system proposed by Taranger et al. (2012a); as low (up to 10% estimated increase in mortality), moderate (between 10 and 30% increase), and high (if the increase is calculated as 30% or more).

In two of the three previous years surveys (2008 and 2009) no fish weight data was recorded. To allow comparison with years when weight data was recorded, a weight was allocated to each trout based on the length of each trout and a condition factor of 1.20 K, which is higher than the average of 1.13 K for two previous years (2010 and 2021) when trout were weighed, so assumes the trout that were not weighed were in good condition.

3. RESULTS

The results of the fyke net surveys in 2025 are described below in terms of the characteristics of the sea trout sampled (3.1), the sea lice burdens of sea trout (3.2), risk analysis of sea lice burdens (3.3) and comparison with historical data (2008-2024) (3.4).

3.1 The sea trout sample

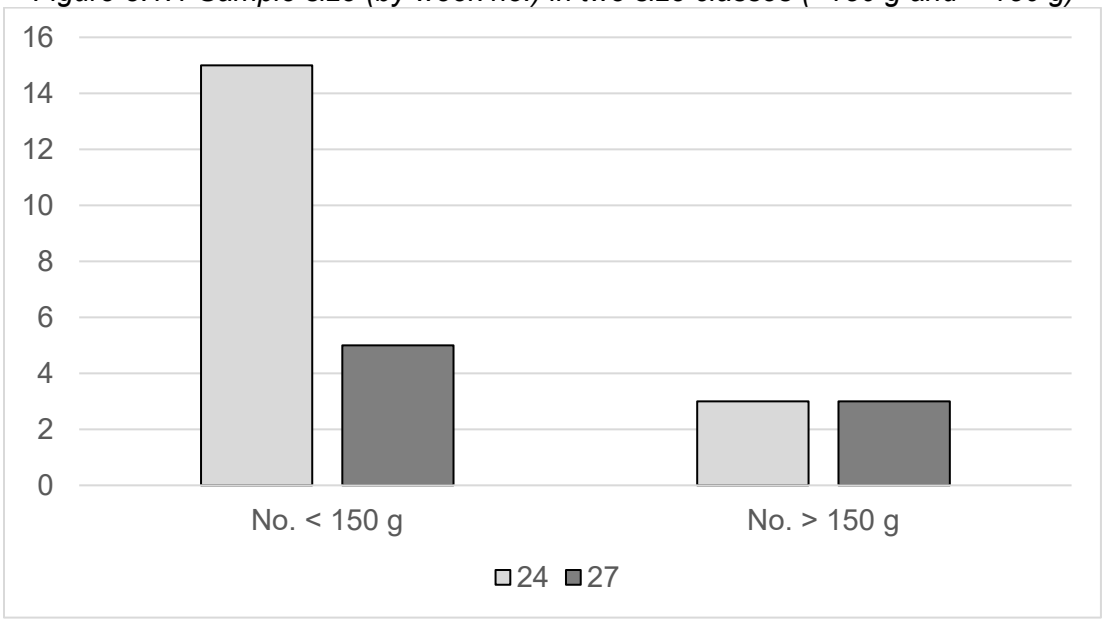
3.1.1 Number of trout

A total of 26 trout were sampled over the two periods. The catch consisted of 20 trout of less than 150 grams wet weight (76.9 % of fish sampled) and 6 trout of more than 150 grams (23.1 % of samples) (Table 3.1.1 and Figure 3.1.1). Total sample numbers ranged from 18 trout in week 24 and eight trout in week 34.

Table 3.1.1 Number and size of trout sampled and analysed (2025)

Week no.	No. Trout	No. < 150 g	No. > 150 g	< 150g (%)	> 150g (%)
24	18	15	3	83.3	16.7
34	8	5	3	62.5	37.5
All Trout	26	20	6	76.9	23.1

Figure 3.1.1 Sample size (by week no.) in two size classes (<150 g and > 150 g)



3.1.2 Characteristics of sea trout

The average length (mm), weight (g) and condition factor (K) of the trout sampled in the surveys are described below in Table 3.1.2.

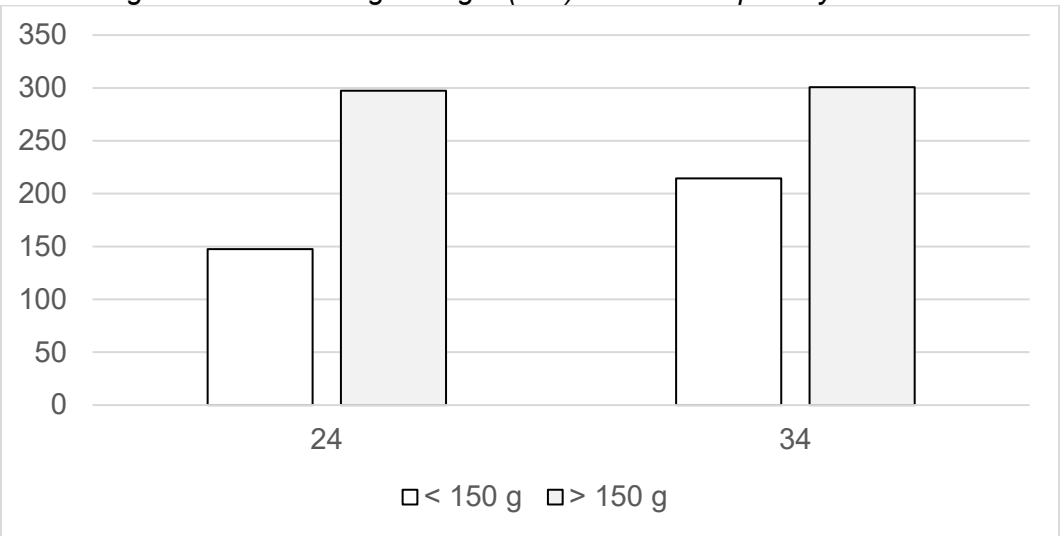
Table 3.1.2 Average length (mm), weight (g) and condition factor (CF) (K) of trout

Week no.	< 150 g			> 150 g			All Trout		
	Length (mm)	Weight (g)	C.F. (K)	Length (mm)	Weight (g)	C. F. (K)	Length (mm)	Weight (g)	C. F. (K)
24	147.47	34.45	1.05	297.33	275.00	1.04	172.44	74.54	1.05
27	214.40	103.36	1.04	300.67	328.33	1.05	246.75	187.73	1.04
All Trout	164.20	51.68	1.05	299.00	301.67	0.98	195.31	109.37	1.05

3.1.2.1 Length of sea trout

The average length of trout (Figure 3.1.2.1) of less than 150 g ranged from 147.7 mm in week 24 (mid-June) to 214.4 mm in in week 34 (mid-August) with a mean of 164.20 mm. The average length of trout of more than 150 g ranged from 297.3 mm in week 24 to 300.7 mm in week 34 with a mean of 299.0 mm.

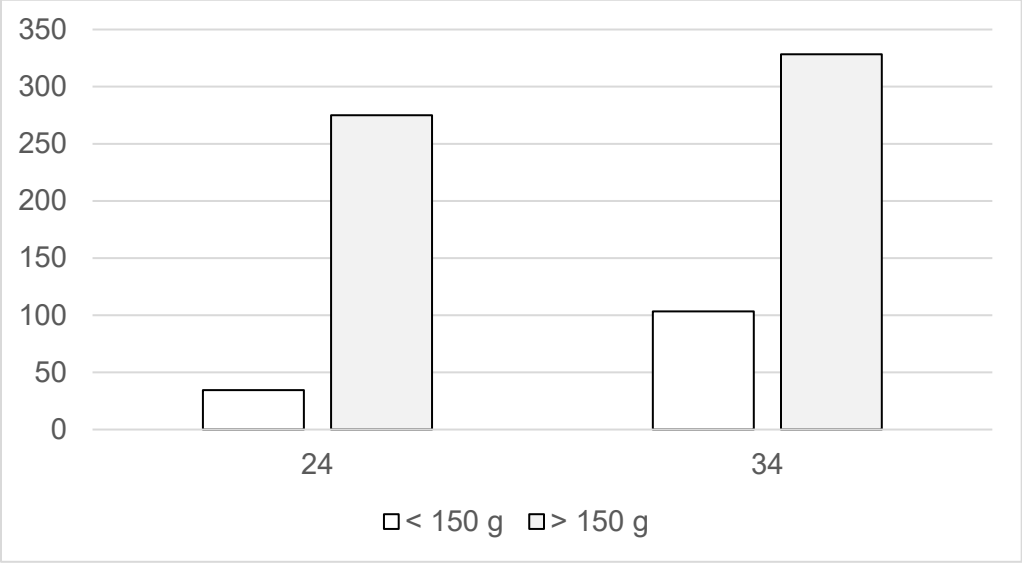
Figure 3.1.2.1 Average Length (mm) of trout sampled by week no.



