West Sutherland Fisheries Trust

Preparing to net Culkein (D. Haines)

2023 Annual Review

Contents

THE WEST SUTHERLAND FISHERIES TRUST

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Chairman's Foreword

Once more, we had a hectic year in 2022! The welcome addition of a second permanent member of staff was a necessary step, but our growing workload places high demands on our small staff and band of volunteers, especially when so much has to be done in spring and summer. I pay tribute to them all for their dedication, hard work and effectiveness.

I must also thank the many local estates, angling clubs and aquaculture companies that support and enable our work.

Just before this review was published our founding Chairman died at the ripe old age of 95. Dr Jean Balfour CBE achieved many things in a busy life, which is all the more amazing given the less-enlightened environment for women in work she worked in. No less a figure than Tam Dalyell described her decade as Chair of the Countryside Commission for Scotland as "successful, effective and pioneering". She was an expert in arctic-alpine vegetation, a forester and, under her maiden name, an artist. Locally, she was the much respected owner of Scourie Estate and she was a staunch supporter of the WSFT, serving as our Chairman from 1996 until 1999. We shall miss her and offer our condolences to her family.

Finally, I thank my fellow trustees for giving so much of their time and energy to our little organisation that somehow manages to punch above its weight.

Simon Jeffreys

Dr Jean Balfour CBE

A summary of 2022

WSFT undertook a range of field work during 2022. In addition to this, we participated in a number of meetings and outreach events. Further details of the different projects are available in the rest of the document or from the Biologist.

Outreach

Field day with 1 primary school;
Attended Moy Country Fair;
Ghillies seminar;
Talk, The secret life of the eel;
Riverwoods screenings

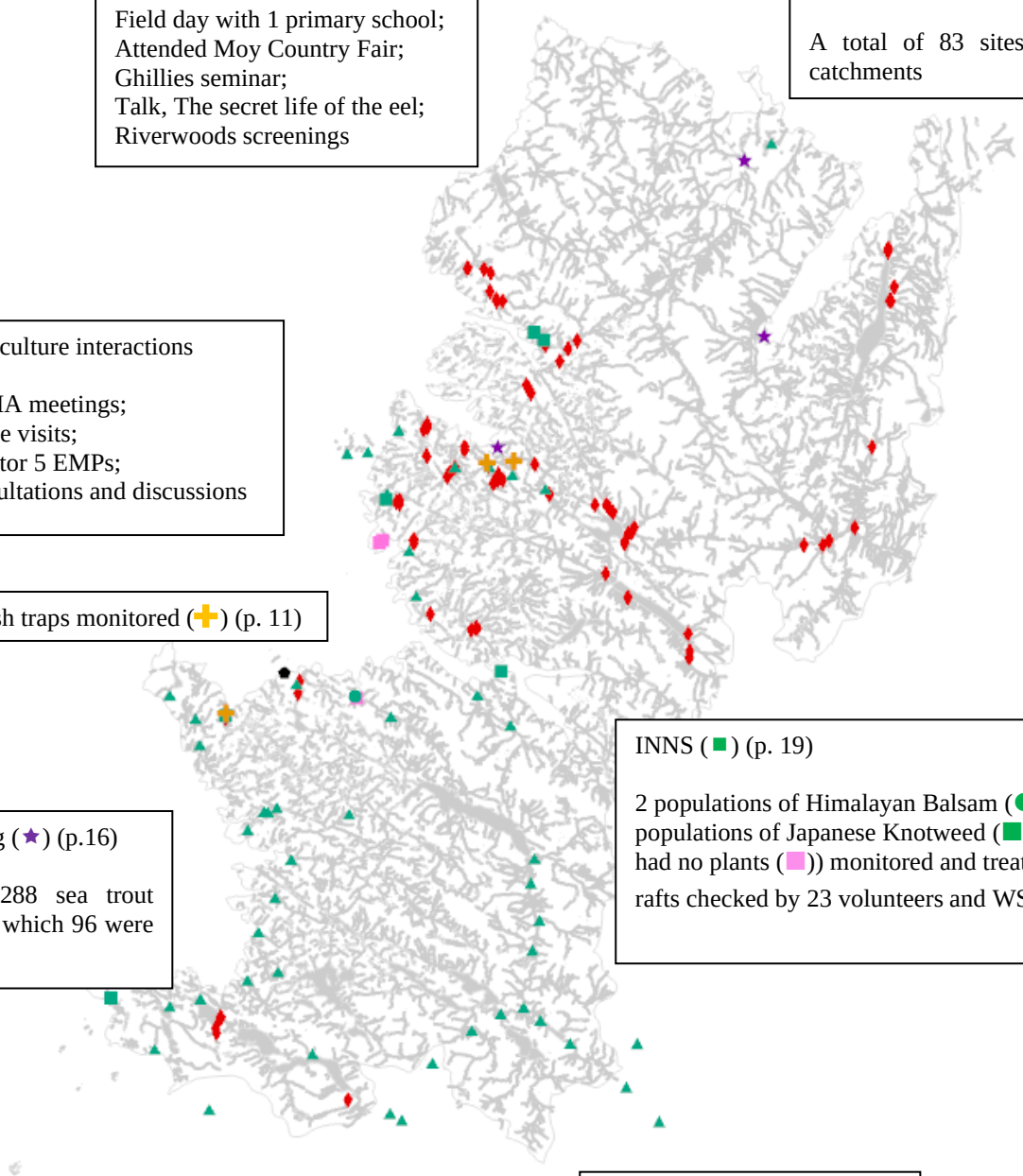
Juvenile surveys (♦) (p. 9)

A total of 83 sites over 15 catchments

Aquaculture interactions

2 AMA meetings;
33 site visits;
Monitor 5 EMPs;
Consultations and discussions

3 Fish traps monitored (✚) (p. 11)



INNS (■) (p. 19)

2 populations of Himalayan Balsam (●) and 9 populations of Japanese Knotweed (■) (of which 3 had no plants (■)) monitored and treated; 54 mink rafts checked by 23 volunteers and WSFT (▲)

Sweep netting (★) (p.16)

A total of 288 sea trout examined, of which 96 were tagged

Sat on 5 external committees;
Participated in 6 multi-area projects

Introduction

The **West Sutherland Fisheries Trust** works towards the conservation and restoration of fish populations. Now entering its twenty seventh year, the information database for the Trust area continues to grow and provide useful data for owners, managers and policy makers. In addition, the Trust retains strong links with a variety of organisations and individuals throughout Scotland and looks forward to cementing these links in the coming years. These links enable the Trust to move towards the integration of management within the Trust area.

Within the Trust area we are developing projects and practical management tools with a variety of local organisations, including Angling Clubs, the Highlife Highland Ranger Service, the school system, estates and community groups. These collaborative projects not only assist the Trust with its work but also further integrate it into the local communities, while taking us into a range of different habitats. It is to be hoped that the Trust will continue to be seen as a valuable resource within the community – both to managers and the general public – providing helpful advice and educational opportunities that can be called upon at any point.

2022 saw the employment of a 2nd full time biologist within the Trust. Morven MacKenzie joined us in April and was very much thrown in at the deep end but has proven to be an excellent swimmer. We have taken part in wide range of activities, with many detailed in this report. The weather was mixed, but despite rain cancelling play on a number of occasions, we still managed to have a good electrofishing (see p. 9) and sweep net (see p. 16) season.

The West Coast Tracking Project (WCTP) started in 2021. This project is managed by the Atlantic Salmon Trust (AST) and involves a number of Fisheries Trust, including WSFT. Salmon were tagged with hydroacoustic tags from a number of catchments along the west coast of Scotland with the aim of examining migration routes. The surveys for 2022 were based on the 2021 results to give a fine tuning of the information being sought (see p. 21).

The mink initiative, now part of the Scottish Invasive Species Initiative, continues to operate under the management of the Trust and we are extremely grateful to all our volunteers for making this possible. While there have been very few sightings, it is important that everyone remains vigilant. The volunteers always rally - increasing efforts following sightings and it is to their credit that we remain a relatively mink free area (see p. 19).

