West Sutherland Fisheries Trust

Garbet Mor (S. Marshall)

2019 Annual Review

Contents

THE WEST SUTHERLAND FISHERIES TRUST

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Chairman's Foreword

Our Trust's remit is to research and understand the state of the fish stocks in our area and then to advise on issues that affect them. Its strength is that it has been embedded in the local community for over 22 years, building contacts, listening to the views and needs of our community. During this period without fear or favour it has researched the impact of the industries in our area. The effects of fish farming, forestry, fishing and estate management have been evaluated, recorded and reported on openly. We understand that many industries will have to coexist in the modern rural environment but they can only do so sustainably where there is an independent evaluation of their impacts. Our Trust has fulfilled that role and will continue to do so as long as it has the support of our local community.

Our Biologists cover an area from the Hope to Achilitibuie and all of the rivers in between. During these 22 years and over this huge area we have amassed a large quantity of data. In fact it is one of the longest and most comprehensive sets of data about freshwater stocks that have been created to date. As each year passes this important asset and research tool grows, allowing greater understanding of the complex population dynamics of our fish stocks.

During 2018 we have continued this work whilst also being involved in a number of very diverse projects. These ranged from electrofishing surveys and sweep netting, through non-native monitoring and eradication to habitat surveys and a tracking project. We are also involved in a number of education projects and attend a number of shows around the area. This allows us to explain the rivers and their inhabitants to a wide range of people. All of the work undertaken by the Trust is aimed at conserving and increasing the fish stocks within the area.

This year saw the completion of an exciting, and long awaited, project for the Trust. Working in conjunction with University of Glasgow and a number of local businesses we undertook a tracking project on sea trout in Loch Laxford. Ninety nine sea trout were tagged and detected by 38 receivers as they moved around the loch. Once the analysis is complete we will have a greater understanding of the ways that sea trout use the sea loch. These data will help in the future management of the loch with regards to sea trout populations and compliment our existing data.

It also saw the Trust participate in a nationwide survey of juvenile populations. Providing data to allow the revision of the Conservation assessments, this saw our Biologists roaming far and wide around the area to electrofish in set locations. There were also water samples taken and genetic samples to look at interactions with fish farms. The results of these studies will provide interesting information about the populations and help to demonstrate the important role played by the Trust nationally as well as locally.

As well as the field work, the Trusts sits on a number of groups, ensuring that freshwater fish populations are given due attention. These include Coigach & Assynt Living Landscape Partnership, 2 Area Management Agreements, the District Salmon Fishery Board and a Marine Scotland Liaison Group. We also provide advice to SEPA, SNH and Marine Scotland Science on the rivers within the area.

In order to function in such a large area, with such a small population, local relationships play a huge part. It is a credit to our team that they have built up an extensive group of contacts and helpers as well as local businesses, estates and fish farms. From a financial and operational standpoint we could not achieve what we do without their help. There is then the enormous effort put in by our volunteers, from Trustee work to netting our volunteers are the life blood of our Trust and without them we would not be able to achieve the workload we do. In good weather or bad they all turn out with a smile on their face and get stuck in. We are indebted to each and every one of them.

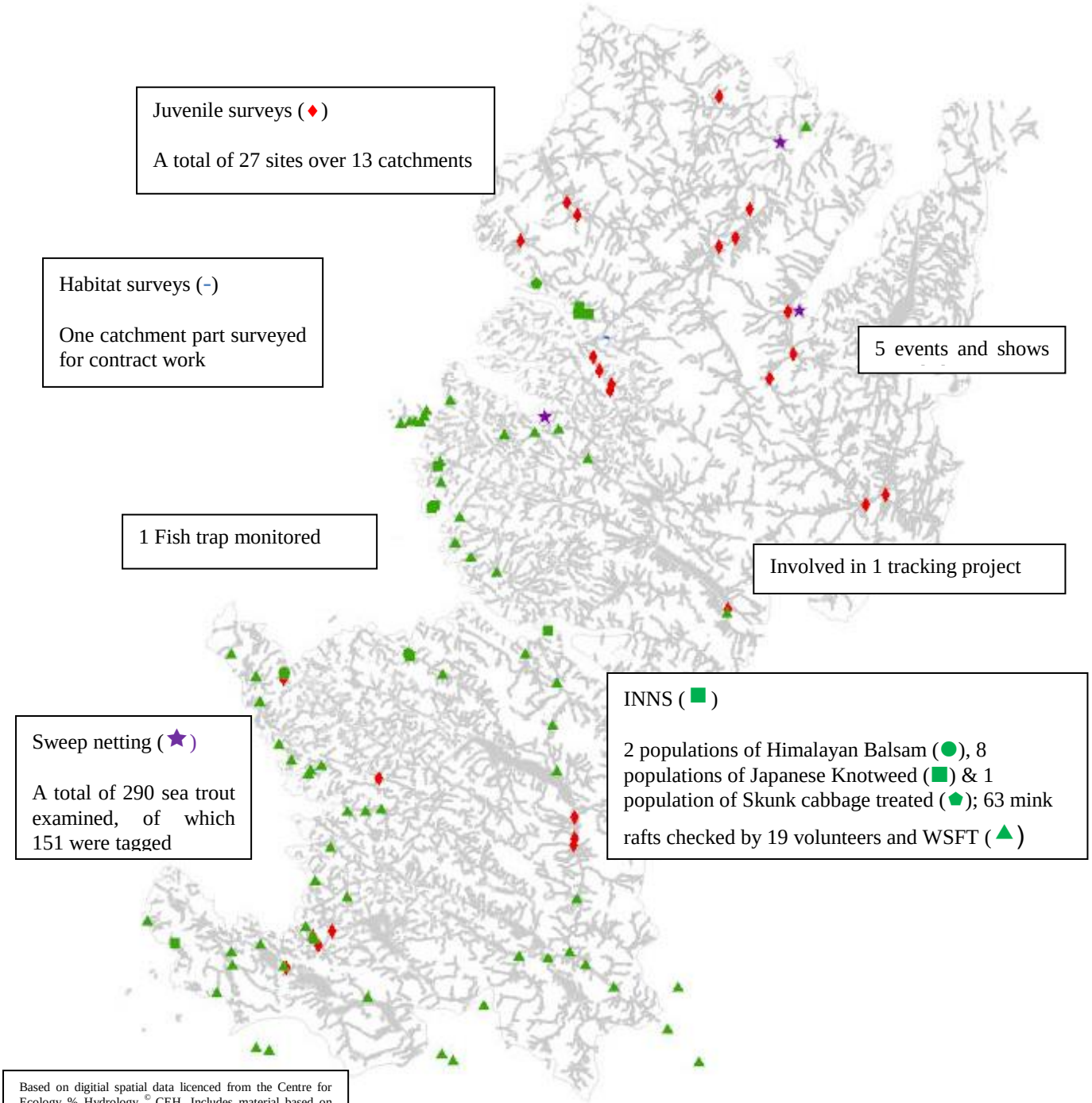
A successful Trust requires a tremendous mix of people. We are lucky to have two committed biologists, living in the area in which they work, known to the local community and respected for what they do. Our work as Trustees is made so much easier by their dedication. I would like also to thank our Trustees for their unswerving support.