3.1.2.2 Weight of sea trout

The average weight of trout (Figure 3.1.2.2) of less than 150 g weight ranged from 34.5 g in week 24 to 103.4 g in week 34 with a mean of 51.68 g. The average weight of trout of more than 150 g weight ranged from 275.0 g in week 24 to 328.3 g in week 34 with a mean of 301.7 g.

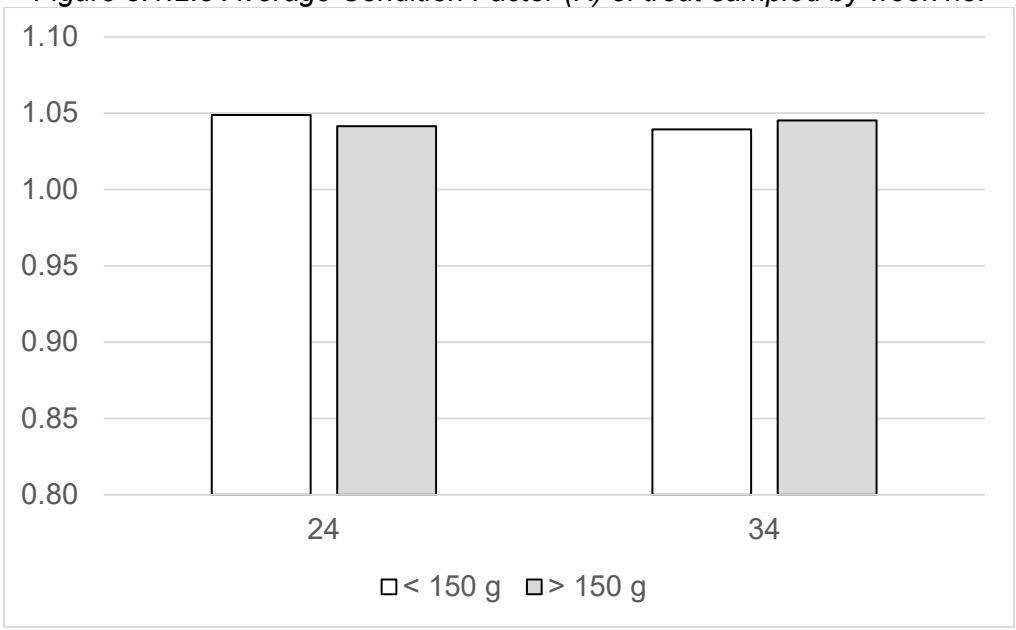
Figure 3.1.2.2 Average Weight (g) of trout sampled by week no.



3.1.2.3 Condition factor of sea trout

The condition factor (CF) of trout (Figure 3.1.2.3) of less than 150 g weight ranged from 1.05 K in week 24 to 1.04 K in week 34 with a mean of 1.05 K. The average condition factor of trout of more than 150 g weight ranged from 1.04 K in week 24 to 1.05 K in week 34 with a mean of 1.04 K.

Figure 3.1.2.3 Average Condition Factor (K) of trout sampled by week no.



3.2 Sea lice burdens of sea trout

The sea lice burdens of sea trout sampled in 2025 are summarised in terms of the prevalence of lice (% of fish infected), abundance of lice (average number of lice per fish) and intensity of infection (average number of lice per infected fish) below (Table 3.2.1). The analysis included first attached (stage 1), mobile (stage 2) and gravid female (stage 3) sea lice.

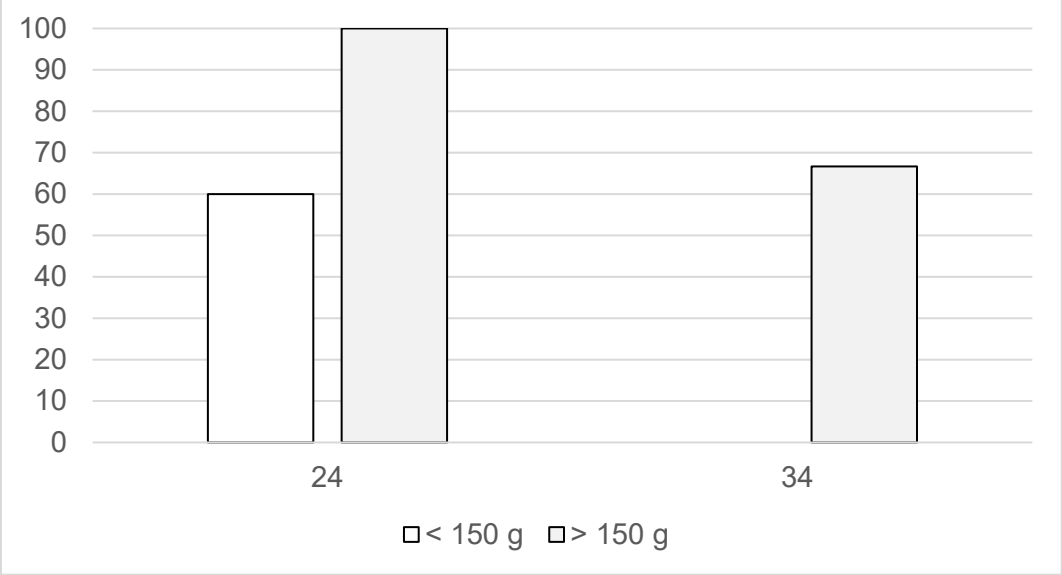
Table 3.2.1 Sea lice burdens of sea trout 2025

Week no.	< 150 g			> 150 g			All Trout		
	Preva-lence	Abund-ance	Intensity	Preva-lence	Abund-ance	Intensity	Preva-lence	Abund-ance	Intensity
24	60.00	8.60	14.33	100.00	18.33	18.33	66.67	10.22	15.33
34	0.00	0.00	0.00	66.67	6.67	10.00	25.00	2.50	10.00
All Trout	45.00	6.45	14.33	83.33	12.50	15.00	53.85	7.85	14.57

3.2.1 Prevalence of sea lice

The mean percentage of trout less than 150 grams weight infected by lice (Figure 3.2.1) was 45.00 % (range 0.0 to 60.0 %) and the percentage of trout more than 150 grams weight infected by lice was 83.3 % (range 66.7 to 100 %).

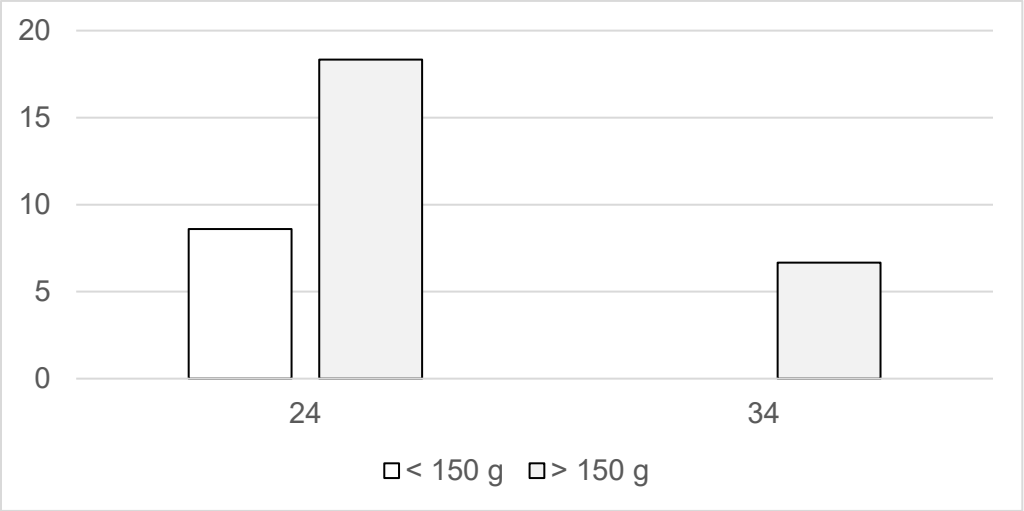
Figure 3.2.1 Prevalence of sea lice infection (% of all trout) by week no.