The Trust would like to take this opportunity to thank the many individuals who have given time and effort to assist with the work programme. Without these committed individuals we would not have the range of information and data currently existing and would therefore not be in the present position of offering advice and guidance to the many owners and managers within the area. In addition, much of the restoration work and biosecurity actions currently in progress would be much further behind.

Partnerships

The Trust continues to maintain a close relationship with partner organisations in Fisheries Management Scotland (FMS) and the Scottish Fisheries Co-ordination Centre (SFCC), and national organisations such as Marine Scotland Science (MSS), Scottish Environmental Protection Agency (SEPA) and Nature Scot (NS). This allows the Trust to access a vast wealth of expertise and information as well as enabling the targeting of research to better further our aims.

The Trust also works closely with the local District Salmon Fishery Board, and the local estates, in order to assist with the management of the area. By providing advice on local issues, as well as assisting with any statutory consultations that arise, we hope to ensure that the fish and their environment are supported and protected. In particular, we are able to provide advice and guidance on stocking, fish farm applications and the Conservation Limits, as well as the use of habitat improvements within the area.

The Future

The WSFT will continue with its current work, maintaining and developing the many datasets and using the data to inform management decisions. It is hoped that we can enlarge the research programme and enhance the many links currently in existence with individuals and organisations. In order to do this, it is reliant on the generosity, both in terms of time and financial aid, of its many supporters, enabling the Trust to move forward with the development of management policies within the area.

Biosecurity remains an important issue for the Trust, in an area that remains relatively free of invasive non-native species (INNS). We hope to keep it like this, operating to decrease the numbers and potentially make the area free of Himalayan Balsam and Japanese Knotweed (see p. 19). Unfortunately 2023 sees the end of the Scottish Invasive Species Initiative (SISI), an HLF funded programme of work managed by NS and involving a number of Trusts throughout Scotland. While there is an application in place for a further project in this area, the Trust will continue the work currently underway even in the absence of this funding.

The Trust will continue to assist community groups and land managers with practical fisheries management and advice. It is hoped that restoration programmes, as laid out in the Catchment Management Plans, will be developed and progressed. The Trust is always available for discussion and should be contacted if you have any queries or suggestions.

The Trust would also like to further develop the educational aspects of our remit through talks, demonstrations and small “hands on” projects. As in previous years this is likely to involve the Ranger Service and schools, although it is hoped that other groups and individuals will also access this service. Shona is a Science and Engineering Ambassador and therefore can also be accessed through the STEMpoint network. This has the potential to extend our educational remit, and information about the Trust, beyond the local area.

Project Laxford, a collaborative project between Atlantic Salmon Trust and Reay Forest Estate, started in 2021 (see p. 23). This long-term project hopes to establish an index river, testing the impacts of management actions, linking to a network of similar rivers world-wide. The Trust is pleased to support this project, together with Marine Scotland Science, and are looking forward to working with Chris now and in the future.

The WSFT also undertake some consultation work as requested. This adds to our knowledge of the area, as well as providing additional funding. While this work can be undertaken for anyone within the area, we currently undertake a substantial body of work with the local aquaculture companies, including the audit of sea lice counting on the cages and the completion of work towards the Environmental Monitoring Plans (EMP).

The emphasis will continue to be the wellbeing of native wild fish in the West Sutherland area and the Trust will represent them where required and defend their interests where it is felt that these are being ignored. The WSFT and its representatives feel that all populations are important, irrespective of size, and that their protection and enhancement are vital to the survival of these magnificent species.

Catches within the West Sutherland area

While catch statistics are generally used to determine the trends in salmonid populations, it must be recognised that there are a number of potential inaccuracies and inconsistencies inherent within this method. These include the following:

- The numbers of fish noted within the tables relate only to those fish recorded within the books. If anglers fail to report all or part of their catch then the figures will be an under-estimate of the total.
- Angling effort varies between years and is not recorded. A change in effort, either number of anglers, experience or time spent fishing, will be reflected in changes in the catch statistics.
- Weather and river conditions affect the number of fish within the systems and their catchability. Thus a low catch in a dry year may not reflect a poor adult run, simply the timing of the run and the ability of the angler to catch fish.

This leads to the view that the relationship between catches and stocks is complex. Catch records do not reflect the number or quality of fish in the system, but rather the angler ability to catch them under the conditions experienced at that time. Catch figures are therefore most valuable when it comes to expressing long-term trends.

2021

The official catch statistics for salmon and sea trout in Scotland have been published (https://data.marine.gov.scot/dataset/salmon-and-sea-trout-fishery-statistics-1952-2021-season-reported-catch-district-and-method) and the data for the West Sutherland area are summarised below (Table 1). These statistics are frequently used to indicate long term trends in populations, by region. By extracting the data relevant to the WSFT area, we can gain a greater understanding of the situation, as represented within this area. The data are given as an amalgamation of several rivers, as previously reported by Marine Scotland (Fig. 1). This is the result of a requirement of the Scottish Executive to mask the catches from individual systems in order to retain the confidential nature of the data.

Table 1 The number of wild fish caught by rod and line, by Fishery district

Fishery Board		Salmon & Grilse	Sea Trout
Hope & Grudie	2021 (2020) *5 yr. ave.*	163 (168) *243.2*	907 (826) *831.2*
Inchard – Kirkaig	2021 (2020) *5 yr. ave.*	230 (331) *319.8*	218 (231) *261.4*

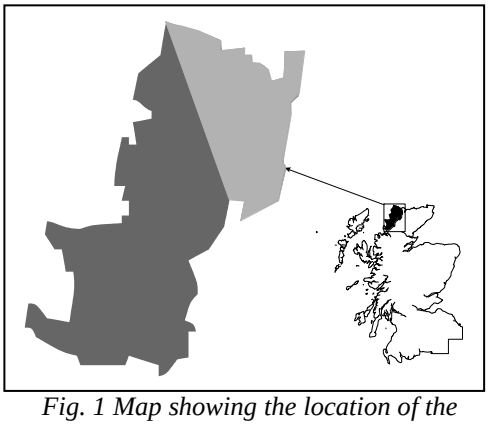


Fig. 1 Map showing the location of the WSFT area and the 2 areas described in the table (pale grey = Hope & Grudie; darker grey = Inchard – Kirkaig)

Total salmon catches within the area were down on the 2020 catches, with the greatest decrease in the Inchard - Kirkaig area. Part of the decline in the Inchard – Kirkaig area is likely to be the result of the River Laxford closing to commercial lets, thus significantly reducing the fishing effort. However, the decline is part of a long-term trend and therefore still important (Fig. 2). Catches across the area remain below the 5-year average.

The release rate within the area was higher than in 2020, at 98.5%, and very encouraging. The greatest proportion of salmon released (>99%) were from the Hope & Grudie, with 98% release in the southern area. This high release rate is welcomed and hopefully will continue in the future. While it is known that released fish can be re-captured on several occasions, thus influencing the suitability of catch returns to estimate adult runs, it is important at this time of low marine survival to release fish in order to increase the spawning stock. Remember, the fish in the freezer or on the table cannot breed!

Sea trout catches within the area showed a slight increase compared to 2020 (Fig. 2), although there was a decrease in the Inchard – Kirkaig area (Table 1). Only 1 sea trout was retained in the Hope & Grudie area, while a total of 20 (9%) fish were retained in the Inchard – Kirkaig area. This was disappointing to see, particularly given the decline in catches observed. There was an overall total of 98% of sea trout released.