This will be my final year as Chair of this Trust. It has been an honour to Chair it not just because it is an important organ for this area but also because it is an area of Scotland that I love very much. The little I have been able to do to help feels hugely worthwhile. As I now live a good way away from the Trust's area and as I am no longer actively involved in the area, I feel it is time for new blood, connected more strongly to the area, to take over. I am very proud that during my tenure the Trust has managed to fund and follow through a tracking project such as the one we completed in Laxford this year. I am sure that the Trust will go on to even greater things. The freshwater ecology of our area in in very good hands.

Nick Joy

A summary of 2018

This gives a brief summary of some of the field work undertaken by the WSFT during 2018. Further details of the different projects are available in the rest of the document or from the Biologist.



Introduction

The **West Sutherland Fisheries Trust** continues to work towards the conservation and restoration of fish populations. Now entering its twenty third 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 schools 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.

Locally, 2018 was an exceptionally dry year. A cold April was followed by a drought through much of the summer. While we like dry weather for electrofishing, unfortunately the hot temperatures that came with it at the start of July meant that we had to delay the start. From an anglers point of view the hot dry summer meant that few fish were seen or caught. Netting was much more doable, and there were few nettings cancelled over the year.

It was a good year for the sweep netting (see page 15), with only 1 netting cancelled on the Polla as a result of Donald's availability, although we couldn't do the September netting in any catchment. The Kyle of Durness nettings were more sporadic as a result of changes in the funding and also the need for additional netting in the Laxford to accommodate the tracking project. The trout were in good condition, with several larger trout seen although as ever post-smolts dominated.

The mink initiative continues to operate under the management of the Trust and we are extremely grateful to all our volunteers for making this possible. There have, thankfully, been few sightings this year, although there was one capture. The volunteers always rally and increase efforts following sightings and it is to their credit that we remain a relatively mink free area (see page 18). Thanks should also go to the many people who remain vigilant and report potential sightings to the Biologists. The new HLF funded national biosecurity project (see page 18) is now fully up and running, with the mink project absorbed into this initiative.

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 Scottish Natural Heritage (SNH). 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 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.

During 2018 we were lucky enough to be able to work with researchers at Glasgow University, the Atlantic Salmon Trust, Marine Scotland Science, Loch Laxford Shellfish, Shorehouse Restaurant and

Loch Duart Ltd to undertake a tracking project within Loch Laxford (see p. 22). Within this project we also had considerable financial help from local Estates and voluntary and financial help from a number of individuals. This exciting project definitely shows what is possible by partnership working.

The Future

The WSFT will continue with its current work, maintaining and developing their extensive range of 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. 18). 2018 saw the development of the Scottish Invasive Species Initiative (SISI), an HLF funded programme of work managed by SNH and involving a number of Trusts throughout Scotland. This will provide funding to enable us to increase our current programme and develop out educational role. In addition, the importance of volunteers to report sightings and locations cannot be over-emphasised. While we have hopes of eradicating some INNS, and potentially find funding to assist, the presence of rhododendron is a larger problem. It will require a more intense effort from everyone but the results will be worth it as the native vegetation returns and the rivers improve.

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.

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.

2017

The official catch statistics for salmon and sea trout in Scotland have been published (http://www.gov.scot/Topics/marine/Publications/stats/SalmonSeaTroutCatches/Data) 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 due to the confidential nature of the information and the requirement of the Scottish Executive to mask the catches from individual systems.

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

Fishery Board		Salmon & Grilse	Sea Trout
Hope & Grudie	2017 (2016) *5 yr. ave.*	401 (623) *464.4*	530 (1120) *783.8*
Inchard – Kirkaig	2017 (2016) *5 yr. ave.*	525 (460) *484*	296 (356) *369.2*

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 once again down on the 2016 catches, with the Hope & Grudie area showing a significant decline, compared to a slight increase to the south. The change in the Hope & Grudie area is likely to be in part the change in ownership and letting of the Hope and Polla systems, with fishing effort being significantly reduced in those catchments.