3.2.2 Abundance of sea lice

The mean abundance of lice found on all trout under 150 grams weight (Figure 3.2.2) was 6.45 lice (range 0.0 to 8.6 lice) and the mean abundance of lice found on all trout over 150 grams weight was 12.50 lice (range 6.7 to 18.3 lice).

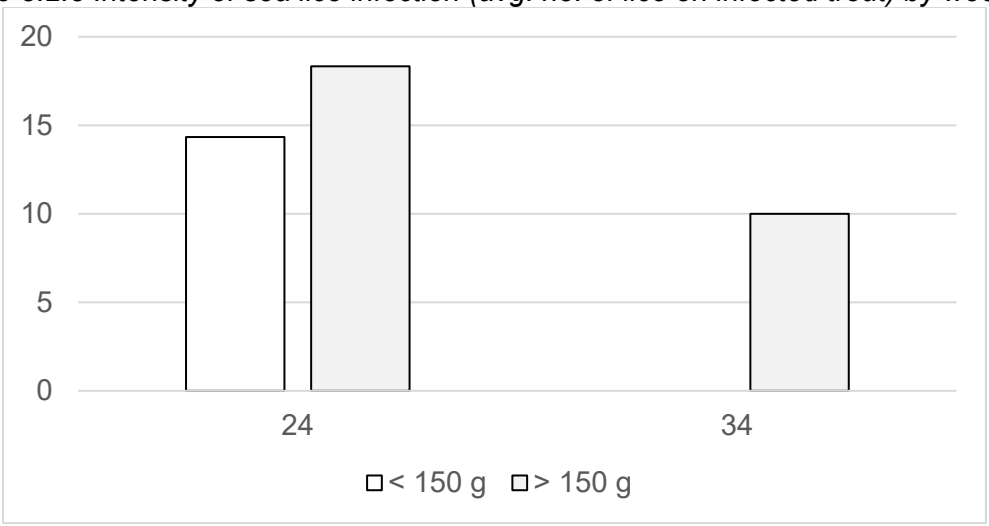
Figure 3.2.2 Abundance of sea lice (avg. no. of lice on all trout) by week no.



3.2.3 Intensity of sea lice infection

The mean intensity of infection found on all trout under 150 grams weight (Figure 3.2.3) was 14.33 lice (range 0.0 to 14.3) and the mean intensity of infection found on all trout over 150 grams weight was 15.00 lice (range 10.0 to 18.3 lice).

Figure 3.2.3 Intensity of sea lice infection (avg. no. of lice on infected trout) by week no.



3.2.4 Life-stage of sea lice

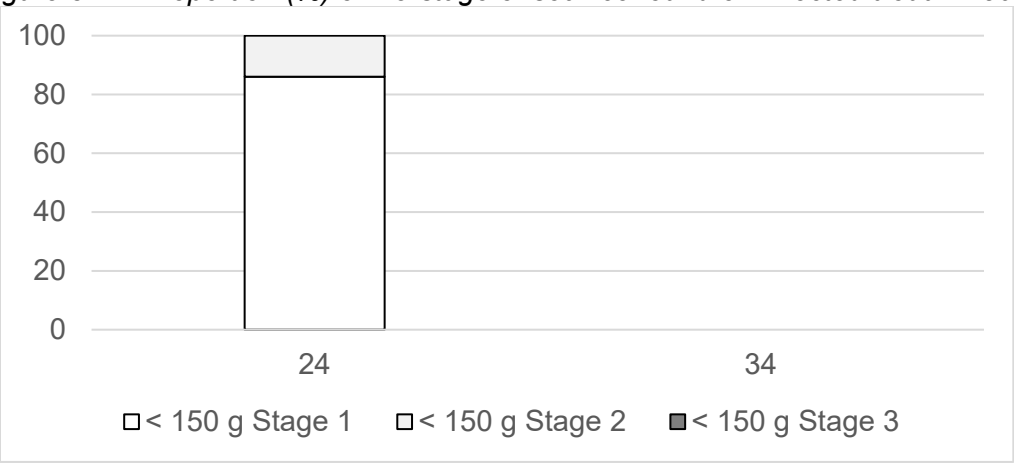
The proportion of the number of each life-stage of sea lice recorded are described below (Table 3.2.2) for trout under and over 150 grams weight. The three stages of lice recorded were attached (stage 1), mobile (stage 2) and gravid female (stage 3).

Table 3.2.2 Proportion of each life-stage of sea lice found on sea trout

Week no.	< 150 g			> 150 g		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
24	86.0	14.0	0.0	69.1	30.9	0.0
34	0.0	0.0	0.0	50.0	35.0	15.0
All Trout	86.0	14.0	0.00	64.0	32.0	4.0

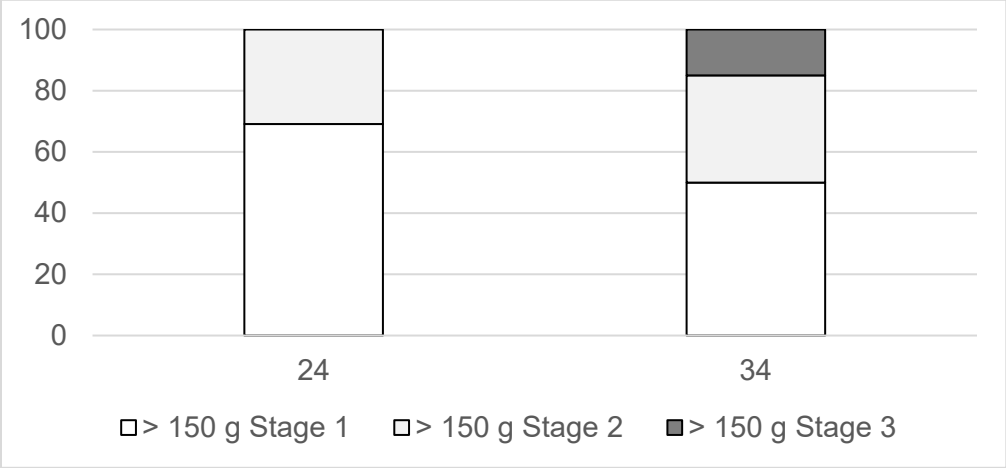
Of the lice found on trout under 150 grams (Figure 3.2.4), the proportion of attached sea lice (stage 1) ranged from none in week 34 to 86.0 % in week 24 with a mean of 86.0 % across all trout under 150 grams. The proportion of mobile sea lice (stage 2) ranged from none in week 34 to 14.0 % in week 34 with a mean of 14.0 %. No gravid sea lice (stage 3) were found on the group of smaller sae trout.

Figure 3.2.4 Proportion (%) of life-stage of sea lice found on infected trout < 150 g



On trout over 150 grams (Figure 3.2.5), the proportion of attached sea lice (stage 1) found ranged from 50.0 % in week 34 to 69.1 % in week 24 with a mean of 64.0 %. The proportion of mobile sea lice (stage 2) ranged from 30.9 % in week 24 to 35.0 % in week 34 with a mean of 32.0 %. The proportion of gravid female mobile sea lice (stage 3) ranged from none in week 24 to 15.0 % in week 34 with a mean of 4.0 % across all trout over 150 grams weight.

Figure 3.2.5 Proportion (%) of life-stage of sea lice found on infected trout > 150 g



3.3 Risk analysis of sea lice burdens

The lice-related risk of marine mortality or return prematurely to freshwater was calculated based on the number of lice per gram of fish weight separately for trout above and below 150 grams weight.

