Caol Mor Management Area EMP Report

2024 Wild Fish and Sea Lice Monitoring Programme

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EXECUTIVE SUMMARY

- As part of the Mowi Caol Mor Environmental Management Plan (EMP), sea trout and sea lice monitoring programmes were conducted in Loch Sligachan and the greater Caol Mor area in the spring of 2024, while electrofishing surveys were carried out in the Rivers Sligachan, Broadford and Strathmor.
- The spring estuarine fyke nets set in the estuary of Loch Sligachan caught the lowest number of sea trout recorded since 2019.
- The spring coastal netting session that occurred in the greater Caol Mor area near Sconser Quarry caught 10 sea trout, demonstrating that the net could effectively catch sea trout in this location.
- Predation attacks are the biggest threat to fish caught in the coastal fyke net, further investigation into the sampling site location is needed.
- Sea lice burdens were more elevated on fish caught in the coastal fyke net, with juvenile lice densities of up to 94 individuals recorded on a single sea trout.
- Sea trout populations were expected to experience a Moderate risk of sea lice-related marine mortality given the observed sea lice burdens on sampled fish at the time of the survey.
- Most electrofishing sites in the Rivers Sligachan and Broadford met the national benchmark for juvenile salmon densities in 2024.
- The Strathmor River could have experienced an unsuccessful spawning season in the winter of 2023. No salmon fry were caught at any of the survey sites in 2024 and limited juvenile trout were seen in the lower reaches of the river.
- Salmonid densities in this area are at low enough levels that any additional negative impacts from environmental and anthropogenic influences in freshwater and marine habitats, like elevated sea lice burdens, could result in severe and harmful effects on local fish populations. Every effort should be made to limit the risks facing salmon and trout in the SLRT area.

1.0 INTRODUCTION

This document summarises the overall findings of native salmonid population monitoring conducted on the Isle of Skye in the Loch Sligachan area and in the Rivers Sligachan, Broadford, and Strathmor as part of an Environmental Management Plan (EMP) for the Mowi Scotland Caol Mor management area (Figure 1.1). National Grid References (NGR) for each location relevant to this document can be found in the table below (Table 1.1).

Catchment/Site	National Grid Reference (NGR)
Caol Mor farm	NG 56752 31036
Cairidh farm	NG 56071 28939
Sconser Quarry farm	NG 56282 32261
Scalpay farm	NG 64033 28804
Broadford River	NG 64154 23618
River Sligachan	NG 49379 30877
Strathmore River	NG 56436 22410

Table 1.1. List of NGR for relevant sites in the general Sligachan/Caol Mor area, freshwater catchments and associated sea lochs monitored as part of this EMP.

The EMP work programme was agreed between Mowi and the Skye and Lochalsh Rivers Trust (SLRT) in 2024 and SLRT conducted the work reported here. The salmonid species monitored for this EMP are *Salmo salar* (Atlantic salmon) and *Salmo trutta* (brown trout).

The purpose of this work programme was to gather information on current juvenile salmonid densities in the Rivers Sligachan, Broadford and Strathmor using electrofishing methods, and monitor local anadromous brown trout populations (hereafter referred to as sea trout) in the marine environment in the Caol Mor management area.

During the marine monitoring work, special focus was given to the sea lice burdens of captured sea trout, specifically *Lepeophtheirus salmonis* and *Caligus elongatus*. There is a large body of scientific research that demonstrates that the presence of open net-pen salmonid aquaculture can result in increased densities of sea lice in the surrounding water column (Thorstad et al., 2015; Shephard et al., 2016). Wild salmonids migrating through and feeding in areas where salmonid aquaculture is present are exposed to the increased parasite levels, which can lead to elevated lice burdens (Taranger et al., 2015). High parasite loads on a wild salmonid can result in physiological damage, a decline in fish health and condition, and ultimately lead to increased levels of mortality amongst wild fish populations (Ives *et al*., 2023).

This monitoring work aims to identify impacts (short- and long-term) affecting wild salmonids that could be related to salmon farming activity in the Caol Mor area and to provide data to inform responsive adaptive management procedures delivered by local Mowi teams.

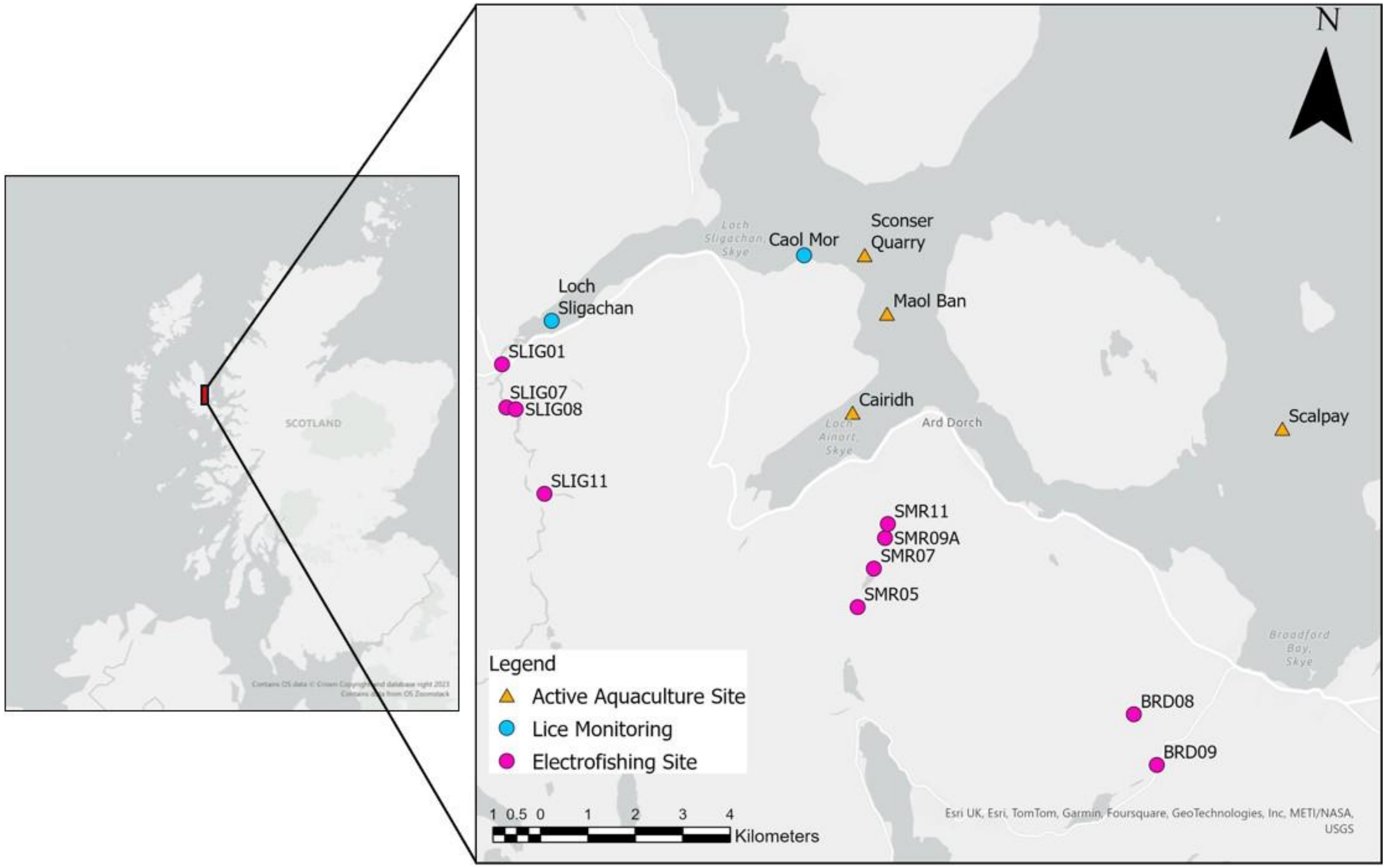

Figure 1.1. Site map with the Mowi Scotland Caol Mor farms, SLRT sea trout monitoring sites, and electrofishing sites identified.

The agreed 2024 Caol Mor EMP programme included three sea trout monitoring surveys, aiming to capture as many anadromous salmonids as possible per survey and a day of electrofishing at historical sites in each of the three identified rivers (Figure 1.1).

2.0 METHODS

2.1 Sea trout and sea lice monitoring

In the agreed EMP work plan, sea trout and sea lice monitoring was to occur using two types of netting methods in two different locations in the Caol Mor area in the spring of 2024, and a third survey was scheduled to occur later in the summer (Table 2.1). SLRT has categorised any sampling that occurs between 1st April-15th June as part of the spring survey period, while sampling that occurs between 16th June-30th September is classed as part of the summer survey period.

Survey site	Survey method	Date	Location (NGR)
BRD08	Electrofishing	06 September 2024	NG 61970 22560
BRD09	Electrofishing	17 July 2024	NG 62450 21496
SLIG01	Electrofishing	07 September 2024	NG 48648 29939
SLIG07	Electrofishing	07 September 2024	NG 48740 29029
SLIG08	Electrofishing	07 September 2024	NG 48937 28996
SLIG11	Electrofishing	07 September 2024	NG 49543 27207
SMR05	Electrofishing	18 September 2024	NG 56142 24820
SMR07	Electrofishing	18 September 2024	NG 56489 25630
SMR09A	Electrofishing	18 September 2024	NG 56717 26280
SMR11	Electrofishing	18 September 2024	NG 56779 26571
Caol Mor Shoreline	Coastal fyke net	27-31 May 2024	NG 55014 32238
Sligachan estuary	Estuarine fyke net	15-18 May 2024	NG 49695 30857

Table 2.1. Monitoring site locations, sampling methodologies and 2024 survey dates.