The proportion of salmon released within the area during 2017 has increased in the south to 96% but declined slightly to 94% in the north. The high release rate is encouraging to see and it is to be hoped that it will remain at this level or increase 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 an increasing number of 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 declined considerably during 2017. Although a decline in reported catches occurred in both areas, this was greatest in the north where less than half of the 2016 catch was recorded. As with salmon, this is likely to reflect the reduced fishing effort on the Hope and Polla during 2017. Catch and release remains high within the area, with the greatest proportion of released fish once again being seen in the Inchard – Kirkaig area. While an overall total of 97% of fish released is encouraging, it is disappointing to see that only 88% were released in the north and it is to be hoped that this will increase in the future while the status of this species remains precarious.

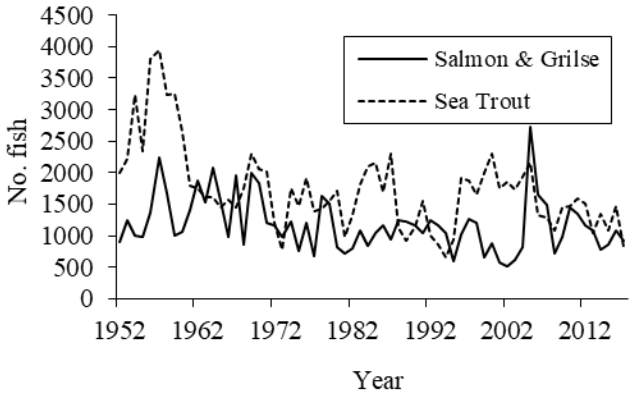


Fig. 2 Rod and line catches within the West Sutherland area, 1952 – 2017

2018

Catch data for the 2018 season are being compiled and will be produced by Marine Scotland Science in 2019. However, some information is available from angler logs and fishing books. Reports indicate a poor season throughout the area, with the greater catches being at the end of the season. This reflects the weather, with an exceptionally hot and dry summer followed by a wet September. There were early reports of fish seen within the estuaries but no records of large numbers of fish within the rivers.

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 conservation limits for the area have been produced, with many rivers once again being moved into Category 1 (see p. 21). This is a reflection of the changes being made to the underlying model rather than an improvement in fish populations, as demonstrated above, and is concerning given the low numbers of fish reported. It is to be hoped that all anglers will continue to return fish, despite this change. While sea trout are not affected by this legislation, the low levels of catches would suggest that catch and release is of equal importance for 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.

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 2018 very few repeat surveys were undertaken as we assisted with the National electrofishing survey, developed by Marine Scotland. This involved fishing in specified locations around the area.

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 (100m^2)			
Catchment	**Salmon fry**	**Salmon parr**	**Trout fry**	**Trout parr**
Hope	7.98	5.54	4.36	4.27
Polla	45.31	23.70	10.27	3.17
Dionard	11.35	3.18	0.52	0
Daill	0	0	40.62	0
Sandwood	0.77	0.38	0	0.48
Oldshoremore	0	1.79	0.89	3.58
Rhiconich	42.26	18.77	1.10	0
Laxford	71.97	40.43	38.01	5.66
Clashnessie	0	0	7.10	7.10
Inver	20.02	18.01	4.08	2.70
Polly	51.14	27.77	2.32	1.35
Garvie	7.31	19.31	2.09	0.52
West Sutherland area average	**25.74**	**14.78**	**6.05**	**1.95**

There is a good distribution of salmonid species throughout the West Sutherland area with trout present in every system surveyed. Within salmon dominated systems, juvenile salmon densities were largely moderate to excellent.

Discussion

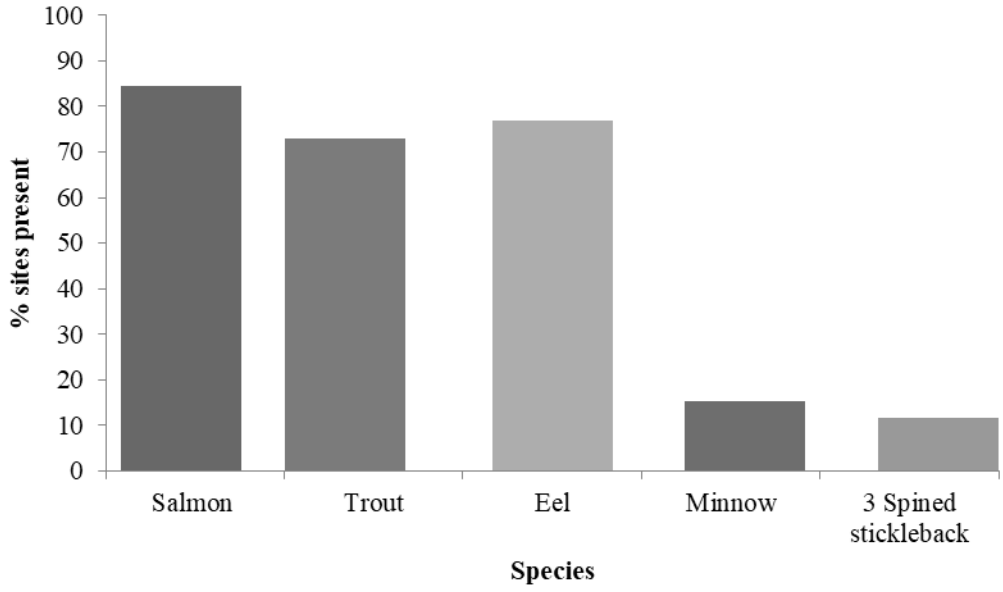
Salmon dominated these surveys in terms of their presence across the survey sites as well as densities within the sites, the Daill catchment and Clashnessie catchment where no salmon were present. This is likely to be due to habitat type and accessibility, as salmon will ordinarily out-compete trout within areas where habitat is suitable for both species. The lower trout densities within these surveys do not necessarily reflect a problem with the population itself. Whilst the sites were picked at random the