3.3.1 Average lice per gram fish weight

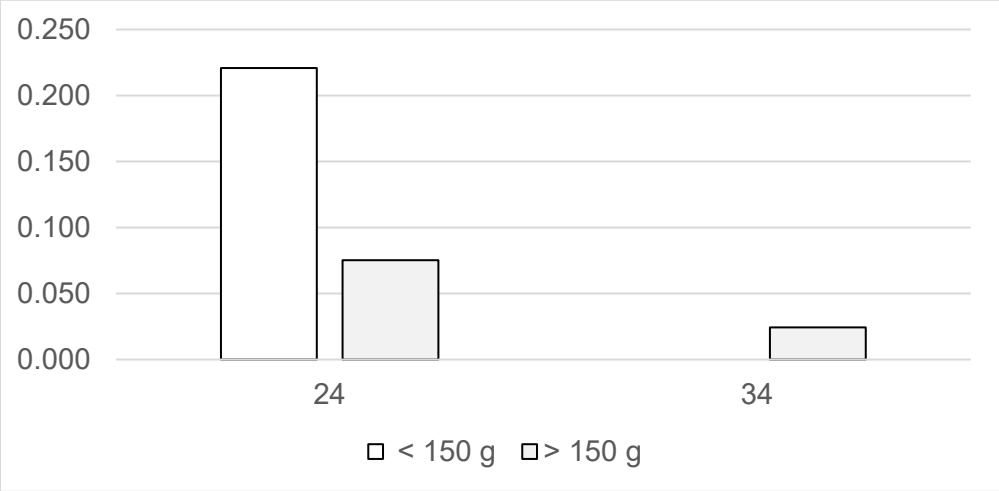
The average lice per gram of fish weight (lice / g^{-1}) is given for fish in both weight categories (above and below 150 grams weight) and across all fish sampled in each survey below (Table 3.3.1 and Figure 3.3.1).

Table 3.3.1 Sea lice burdens found on sea trout (Avg. no. lice/g^{-1})

Week no.	< 150 g	> 150 g	All trout
24	0.221	0.075	0.197
34	0.000	0.024	0.009
All Trout	0.166	0.078	0.139

The average number of sea lice per gram found on trout under 150 grams ranged from none in week 34 to 0.221 in week 24 with a mean of 0.166 lice per gram. The average number of sea lice per gram on trout over 150 grams ranged from 0.024 in week 34 to 0.075 in week 24 with a mean of 0.078 lice per gram. The number of sea lice per gram on all fish sampled averaged 0.139 lice per gram.

Figure 3.3.1 Sea lice burdens found on sea trout (Avg. no. lice/g⁻¹) by week



3.3.2 Risk analysis for trout under 150 grams weight

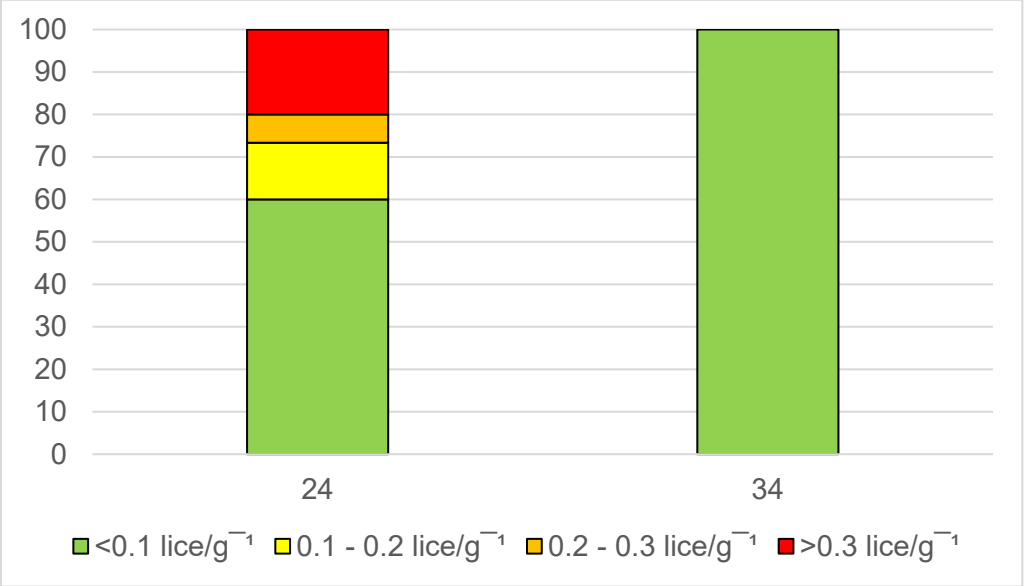
The average sea lice burden per gram of fish weight (for sea trout under 150 grams) is categorised below using the salmon lice risk index described by Taranger et. al. (2015). This is shown as a proportion of fish which fell into each category on each sample date (Table 3.3.2 and Figure 3.3.2).

Table 3.3.2 Lice-related risk index for trout < 150g (2025)

Week no.	Proportion (%) of sea trout (<150g) which fell into each risk assessment category				Total Risk (%)
	<0.1 lice/g⁻¹	0.1 - 0.2 lice/g⁻¹	0.2 - 0.3 lice/g⁻¹	>0.3 lice/g⁻¹	
24	60.00	13.33	6.67	20.00	26.0
34	100.00	0.00	0.00	0.00	0.0
All < 150g	70.00	10.00	5.00	15.00	19.5

The percentage of smaller trout (<150 g) which had a burden of <0.1 lice/g⁻¹ ranged from 60.0 % in weeks 24 to 100 % in week 34 and 70.0 % across all smaller trout. The percentage of smaller trout which had between 0.1 – 0.2 lice/g⁻¹ ranged from none in week 34 to 13.3 % in week 24 % and 10.00 of all smaller trout. The percentage having between 0.2 – 0.3 lice/g⁻¹ ranged from none in week 34 to 6.7 % in week 24 with 5.0 % of all smaller trout. The percentage of smaller trout which had > 0.3 lice/g⁻¹ ranged from none in week 34 to 20.0 % in week 24 and 15.0 % across all smaller trout.

Figure 3.3.2 Lice-related risk index for trout as the proportion (%) of trout < 150g (by week no.)



The Total lice-related risk is calculated as the sum of the increased additional risk of marine mortality or early return to freshwater in the sample (Table 3.3.2 and Figure 3.3.4). The Total lice-related risk ranged from none (0.0 %) in week 34 to 26.0 % in week 24 and 19.5 % across all smaller trout sampled. The total risk to smaller trout were therefore categorised as being moderate (between 10 and 30% total lice-related risk).

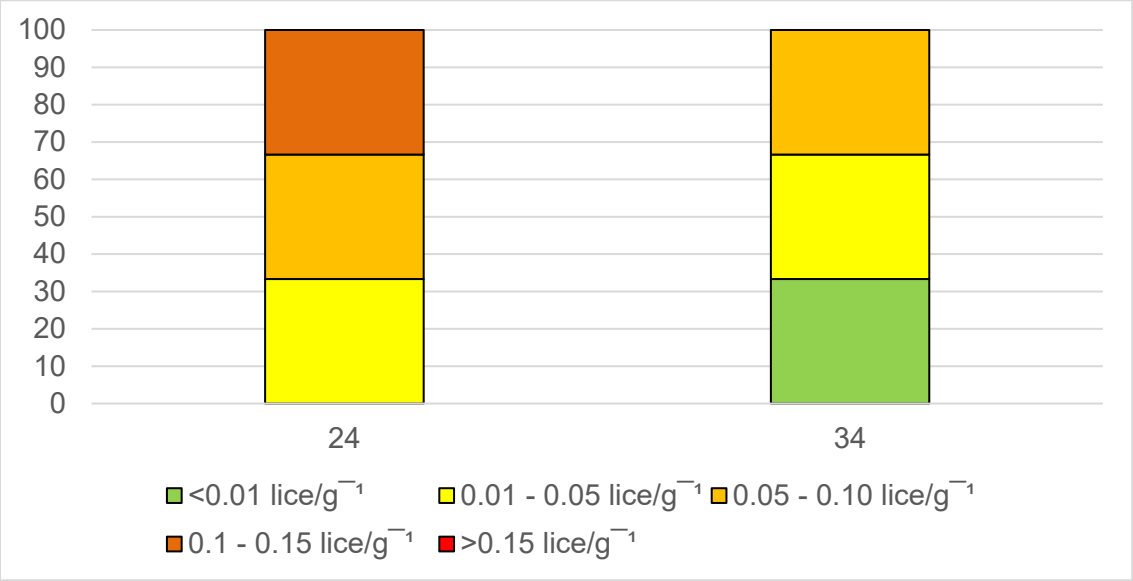
3.3.3 Risk analysis for trout over 150 grams weight

The average sea lice burden per gram of fish weight (for sea trout over 150 grams) is categorised below using the salmon lice risk index described by Taranger et. al. (2015). This is shown as a proportion of fish which fell into each category on each sample date (Table 3.3.3 and Figure 3.3.3). The proportion of larger trout that had a burden of <0.01 lice/g^{-1} was none (0.0 %) in week 24 and 33.3 % in week 34 and 16.7 % of all larger trout. The percentage of trout which had between 0.01 – 0.05 lice/g^{-1} was 33.3 % in weeks 24 and 34. The percentage of trout which had between 0.05 – 0.10 lice/g^{-1} was 33.3 % in weeks 24 and 34. The proportion of larger trout that had between 0.10 – 0.15 lice/g^{-1} was none (0.0 %) in week 34 and 33.3 % in week 24 and 16.7 % for all larger trout. No larger trout sampled had over 0.15 lice/g^{-1} in 2025.