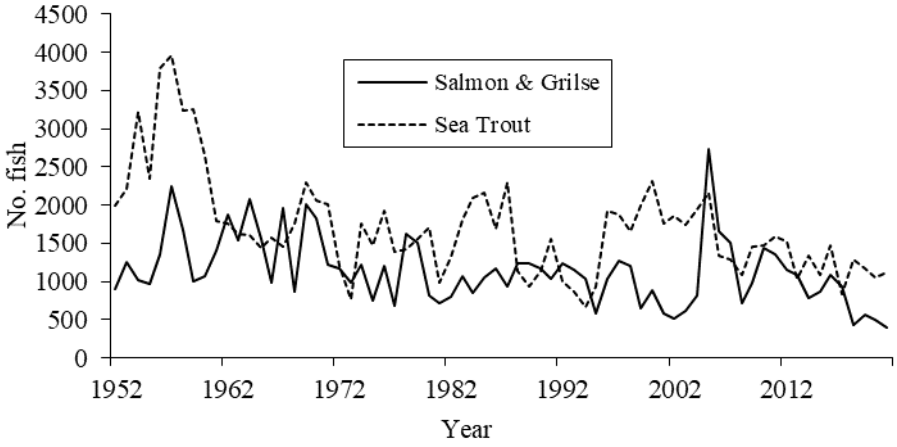


Fig. 2 Rod and line catches within the West Sutherland area, 1952 – 2021

2022

Catch data for the 2022 season are being compiled and will be produced by Marine Scotland Science later in 2023. However, some information is available from angler logs and fishing books. Reports indicate that there were good numbers of fish present in the early part of the season, although this declined in August and September. However, the fish that were caught were in good condition and of a good size.

Catch and release continues to be an important fisheries management technique within the area and has been adopted by a number of estates. It is to be hoped that this continues to be used, and hopefully increased, by the various estates and their angling clients, adding as it does to efforts throughout the area to improve the situation for fish populations through biosecurity, removal of non-native species and habitat improvements amongst others.

The new Scottish Government conservation limits for the area have been produced, with no rivers moving category (see p. 24). The model has not been altered since 2020, so movement should reflect alterations in catches and a better understanding of the underlying figures within the model. While sea trout are not affected by this legislation, the continuing low levels of catches would suggest that catch and release is of equal importance to this species.

All information on the fish populations within lochs and rivers is important when undertaking fisheries management. Any further information that can be provided will be gratefully received, particularly on the brown trout lochs within the area.

Salmon (S. Barnes)

A survey of juvenile abundance

Electrofishing surveys are designed to assess the juvenile populations within a system. The equipment operates by creating an electrical field within the water that at first attracts and subsequently stuns them for a brief period, at which point the fish can be netted out and examined under anaesthetic. The Trust has a rolling programme of surveys, with most sites visited every 2 years, while a small number may be sampled annually. When possible, all sites are revisited although some may not be accessed due to time and flow constraints, while others may be added. In 2022 we repeated surveys of 13 catchments, plus a further 2 undertaken for contract and not reported here.

The average densities of fish within each catchment are summarised (Table 2). This allows comparison between the catchments, although it should be noted that temporal changes in density throughout the summer months and habitat differences between catchments are not considered in this table, and neither is the number of sites per catchment. The timing of sampling is important, with fish moving within the tributaries as a result of water height and temperature, food availability and size. Thus, sampling after a spate may give a low density as a result of washout, whilst drought may decrease density as fish move into deeper water to avoid predation or desiccation, or may increase density as a result of concentration in severe cases. Similarly, densities will be greater shortly after hatching, reducing with time as the fish grow and require a larger territory for survival.

Table 2 Average densities of salmonids per catchment surveyed

	Average density (100 m^2)			
Catchment	**Salmon fry**	**Salmon parr**	**Trout fry**	**Trout parr**
Hope	17.96	10.09	21.29	5.18
Achriesgill	18.01	12.61	5.47	2.70
Oldshoremore	5.73	2.64	17.64	13.07
Loch Innis na Ba Buidhe	0.00	0.00	54.80	19.69
Loch na Thull	51.41	20.69	22.23	3.13
Laxford	21.88	4.14	24.85	5.62
Bad na Baighe	15.65	20.56	4.24	3.53
Claise na Fearna	7.05	11.43	7.14	5.59
Loch nam Brac	0.00	0.00	34.07	5.16
Bhadaidh Daraich	0.00	0.00	13.53	8.38
Geisgeil	10.52	9.52	2.49	7.92
Duart	0.00	28.97	9.67	12.50
Garvie	5.69	5.53	13.08	11.36
West Sutherland area average	**12.82**	**9.74**	**17.63**	**7.90**

There is a good distribution of salmonid species throughout the West Sutherland area with trout present in every system surveyed. A comparison of the area average with the SFCC absolute regional classification scheme for salmonids indicates that salmon densities for the area are moderate to good, while trout densities are good to excellent. This is likely to reflect the fact that trout are present throughout the survey, while salmon are only present in 69% of the catchments.

An assessment of all sites surveyed against the SFCC regional classification demonstrates that 36.0% of all sites support good and excellent densities of salmon fry, with parr classified as good and excellent in 33.3% of sites surveyed. Trout fry densities were seen at excellent and good densities in 46.7% of sites, and 49.3% of sites were found to have good and excellent densities of trout parr.

Discussion

Catchments surveyed during 2022 included 3 trout dominated systems, of which 2 are inaccessible to migratory fish. This is balanced with the inclusion of 2 larger salmon dominated catchments which would suggest that the area average is a good reflection of the situation within West Sutherland and not

dominated by catchment selection. This indicates that there is a good balance between the species, although trout are more numerous.

The spread of minnows within the area is of some concern and reflects angler practice to a large extent. Introduced historically as live bait, their spread partly reflects the accessibility of the sites, i.e. proximity to roads, and their relatively high reproductive rate. Where present they can out-compete salmonids, thus impacting on their population. This should therefore be monitored to ensure that there is no spread to virgin sites.

Whilst instream habitat characteristics within the West Sutherland area are generally favourable for salmonids, strategic planting of mixed broadleaf trees within riparian zones would undoubtedly improve fish cover, food availability, and bankside stability.

While undertaking these surveys we also encounter other species within the sites (Fig. 3). Trout can be seen to be present at the majority of sites surveyed, with only 3 catchments having sites that did not contain the species. Salmon, in contrast, were only present at all sites in 4 catchments. Eels were present in all catchments, but only at all sites within 3 catchments, indicating some variability in distribution. Minnows were also widespread throughout the area, present in 8 catchments, although only the Duart returned minnows at each site. This is likely to reflect the location of the sites and the fact that the minnow is an introduced species and therefore more likely to be patchily distributed. Stickleback were not recorded during this survey.

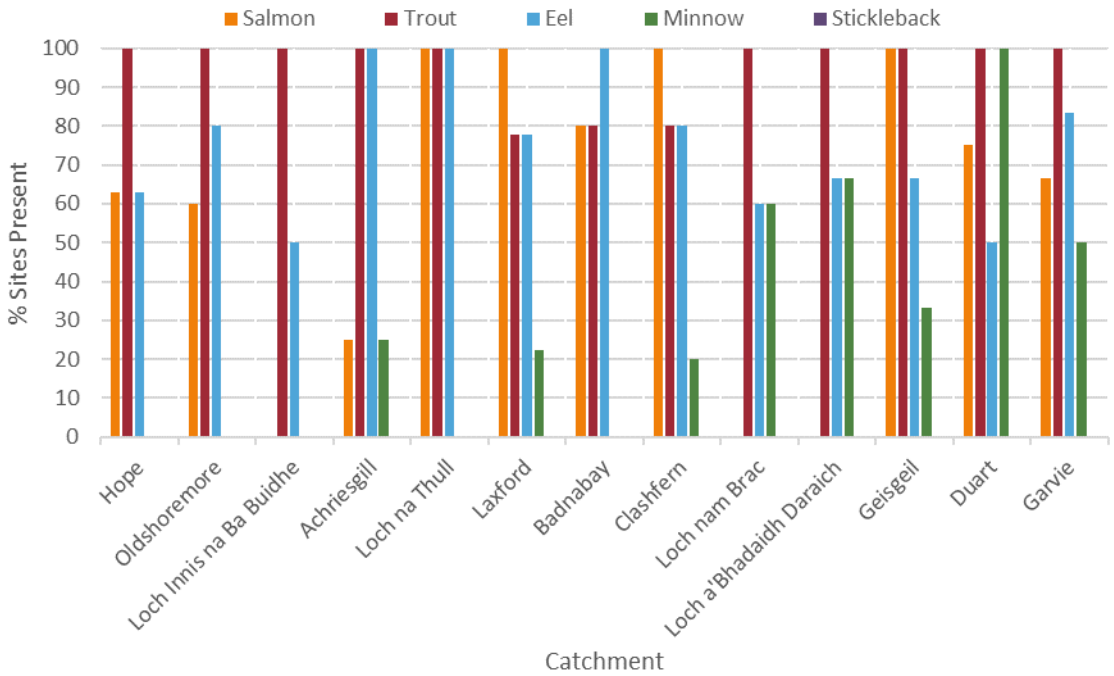


Fig. 3 Species composition and distribution per catchment

Smolt Traps

Counting the number of smolts leaving the river is a good way of determining the composition and health of the salmon and sea trout populations. Additional information can also be gained on the timing of the run and changes in the size composition.