2.1.1 Estuarine fyke netting

In previous years, sea trout monitoring has occurred in the intertidal zone of Loch Sligachan using small estuarine fyke nets. While this has been an effective methodology for catching salmonids in the springtime, particularly sea trout post-smolts, it was not as effective during the summer months and it was agreed in 2023 that this method would only be used during the spring season.

Two 1-metre high estuarine fyke nets were deployed in the intertidal zone of Loch Sligachan from 15th-18th May, one facing upstream and one facing downstream. Further use of additional leader nets connected to each of the fyke nets made the full width of the river impassible to migrating fish within several hours of low tide. Any fish attempting to migrate through the watercourse as the tide dropped would be forced to swim into the nets. The nets were constantly fishing during the sampling period and were checked and emptied at low tide every day by SLRT staff.

Any fish caught in the upstream-facing net were released downstream of the netting site, and any fish caught in the downstream-facing net were released upstream of the netting site to minimise disturbance to the natural migratory movements of the fish.

2.1.2 Coastal fyke netting

The coastal fyke net was introduced as a monitoring method in the Caol Mor area in 2023. A predator attack on the coastal fyke net in the autumn of 2023 resulted in the death of several fish. To deter future predator attacks, SLRT added a layer of anti-predator netting around the back half of the coastal fyke net to prevent seals from biting through the net and killing any captured fish.

The coastal net was deployed in the Caol Mor area, near Sconser Quarry, from the 27th-31st May. The net was deployed by boat with the assistance of the local Mowi Caol Mor staff. The fyke net was attached at a perpendicular angle to the shoreline at three points via a leader net and two wing nets. Fish migrating around the coast would be intercepted by the leader net and subsequently funnelled into a series of non-return chambers where they were held until the net was emptied. The main body of the net was tensioned at four points around the outside of the heart of the net and by a fifth anchor point at the tail of the net. The net was checked and emptied every day.

Sea trout caught in the coastal fyke net were processed on the boat or on the shoreline near the net so that they could be released in the same area where they were caught.

2.1.3 Fish processing

All captured salmonids were processed according to Scottish Fisheries Coordination Centre (SFCC) protocol. Each fish was anaesthetised using MS-222, measured to fork-length (mm) and weighed (g). A subset of sampled fish had a scale sample and a fin clip taken for future research. Additionally, any *L. salmonis* found on the fish were counted and categorised by life stage:

- Juvenile- attached copepodid and chalimus life stages
- Mobile- preadult and adult life stages
- Ovigerous females- gravid female life stage

If *Caligus elongatus* were found on the fish, they were counted separately but not categorised by life stage. Once a fish had been processed, it was allowed to recover in a holding tank before being released back into the water.

Other captured fish species (by-catch) were identified and counted without the use of anaesthetic and immediately released back into the water.

2.1.4 Sea lice data analysis

Data from the physical characteristics (length and mass) of the sampled salmonids and their sea lice burdens were used to calculate the following:

- Condition factor (K) – coefficient of the condition of the fish (Ricker, 1975)
- Abundance of lice- the mean number of sea lice per fish in a sampled population
- Prevalence of lice- number/percentage of all fish sampled with a sea lice burden
- Intensity of infection- the mean number of lice per infected fish in a sampled population

Analysis was also carried out using the Norwegian risk assessment framework created by Taranger *et al*. (2015) to categorise the increased lice-related risk of mortality to individual sea trout according to the number of lice present in relation to the mass of the fish (no. lice/g^{-1}). The framework assumes that small sea trout post-smolts (<150 g) will suffer 100% lice-related marine mortality, or premature return to freshwater, if they are infected with >0.3 lice/g^{-1} fish mass. If the lice infection of a sea trout is between 0.2 and 0.3 lice/g^{-1} fish mass, the additional lice-related marine mortality is estimated to be 50%, if the infection rate is between 0.1 and 0.2 lice/g fish mass, the additional mortality is estimated to be 20%, and if the salmon lice infection rate is <0.1 lice/g^{-1} fish mass, it is estimated that there will be little to no lice-related mortality. Each sea trout within a sampled population will fall into one of these four categories (or “infection classes”) based on their lice burden. The percentage of the sampled population that falls into each “infection class” is then reported.

Additionally, overall increased lice-related risk of marine mortality to a sampled population, or premature return to freshwater, is calculated as the sum of the expected lice-related mortalities for each of the “infection classes”. The overall risk of additional mortality to a sampled population is then scored according to the system proposed by Taranger *et al*. (2015) as Low Risk (up to 10% estimated increase in overall mortality), Moderate Risk (between 10 and 30% increase in overall mortality), and High Risk (if the overall mortality increase is calculated as 30% or more).

Similarly to Taranger *et al.* (2015), sea trout from these EMP surveys were grouped into two subsets, those with a mass of less than 150g and those with a mass of more than 150g. The risk index included in the EMP report is designed for fish weighing less than 150g. The same methodology has been used to assess risk for fish with a mass of more than 150g, but this will result in a more conservative estimate of lice-related mortalities for these larger fish.

2.2 Electrofishing

A mixture of fully and semi-quantitative electrofishing surveys were conducted at multiple sites along the Rivers Sligachan, Broadford and Strathmor (Figure 1.1 & Table 2.1) using SFCC electrofishing protocols. This protocol was designed to survey 0+ and >0+ age classes of salmon and trout. Fully quantitative electrofishing requires at least 3 passes or ‘rounds’ of electrofishing at the same site in order to report the most accurate estimate of fish density. Sites were selected to replicate previous surveys and monitor for temporal changes in juvenile salmonid densities.

The electrofishing equipment used was an E-Fish Solutions backpack unit that provided a smooth direct current output of voltage which was modified on a site-by-site basis to reflect the water conductivity at each location. Voltage was regulated upwards to maximise catches at sites with low conductivity and downwards to minimise negative effects on fish in areas of high conductivity.

All salmonids collected during the survey period were processed following SFCC protocols, anaesthetised using MS-222, identified for species, counted, and measured to fork-length (mm). The fish were allowed to recover from the anaesthetic in a holding tank before being returned to the river unharmed.

2.2.1 Electrofishing data analysis

To account for differing sampling effort between rivers and between years, catch data were corrected to a catch per unit effort (CPUE) metric expressed as the number of fish collected per minute electrofishing.

The salmon data collected during the 2024 survey were also entered into an electrofishing data analysis app maintained by the Marine Directorate as part of the National Electrofishing Programme for Scotland (NEPS). The app uses the submitted data to obtain estimates of the total density of salmon fry and parr at a particular site (Marine Directorate, 2024). Additionally, the density estimates can be compared to a benchmark, or expected density, for the site. This app will be referred to hereafter as the NEPS app.

3.0 RESULTS

The raw data collected from this monitoring programme are reported in Appendix A. The sea lice counts from individual fish farms that are referenced in this report can be found at https://aquaculture.scotland.gov.uk/.

3.1 Sea trout and sea lice monitoring

3.1.1 Loch Sligachan estuary

3.1.1.1.1 Sampled population characteristics

A total of 15 salmonids were caught by fyke nets during the 15th-18th May survey conducted in the Loch Sligachan estuary in 2024. The following table (Table 3.1) summarised the number of different species and brown trout life history strategies caught during this sampling period.

Species	N
Salmon	2
Sea trout	11
Residential trout	2
Total fish	**15**

Table 3.1. A summary table of the number of species (N) and life history strategies of anadromous salmonids caught in the Loch Sligachan estuary during the 2024 spring sampling period.

Two residential brown trout (parr/individuals that did not show any physiological signs of smolting (silvery, streamlined bodies)) were caught during the spring sampling period. The mean fork length (mean ± Standard Deviation (SD)) of this subset of fish was 118.5 ± 14.9 mm and the mean condition factor was 1.1 ± 0.1 (Appendix A). Based on their physical appearance, it is unlikely that these individuals had fully entered the marine environment before the survey and therefore had not been exposed to local lice levels prior to their capture. Because of this, they were removed from the analysis of the sea lice dataset.

Two salmon smolts were also caught during the spring sampling period in Loch Sligachan. The mean fork length (mm) of this subset of fish was 121.0 ± 2.8 mm and the mean condition factor was 1.0 ± 0.1 (Appendix A). From what is known about salmon smolt migration, it is unlikely that these fish would have entered the marine environment and remained near their natal river long enough to be recaptured by a passive fyke net. It was decided that these two fish had been caught during their initial migration from fresh to salt water and therefore had not been exposed to local lice levels prior to their capture, similar to the residential brown trout. Therefore, the fish were removed from further analysis of the dataset.

Therefore, a total of 11 sea trout were included in the analysis of the Sligachan estuary sea lice dataset. The following table (Table 3.2) summarises the general physical characteristics of the sampled population.

Sligachan Estuary Sea Trout Physical Characteristics Summary Table			
	<150 g	**>150 g**	**All Fish**
N	10	1	11
Fork length (mm)	145.1 ± 16.7	367.0	165.3 ± 68.8
Mass (g)	31.8 ± 12.4	463.0	71.0 ± 130.5
Condition factor (k)	1.0 ± 0.1	0.9	1.0 ± 0.1

Table 3.2. A summary table of the number of sea trout (N) caught in the spring sampling period in the estuary of Loch Sligachan. Fish have been divided into three groups (<150g, >150g, All Fish) and the mean physical characteristics (mean ± SD) of each group are reported here.