potential presence of salmon and specific river orders were requirements of the study and therefore selection process. This may have biased the site selection to sites more suitable for salmon than trout.

Within the Dionard system in particular salmon densities appear low. However, this is likely due to habitat type and survey site situation. These were wide main river stem sites, where escapement is very high during electro-fishing surveys. In addition to this, the sites were very shallow, with fine gravel substrates which provides very poor instream cover. Whilst it was important for the purposes of these surveys to take samples at random areas within the catchments, it should be remembered that these surveys will not necessarily reflect the true juvenile population status of each of the catchments.

The start of the 2018 electro-fishing survey season was extraordinarily warm and dry, with extremely low river levels and water temperatures that were encroaching upon dangerous levels for salmonids. Hence, there were instances where surveys were cancelled due to the danger of fish mortalities due to the additional stress of capture and processing. Conversely, the end of the summer and early autumn was exceptionally wet with high river levels, making surveying difficult. Low river levels can have an effect on fish densities due to fish being forced into smaller areas of water, therefore creating a higher density than that normally present within a tributary. During high water, escapement rates are higher due to faster flows and higher likelihood of operator error, due to water clarity and turbulence. While taking this into account, both in cases where factors may have augmented results to reflect higher or lower densities than normally expected, salmon densities appear to be healthy within the major salmon systems.

The high temperatures experienced during the early summer of 2018 do however highlight a need for improved climate control, particularly within salmonid nursery tributaries. Salmonids fare better when water temperatures are stable, and increase/decrease at a natural rate. Planting of broadleaf trees within riparian zones would assist with this due to canopy shading helping to keep water temperatures more stable, and preventing dramatic/rapid temperature fluctuations between extremes.



Species composition and distribution per site

The Bad na Baighe Smolt Trap

A mobile smolt trap was deployed in Bad na Baighe from 14.4.18 to 31.5.18. A temperature recorder was placed in the trap, set to record hourly for the duration of the project.

While the number of salmon moving through the trap has been declining over the past few years (Fig. 3), this decline has been small. In contrast, very few trout were taken during the 2017 and 2018 sampling seasons compared to previous years. As with previous years, the lead net was overtopped on 21.5.18 and 22.5.18 permitting fish to evade the trap, and a hole was found in the side of the trap on 10.5.18 and repaired.

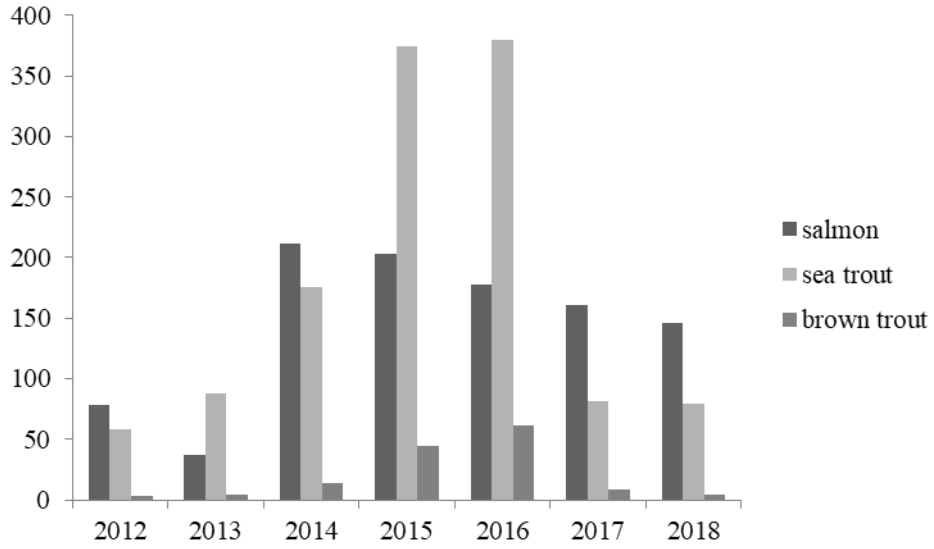


Fig. 3 Comparison of captures within the trap by species and year

Water temperature remained relatively static during the trapping period, with diurnal fluctuations dominating (Fig. 4). Temperatures increased slowly over the period and there was a colder snap in May over 3 days. Salmonids require a temperature of about 7^{o}C before starting to move, and this temperature was exceeded over the entire study period.

Salmon dominated the smolt run during 2018, with most migrating in April (Fig. 4). The sea trout migration was also primarily in April. This is contrary to previous years where May was the primary migration month for trout. Badna Bay has always been considered as primarily a trout system, with a small but significant salmon run. These results would suggest that this situation is changing.