During 2022 we operated 3 smolt traps within the area. Each had a different purpose, but all gave important information on the fish populations within the catchments.

1 Laxford

A rotary screw trap was operated in the River Laxford from 13.4.22 to 3.5.22. A temperature recorder was placed in the trap, set to record hourly while the trap was installed. The RST operated each day with the exception of 29.4.22 when it was raised as there was no one available to check it. The trap was repositioned within the flow on 21.4.22 to reduce the capture efficiency and therefore number of sea trout kelts captured. All fish captured were removed and the species recorded. In addition, 100 salmon and 90 sea trout were acoustically tagged. The salmon formed part of the West Coast tracking project (see p.21) while the sea trout were tagged (together with 10 from the estuary netting) as part of a project to examine the trout usage of Loch Laxford.

Sea trout kelts dominated the catches at the start of the sampling period. Repositioning the trap resulted in a switch to smolts, with salmon dominating the catch throughout the survey period (Fig. 4). Few brown trout were seen. The trap was removed following the completion of the tagging but before the smolt run ended.

The water temperature started warm, increasing over the survey period. (Fig. 4). Salmonids require a temperature of about 7ºC before starting to move, and this temperature was exceeded at most points over this period.

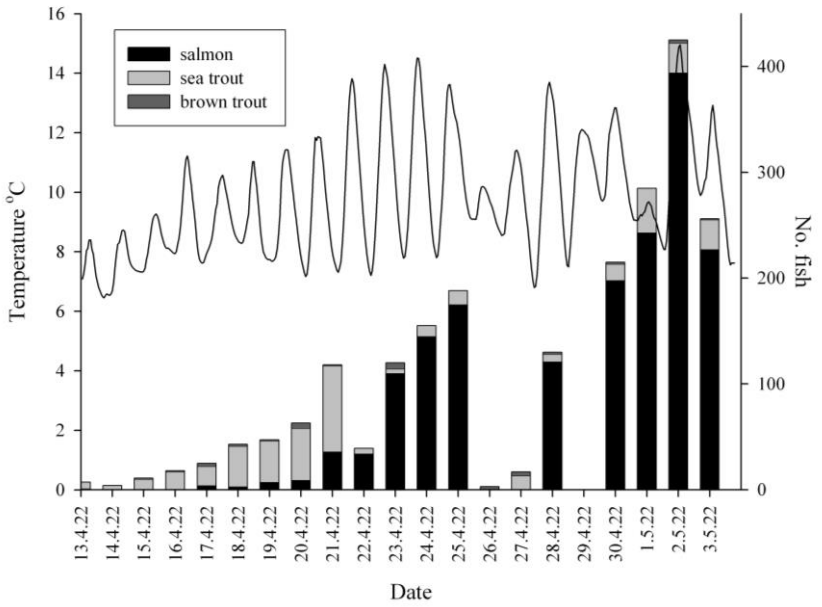


Fig. 4 Showing the temperature regime within the river (line) and no. of fish caught on each day (bar)

2 Bad na Baighe

A mobile smolt trap has been deployed annually in the Bad na Baighe catchment since 2012. A temperature recorder was placed in the trap, set to record hourly while the trap was installed.

In 2022, the trap was operated from 13.4.22 to 4.5.22. During this time there were few fish captured and the trap did not run for much of the time, with the river opened to allow movement of fish. No salmon were caught in the trap on this occasion.

The water temperature was warm throughout the survey period, with diurnal fluctuations dominating (Fig. 5). Salmonids require a temperature of about 7°C before starting to move, and this temperature was exceeded for most of the study period.

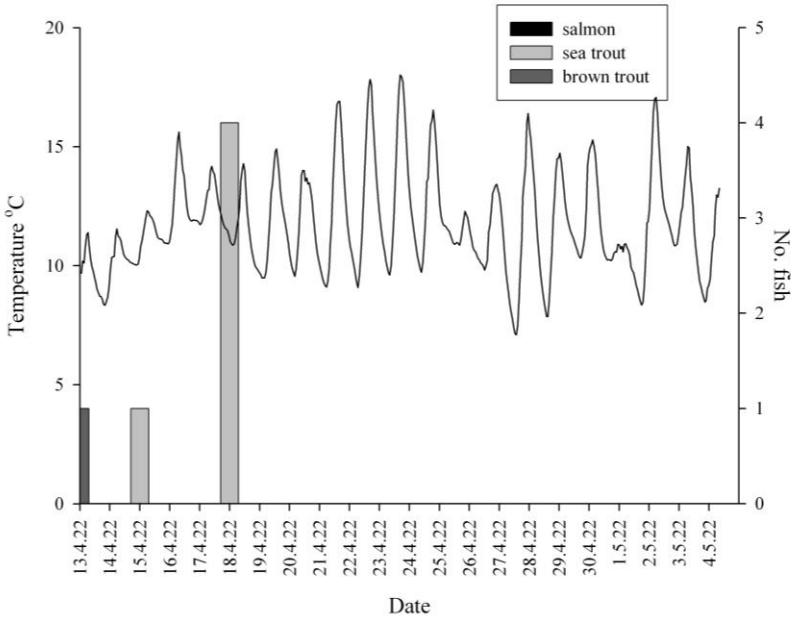


Fig. 5 Showing the temperature regime within the river (line) and no. of fish caught on each day (bar)

3 Clashnessie

A mobile smolt trap was operated in the Clashnessie Burn from 15.4.22 to 25.5.22. The purpose of this trap was to determine the size and nature of the smolt run from this burn, and was operated in conjunction with Loch Duart Ltd.

While operating, a small number of fish were taken within the trap (Fig. 6). However, despite the presence of trout, there were no smolts seen. This would suggest that there is no regular migratory salmonid population within the Clashnessie burn and confirms the anecdotal information for the system.