3.1.1.1.2 Sea lice burdens of sea trout

The *L. salmonis* burdens of sea trout sampled in 2024 in the estuary of Loch Sligachan were summarised as the mean numbers (mean ± SD) of “Juvenile”, “Mobile” and “Ovigerous Female” life stages (as described in the Methods section of this report) found on wild fish during the survey. The mean number (mean ± SD) of *Caligus elongatus* found during each survey is reported separately. Additionally, the abundance, prevalence, and the intensity of *L. salmonis* burdens were calculated The results are reported below for each fish mass (Table 3.3).

Lice Burden Summary Table			
	<150 g	**>150 g**	**All Fish**
N	10	1	11
Caligus	0.0	0.0	0.0
Juvenile stage	0.0	30.0	2.7 ± 9.0
Mobile stage	0.0	9.0	0.8 ± 2.7
Ovigerous female stage	0.0	1.0	0.1 ± 0.3
***L. salmonis* Abundance**	0.0	40.0	3.6 ± 12.1
***L. salmonis* Prevalence %**	0	100	9
No. of infected fish	0.0	1.0	1.0
***L. salmonis* Intensity**	0.0	40.0	40.0

Table 3.3. The number of sea trout (N) sampled in the estuary of Loch Sligachan and the summarised results of their sea lice burdens (mean ± SD), divided by fish mass (<150g, >150g, and All Fish). No sea lice were found on sea trout weighing less than 150g.

No sea lice were found on sea trout weighing less than 150g. One sea trout (weighing more than 150g) was infected with *L. salmonis*. No *Caligus* were found during this survey.

3.1.1.1.2.1 Abundance

The overall abundance of sea lice (the mean number of total *L. salmonis*/fish in a sampled population) on wild sea trout in the spring survey was 3.6 ± 12.1 lice/fish (Table 3.3) with individual lice levels ranging from zero to 40 lice/fish. No sea lice were found on any sampled sea trout weighing less than 150g. A sea trout weighing more than 150g was the only individual acting as a host for sea lice and had a lice abundance of 40 lice/fish.

3.1.1.1.2.2 Prevalence

The overall prevalence of sea lice (the overall percentage of sampled sea trout infected by *L. salmonis*) during the spring survey in the Loch Sligachan estuary was reported as 9%, however, when the sampled population was split into weight classes, the prevalence of the >150g subset increased to 100% (Table 3.3).

3.1.1.1.2.3 Intensity

The overall intensity of sea lice burdens (the mean number of *L. salmonis* per infected sea trout in a sampled population) in the estuary of Loch Sligachan was 40 lice/fish (N=1) (Table 3.3).

3.1.1.2.1 Risk Analysis

The mean *L. salmonis* burden per gram of fish mass for sea trout under 150g (N=10) and sea trout over 150g (N=1) sampled during the spring sampling period in the estuary of Loch Sligachan is categorised below (Table 3.4) using the salmon lice risk index described by Taranger *et al*. (2015). This is recorded as a proportion (%) of fish which fell into each risk category, or 'infection class', during the sampling period. Also included in Table 3.4 is a mortality score (%) that reported the overall risk of increased lice-related mortality to each weight class of the sampled sea trout population.

	Salmon lice risk index infection classes					
Fish Mass	**N**	**<0.1 lice/g^{-1}**	**0.1-0.2 lice/g^{-1}**	**0.2-0.3 lice/g^{-1}**	**>0.3 lice/g^{-1}**	**% Mortality**
<150g	10	100%	0%	0%	0%	0%
>150g	1	100%	0%	0%	0%	0%

Table 3.4. Salmon lice risk index results for two weight classes (<150g and >150g) of sea trout (N) caught during the spring sampling period in the estuary of Loch Sligachan. The proportions (%) of the sampled sea trout population that fall into each "infection class" of the lice risk index based on L. salmonis burdens of each fish are reported here. The % Mortality column reports the overall risk of mortality to the sea trout population based on the "infection class" results (Low Risk - <10% mortality, Moderate Risk – 10%-30% mortality, High Risk – >30% mortality) (Taranger et al., 2015).

During the spring survey in the Loch Sligachan estuary, 100% of sampled sea trout (N=11) reported a lice burden of <0.1 lice/g^{-1} and were therefore expected to experience little to no lice-related marine mortality or premature return to freshwater at the time of sampling (Table 3.4 & Figure 3.1).

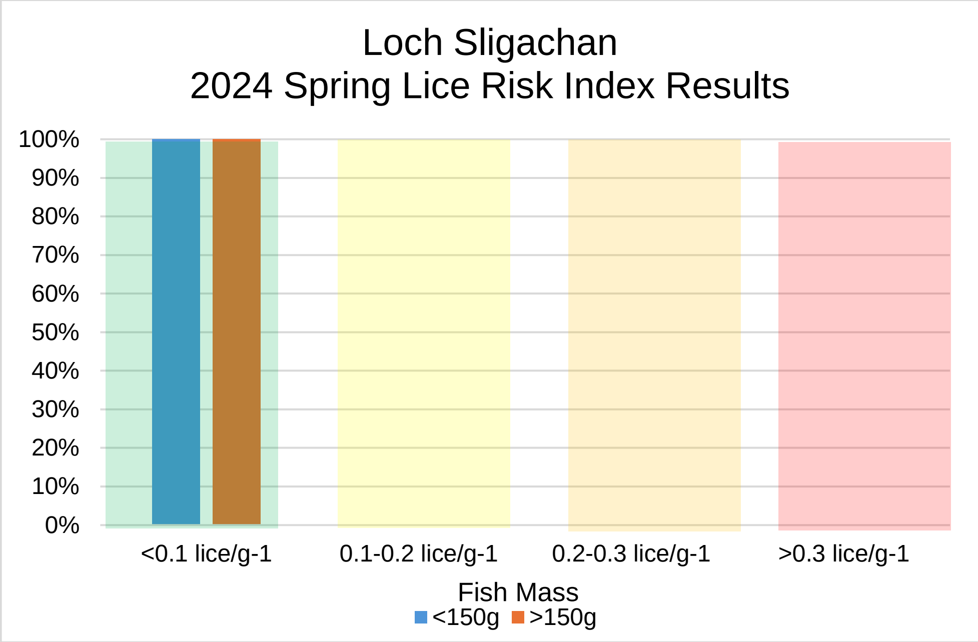

Figure 3.1. The proportions (%) of sea trout sampled in the spring sampling period in Loch Sligachan estuary that fall into each "infection class" of the salmon lice risk index (Table 3.4). The sampled individuals have also been split by mass (<150g (blue) and >150g (orange)) within each infection class. The proportions of fish in the green shaded infection class were expected to experience little to 0% lice-related mortality, while the additional shaded infection classes represent 20% (yellow), 50% (orange), and 100% (red) increased lice-related mortality.

3.1.1.2.2 Historic lice risk analysis

To further investigate temporal patterns in sea lice burdens and associated risk levels in Loch Sligachan, sea lice data from previous spring surveys dating back to 2019 (except 2020 when no data was collected) were collated and compared between sea trout weight classes and across years.

The annual mean *L. salmonis* burden/gram of fish mass for sea trout weighing <150g and >150g (2019-2024) is reported below (Table 3.5) using the salmon lice risk index described by Taranger *et al*. (2015). These data are recorded as the proportion of the sampled sea trout populations that fall into each "infection class" category.

The sea lice burdens of sea trout caught in the estuary of Loch Sligachan have fluctuated since 2019 (Table 3.5 & Figures 3.2-3.3). The highest recorded lice levels were reported in 2021 when almost 70% of captured sea trout (N=48) were expected to experience increased lice-related marine mortality if they were unable to rid themselves of their lice burdens. In the last three years (2022-2024) sea lice burdens on captured sea trout have declined and the majority of sampled fish have had parasite levels of <0.1 lice/g^{-1} meaning they were expected to experience little to no lice-related marine mortality.

Year	Fish Mass	N	<0.1 lice/g^{-1}	0.1-0.2 lice/g^{-1}	0.2-0.3 lice/g^{-1}	>0.3 lice/g^{-1}
2019	<150g	7	71%	0%	0%	29%
	>150g	6	17%	33%	17%	33%
2021	<150g	48	31%	10%	5%	54%
	>150	0	-	-	-	-
2022	<150g	107	94%	4%	1%	1%
	>150g	3	100%	0%	0%	0%
2023	<150g	15	100%	0%	0%	0%
	>150g	1	0%	100%	0%	0%
2024	<150g	10	100%	0%	0%	0%
	>150g	1	100%	0%	0%	0%

Table 3.5. Salmon lice risk index results for two weight classes (<150g and >150g) of sea trout (N) caught during the spring sampling period (1st April-15th June) in the Loch Sligachan estuary from 2019-2024 (except 2020). N represents the total number of fish caught in each weight class. The proportions (%) of the sampled sea trout population that fall into each “infection class” level of the lice risk index based on the L. salmonis burdens of each fish are reported here.