Table 3.3.3 Lice-related risk index for trout > 150g

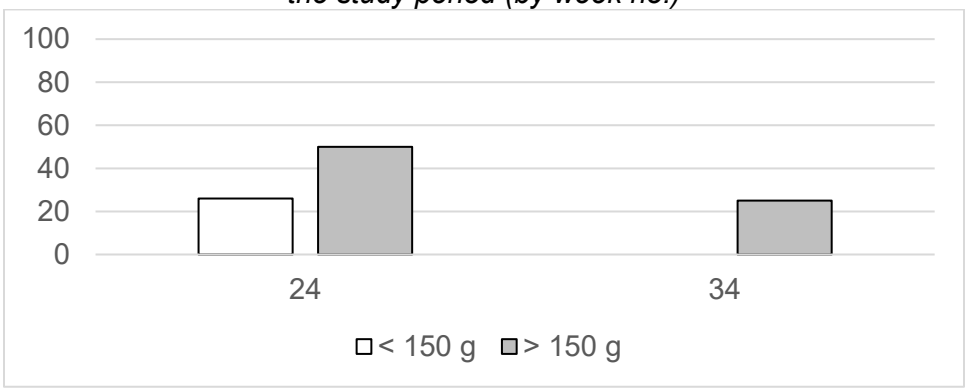
Week no.	Proportion (%) of sea trout (>150g) which fell into each risk assessment category					Total Risk
	<0.01 lice/g^{-1}	0.01 - 0.05 lice/g^{-1}	0.05 - 0.10 lice/g^{-1}	0.1 - 0.15 lice/g^{-1}	>0.15 lice/g^{-1}	(%)
24	0.00	33.33	33.33	33.33	0.00	50.0
34	33.33	33.33	33.33	0.00	0.00	25.0
All > 150g	16.67	33.33	33.33	16.67	0.00	37.5

Figure 3.3.3 Lice-related risk index for trout as the proportion (%) of trout > 150g (by week no.)



The total lice-related risk is calculated as the sum of the increased mortalities in the sample (Table 3.3.3 and Figure 3.3.4). Total lice-related mortality for trout over 150 grams ranged from 25.0 % in week 34 to 50.0 % in week 24 and was 37.5 % across all larger trout sampled. The total lice-related risk for larger trout was therefore described as high (> 30 % mortality) in 2025.

Figure 3.3.4 Total lice-related risk for smaller and larger trout as the proportion (%) sampled over the study period (by week no.)



3.4 Comparison of historical data

A comparison of previous survey results can be made to provide additional context for the 2025 survey results. Trout over 150 grams were sampled only in 2021, 2022, 2023, 2024 and 2025 while trout under 150 grams were sampled in all seven survey years between 2008 and 2025 (Table 3.4.1).

3.4.1 Number of trout

The number of trout sampled under 150 grams ranged from one in 2010 to 126 in 2022, with an average of 30.1 trout per year over the study period. The number of larger trout sampled, ranged from none (2008-10) to 16 in 2022 with an average of 5.3 larger trout (Table 3.4.1).

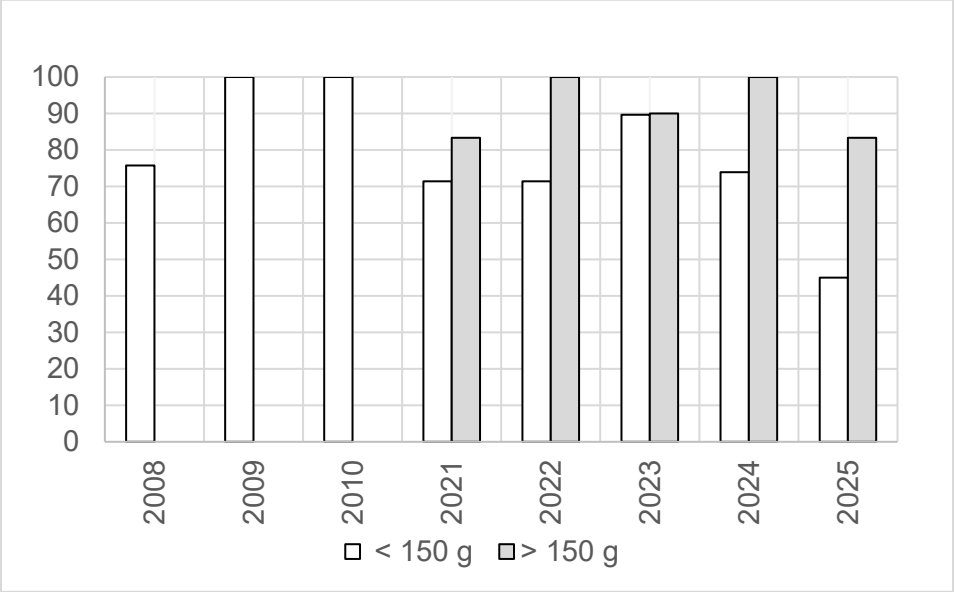
Table 3.4.1 Number of trout sampled and analysed (2008-2025)

Year	< 150 g				> 150 g			
	No. Trout	Prevalence (%)	Abund-ance	Intensity	No. Trout	Prevalence (%)	Abund-ance	Intensity
2008	33	75.8	7.6	10.0	0			
2009	2	100.0	2.5	2.5	0			
2010	1	100.0	7.0	7.0	0			
2021	7	71.4	20.7	29.0	6	83.3	15.0	18.0
2022	126	71.4	5.3	7.4	16	100.0	7.9	7.9
2023	29	89.7	28.0	31.2	10	90.0	17.6	19.6
2024	23	73.9	14.2	19.2	4	100.0	37.0	37.0
2025	20	45.0	6.5	14.3	6	83.3	12.5	15.0
Avg.	30.1	78.4	11.5	15.1	5.3	91.3	18.0	19.5

3.4.2 Prevalence of sea lice

The percentage of trout under 150 grams infected by sea lice (Table 3.4.1 and Figure 3.4.2) ranged between 45.0 % (in 2025) and 100 % in 2009 and 2010, averaging 78.4 % across all trout sampled. The percentage of trout over 150 grams infected by sea lice ranged between 83.3 % in 2021 and 2025 and 100 % 2022 and 2024 and averaged 91.3 %.

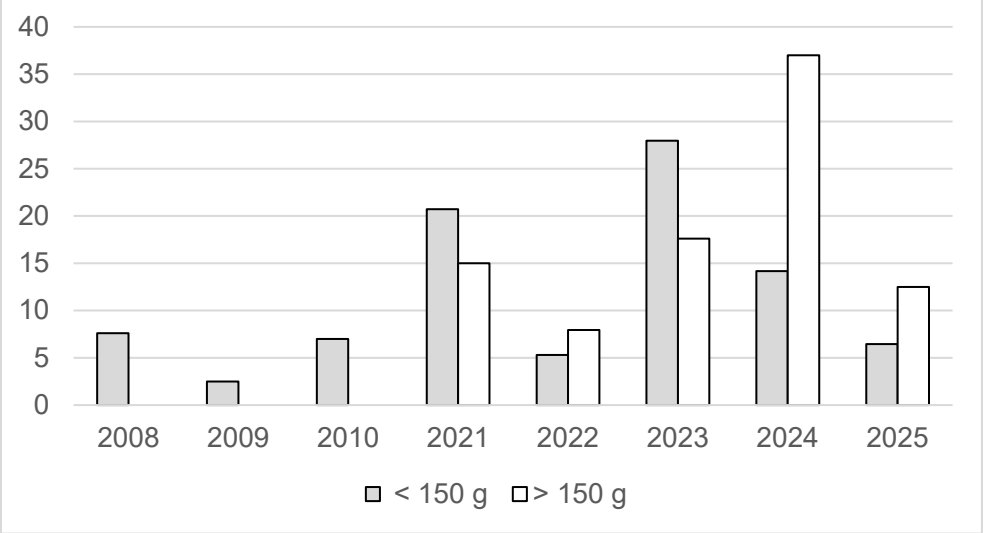
Figure 3.4.2 Prevalence of sea lice (%) found on sea trout (2008-2025)



3.4.3 Abundance of sea lice infection

The average number of sea lice (Table 3.4.1 and Figure 3.4.3) found on all trout under 150 grams ranged from 2.5 lice in 2009 to 28.0 lice in 2023, averaging 11.5 lice over the study period. The abundance of lice on trout over 150 grams ranged between 7.9 lice in 2022 and 37.0 lice in 2024 and averaged 18.0 lice between 2021 and 2025.