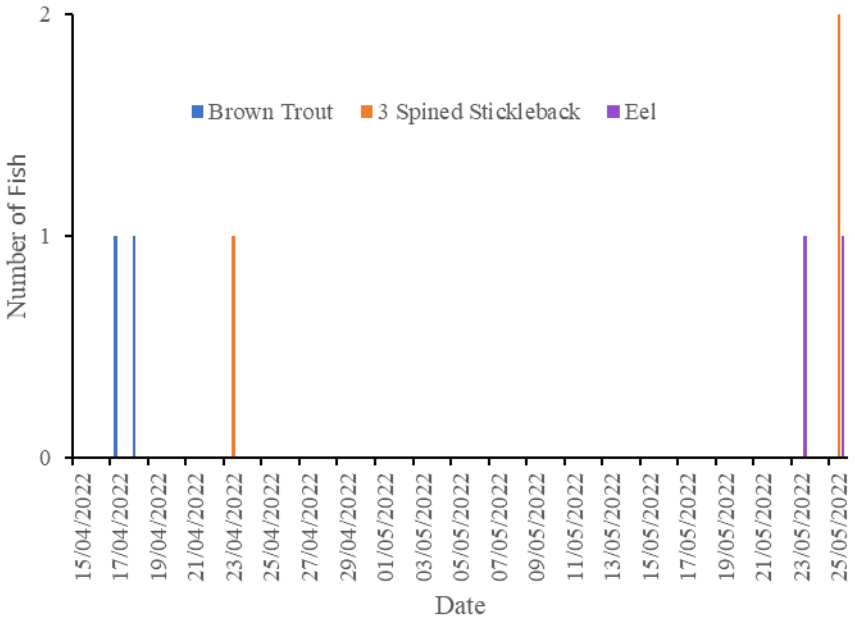


Fig. 6 Fish captures by species and date

The rotary screw trap in position (S. Marshall)

Sandeel (S. Marshall)

The scenic office (S. Marshall)

Extreme sampling! (S. Marshall)

Pipefish (S. Marshall)

Pulling the net (D. Haines)

On guard (S. Marshall)

Lamprey (S. Marshall)

Balsam pulling behind bars! (S. Marshall)

A busy mink raft (S. Marshall)

An unwanted visitor in the fyke net (S. Marshall)

At the Moy Country Fair (S. Marshall)

After the netting (S. Marshall)

Monitoring of sea trout post-smolts

Introduction

Started in 1997, this project was originally designed to give an indication of the migrations and growth of sea trout within the area. In addition to these data, the numbers of sea lice were also assessed. This has now progressed, such that sea lice counts are the most important part of the project given our position within the marine aquaculture zone.

Materials & Methods

Three estuaries, Laxford Bay, the Polla estuary and the Kyle of Durness were sampled monthly where possible from April to September, at low tide. A total of 288 fish were individually measured and scale samples taken. The fish were also examined for the presence of sea lice, which were counted and staged.

Results and Discussion

The fish caught were of varied age and length, reflecting a mixed population structure. The age structure in the estuaries was similar, with a predominant smolt age in the river of 2 years (S2), although there were several S3's also present. S1's were observed in small numbers in both the Polla and Laxford. The length distribution of fish within the estuaries was similar, although with a greater range in size in the Polla. Post-smolts dominated the Polla and Laxford samples. There were several mature fish taken in both estuaries, with the largest being seen in the Polla.

The presence of post-smolts at all sites throughout the year indicates a heavy usage of estuaries by this group, presumably for feeding and shelter.

Recaptures

There were 5 recaptures during 2022, 2 within the Polla estuary and 3 within the Laxford estuary. Of the recaptured trout 4 were tagged in 2022 and 1 in 2021. All fish were tagged and re-captured in the same location. This pattern is common to the sampling programme over the past 25 years and demonstrates that the majority of sea trout do not stray far from their home rivers.

Average growth rates within the Polla were 19.2 mm, and 103 g per month. Within the Laxford these were 7 mm and 15.2 g respectively.

Sea Lice Infestations

Sea lice were present to a varying degree in both the Polla and Laxford throughout the year. With only one fish captured in the Kyle of Durness, this system has not been included in further analysis. Both estuaries showed a mixture of lice stages. The highest numbers were seen in the Laxford during September. However, the total lice number per sample is dependent on sample size and the use of abundance and intensity data give a better assessment of the situation.

Laxford

Lice were present throughout the year, with the exception of May. Abundance increased over this time, although the intensity was greatest in April indicating that the few fish with lice had greater numbers than in September when prevalence was greater but numbers of lice per infected fish lower. *Caligus* were present in August and September on a small number of fish.

The neighbouring fish farm cages were stocked in October 2021. *Lepeophtheirus* numbers have been zero or very low throughout this period. However, *Caligus* were present throughout the period.

Polla

Lice were present in April and July, with abundance increasing between the 2 months. *Caligus* were only present in July.

Within the neighbouring fish farm cages, Sian was stocked in March, while Kempie remains fallow. *Lepeophtheirus* numbers have been zero or very low throughout this period.

A risk assessment of the lice numbers present within the wild trout

Taranger, *et al.* (2014) gives a method to assess the increased mortality risk to salmonid populations based on the number of lice present per gram of fish. This is based on physiological effects determined from laboratory experiments taken from literature, and the use of sentinel cages within fjords.

The data are treated differently depending on fish size and give a potential increased risk of mortality to each fish, with increasing risk as the number of lice increase. In order to determine the likely population effect, the proportion of fish within the population appearing in each band is calculated and a population risk determined. Fig. 7 gives the results by year for each estuary, with the banding indicating whether the risk is low (green), moderate (yellow) or high (red). Within the green zone it can be taken that there is minimal risk to the population, while the yellow and red zones show potentially population altering impacts.

From this, it can be seen that the potential risk in all estuaries examined was considered to be low for 2022. In this instance, the Laxford showed the highest 'risk' at 2.27% increased mortality.

The Laxford and Polla data continue to show a biannual pattern in risk, reflecting the stage of production within the local fish farm. While sampling within the Kyle of Durness has been less regular over time than the other 2 estuaries, there would appear to be no real pattern within the data. However, the peaks in potential risk do appear to follow the Laxford more closely than the Polla. While not significant, this may reflect the tidal flows around the west coast.

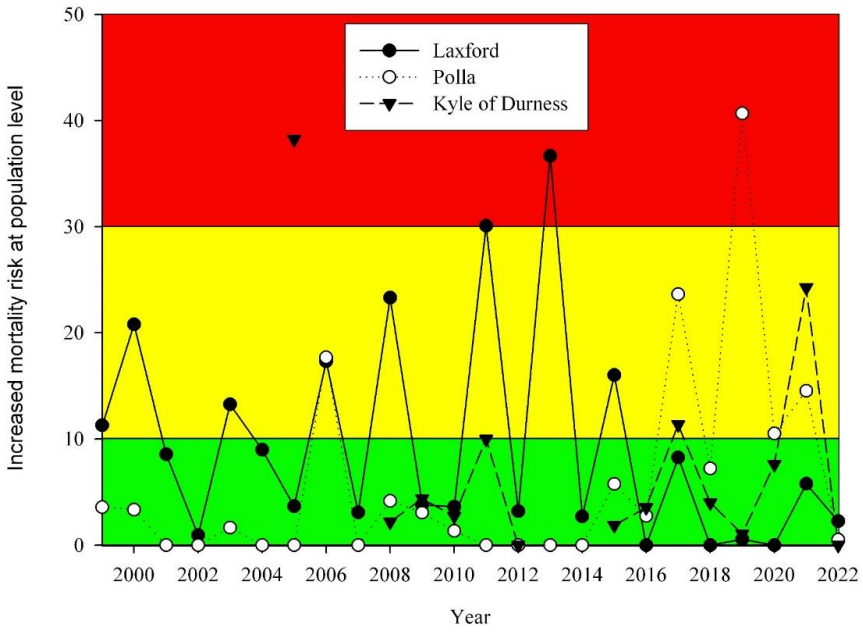


Fig. 7 Showing the increased mortality risk at population level created by sea lice

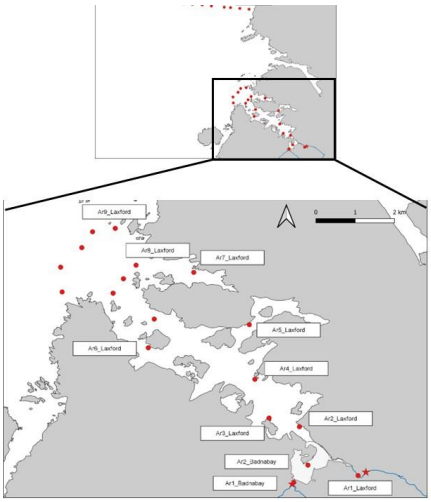
The full report of this project can be downloaded from the website or obtained by contacting the Biologist. Videos of the sweep netting process are also available to view on the website, Facebook or Youtube (https://www.youtube.com/user/WSFTrust).