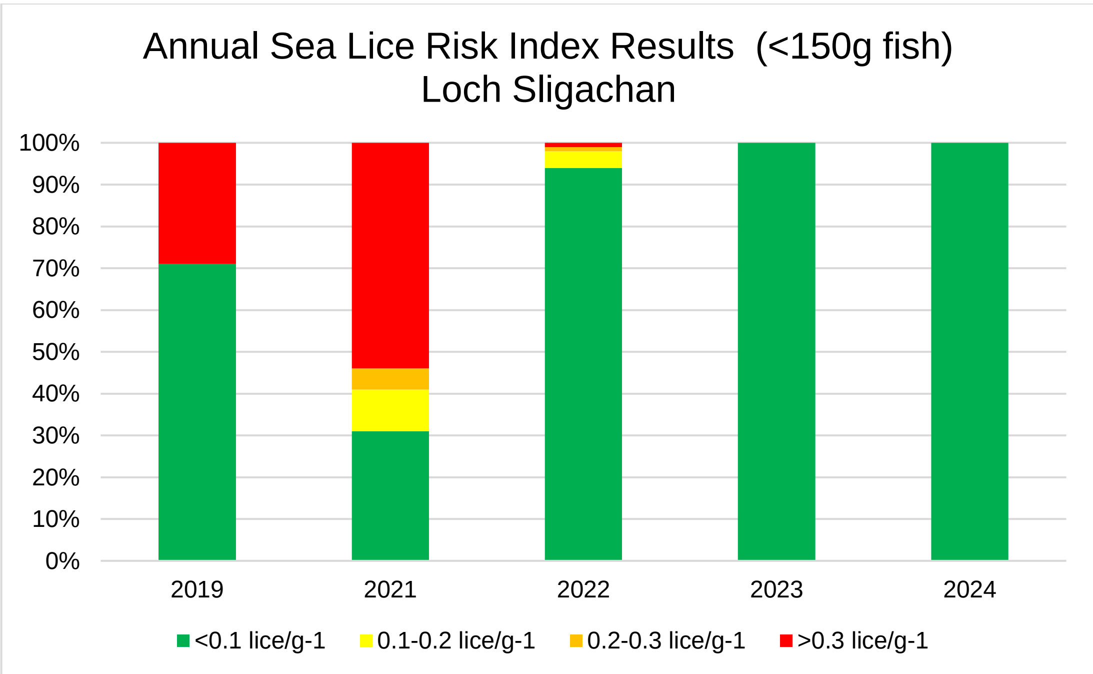

Figure 3.2. A comparison of the annual salmon lice risk index results reported from sampled sea trout weighing <150g that were surveyed in the spring sampling period (1st April-15th June) of 2019, 2021-2024) (Table 3.5).

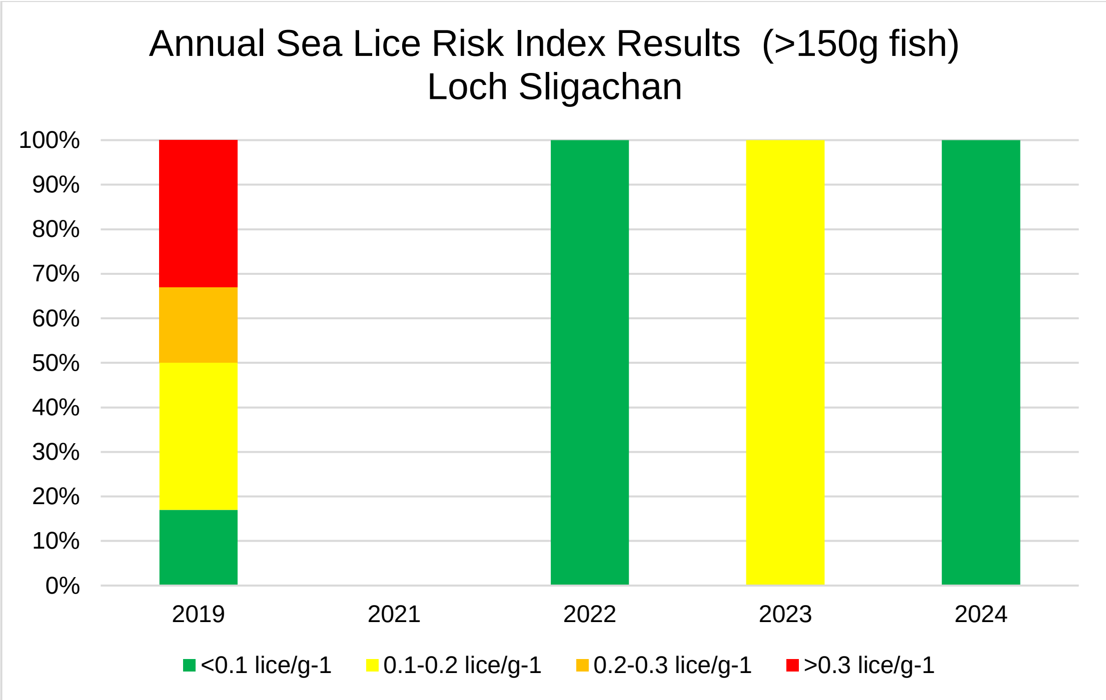

Figure 3.3. A comparison of the annual salmon lice risk index results reported from sampled sea trout weighing >150g that were surveyed in the spring survey period (1st April-15th June) of 2019, 2021-2024) (Table 3.5).

3.1.1.3.1 Other fish and by-catch

Several other species of fish were caught in the estuary fyke nets during this sampling period, including 3-spine stickleback (*Gasterosteus acleatus*), flounder (*Platichthys flesus*), and butterfish (*Pholis gunnellus*). Sticklebacks were caught on multiple days.

3.1.2 Caol Mor Shoreline

SLRT deployed a coastal fyke net in the Caol Mor area during the spring sampling period but poor weather conditions and scheduling conflicts with the Caol Mor production cycle prevented the deployment of the net for a second time during the summer sampling period. The following data were collected during the spring survey (Appendix A).

A seal attack occurred on the last day of the survey and killed a mullet and two sea trout. The two sea trout were still intact (they had been bitten through the net but not dismembered) so physical data was collected from them.

3.1.2.1.1 Sampled population characteristics

A total of 10 sea trout were caught during the spring sampling period (27th- 31st May) in the Caol Mor area near Sconser Quarry. The following table (Table 3.6) summarises the general physical characteristics (mean ± Standard deviation (SD)) of the sampled population.

Physical Characteristics Summary Table			
	<150 g	>150 g	All Fish
N	5	5	10
Fork length (mm)	193.6 ± 27.0	326.4 ± 35.2	260.0 ± 76.0
Mass (g)	73.0 ± 23.1	339.0 ± 71.5	206.0 ± 148.9
Condition factor (k)	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1

Table 3.6. A summary table of the number of sea trout (N) caught in the spring sampling period in the Caol Mor area. Fish have been divided into three groups (<150g, >150g, All Fish) and the mean (mean ± SD) physical characteristics of each group caught are reported here.

3.1.2.1.2 Sea lice burdens of sea trout

The *L. salmonis* burdens of sea trout sampled in 2024 in the Caol Mor area were summarised as the mean numbers (mean ± SD) of "Juvenile", "Mobile", and "Ovigerous Female" life stages (as described in the Methods section of this report) found on wild fish during each survey. The mean number (mean ± SD) of *Caligus elongatus* found during each survey is reported separately. Additionally, the abundance, prevalence, and the intensity of *L. salmonis* burdens were calculated. The results are reported below and have been divided by fish mass (Table 3.7).

Caol Mor Sea Trout Lice Burden Summary Table			
	<150 g	>150 g	All Fish
N	5	5	10
Caligus	0.4 ± 0.9	1.6 ± 2.3	1.0 ± 1.8
Copepodid stage	9.4 ± 11.8	46.0 ± 30.8	27.7 ± 29.3
Mobile stage	5.4 ± 9.4	7.4 ± 8.5	6.4 ± 8.5
Ovigerous female stage	0.0 ± 0.0	1.0 ± 1.7	0.5 ± 1.2
***L. salmonis* Abundance**	14.8 ± 21.0	54.4 ± 34.9	34.6 ± 34.3
***L. salmonis* Prevalence %**	80	100	90
No. of infected fish	4	5	9
***L. salmonis* Intensity**	18.5 ± 22.3	54.4 ± 34.9	38.4 ± 34.0

Table 3.7. The number of sea trout caught (N) during the spring sampling session in the Caol Mor area and the summarised results of their sea lice burdens (mean ± SD), divided by fish mass (<150g, >150g, and All Fish).

The two sea trout killed by the seal attack were included in the analysis of the sea lice dataset, but it is important to note that their sea lice burdens might not be accurate since attached lice could have dropped off during or after the attack once their host was dead. The decision to keep the sea trout in the analysis of the data was based on the presence of 10 juvenile lice on the larger fish (300mm and 276g), indicating that the attack could have happened recently enough for the lice counts to still be representative of what parasite burdens the fish had before they died. However, no lice were found on the second deceased fish (153mm and 38g). Because of the inclusion of these two fish, the overall lice burdens of this sampled population could have been higher than what has been reported here.

3.1.2.1.2.1 Abundance

The overall abundance of sea lice (the mean number of total *L. salmonis*/fish in a sampled population) on wild sea trout in the spring survey was 34.6 ± 34.3 lice/fish (Table 3.7) with individual lice levels ranging from 0 to 104 lice/fish. When comparing the abundance between the two weight classes, fish weighing more than 150g reported a higher abundance (54.4 ± 34.9 lice/fish, N=5) than fish weighing less than 150g (14.8 ± 21.0 lice/fish N=5).

3.1.2.1.2.2 Prevalence

The overall prevalence of sea lice (the overall percentage of sampled sea trout infected by *L. salmonis*) amongst sea trout during the spring survey was reported as 90% (Table 3.7). When the sampled population was split into weight classes, there was a higher prevalence amongst fish weighing more than 150g (100%) than amongst fish weighing less than 150g (80%).

3.1.2.1.2.3 Intensity

The overall intensity of sea lice burdens (the mean number of *L. salmonis* per infected sea trout in a sampled population) in the spring survey was 38.4 ± 34.0 lice/infected fish. The intensity of lice burdens on fish weighing less than 150g was reported as 18.5 ± 22.3 lice/infected fish (N=5), which was less than the mean lice burden of infected fish weighing more than 150g (54.4 ± 34.9 lice/infected fish, N=5)).