All sea trout were examined for tags and a number of the fish were tagged at the trap prior to release. Six of the trout examined within the estuary netting were connected to Badna Bay. This indicates that a number of the fish taken in the estuary sweep netting come from the Bad na Baighe catchment rather than the Laxford, highlighting the relationship between the two systems, which share a common estuary. It would be interesting to know more about trout usage of the estuary and the relationship between the 2 populations, a subject for further work should funding become available.

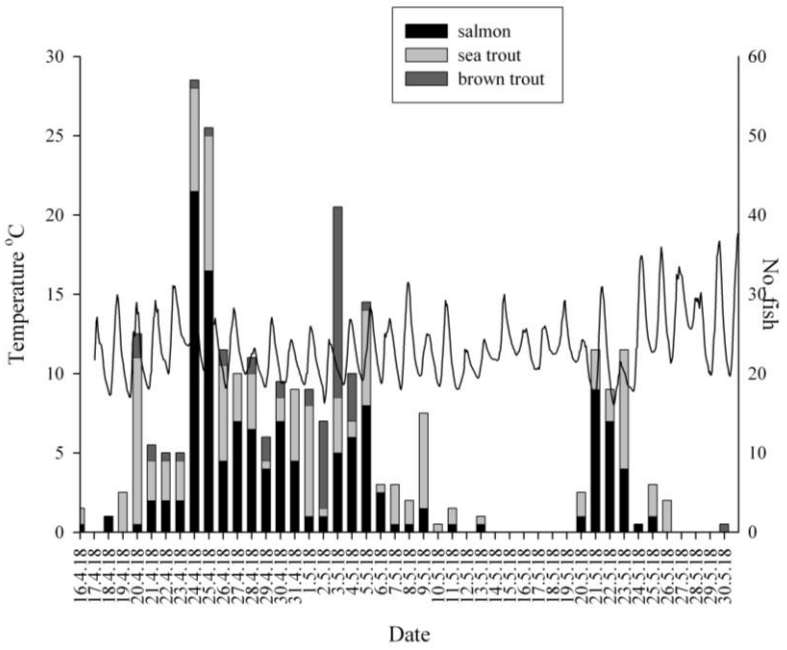


Fig. 4 Showing the temperature regime within the river (line) and no of fish caught on each day (bar)

What's the temperature? (S. Marshall)

Deploying receiver (I. Moore)

Do you think the eye shadow suits me?(S. Marshall)

Smile for the camera! (S. Marshall)

A viviparous blenny, hiding with the trout (S. Marshall)

This way boys… (S. Marshall)

A good catch in the Olashoremore rock pools (S. Marshall)

Recording fish in the sun (J. Delaney)

A good bunch of helpers at the Laxford (S. Barnes)

Ready, steady, go….. (H. Mason)

Checking out the camera (S. Marshall)

Ready for tagging (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. The individual tagging of fish, combined with the measurements taken at capture, gave a baseline from which to assess these parameters following re-capture by nets or rod and line. 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, with the tagging of fish giving additional information.

Materials & Methods

Three estuaries, Laxford Bay, Kyle of Durness and the Polla estuary, were sampled monthly where possible from April to September. A total of 290 fish were individually measured and scale samples taken, of which 151 were tagged using a visible implant tag behind the eye. 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 three estuaries was similar, although the Polla produced a greater number of mature fish. Few fish were taken in the Kyle of Durness nets this year. The predominant smolt age in the rivers is 2 years (S2), although there were a number of S3's also present. S1's were also observed in small numbers in the Polla and Laxford. The length distribution of fish within the estuaries was also similar, with post-smolts dominating each estuary. However there were a few larger fish within the Polla samples.

The majority of the fish examined were from the 2018 smolt run. A May smolt run is normal for the Sutherland area and this is supported by these data. With no sweeps possible in September we could not confirm the presence of the autumn run witnessed in previous years.

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. That the sea trout populations are relatively static can be inferred from the information on recaptures, where all of the tagged fish recaptured during 2018 were taken in the same location as originally tagged. Further information on the usage of the estuary by sea trout will be acquired from the Laxford sea trout tracking undertaken in 2018 and to be reported elsewhere.

The condition index was variable, with poor condition being recorded in each estuary. In the Laxford and Kyle of Durness this was at the start of the year, with condition improving with time at sea. However the Polla showed a more mixed pattern and indicated a decline in June following smolting. The low value in August may be a reflection of equipment failure but will be monitored in 2019.

Average growth rates within the Laxford were 7.92 mm, and 16.22 g per month. This is lower than that seen in 2017.

There were 8 recaptures during 2018, all within the Laxford estuary. Of the recaptured trout, 3 were originally tagged in 2016, 1 in 2017 and the rest in 2018. All fish were tagged and re-captured in the same location. This pattern is common to the sampling programme over the past 21 years and demonstrates that the majority of sea trout do not stray far from their home rivers.

Figure 5 shows that the specific growth rates (SGR) in the Laxford, while lower than that seen in 2017 remains high compared to levels seen previously within this estuary. The good condition was evident from the appearance of the fish in the net. The results from this analysis demonstrate the complexity of trout population dynamics and the interactions with external factors, such as food supply and temperature.