Figure 3.4.3 Abundance of sea lice (no. of sea lice) found on sea trout (2008-2025)

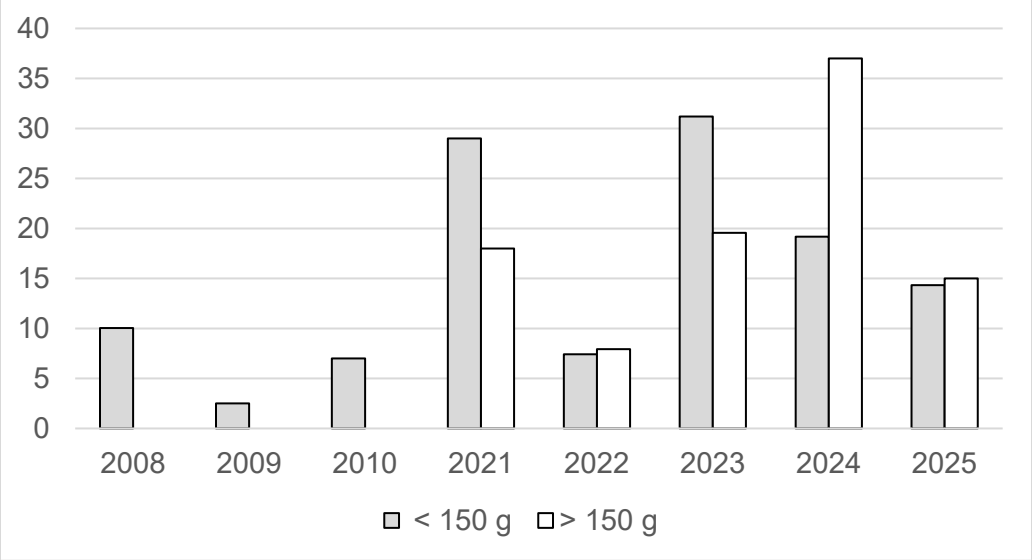


3.4.4 Intensity of sea lice infection

The average number of sea lice found on infected sea trout (Table 3.4.1 and Figure 3.4.4) under 150 grams ranged from 2.5 lice in 2009 to 31.2 lice in 2023, averaging 15.1 lice over the study

period. The intensity of infection on trout over 150 grams ranged from 7.9 lice in 2022 to 37.0 lice in 2024 with a mean of 19.5 lice across the study period.

Figure 3.4.4 Intensity of infection (no. of sea lice) found on trout (2008-2025)



3.4.5 Comparison of lice-related risk index for trout under 150 grams (2008-2025)

Of the smaller trout sampled over the study period 2008 – 2025, the proportion of trout that had a lice burden of less than 0.1 lice/g^{-1} ranged from none in 2010 to 100 % in 2009 and averaged 50.8 % across all surveys (Table 3.4.2 and Figure 3.4.5).

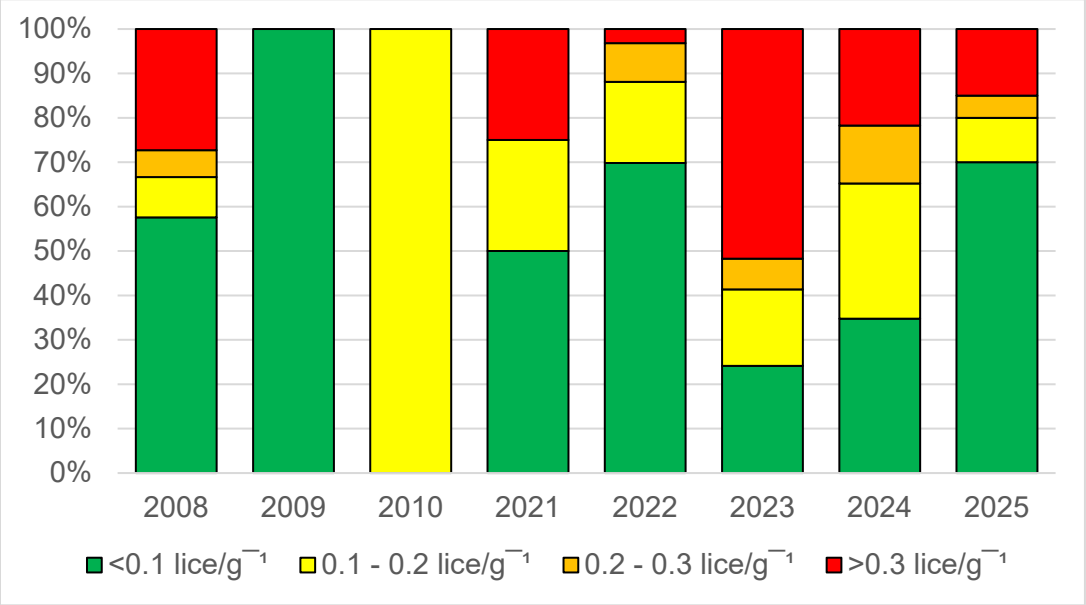
Table 3.4.2 Lice-related risk for trout < 150 grams (2008-2025)

Year	Proportion (%) of sea trout (<150g) which fell into each risk assessment category				Total Risk (%)
	<0.1 lice/g^{-1}	0.1 - 0.2 lice/g^{-1}	0.2 - 0.3 lice/g^{-1}	>0.3 lice/g^{-1}	
2008	57.6	9.1	6.1	27.3	32.1
2009	100.0	0.0	0.0	0.0	0.0
2010	0.0	100.0	0.0	0.0	20.0
2021	50.0	25.0	0.0	25.0	30.0
2022	69.8	18.3	8.7	3.2	11.2
2023	24.1	17.2	6.9	51.7	58.6
2024	34.8	30.4	13.0	21.7	34.3
2025	70.0	10.0	5.0	15.0	19.5
Avg.	50.79	26.25	4.97	17.99	25.72

The proportion of smaller trout that had a burden between 0.1 and 0.2 lice/g^{-1} ranged from none in 2009 to 100 % in 2010 and averaged 26.3 % across all years. The proportion of smaller trout

that had between 0.2 and 0.3 lice/g^{-1} ranged from none in three samples to 13.0 % in 2024 and averaged 5.0 %. The proportion of smaller trout that had more than 0.3 lice/g^{-1} ranged from none in 2009 and 2010 and 51.7 % in 2023 and averaged 18.0 % over the study period.

Figure 3.4.5 Lice-related risk as % of samples under 150 grams (2008-2025)



3.4.5 Comparison of lice-related risk index for trout over 150 grams (2008-2025)

Of the larger trout sampled over the study period (2021 to 2025 only), the proportion of larger trout that had a lice burden of less than 0.01 lice/g^{-1} ranged between none in 2024 and 31.3 % in 2022 and averaged 18.92 % across all surveys (Table 3.4.3 and Figure 3.4.6).