Sea Trout Migrations

As part of the West Coast Tracking Project (see p.21) during 2021 and 2022 we also tagged 100 sea trout. The aim of this was to assess the usage of the sea loch by sea trout, and build on the findings of a similar project carried out by the University of Glasgow in 2018 (https://wsft.org.uk/images/pdf/Laxford_sea_trout_tracking.pdf). The data from this survey was analysed by J. Rodgers, AST.

2021

Of the 100 sea trout tagged, 37 were captured in the River Laxford and 63 in Bad na Baighe. Both rivers flow into Loch Laxford at a similar location. Due to battery size the tags have a lifespan of approximately 3 months. During analysis the results were separated by river to allow comparisons between the rivers.



Location of acoustic receivers. Red stars are where sea trout were tagged. Red dots are acoustic receivers.

After tagging, 34 fish from the River Laxford and 57 from Bad an Baighe were recorded at the appropriate freshwater receiver. It is assumed that the fish not recorded on these receivers did not enter the sea loch. During May most of the sea trout from both rivers remained within the inner loch, before starting to disperse in June.

During June, as well as dispersing out through the sea loch, a small number of fish were once again recorded on the River Laxford freshwater receiver. Of these, 7 were originally tagged in the river and 1 in Bad na Baighe. This pattern continued through July, with a further 5 from the Laxford and 2 from Bad na Baighe detected at the Laxford freshwater receiver. Within the sea loch, trout from the Laxford spent 2.6 days at the outer array in comparison to those from Bad na Baighe, which spent 0.3 days in that area.

Over this period 6 fish tagged in the River Laxford were detected on the Oldshoremore receivers, with a further 3 leaving the sea loch but not detected at Oldshoremore. All fish returned to the sea loch after an average of 5.6 days, with timing ranging from 13.5 hours to 13.2 days. In contrast, only 2 sea trout tagged in Bad na Baighe left the sea loch, with only 1 of those being recorded on the Oldshoremore array. These fish returned to the sea loch after 4 and 6.8 days.

While the dispersal patterns for the fish from both rivers are similar, the fish from the River Laxford appear to spend more time in the outer sea loch and are more likely to leave the sea loch than those originating in Bad na Baighe – 16% from the River Laxford compared to 3% from Bad na Baighe. On a similar vein, 85% of the Bad na Baighe trout remained within the Inner loch compared to 60% from the River Laxford.

The results from this study were similar to those found in 2018, although showing differing degrees of dispersal within the sea loch. The differences between the 2 rivers were unexpected and show the complexities present within trout populations. During 2018 all sea trout were captured and tagged within the estuary netting, which may explain the differences in dispersal, as the fish tagged would be a mix of both rivers.

2022

During 2022 most of the sea trout (90) were tagged within the River Laxford, with the remainder captured at the estuary netting. Of these fish, 62 were smolts and 38 adults, taking 22.5 cm as the arbitrary cut off between the 2. Results for this study will be available later in the year.

Biosecurity Management

The Trust are partners in the Scottish Invasive Species Initiative (SISI), a 4-year partnership project covering an area of over 29,500km^2 and involving 10 fisheries trusts and boards. An extension was provided until March 2023 as a result of Covid. As part of the project, we will be continuing and developing the work started in 2009. SISI is being funded by the Heritage Lottery Fund and Nature Scot.

Awareness Raising

Most awareness raising of Biosecurity was undertaken through social media, although we also gave a talk at the Trusts annual Ghillies Seminar, raised the matter at the District Salmon Fishery Board meeting and promoted it at the Moy Country Fair. Biosecurity includes the use of the simple 'Check, Clean, Dry' method by anglers, walkers and other water users, something that everyone can practice.

Biosecurity is an important issue within Sutherland as there are few non-native species compared to many other areas within the UK. This can make people blasé to the risks posed and the need for care and vigilance. It is important to prevent the spread of non-native species into the area and it is incumbent on all residents and water users to play their part. Gardens, ponds, fishing tackle and water sports equipment are all routes of infection and ones that should be easy to block if care is taken.

American Mink

A network of rafts and tunnels was established as part of the now obsolete Scottish Mink Initiative, monitored by volunteers and Trust staff. This network has been maintained and expanded in areas. During 2022 there have been a few sightings reported, although no animals have been captured. This would suggest that the population is currently small, possibly comprising of roaming males.

WSFT is extremely grateful to all our volunteers for their assistance with this project. Without the time and commitment donated by these individuals we would be less able to protect this area against this invasive species. If you would like to look after a mink raft, then please contact the Biologist and we'll get you set up. Any mink sightings, or potential sightings, should be reported to the Biologist. This information will then be passed on to the relevant volunteers.

In addition to the mink rafts, WSFT have been using trail cameras to monitor for mink. With camera's covering 2 systems we have thankfully not seen any mink, although have a surfeit of deer and sheep – together with a star turn from a heron. This provides another means of monitoring in an area with a small human population and could be rolled out in other areas.

Himalayan Balsam & Japanese Knotweed

2022 saw the Biologists once again descend on Nedd and Clashnessie to continue efforts to eradicate Balsam plants from the catchments. It is encouraging to see that Nedd remains relatively clear of the plants in the wider area around the 'starter' population. However there appeared to be a large eruption of the plant in parts of Clashnessie. While the starter population remains present then this is likely to keep recurring but is disappointing. This area has been treated since 2010 and it has been good to see the population declining. Hopefully 2022 in Clashnessie was an aberration but demonstrates the need to get all plants, as well as the resilience of the seed bank.

Japanese Knotweed is also present within the area, although in small patches. In 2015 it was decided to assess some of the know populations and put out requests for records of others. Treatment of several populations was then started and has continued, with a large decline in the number and size of plants observed. This has made for a more difficult treatment policy, with many of the plants too small to inject and therefore requiring spraying or spot treatment where possible. Treatment has also started on a number of other stands within the area. These plants appear to have a persistent seed, or root, bank and there will remain a need for vigilance in all areas. However, again the success of the treatment is encouraging with no or very few plants found in the majority of the plots.

Plans for 2023

We will continue to push the issue of biosecurity and the need for everyone to play their part in the prevention of the spread of non-native species. At the same time, we will be monitoring the area for the presence of non-native species and would welcome reports from members of the public.

The mink monitoring network is an important part of the INNS work, and the Trust and our team of volunteers will continue to monitor rafts and respond to sightings. The Trust is a contact point for any new sightings or the collection of carcasses and is happy to respond to any calls. Carcasses will be sampled and passed to Aberdeen University for future genetic analysis.

We are involved in a new partner project to continue and extend the work of SISI. We will continue, with the help of our volunteers, to monitor and control mink and to treat the Himalayan balsam and Japanese knotweed where eradication is possible. Volunteer assistance with this would be gratefully received. If you feel that you could help, then please contact the Biologist.

The Check, Clean and Dry Campaign

Principles

- Non-native species could be spread in any water or material. If you are visiting a water body there is a real risk that you could spread harmful organisms unless you follow good biosecurity practice.
- Biosecurity means taking steps to make sure that good hygiene practices are in place to reduce and minimise the risk of spreading invasive non-native species. A good biosecurity routine is always essential, even if invasive non-native species are not always apparent.

Check, Clean, Dry disinfection procedure

- **Check** - All clothing and equipment should be thoroughly inspected and any visible debris (mud, plant or animal matter) should be removed and left at the water body where it was found. Particular attention must be paid to the seams and seals of boots and waders. Any pockets of pooled water should be emptied.
- **Clean** - Equipment should be hosed down or pressure-washed on site. If facilities are not available equipment should be carefully contained, e.g. in plastic bags, until they can be found. Washings should be left at the water body where the equipment was used, or contained and not allowed to enter any other watercourse or drainage system (i.e. do not put them down the drain or sink). Where possible, clean equipment should be dipped in disinfectant solution (e.g. Virkon) to kill diseases, but note this is unlikely to kill non-native species.
- **Dry** - Thoroughly drying is the best method for disinfecting clothing and equipment. Boots and nets should be hung-up to dry. Equipment should be thoroughly dry for 48 hours before it is used elsewhere. Some non-native species can survive for as many as 15 days in damp conditions and up to 2 days in dry conditions, so the drying process must be thorough.