3.1.2.2.1 Risk Analysis

The *L. salmonis* burdens per gram of fish mass for sea trout under 150g (N=5) and sea trout over 150g (N=5) that were caught during the spring survey in the Caol Mor area are categorised below (Table 3.8) using the salmon lice risk index developed by Taranger *et al.* (2015). This is recorded as a proportion (%) of sampled fish which fell into each risk category, or “infection class”, during the spring survey. Also included in Table 3.8 is a mortality score (%) that reports the overall risk of increased lice-related mortality to each weight class of the sampled sea trout population.

	Sea lice risk index infection classes					
Fish Mass	**N**	**<0.1 lice/g^{-1}**	**0.1-0.2 lice/g^{-1}**	**0.2-0.3 lice/g^{-1}**	**>0.3 lice/g^{-1}**	**% Mortality**
<150g	5	60%	20%	0%	20%	24%
>150g	5	20%	60%	20%	0%	22%

Table 3.8. Salmon lice risk index results for two weight classes (<150g and >150g) of sea trout (N) caught during the spring sampling period in the Caol Mor area. The proportions (%) of the sampled sea trout population that fall into each "infection class" of the lice risk index based on L. salmonis burdens of each fish are reported here. The % Mortality column reports the overall risk of mortality to the sea trout population based on the "infection class" results (Low Risk - <10% mortality, Moderate Risk – 10%-30% mortality, High Risk – >30% mortality) (Taranger et al., 2015).

Of the sampled population caught during the spring survey that weighed less than 150g (N=5), 60% had a lice burden of <0.1 lice/g^{-1} (Table 3.8 & Figure 3.4). From the Taranger index, those fish were expected to face little to no increased threat of mortality due to lice. One fish had a lice burden of 0.1-0.2 lice/g^{-1} and was expected to experience 20% increased lice-related marine mortality. Another sea trout had a lice burden of >0.3 lice/g^{-1} and was expected to experience 100% lice-related marine mortality if it was unable to shed its lice load. There was a Moderate Risk (24%) that sea trout weighing less than 150g would experience increased lice-related mortality at the time of the survey.

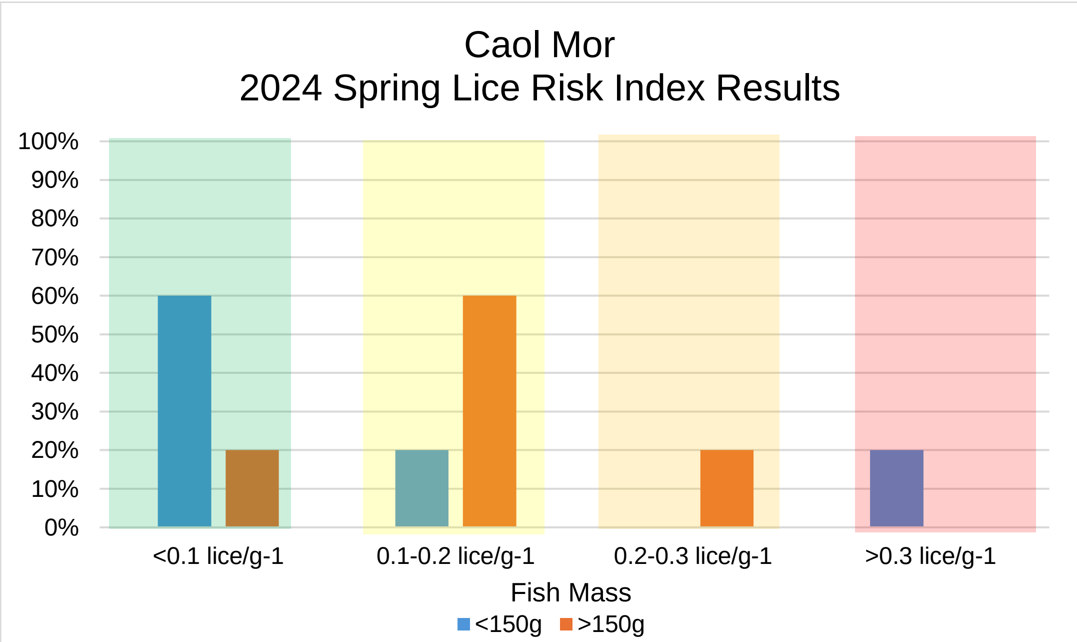

Figure 3.4. The proportions (%) of sea trout sampled in the spring survey in the Caol Mor area that fall into each "infection class" of the salmon lice risk index (Table 3.4). The sampled individuals have also been split by mass (<150g (blue) and >150g (orange)) within each infection class. The proportions of fish in the green shaded infection class were expected to experience little to no lice-related mortality, while the additional shaded infection classes represent 20% (yellow), 50% (orange), and 100% (red) increased lice-related mortality.

Of the sampled population caught during the spring survey that weighed more than 150g (N=5), 20% had a lice burden of <0.1 lice/g^{-1} (Table 3.8 & Figure 3.4). From the Taranger index, those fish were expected to face little to no increased threat of mortality due to lice. Three fish (60%) had a lice burden of 0.1-0.2 lice/g^{-1} and were expected to experience 20% increased lice-related marine mortality. Another sea trout had a lice burden of 0.2-0.3 lice/g^{-1} and was expected to experience 50% lice-related marine mortality if it was unable to shed its lice load. There was a Moderate Risk (22%) that sea trout weighing more than 150g would experience increased lice-related mortality at the time of the survey.

3.1.2.2.2 Historic lice risk analysis

Sea lice data from the spring sampling period (1st April- 15th June) of 2023 and 2024 were collated to investigate temporal patterns in sea lice burdens and associated risk levels in the Caol Mor area. This data was compared between sea trout weight classes and across years.

The annual mean *L. salmonis* burden/gram of fish mass for sea trout weighing less than 150g and those weighing more than 150g is reported below (Table 3.9) using the salmon lice risk index described by Taranger *et al*. (2015). These data are recorded as the proportion of the sampled sea trout populations that fall into each “infection class” category.

Year	Fish Mass	N	<0.1 lice/g^{-1}	0.1-0.2 lice/g^{-1}	0.2-0.3 lice/g^{-1}	>0.3 lice/g^{-1}
2023	<150g	4	25%	25%	50%	0%
	>150g	5	0%	0%	0%	100%
2024	<150g	5	60%	20%	0%	20%
	>150g	5	20%	60%	20%	0%

Table 3.9. Salmon lice risk index results for two weight classes (<150g and >150g) of sea trout (N) caught during the spring sampling period (1st April-15th June) in the Caol Mor area from 2023-2024. N represents the total number of fish caught in each weight class. The proportions (%) of the sampled sea trout population that fall into each “infection class” level of the lice risk index based on the L. salmonis burdens of each fish are reported here.

In the last two years, sea trout of both weight classes were expected to experience increased risk of marine mortality due to their lice levels. The highest lice burdens found on sea trout were reported in 2023, with 75% of fish weighing less than 150g and 100% of fish weighing more than 150g expected to experience increased lice-related marine mortality if they were unable to shed their lice loads (Table 3.9 & Figures 3.5, 3.6).

Lower lice burdens were reported in 2024, but 40% of sea trout weighing less than 150g and 80% of sea trout weighing more than 150g were expected to experience increased lice-related marine mortality.

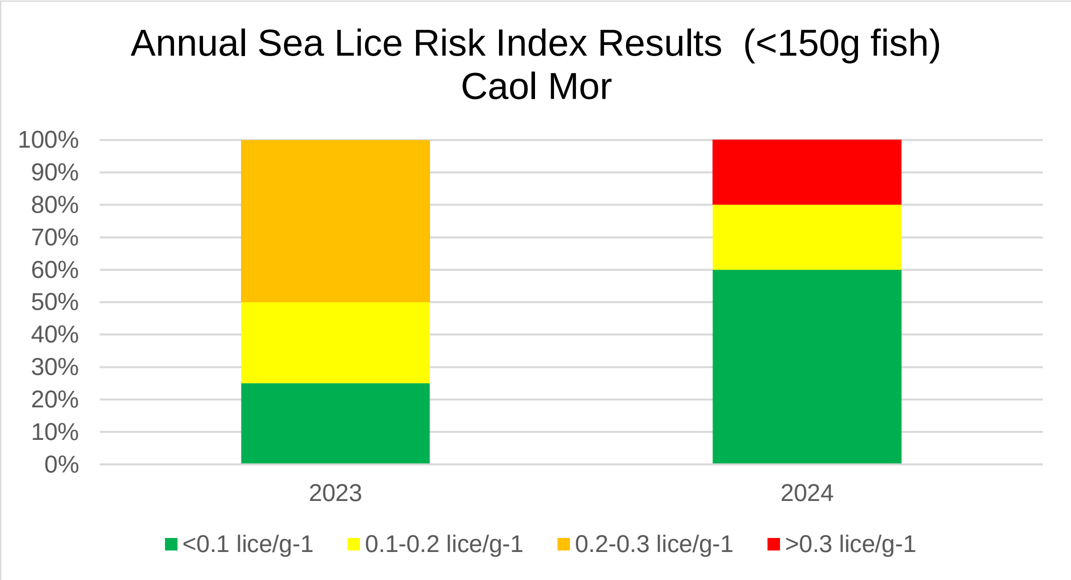

Figure 3.5. A comparison of the annual salmon lice risk index results reported from sampled sea trout populations weighing <150g that were surveyed in the spring sampling period (1st April-15th June) in the Caol Mor area in 2023- 2024) (Table 3.9).