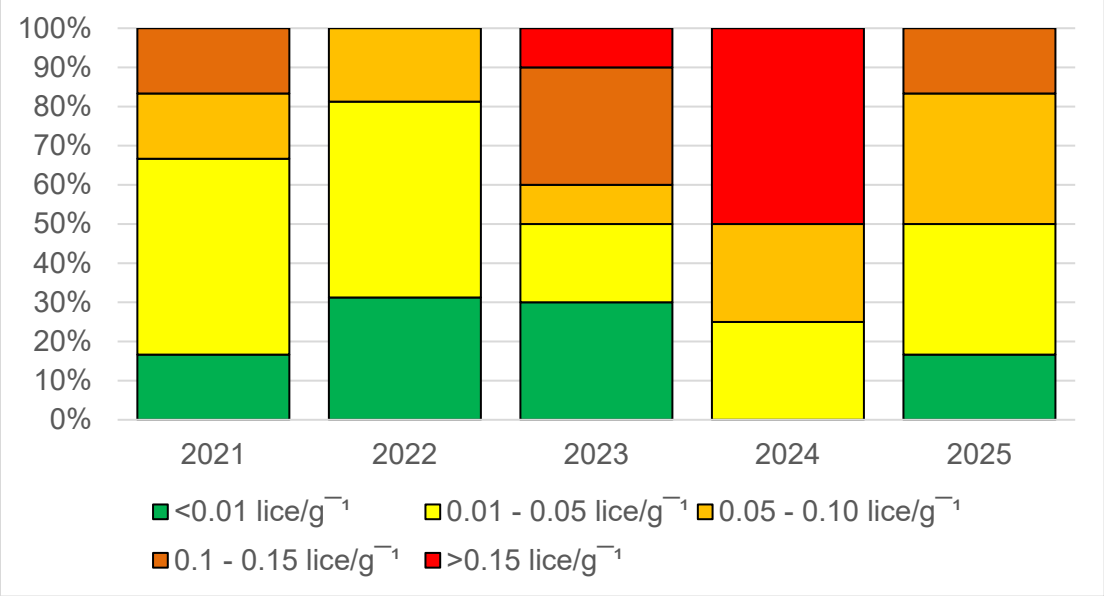
Table 3.4.3 Lice-related risk for trout >150 grams (2008-2025)

Year	Proportion (%) of sea trout (>150g) which fell into each risk assessment category					Total Risk
	<0.01 lice/g^{-1}	0.01 - 0.05 lice/g^{-1}	0.05 - 0.10 lice/g^{-1}	0.1 - 0.15 lice/g^{-1}	>0.15 lice/g^{-1}	(%)
2021	16.7	50.0	16.7	16.7	0.0	33.3
2022	31.3	50.0	18.8	0.0	0.0	21.9
2023	30.0	20.0	10.0	30.0	10.0	42.5
2024	0.0	25.0	25.0	0.0	50.0	68.8
2025	16.7	33.3	33.3	16.7	0.0	37.5
Avg.	18.92	35.67	20.75	12.67	12.00	40.79

The proportion of larger trout that had a burden between 0.01 and 0.05 lice/g^{-1} ranged between 20.0 % in 2023 and 50.0 % in 2021 and 2022 with a mean of 35.7 %. The proportion of larger trout

that had between 0.05 and 0.10 lice/g⁻¹ ranged between 10.0 in 2023 and 33.3 % in 2025 and 20.8 % across all years. The proportion of larger trout that had between 0.1 and 0.15 lice/g⁻¹ ranged between none in 2022 and 2024 and 30.0 % in 2023 and 12.67 % across all years. No larger trout were found to have more than 0.15 lice/g⁻¹ in 2021, 2022 and 2025, 10 % in 2023 and 50 % in 2024, averaging 12.0 % across all four years.

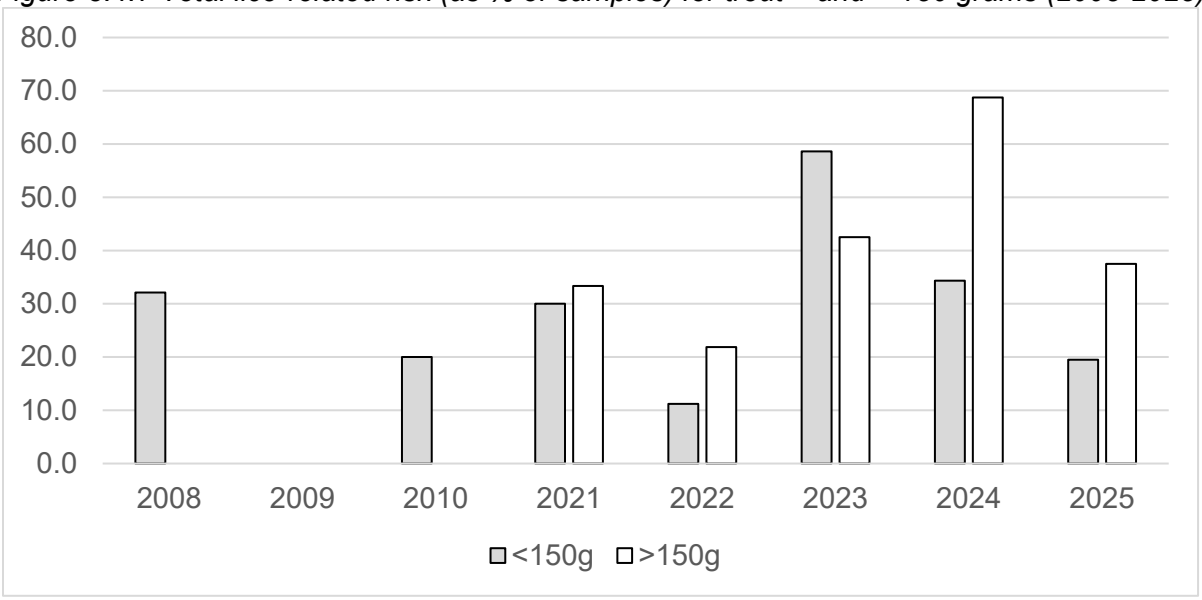
Figure 3.4.6 Lice-related risk as % of samples over 150 grams (2008-2025)



3.4.6 Comparison of total lice-related risk for trout under and over 150 grams (2008-2025)

The total lice-related risk is calculated as the sum of the increased mortalities in the sample. Total lice-related risk for trout under 150 grams (Table 3.4.2 and Figure 3.4.7) was estimated to be high (> 30% total risk) in 2008 (32.1 %), 2021 (30.0 %), 2023 (58.6 %) and 2024 (34.3 %), moderate (between 10 and 30 %) in 2010 (20 %), 2022 (11.2 %) and 2025 (19.5 %) and low risk (< 10 % total risk) in 2009 (0%). Total lice-related risk for larger trout (Table 3.4.3 and Figure 3.4.7) was estimated to be high (> 30 %) in 2021 (33.3 %), 2023 (42.5 %), 2024 (68.8 %) and 2025 (37.5 %) moderate (between 10 and 30 %) in 2022 (21.9 %).

Figure 3.4.7 Total lice-related risk (as % of samples) for trout < and > 150 grams (2008-2025)



4 DISCUSSION

4.1 Factors affecting the number of trout

The number and size of trout sampled by the survey may be influenced by several factors, including survey location, method, and timing. The 2021 surveys sampled relatively few trout in both the mobile seine net and the fixed fyke net sampling. The 2022 seine net surveys also caught few trout, but the fyke net caught 142 trout throughout its deployment over eight weeks at Traigh nam Musgan in 2022. The redeployment of the fyke net at the same site in 2023 over a period of five weeks caught 30 trout and 27 trout in 2024 in seven weeks. In comparisons, the 2025 survey caught 26 trout in two weeks. While the 2025 survey did not collect the target number of 30 trout, it suggests that a further week would likely produce the target number of samples.

Data collected from numerous sites over several years in the region suggest sea trout post-smolts remain relatively close to river estuaries for the first few weeks after entering the sea before dispersing more widely as the summer progresses. This dispersal behaviour of post-smolts in the sea may be seen in this survey as the highest catches were found in June in all years. Limited sampling effort in May 2024 caught just one trout (possibly due to the cold weather), while the limited sampling in August and September also caught trout at times when rain and elevated flows in the nearby freshwater catchment may have attracted trout into the area. Outside of the wetter weather events, sampling sea trout in significant numbers becomes more difficult later in the summer. The September sampling in 2022 was hampered by the amount of bycatch, particularly shoals of Mackerel, which caused the net to become less manageable, caused damage to sea trout in the net and attracted predators to the site. Therefore, fishing the net later in the summer and early autumn may not be sustainable in terms of conserving fish stocks in the area.