Further details from: https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/

Teletubbies in action! (S. Marshall)

West Coast Salmon Tracking Project

As anadromous fish, salmon have both a freshwater and a marine part to their life cycle. Relatively speaking, freshwater areas are straightforward to monitor, and much is known about this part of the life cycle. The difficulties come in looking at the marine phase – where salmon are more widespread and the monitoring area significantly larger.

Having left the freshwater, the fish migrate through the estuary and coastal waters, heading for their feeding grounds in the Norwegian Sea and around Greenland. This project aims to determine the routes used by the smolts as they move out of the estuaries and up the west coast of Scotland.

Started in 2021 and running over 3-years, the project is managed and coordinated by the Atlantic Salmon Trust in partnership with FMS and Marine Scotland Science (MSS). It is being delivered by partners from the Trust and Board network from Galloway to Sutherland. The data collected will ground truth the smolt migration model being developed by MSS. Full details of the project, and a short animation detailing initial findings from 2021, can be found at https://atlanticsalmontrust.org/our-work/the-west-coast-tracking-project/

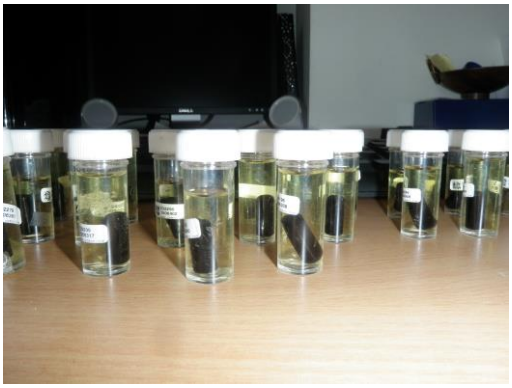
By understanding the coastal migration routes, better management of the coastal waters for salmon will be possible. How do you know where to locate industrial developments – aquaculture, marine renewables, fishing, etc. – if you don't know the sensitive areas? This isn't to say that all the issues are in coastal waters or industrial, but it's the next step and something that we can address.

This project is starting to indicate migratory patterns and preferences, including how individual smolts move through sea lochs and their speed of travel. This is of particular importance with regards to the new regulatory framework being proposed for the aquaculture industry, with the 'residence time' forming a major part of the analysis of sea lice impacts. Once out of the sea lochs and into the wider marine environment salmon smolts were shown to disperse widely along the west coast and migrate using many different routes.

The design for the 2022 project was shaped and guided by the information gained from Year 1 of the study. Efforts were concentrated closer to shore to get a better understanding of the vital first few days the smolts spend at sea by investigating their speed and timings through the sea lochs in much greater detail.

West Sutherland

During 2022, 100 salmon were acoustically tagged within the Laxford system (see p. 11 for details of the traps used). Receivers were placed upstream of the trap and at the mouth of both Bad na Baighe and the River Laxford, with a further array of receivers spread through Loch Laxford and perpendicular to the coast near Oldshoremore. Each tag has a unique code and therefore the receivers will record the passage of individual fish through these areas and provide information on migration timings and routes.



Tags ready to go (S. Marshall)

Education

Education forms a large part of our remit and the WSFT are particularly keen to get involved with schools and colleges within the area, as well as giving talks and demonstration to adult groups. It is an important link between the Trust, the public, nature groups and the local community. It is a medium whereby scientific research data can be available to those interested in it.

Ghillies Seminar

The Ghillies Seminar was resurrected in 2022 following a break for Covid. It provides an opportunity for the Ghillies, managers and interested anglers within the area to meet and discuss what's happening in their rivers as well as question some experts in the fields of fisheries management and salmonid biology. A platform for those working in the field to discuss issues that affect them directly, it is also a two-way process not only moving information to the workers, but also taking suggestions and ideas to the scientists and policy makers.

This year's seminar was a mix of different topics linking some of the work of the Trust. Chris Conroy started off with an introduction to Project Laxford. After lunch we moved on to look at the West Coast Tracking Project and the results from year 1. We finished with a discussion on Biosecurity – the why's and how's.

There was keen participation and a genuine desire to address issues particular to this area. The meeting was well received, and the notes can be found on the Trust website.

School days

During 2022 we worked with the local primary school to introduce the children to the river and its many inhabitants. Using electrofishing, kick sampling and bathyscopes we caught and looked at different fish species, invertebrates, and freshwater pearl mussels, learning about their interactions and their threats and potential conservation. Of course, we then had to check out the flow rates with a bit of a duck race! The enthusiasm shown for the natural environment is heartening and should be encouraged at all stages.

Public talks

'The secret life of the eel' was the title of a presentation in Achiltibuie about all things eel and riparian habitat related. Exploring the life cycle of the eel and the importance of riparian woodland to their conservation (and that of salmon and trout), this generated a lively discussion.

WSFT also assisted at local viewings of 'Riverwoods: an untold story' to both school children and the general public. This interesting and very cinematic film was produced by Scotland: The Big Picture and introduces the relationship between salmon, trees, nature and the wider landscape. Lots of questions and enlightened discussion from the audience – our landscape is in good hands.

Other Open Events

For the first time since 2019 the Trust was delighted to join our colleagues from the Ness District Salmon Fishery Board and the Cromarty District Salmon Fishery Board with a stall at the Moy Country Fair. A great opportunity to meet and talk to members of the public -as well as partners from Police Scotland and Peatland Restoration to name but a couple – and promote the area and the work of the Trust. Thanks must go the individuals who assisted on the day - manning the stall, putting up tents and organising the merchandise. These types of events are good fun to do and help in the promotion of the Trust and its works to the wider public.

Project Laxford

A partnership between Reay Forest Estate and the Atlantic Salmon Trust, with support from Marine Scotland Science, Project Laxford is a 10-year project aimed at restoring wild fish populations through habitat improvement. Starting in October 2021, the project has initiated a number of exciting projects, all with the aim of monitoring the restoration actions and their impacts on the fish and the environment.

A year into the project, there has been a significant amount of work undertaken, all aimed at getting a better understanding of the status of the catchment and its fish populations. This includes the production of a catchment audit as well as the development of a comprehensive monitoring network. The latter will allow the effects of any restoration activities to be assessed.

Fish counter

Placed in the tidal zone, this will give a count of all the fish entering and leaving the river. By counting the smolts out and the adults in we will have a good indication of the size of the run, together with marine survival.

Aris counter in situ (S. *Marshall)*

PIT array and tagging

Passive Integrated Transponder (PIT) tags are similar to the microchips used in dogs. Inserted in the body cavity of the fish, these uniquely coded tags are identified by special receivers, which record the number, date and time. With no battery, these tags continue to operate through the lifetime of the fish and will give information on freshwater movements for both juveniles and adults as well as information on the timing of the run and marine survival of individual animals.

Ready to tag (S. Marshall)

There are 4 receiver arrays within the catchment, covering the width of the river. At the mouth of the main spawning tributary, downstream of both the lochs and at the mouth of the river. Up to 2000 autumn salmon parr per year will then be tagged from around the catchment to give information on winter survival, movements, smolt timing and ultimately adult return and marine survival. In addition, during tagging the presence of any precocious parr was noted, giving additional information on this life strategy. During 2022 just over 1400 fish were tagged from a combination of major tributaries and the main stem of the river.

Temperature network

Rising temperatures have been an issue for the salmonid populations for several years throughout Scotland, with water temperatures regularly exceeding levels that impact on salmonid growth and survival. The temperature network will help to assess the effects of restoration actions -such as riparian tree planting- on the catchment. Riparian woodland has many beneficial effects on rivers, from bank stabilisation, food supply, shelter, and nutrient provision, to reduced water temperatures as a result of shading by the canopy.