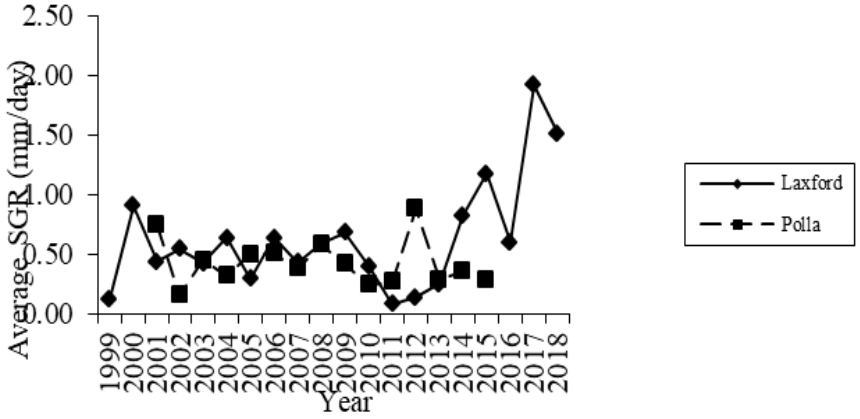


Fig. 5 Showing the average SGR for fish within the Laxford and Polla estuaries, by year

Sea Lice Infestations

Sea lice were present to a varying degree in all estuaries, although there were several sampling occasions with no lice observed. Each estuary showed a mixture of lice stages, with mobile to adult stages dominating. Total number of lice was low in both the Laxford and the Kyle of Dionard but higher in the Polla. The total number of lice increased with time in all estuaries. 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 within the Laxford during June and July only, at low densities. The pattern of lice presence would appear to reflect a wild population. Very few *Caligus* were present on the fish, again in June (1) and July (2).

The neighbouring cages contained fish throughout this survey period. Lice numbers were well controlled throughout the year with few *Caligus* as well, a reflection of the situation within the sweep nets.

Polla

Lice were only present in July and August within the survey. Abundance increased significantly in August with maturation and breeding of the population. As with *Lepeophtheirus, Caligus* were only present in July (6) and August (104), increasing with time.

This pattern was not reflected in the neighbouring cages, where *Lepeophtheirus* densities were low over the sampling period. *Caligus* numbers did, however, rise in August, similar to that seen in the wild population.

Kyle of Durness

Lice were present on both sampling occasions in the Kyle of Durness. Densities were low and there was a mix of stages present in August. There were no *Caligus* present on the fish sampled.

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. Thus, 0.1 – 0.2 lice/g will give a 20% increased risk of mortality to a salmonid of < 150g. 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. 6 gives the results by year for each estuary, with the banding indicating whether the risk is low, moderate or high. Within the lowest zone it can be taken that there is minimal risk to the population, while the other zones show potentially population altering impacts.

From this, it can be seen that the potential risk in each estuary during 2018 were considered to be low, indicating that population changing effects are unlikely throughout the area. The Laxford data continue to show a biannual pattern in risk, reflecting the stage of production within the farm. While this pattern was not previously seen within the Polla samples, it has been witnessed in the last 4 years.

Sampling within the Kyle of Durness has been more restricted than the other 2 estuaries, but again, there would appear to be a slight pattern within the data. While not an exact reflection, this would appear to follow the Laxford more closely than the Polla. While not significant, it may reflect the tidal flows around the west coast.

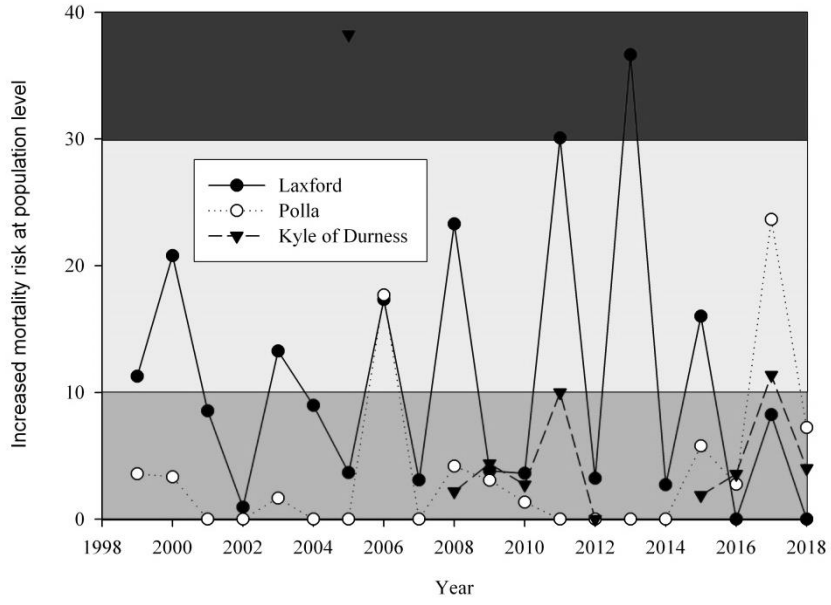


Fig. 6 Showing the increased mortality risk at population level created by sea lice

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).

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. As part of the project we will be continuing and developing the work started in 2009. We will also be updating the Biosecurity Plan for the area. SISI is being funded by the Heritage Lottery Fund and Scottish Natural Heritage.

Awareness Raising

Undertaken at the Ghillies Seminar, Trust Meetings, the DSFB meetings, the Highland Field Sports Fair, Scourie Gala and Assynt Highland Games, as well as on Facebook and Twitter, issues of Biosecurity and the presence of Invasive Non-Native Species were raised regularly. In particular, the need to disinfect equipment between catchments and the need for added awareness and reporting with regards to non-natives within the area were highlighted.

Biosecurity is an important issue within Sutherland as there are few non-native species present 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, thankfully with few sightings and only one mink captured. This would suggest that the population is currently small, possibly comprising of roaming males. However we would like to remain ‘mink free’, so please keep an eye out for them and report any sightings.