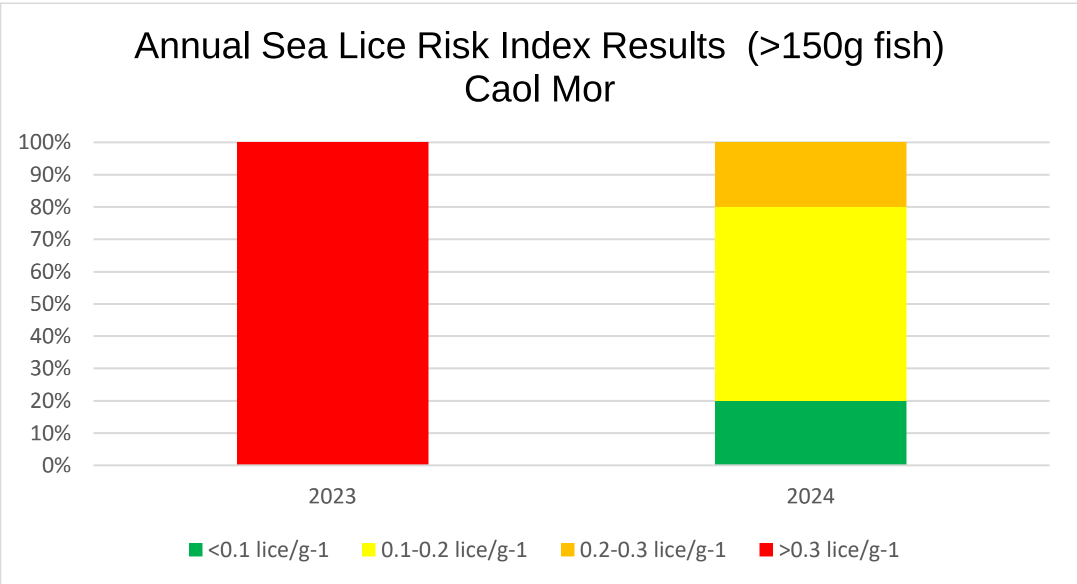

Figure 3.6. A comparison of the annual salmon lice risk index results reported from sampled sea trout populations weighing >150g that were surveyed in the spring sampling period (1st April-15th June) in the Caol Mor area in 2023- 2024) (Table 3.9).

3.1.2.3.1 Other fish and by-catch

Multiple other species of fish were caught in the coastal fyke net during the Caol Mor spring survey, including pollock (*Pollachius pollachius*), grey mullet (*Mugilidae* family), brown shrimp (*Crangon crangon*), 15-spine stickleback (*Spinachia spinachia*), corkwing wrasse(*Symphodus melops*), rock cook wrasse (*Centrolabrus exoletus*), and pouting (*Trisopterus luscus*).

3.2 Electrofishing

3.2.1 River Sligachan

Semi-quantitative electrofishing surveys were carried out at all four sites that were surveyed in the River Sligachan in 2024 (Figure 1.1 & Table 2.1). Each site was electrofished for a minimum of 15 minutes (Appendix A).

Juvenile salmon and trout were found at all sites. The largest number of salmon were captured at Site SLIG01 (N=43) and the largest number of trout were captured at Site SLIG11 (N=7) (Appendix A).

European eels (*Anguilla anguilla*) were caught at Site SLIG01 (N=8) (Appendix A). No eels were captured at Sites SLIG07, SLIG08 and SLIG11.

3.2.1.1 Catch per unit effort (CPUE)

The data were corrected for sampling effort using a catch per unit effort (CPUE) metric and compared to the data from the most recent electrofishing surveys conducted at the same sites to investigate potential temporal changes in fish density.

All of the sites that were electrofished demonstrated a change in CPUE between data collected in previous years and data collected in 2024 (Table 3.10 & Figure 3.7).

Site	Year	Salmon CPUE	Trout CPUE
SLIG01	2005	1.00	0.40
	2024	1.87	0.09
SLIG07	2022	0.85	0.08
	2023	0.25	0.06
	2024	0.48	0.17
SLIG08	2022	0.67	0.00
	2023	0.07	0.07
	2024	0.24	0.06
SLIG11	2022	0.67	0.33
	2023	0.24	0.12
	2024	0.80	0.47

Table 3.10. Catch per unit effort (fish per minute electrofishing) for Sites SLIG01, SLIG07, SLIG08, SLIG11 in the River Sligachan (2005-2024, included years vary based on site history).

Figure 3.7. Annual catch per unit effort (fish per minute electrofishing) for Sites SLIG01, SLIG07, SLIG08 and SLIG11 in the River Sligachan (2024) and the data from the most recent surveys prior to 2024 that occurred at the same sites.

Juvenile salmon were found at all four survey sites. Additionally, the 2024 CPUE values of juvenile salmon were higher at each site than the values that were reported from the last surveys that occurred there (Table 3.10). The largest increase in CPUE was reported at Site SLIG01 where an increase from 1.00 to 1.87 was observed. This was the first time this location had been visited since 2005. The remaining three sites reported CPUE values closer to those observed in 2022.

Low numbers of juvenile brown trout were captured at all four survey locations. Declines in CPUE values were reported at Sites SLIG01 and SLIG08 (Table 3.10). The largest increase in CPUE for juvenile brown trout was reported at Site SLIG11, which increased from 0.12 (2023) to 0.47 (2024). The 2024 results from Sites SLIG07 and SLIG11 reported the highest CPUE values for brown trout for the last three years, although the total number of fish caught remained low.

3.2.1.2 Expected densities

The observed densities of salmon fry and parr were compared to benchmark densities (average expected densities) calculated by the NEPS app. The difference between observed and predicted densities can be found below (Table 3.11).

Site	Salmon Life stage	N	Area (m^2)	Observed Density (life stage/m^2)	Benchmark Fry Density (fry/m^2)	Benchmark Parr Density (parr/m^2)	Density Difference (life stage/m^2)
SLIG01	Fry	40	124	0.57	0.03	0.02	0.54
	Parr	3	124	0.04	0.03	0.02	0.01
SLIG07	Fry	9	99	0.16	0.06	0.03	0.10
	Parr	5	99	0.08	0.06	0.03	0.05
SLIG08	Fry	4	80.5	0.09	0.31	0.08	-0.22
	Parr	0	80.5	0.00	0.31	0.08	-0.08
SLIG11	Fry	7	63.8	0.19	0.03	0.03	0.16
	Parr	5	63.8	0.12	0.03	0.03	0.10

Table 3.11. Number of juvenile salmon (N) recorded at each electrofishing site on the River Sligachan and the observed and predicted densities of each life stage as calculated by the NEPS app (Marine Directorate, 2024). Where the observed density was higher than the predicted value, the increase is noted in green and where the observed density was lower than predicted, the decrease is noted in red.

The observed densities of salmon fry and parr were found to be greater than the NEPS predicted densities at Sites SLIG01, SLIG07 and SLIG11. Most notably, Site SLIG01 reported a +0.54 fry/m^2 difference between the observed and expected fry density (Table 3.11).

Site SLIG08 reported lower than expected densities of both life stages of juvenile salmon, with a value of -0.22 fry/m^2 and -0.08 parr/m^2 (Table 3.11).

3.2.2 Broadford River

Fully quantitative 3-pass surveys were conducted at both Sites BRD08 and BRD09 (Figure 1.1). Juvenile Atlantic salmon and brown trout were observed at both locations. Higher numbers of trout were caught at Site BRD08 (N=18), while more salmon were caught at Site BRD09 (N=56) (Appendix A).

European eels were observed at both sites, with 4 being captured at Site BRD08 and 23 being captured at Site BRD09. A total of 45 minnows (*Phoxinus Phoxinus*) were also caught at Site BRD09 (Appendix A).

3.2.2.1 Catch per unit effort

The data were corrected for sampling effort using a catch per unit effort (CPUE) metric and compared to data from the most recent electrofishing surveys completed at the same sites to investigate potential temporal changes in fish density.

All of the sites visited on the Broadford River showed a change in CPUE between data collected in previous years and data collected in 2024 (Table 3.12).

Site	Year	Salmon CPUE	Trout CPUE
BRD08	2021	0.38	0.04
	2022	0.27	0.06
	2024	0.15	0.26
BRD09	2022	0.29	0.07
	2023	0.24	0.02
	2024	0.82	0.15

Table 3.12. Catch per unit effort (fish per minute electrofishing) for Sites BRD08 and BRD09 in the Broadford River (2021-2024, included years vary based on site history).

Site BRD08 showed a decrease in salmon CPUE when compared to previous years, declining from 0.27 (2022) to 0.15 (2024) (Table 3.12 & Figure 3.8). Site BRD09 showed an opposing trend, with the CPUE increasing from 0.24 in 2023 to 0.82 in 2024.

The trout CPUE values from Site BRD08 increased from 0.06 (2022) to 0.26 (2024) (Table 3.12). Data from Site BRD09 also reported an increase in trout CPUE from 0.02 (2023) to 0.15 (2024).