Environmental DNA (eDNA)

All organisms release genetic material into the water and the use of eDNA allows this to be analysed. Collecting water samples from around the catchment and analysing these for traces of genetic material gives an inventory of the species present and can be used to monitor the effects of restoration activities on invertebrates and fish. eDNA sampling is remote and may identify the presence of rarer individuals within the area, ones not identified from more traditional sampling methods. Further, the method is potentially less labour intensive and destructive.

For further details on the project visit https://atlanticsalmontrust.org/project-laxford/

Salmon conservation regulations

This policy was introduced during the 2016 season. It implemented a variety of measures, including:

- A ban on the taking of any salmon, by rod or net, before 1 April;
- A ban on fishing outwith estuary limits for a period of 3 years;
- The classification of rivers based on a model of population estimates, exploitation rates and biological recruitment. (Further information can be found at: http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/status)

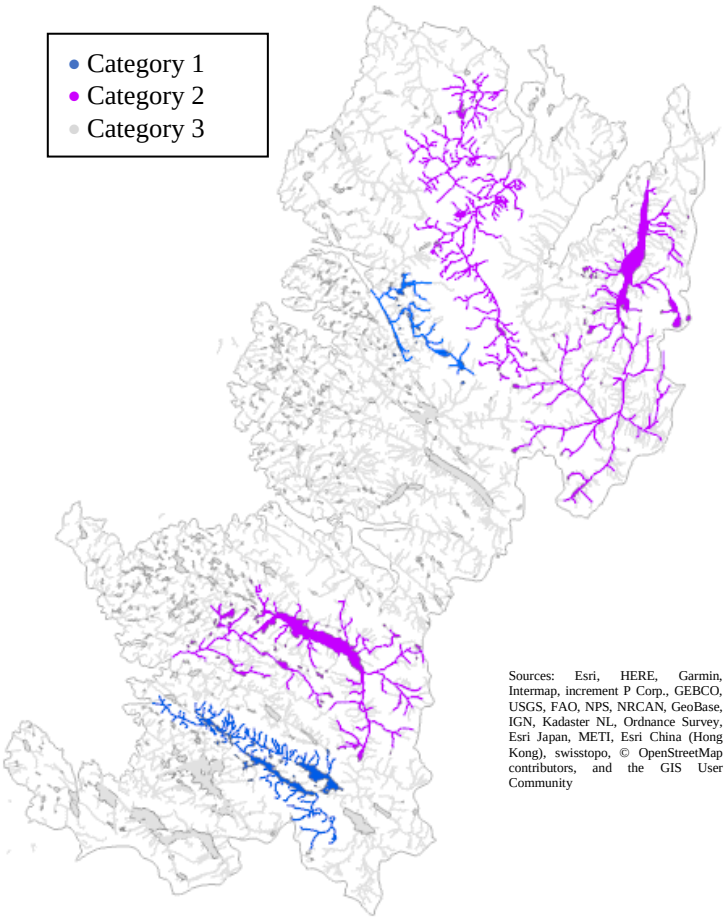
The categories denote the conservation measures required such that, for West Sutherland during 2023:

Category 1 – (Rivers Rhiconich and Kirkaig) where the conservation limit has been met on 4 of the last 5 years, exploitation is sustainable and therefore no additional management action is required.

Category 2 – (Rivers Hope, Grudie, Dionard, Daill and Inver) where the conservation limit has been met on 3 out of the past 5 years, meaning that management action is necessary to reduce exploitation. While mandatory catch and release will not be required in the first instance, this will be reviewed annually.

Category 3 – (Rivers Polla, Strath Shinary, Oldshoremore, Laxford, Duartmore, Gleann Dubh, Polly and Osgaig) where the conservation limit has not been met on 3 out of the past 5 years, meaning that exploitation is unsustainable and management actions are required to reduce exploitation for 1 year i.e. mandatory catch and release (all methods).

All systems not listed above have insufficient data and therefore will be classed as Category 3.



Acknowledgements

The Trust would not be able to function without the assistance of an army of volunteers, many of whom give up substantial amounts of time to the Trust. Similarly, we would like to acknowledge those who support us financially and without whose help we would not be able to operate. Grateful thanks also for the assistance of the various estates. In particular, sincere thanks must be expressed to Reay Forest Estate and Scourie Estate for their donation of accommodation, and Adam and Liam Barnes for stepping up to the mark and assisting with field work throughout the year.

A number of other individuals have assisted the Trust with its work programme, some listed below. Apologies to those not mentioned by name, but our grateful thanks all the same.

Catches and Scale Reading

The WSFT acknowledges the assistance of hotels, estates and anglers in compiling catch records and collecting scale samples. In particular to the staff of the Inver & Kirkaig for their assistance with the Adult Sampling Programme.

Monitoring of sea trout post-smolts

This work would not be capable of completion without the assistance of the Reay Forest Estate and Wildland Ltd. Also to Adam, Liam, Andy, Donald, Keith and Alex for their assistance, together with the staff of Loch Duart Ltd.

Funding for this work comes from a variety of sources. The North & West District Salmon Fishery Board, Scottish Government, estates and individuals.

Biosecurity Planning

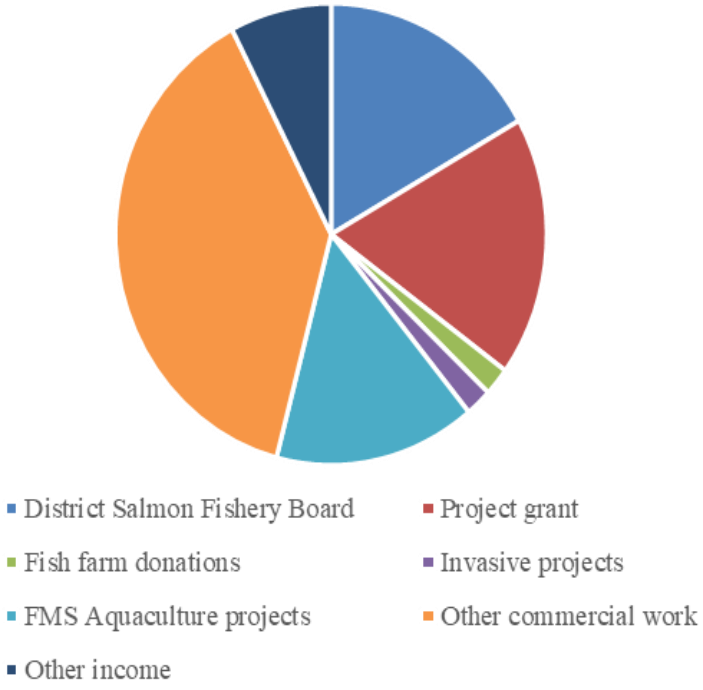
Funding of the Scottish Invasive Species Initiative by the Heritage Lottery Fund is gratefully acknowledged. Thanks also to Nature Scot for their management of the project.

The following Charitable Trusts, Foundations, Estates and organisations have kindly donated funds or provided grant funding towards the West Sutherland Fisheries Trust. Our sincere thanks to all listed, and to the many individuals who will remain anonymous but have donated time and money to the Trust and its activities. Without all of this support we would not be able to operate.

Trusts & Organisations
Assynt Angling Company Ltd
Atlantic Salmon Trust
Heritage Lottery Fund
North & West District Salmon Fishery Board
Scottish Government
Scourie & District Angling Club

Estates
Reay Forest Estate
Scourie Estate
Wildland Ltd

Businesses
Loch Duart Ltd



Gorm Track to Ben Stack

Clive Halnan, professional artist (http://clivehalnan.co.uk), has kindly donated some money from the sale of his picture 'Gorm Track to Ben Stack' to the Trust. The picture is available as a limited edition run of 125 prints and is also available as a card.

They can be purchased from the Trust by contacting the Biologist or directly from the artist (info@clivehalnan.co.uk)