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 invasive species. If you would be able 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.

Himalayan Balsam, Japanese Knotweed & Skunk Cabbage

2018 saw the Biologists and their intrepid volunteers once again descending on Nedd and Clashnessie to remove any Balsam plants spotted within the river corridors. It is getting increasingly difficult to find these plants, although there are occasional eruptions in numbers in some areas. Thanks go to all those who gave up their time in order to improve the habitat in a small part of Sutherland. This area has been treated since 2010 and it is encouraging to see the success of the work. In fact, we found no plants in the main croft area at Nedd, the first time this has happened. While the resilience of the seed bank means that we will have to keep monitoring a few more years we are all encouraged by the results and hope to make the area ‘balsam free’.

Japanese Knotweed is also present, although in small patches. In 2015 it was decided to asses some of the know populations, and put out requests for records of others. Treatment of some of the populations was then started. Treatment of these populations 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.

Skunk cabbage was reported to us in 2017 and the first treatment carried out in 2018. The success or otherwise of this treatment will be assessed next year but it’s hoped that we can get on top of this as well. As with the other species, there are few populations within the area and eradication will hopefully follow.

Plans for 2019

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.

Treatment against *Gyrodactylus salaris* (Official Scottish Government Guidelines)

1. Drying to a minimum temperature of 20°C for at least two days
2. Heating to above 60°C for at least one hour
3. Deep freezing for at least one day
4. Immersion of materials in a solution of, or addition of one of the following chemicals to water to the concentration indicated:

- Virkon* 1%
- Wescodyne* 1%
- Sodium chloride 3%
- Sodium hydroxide 0.2%

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/

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 considered to be an important link between the Trust, the general 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

This annual event provides a forum for the Ghillies, managers and interested anglers within the area, giving them an opportunity 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 affects 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 loosely centred on the marine environment. David Morris started us off with a look at the tracking studies being undertaken by Marine Scotland on the west coast. This was then followed by Adam, who introduced the Laxford tracking project to the audience. After lunch we moved on to looking at Pacific salmon and the work on the Ness, followed by a round up of the stocking programme on the River Garry. We finished with an introduction to the Scottish Invasive Species Initiative and requests for help with its running.

There was keen participation and a genuine desire to address issues particular to this area, with feedback forms enabling future events to be tailored specifically to the audience. The meeting was well received and the notes can be found on the Trust website.

John Muir Trust Open Day

On a very sunny day at the end of June the Trust Biologist could be found down at Oldshoremore with electrofishing backpack, nets and buckets. A small group of biologists-in-the-making managed to catch salmon, trout, eels and flounder in the burn before heading down to the shore to explore the rock pools. A really good day out and hopefully lots learnt. Congratulations to the John Muir Trust for organising both the day and the fabulous weather!

Angling Demonstration

At Scourie Gala this year Adam held a fly fishing demonstration and tuition event. Participants were given lessons in fly fishing and had the chance to enter a distance casting competition. Many thanks to Ben for his help on the day and the participants that kept them busy. Everyone seemed to have a good time and will hopefully be more adept at the casting in future. Congratulations to the distance winners.

Other Open Events

The Trust also participated in The Highland Field Sports Fair, Assynt Highland Games and Scourie Gala, having a stall at each. These events gave us another chance to talk to members of the public and promote 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, and to those who donated prizes for 'Find the Whisky'. These events are good fun to do and help in the promotion of the Trust and its works.

Wellies & Wildlife

During 2018 the Trust managed to secure Grant aid to help with the preparation of an educational booklet for the area. Aimed at helping people to explore the natural environment around Sutherland, this gives 'how to' information, as well as some of the species that might be seen in each habitat. The booklets are available for purchase at a number of local outlets and the information has also been made available for download as a number of fact sheets on the Trust website. A massive thanks to the many groups and individuals who supported this project, either with grant funding, editing assistance or the provision of photos. Hopefully this will help residents and visitors alike to appreciate this wonderful area.

Salmon conservation regulations

This policy was introduced for 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 2019:

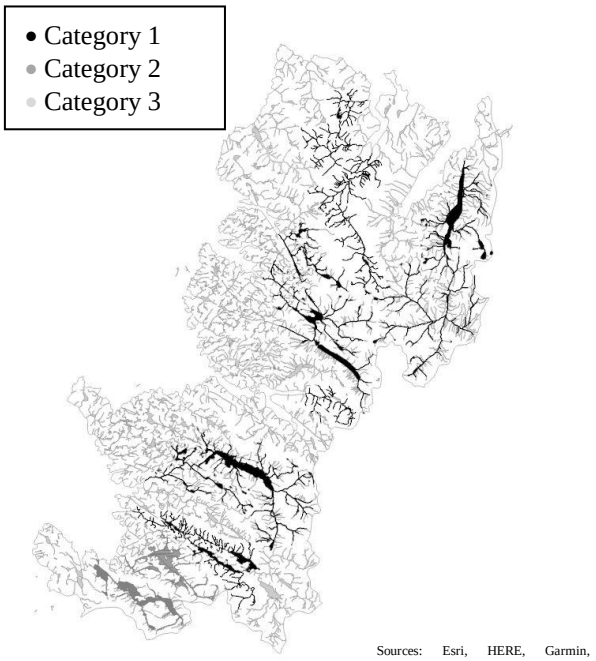
Category 1 – (Rivers Hope, Grudie, Dionard, Daill, Rhiconich, Laxford, Glendhu, Inver and Kirkaig) where the conservation limit has been met on 4 of the last 5 years, exploitation is sustainable and therefore no additional management action is required.