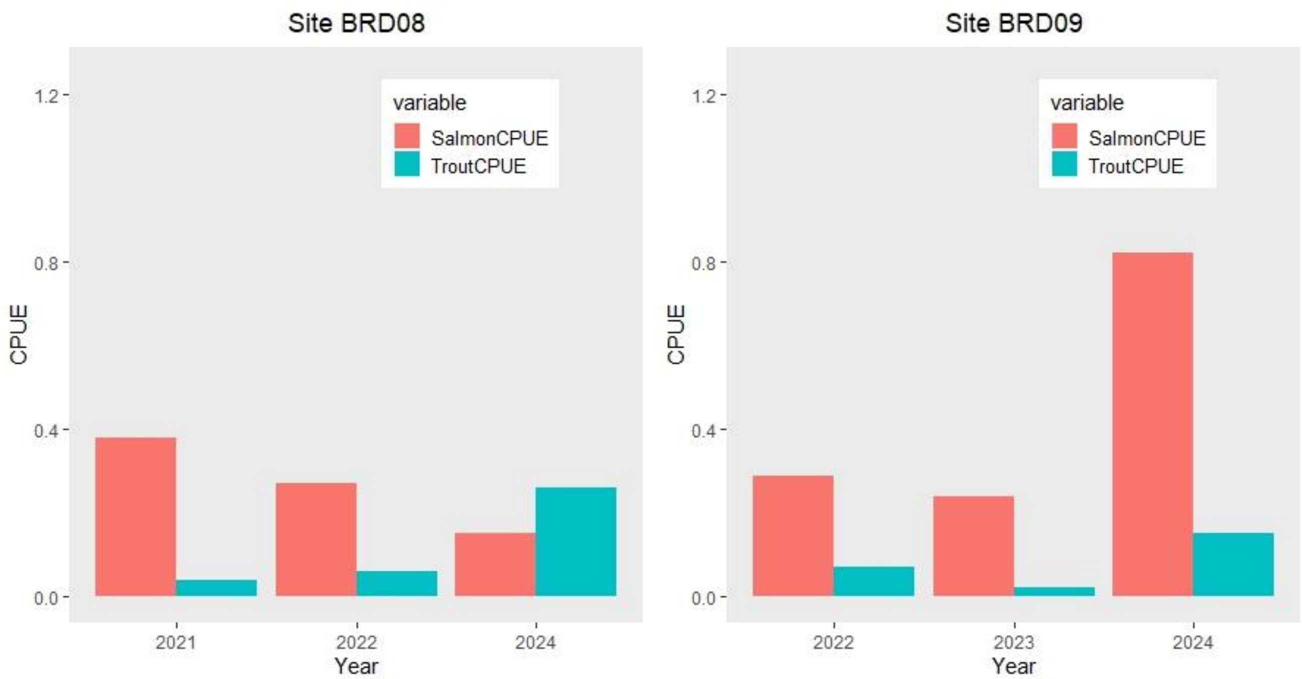

Figure 3.8. Annual catch per unit effort (fish per minute electrofishing) for Sites BRD08 and BRD09 on the River Broadford sampled (2024) and the data from the most recent surveys prior to 2024 that occurred at the same sites.

3.2.2.2 Expected densities

The observed densities of salmon fry and parr were compared to benchmark densities (average expected densities) calculated by the NEPS app. The difference between observed and predicted densities can be found below (Table 3.13).

Site	Salmon Life stage	N	Area (m^2)	Observed Density (life stage/m^2)	Benchmark Fry Density (fry/m^2)	Benchmark Parr Density (parr/m^2)	Density Difference (life stage/m^2)
BRD08	Fry	0	97.46	0.00	0.05	0.03	-0.05
	Parr	10	97.46	0.11	0.05	0.03	0.08
BRD09	Fry	40	114.8	0.40	0.26	0.10	0.15
	Parr	16	114.8	0.15	0.26	0.10	0.05

Table 3.13. Number of juvenile salmon (N) recorded at each electrofishing site on the Broadford River and the observed and predicted densities of each life stage as calculated by the NEPS app (Marine Directorate, 2024). Where the observed density was higher than the predicted value, the increase is noted in green and where the observed density was lower than predicted, the decrease is noted in red.

As no salmon fry were captured at Site BRD08, the observed density was lower than the NEPS predicted density (Table 3.13). Parr density at the same site was found to be higher than the NEPS predicted value with a difference of +0.08 parr/m^2. Site BRD09 reported higher than predicted densities for both life stages of juvenile salmon (+0.15 fry/m^2 and +0.05 parr/m^2).

3.2.3 Strathmore River

Semi-quantitative electrofishing surveys were conducted at all four sites visited on the Strathmore River in 2024. Each site was electrofished for a minimum of 15 minutes (Figure 1.1 & Appendix A). When SLRT staff arrived at Site SMR09 (which has been monitored annual for several years years), it was determined that the riverbed and substrate was too unstable to survey safely. This change in the habitat is due to the movement of substrate and resulting erosion from heavy flooding events. Therefore, a new site (SMR09A) located approximately 50m downstream of Site SMR09 was added to the 2024 monitoring programme.

Salmon parr were observed at Sites SMR05, SMR07 and SMR09A. No salmon parr were caught at Site SMR11. No salmon fry were caught at any of the Strathmor sites that were visited during the 2024 monitoring programme.

Trout were captured at all sites except Site SMR05.

European eels were caught at all sites (Appendix A).

3.2.3.1 Catch per unit effort (CPUE)

The data were corrected for sampling effort using a catch per unit effort (CPUE) metric and compared to data from the most recent electrofishing surveys completed at the same sites to investigate potential temporal changes in fish density.

The juvenile salmon CPUE at Site SMR05 increased from 0.00 in 2023 to 0.05 in 2024 (Table 3.14 & Figure 3.9). Decreases in salmon CPUE were reported at Sites SMR07 and SMR11.

Site	Year	Salmon CPUE	Trout CPUE
SMR05	2022	0.13	0.80
	2023	0.00	0.47
	2024	0.05	0.00
SMR07	2022	0.13	0.33
	2023	0.13	0.33
	2024	0.05	0.15
SMR09A	2024	0.07	0.80
SMR11	2022	0.33	0.60
	2023	0.20	0.60
	2024	0.00	0.21

Table 3.14. Catch per unit effort (fish per minute electrofishing) for Sites SMR05, SMR07, SMR09A, and SMR11 in the Strathmor River (2022-2024, included years vary based on site history).

Figure 3.9. Annual catch per unit effort (fish per minute electrofishing) for Sites SMR05, SMR07, SMR09A and SMR11 in the River Strathmore (2024) and the data from the most recent surveys prior to 2024 that occurred at the same sites.

The CPUE values of trout declined at all three previously surveyed sites (SMR05, SMR07 and SMR11) (Table 3.14). The largest decrease was reported at Site SMR05 where the CPUE decreased from 0.47 (2023) to 0.00 (2024). Site SMR09A reported a trout CPUE value of 0.80.

3.2.3.2 Expected densities

The observed densities of salmon fry and parr were compared to benchmark densities (average expected densities) calculated by the NEPS app. The difference between observed and predicted densities can be found below (Table 3.15).

Site	Salmon Life stage	N	Area (m^2)	Observed Density (life stage/m^2)	Benchmark Fry Density (fry/m^2)	Benchmark Parr Density (parr/m^2)	Density Difference (life stage/m^2)
SMR05	Fry	0	121.55	0.00	0.13	0.06	-0.13
	Parr	1	121.55	0.01	0.13	0.06	-0.05
SMR07	Fry	0	83.79	0.00	0.11	0.05	-0.11
	Parr	1	83.79	0.02	0.11	0.05	-0.04
SMR09A	Fry	0	177.65	0.00	0.10	0.05	-0.10
	Parr	1	177.65	0.01	0.10	0.05	-0.04
SMR11	Fry	0	67.60	0.00	0.08	0.04	-0.08
	Parr	0	67.60	0.00	0.08	0.04	-0.04

Table 3.15. Number of juvenile salmon (N) recorded at each electrofishing site on the Strathmore River and the observed and predicted densities of each life stage as calculated by the NEPS app (Marine Directorate, 2024). Where the observed density was higher than the predicted value, the increase is noted in green and where the observed density was lower than predicted, the decrease is noted in red

The observed densities of salmon fry and parr were lower than the NEPS predicted benchmark densities at all four sites in the Strathmor River. The largest difference was reported at Site SMR05, where the observed density of fry was found to have a difference of –0.13 fry/m^2 when compared to the NEPS predicted density.

4.0 DISCUSSION

4.1 Sea trout and sea lice monitoring

4.1.1 Sligachan estuary

The use of estuarine fyke nets in the intertidal zone of Loch Sligachan has proved to be an efficient method of capturing migrating salmonids, particularly anadromous trout. Although the number of fish caught in a session fluctuates annually, this method has yielded robust numbers of sea trout smolts and post-smolts in the past (particularly in 2021 and 2022) and provided information on the local sea lice levels that smolts are exposed to when they first enter the sea loch.

The total number of sea trout caught at this site in 2024 was the lowest catch reported in the last six years. The fyke nets were set in Loch Sligachan in mid-May, similar to the timing of previous surveys when larger numbers of smolts and post-smolts were caught. The low numbers of fish relative to other years could suggest that the netting occurred prior to or after the main smolt run of the river. However, because the full duration of the Sligachan smolt run has not been monitored previously, there are not enough data to confirm this hypothesis.

The majority of the captured sea trout (91%) were thought to be smolts who were entering the estuary for the first time. This theory is supported by their size and the absence of marine ectoparasites, including *Cryptocotyle lingua*. *C. lingua* is a common, benign parasite that presents as small black spots on the fins of salmonids and has been regularly seen on post-smolts and adult sea trout in Loch Sligachan in previous years. Because the captured sea trout smolts were unlikely to have migrated into the marine environment before they were intercepted by the fyke nets, they would not have been exposed to local sea lice densities in the water column prior to sampling. Therefore, it is probable that the lice data collected from the sampled sea trout smolts (i.e. no attached lice) is not an accurate representation of the levels of sea lice in Loch Sligachan.

The lice burden of the captured adult sea trout (367mm and 463g) consisted of 30 Juvenile stage lice, nine Mobile stage lice, and one ovigerous female (Appendix A). The presence of 30 juvenile lice would suggest that they attached to the sea trout relatively recently before the fish was caught during the spring survey. Although it is not possible to determine where the sea trout had been prior to its capture, SLRT has conducted research that has demonstrated that most sea trout will remain in or nearby the same sea loch system for months at a time. Therefore it is possible that this individual became infected with the juvenile sea lice while feeding in Loch Sligachan.