4.2 Sea lice burdens of sea trout

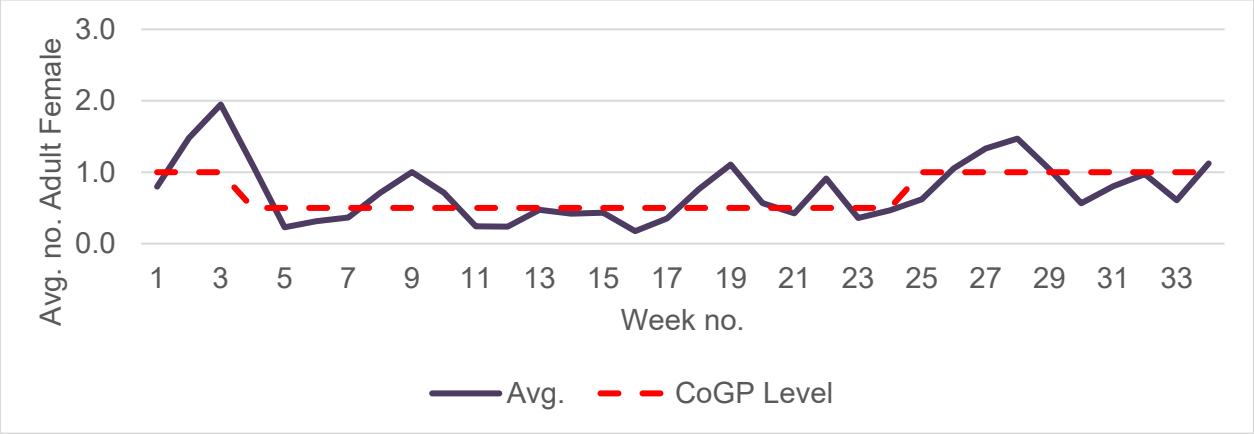
The average number of sea lice per gram of fish weight found on the smaller trout (20 trout of less than 150 grams) sampled in 2025 suggest that burdens of lice decreased between June and August. The lice present on smaller trout appeared to consist of a high proportion (average of 86 %) of the first-attached life-stage of sea lice (stage 1) in June, which suggest that there was a significant infection pressure from sea lice, but no pressure of infection in August. The larger trout were also found to have a higher proportion of first-attached (stage 1) lice (average 64 % of lice) suggesting that the infection pressure affected trout from both groups in both visits.

4.3 Factors affecting the lice-related risk for sea trout

Environmental factors impacting the reproduction of sea lice and the distribution of larvae can influence sea lice numbers found on sea trout at the survey site. The influence of these many factors may vary significantly from year-to-year making it difficult to attribute the influence of any specific environmental factor on sea lice burdens found on sea trout. Anthropogenic influences on sea lice larvae in the environment such as fish farms are more easily identified and can be managed through a variety of on-farm lice control methods. The number of potential hosts for sea lice at fish farm sites and the average number of adult female sea lice (i.e., the reproductive stage) per fish on the farm can be calculated and therefore their potential influence on the results of surveys can be estimated. The number of lice on farm fish generally tend to increase over time during a farm's production cycle and therefore, the number of lice larvae present in the environment is expected to be higher in the second year of the production cycle.

In summer 2025, published sea lice data for salmon farms (through Scottish Government's Aquaculture website) show that average adult female lice numbers (abundance) on farmed fish in the Sound of Shuna farm management area were higher than the Industry's Code of Good Practice (CoGP) 0.5 adult female lice per fish level (Figure 4.3.1) in 12 weeks between weeks 1 and 33. It is important to note that the thresholds set under the Industry's CoGP are predicated on farmed fish health and are not designed to protect wild fish.

Figure 4.3.1 Average adult female sea lice (no. lice per fish by week no.) on farms and estimated for wild sea trout, weeks 1 to 33, 2025



The lice burdens found in 2025 appear to be of moderate risk to the health of sea trout and of high risk to larger trout when analysed by the methods described by Taranger. When analysed week-to-week, risk was moderate (10-30 %) for smaller trout in week 24 but fell to a low risk (< 10 %) in week 34. Sea lice-related risk to larger trout was high in both weeks, however, the location of the fyke net close to the estuary may affect the lice burdens found on smaller trout after rain if they had remained at the site compared to larger trout which may be more mobile. More frequent sampling is likely to have provided a more robust information on the dynamics of the infestation of lice on wild sea trout to better inform future management.

4.4 Sampling site and method considerations for future monitoring

The risk analysis assumes that individuals caught in the study are representative for the sea trout populations in the area, which may originate from several different rivers in the Sound of Shuna Farm Management Area. The location of the fyke net survey site that sampled most of the trout, is close to the estuary of Staing Mhor, a coastal stream which sea trout are likely to use for spawning and juvenile recruitment. Therefore, the fyke net may have sampled a higher proportion of trout originating from this river and therefore could be less representative for those populations of trout originating from rivers located further away from the survey site. Despite this potential bias, the site provided a much higher number of samples than other sites trialled in the management area which can be used to provide an assessment of potential effects of aquaculture on wild sea trout. It may be productive to sample other sites with similar physical characteristics, although the current location is close to the shore base at Craobh Haven which allow easier access to the sampling site at Traigh nam Musgan.

The risk analysis is also not able to identify the proportion of the population that are resident or have returned to the site to shed lice or visit the site for short periods. The datasets from other sampling sites do suggest that relatively high numbers of trout with no or relatively low lice burdens are sampled at sites close to estuaries, suggesting that smaller trout do normally inhabit these estuarine sites in the late spring and early summer period. The surveys sample fish that have not ventured very far from the estuary and therefore may have a reduced risk of infection. The fyke net locations used in 2021 were further away from estuaries but did not catch sufficient numbers of trout to make a reliable analysis of sea lice on local sea trout populations. The 2022 and 2023 surveys did however sample a higher proportion of larger trout, providing some indication that the technique can be useful in monitoring the lice burdens on the larger trout that are thought to be more transient and more likely to accumulate a lice burden over time. The location of the fyke net

may be crucial in sampling enough trout to make the findings more conclusive and therefore gathering information on the movement of trout in the Sound of Shuna may be key to ensuring that monitoring efforts provide sufficient samples from which to draw firm conclusions. Acoustic tags and receivers could be used to track the movements of individual sea trout to better identify potential sampling sites and understand any differences in the risk of infection to different age groups of trout over a wider area.

The results of the 2022 to 2025 surveys suggest that sampling using the fyke net over a period in the summer months has potential to provide sufficient samples to assess the sea lice burdens of trout in the Sound of Shuna Management Area.

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Appendix I – Sampling data

Sampling			Sea trout			Sea Lice				
Date	count	Fish No.	Length (mm)	Weight (g)	Condition factor	1	2	3	Total	Lice / gram^{-1}
09/06/25	1	1	164	42	0.952	0	0	0	0	0.000
09/06/25	2	2	157	44	1.137	0	5	0	5	0.114
09/06/25	3	3	292	223	0.896	20	12	0	32	0.143
09/06/25	4	4	165	45.2	1.006	8	0	0	8	0.177
09/06/25	5	5	157	40.2	1.039	0	0	0	0	0.000
09/06/25	6	6	315	332	1.062	2	2	0	4	0.012
09/06/25	7	7	132	25	1.087	0	0	0	0	0.000
09/06/25	8	8	145	29	0.951	19	6	0	25	0.862
09/06/25	9	9	184	62.5	1.003	28	6	0	34	0.544
09/06/25	10	10	142	28	0.978	8	0	0	8	0.286
09/06/25	11	11	139	25.1	0.935	0	0	0	0	0.000
09/06/25	12	12	285	270	1.166	16	3	0	19	0.070
11/06/25	13	1	140	26.8	0.977	2	0	0	2	0.075
11/06/25	14	2	133	23.6	1.003	0	0	0	0	0.000
12/06/25	15	1	137	25	0.972	0	0	0	0	0.000
13/06/25	16	1	134	23.1	0.960	1	0	0	1	0.043
13/06/25	17	2	145	39.3	1.289	1	1	0	2	0.051
13/06/25	18	3	138	37.9	1.442	44	0	0	44	1.161
13/08/25	19	1	207	102.5	1.156	0	0	0	0	0.000
15/08/25	20	2	390	640	1.079	0	7	3	10	0.016
20/08/25	21	3	257	171	1.007	0	0	0	0	0.000
20/08/25	22	4	255	174	1.049	10	0	0	10	0.057
21/08/25	23	5	205	85.3	0.990	0	0	0	0	0.000
21/08/25	24	6	235	136.5	1.052	0	0	0	0	0.000
21/08/25	25	7	210	85	0.918	0	0	0	0	0.000
21/08/25	26	8	215	107.5	1.082	0	0	0	0	0.000