Based on the Taranger lice risk index, this sea trout had a lice burden of <0.1 lice/g^{-1} and was expected to experience little to no lice-related marine mortality. The likelihood of lice-related risk would decrease further if it was able to shed its parasite load. The presence of the sea trout in the intertidal zone of the River Sligachan could suggest that it was seeking out freshwater to “de-louse” itself before returning to sea (Aldven & Davidsen, 2017).

While it is likely that this specific adult sea trout would experience minimal negative impacts from the attached lice, a parasite burden of 30 juvenile sea lice on a sea trout post-smolt weighing less than 100g would result in a lice load of >0.3 lice/g^{-1}, and that fish would be expected to experience 100% lice-related marine mortality if it was unable to shed its lice load. Therefore, if the juvenile lice levels on the adult sea trout are reflective of the lice levels found in Loch Sligachan and the surrounding area at the time of the survey, it is possible that salmonids smolts migrating into the marine environment for the first time in May 2024 could have been exposed to substantial risk from sea lice in the water column.

The highest lice levels on fish weighing more than 150g in this area were reported in 2019 when 83% of fish were expected to experience some level of lice-related marine mortality (Table 3.5). Since 2022, the reported lice levels on sea trout weighing more than 150g have appeared to decline and the population mortality risk has been calculated as Low to Moderate (Taranger *et al.*, 2015). However, because the Sligachan estuary monitoring window is short and the adult sample size has been small (i.e. 1-3 fish a year), it is difficult to determine precise temporal fluctuations in lice levels.

4.1.2 Caol Mor shoreline

The 2024 spring survey marked the second time that a coastal fyke net was deployed at a site near Sconser Quarry. Although no sea trout were caught here in 2023, the net was able to catch multiple other species, demonstrating that it was a good location to intercept fish swimming around the coastline. A total of 10 sea trout were caught during the 2024 spring survey, confirming that it is a successful site for sea trout monitoring.

The majority of the captured sea trout had lice burdens of <0.2 lice/g^{-1} and were expected to experience a 0-20% increased risk of sea lice-related marine mortality, but there were two individuals that reported a lice burden of >0.2 lice/g^{-1} and therefore could experience a 50% or higher increased risk of lice-related marine mortality (Table 3.8). Juvenile lice life stages were the most commonly seen, with one sea trout hosting 94 juvenile lice. The presence of juvenile sea lice life stages could suggest that sea trout were infected recently in the area, similarly to the sea trout caught in Loch Sligachan.

Although varied, lice burdens on the 10 sea trout appeared to be lower than the levels seen on sea trout caught in the spring of 2023 in a nearby area (Table 3.9). This is a similar pattern to the lice levels observed on migratory fish caught in the estuary of Loch Sligachan.

These fluctuations in parasite burdens at both sites could be linked to the lice levels reported from the salmon farms in the Caol Mor area (Maol Ban and Sconser Quarry). Both sites had been stocked for a year prior to the 2023 spring survey and had reported adult female lice levels that had exceeded Code of Good Practice (0.5 adult female lice/fish February-July, 1.0 females/fish July-January) several times in the months leading up to April 2023. Lice levels on both sites did drop below CoGP levels in May 2023, but the cumulative lice levels in the surrounding area could have remained elevated (maintained by wild and farmed fish populations) and led to increased levels of lice on wild fish which were observed during the 2023 spring monitoring work.

Both sites reported lice levels that exceeded 1.0 adult female lice/fish several times in the months leading up to a completed harvest in February 2024. After harvesting, Maol Ban and Sconser Quarry remained fallow until April 2024. The approximate 9-week fallow period (26th Feb- 22nd April) would have helped to decrease the number of lice in the surrounding water column and could have resulted in lower mean lice burdens on wild sea trout in May 2024 (34.6 ± 34.3 *L. salmonis*/fish) relative to the mean lice burden reported during the May 2023 survey (43.5 ± 59.6 *L. salmonis*/fish).

However, the lice levels recorded at Caol Mor were the highest reported in the SLRT area in the spring of 2024, and there were several sea trout caught during the survey with lice burdens that would have resulted in an increased risk of lice-related marine mortality. Therefore, it is possible that a 2-month fallow period does not provide enough time for elevated lice populations in areas of intensive aquaculture to reach a level that substantially reduces the risk of lice-related marine mortality for wild salmonids in the same habitat.

4.1.3 Predation

In response to a predator attack on the coastal fyke net in 2023, SLRT added anti-predator netting to the back of the coastal net in 2024 to deter seals from biting through the it. Unfortunately, the addition of this netting was not enough to stop the seals from killing sea trout on the final day of the spring survey.

The Caol Mor area has a large seal colony and it is clear that this will be an ongoing problem for this site. Other locations with a smaller seal presence should be considered for future monitoring.

4.2 Electrofishing

4.2.1 River Sligachan

The 2024 electrofishing surveys demonstrated that salmon and brown trout are present in the River Sligachan, but at low levels. While numbers of juvenile salmon caught in the River Sligachan during annual monitoring work remain consistently low, it is encouraging to see a slight increase in CPUE at every site visited in 2024 when compared to previous electrofishing survey results.

Site SLIG01 had not been surveyed since 2005 but the number of salmon fry caught at this site (N=40) could suggest that the most downstream reaches of the Sligachan are acting as important juvenile habitats. Given that this section of the river is in an increasingly popular tourist attraction, further monitoring should occur to ensure that local fish populations are not being negatively impacted by anthropogenic influences.

Similarly to previous years, the tributaries that were fished during the 2024 monitoring programme appeared to contain higher densities of juvenile salmon and trout when compared to the main stem of the river. This indicates that these tributaries are important spawning habitats.

4.2.2 Broadford River

Juvenile brown trout and Atlantic salmon were found in the Broadford River, indicating that both species are continuing to spawn successfully. The 2024 survey results reported an increase in the number of juvenile salmon and/or trout caught at each site compared to recent years. This is an encouraging result although monitoring should be continued to investigate temporal trends.

The continued presence of European eels at both survey locations show that the catchment is utilised by other threatened diadromous species.

There is an established population of non-native minnows at Site BRD09, and in other sections of the main stem of the river. It is possible that they are acting as a food source for larger salmonids that occupy the same area.

4.2.3 Strathmor River

The results from the 2024 survey of the Strathmor River reported a concerning lack of juvenile fish in areas where they had been previously found. The complete absence of salmon fry in any of the survey sites could suggest that little to no adult salmon were able to spawn successfully in the winter of 2023. The presence of a single trout fry across both of the two downstream sites could indicate a similarly unsuccessful spawning season for adult trout in the lower reaches of the river.

Site SMR09A reported the largest number of trout caught in the 2024 Strathmor surveys, but only one salmon parr was found at this site. No salmon were found upstream in Site SMR11. The lack of salmon fry at both Sites SMR09A and SMR11 could be related to the creation of a new natural barrier in the system. Upon arrival at Site SMR09A, SLRT staff observed that a large amount of sediment had built up in the river channel and was blocking water flow. The amount of sediment at this site has been gradually increasing over the years, but it is likely that prolonged flooding periods between the 2023 and 2024 surveys could have added a substantial amount of sediment to the site, making it impassible to migrating fish except during extreme high flows. The natural flow of the river was diverted into the hill loch downstream, but it appears that the inlet connecting the upper reaches of the river and the loch is shallow and filled with dense vegetation so it is unclear how easy it would be for fish to navigate between the two.

Future surveys could be conducted above the barrier in order to determine if it is having a long term impact on salmonid migration.

5.0 CONCLUDING COMMENTS

Since 2022, Mowi and SLRT have communicated early in the year about the management decisions being made on the three Caol Mor farms to minimise sea lice densities in the wider Loch Sligachan area prior to the smolt run. This level of open communication between the two organisations is beneficial to the protection of wild salmonids and should continue.

While the results of this year’s monitoring work do appear to show that lower levels of lice were found on wild salmonids in the Caol Mor area relative to 2023 data, there are several other factors to consider. Sea trout smolts making their first migration into the marine environment in 2024 had not been exposed to local lice levels prior to sampling and therefore the ‘0’ lice burdens reported this year are not directly comparable to the lice burdens observed on sea trout post-smolts in 2021 when they were caught while re-entering the River Sligachan.

The sea lice burden found on one adult sea trout weighing more than 150g is more likely to be representative of the lice levels in the water column, as the fish would have been moving through the sea loch prior to sampling. Through the Taranger lice risk index, this larger individual was not expected to experience lice-related mortality, but smaller sea trout smolts could accumulate similar lice burdens after their initial marine migration and could be heavily impacted by the same number of parasites. Therefore it is important to continue improving the lice management on farm sites in the area with the intention of decreasing the number of lice that enter the surrounding water column from open-net pens.

It is also evident after this year that there are still some adjustments needed to improve wild fish capture efficient and safety in Caol Mor and therefore site selection and deployment timing should remain flexible in future years.

The electrofishing results from 2024 showed mixed results for all three rivers. Sites in the Rivers Sligachan and Broadford reported numbers of juvenile salmonids similar to what has been caught in the same locations in previous years. Most sites are supporting juvenile salmon densities that are similar to the national juvenile benchmark set for these types of rivers, which is a positive result. Unfortunately the Strathmor River seems to have suffered a noticeably unsuccessful spawning year in the winter of 2023 for both salmon and trout and it is important to continue monitoring this river to determine if future spawning seasons are more prolific.

Wild salmonids in Scotland, including local populations in Skye and Lochalsh, are facing increasing pressures in both marine and freshwater environments. Every effort should be made to reduce the environmental and anthropogenic risks that negatively impact their survival.

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