Category 2 – (Rivers Oscaig and Polly) 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 and Duartmore) 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) (*in pale grey).*

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

In addition to the measures introduced above, all District Salmon Fishery Boards will be required to complete a Fisheries Management Plan, to a template to be advised by Marine Scotland Science. The Trust will work closely with the Board to complete this, when the template is released by Marine Scotland Science. This is likely to be a web-based report aimed at determining local issues and help to build a national picture of impacts and issues for Atlantic salmon throughout Scotland. While centred on the freshwater, there is likely to be the possibility of mentioning marine and coastal issues also, as well as highlighting issues where a lack of resources is contributing to the problem.



Tracking studies

Acoustic tracking is becoming increasingly popular as a means of determining fish usage of an area. The tags can be fitted to a range of sizes of fish and can be either internal or external. Detection is *via* receivers strategically placed in the study area, thus giving good coverage that is unaffected by human capabilities. The receivers are not 100% efficient and some fish can be missed as they move past a receiver, but are suitable for following a large number of fish over the battery life of the tags.

Armadale tracking

During 2017 the Trust was involved in a Marine Scotland Science (MSS) tracking project. This project was a Scotland-wide assessment of salmon migrations. Adult salmon were caught at the Armadale netting station on the north coast and acoustic tags fitted before being released. Receivers were located in rivers around the coast of Scotland in June, with main rivers from the Tweed to the Laxford having 2 receivers installed – one just above high tide and one about 1 km from high tide. From the Laxford south, one receiver was installed above high tide. The receivers remained in place until the end of October.

The results for this project have now been produced. Of the 81 salmon tagged within the project 44 were detected within the rivers. This is an exceptionally high detection rate for tag-recapture studies and demonstrates the potential of the method. Of these, 9 were found to have entered multiple rivers before selecting a final river. Within this area 2 fish were detected within the River Hope and one within the River Polla. All fish, with the exception of one in the Spey, were detected in rivers on the north coast.

The full report can be viewed at https://data.marine.gov.scot/sites/default/files//SMFS%200905.pdf.

Laxford sea trout tracking project

West Sutherland Fisheries Trust, Atlantic Salmon Trust, The Scottish Centre for Ecology and the Natural Environment, and Marine Scotland Science entered into a collaborative project during early 2018 in order to determine sea trout movements and habitat usage within Loch Laxford. The intention of this study is to answer a host of queries about coastal sea trout behaviour, with the outcomes being largely two-fold; firstly, to use the data to inform local management strategies with regard to improved conservation of sea trout populations. Secondly, the information gathered through this project can be cross referenced with similar sea trout tracking studies on the west coast of Scotland in order to determine whether or not separate sea trout populations are behaving in the same manner across different sites. If this is the case, then wider management strategies may be developed with regard to broader sea trout conservation measures.

This project stemmed through WSFT's estuary sweep netting surveys, which have been carried out since 1997; visual implant tagging information and genetic research gleaned through these surveys strongly suggest that a large proportion of the local sea trout populations do not stray far from the estuaries and sea lochs corresponding to their river of origin. This infers that the estuaries and sea lochs form the mainstay of the marine habitat essential to local sea trout survival. In addition to this, whilst there are many theories regarding sea trout behaviour during the marine phase of their lifecycle, there are many unanswered questions due to the relatively small amount of detailed scientific evidence regarding sea trout habits within the coastal environment.

Project objectives include (but are not limited to) the following:

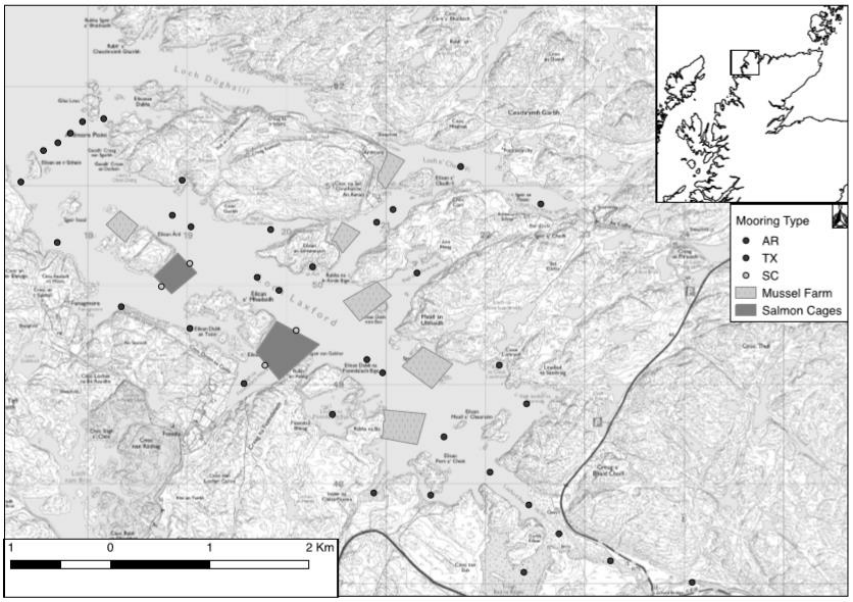
- Determine spatial use of Loch Laxford by sea trout
- Determine proportion of sea trout migrating out of Loch Laxford into the open sea
- Determine spatial interactions with aquaculture units: Finfish and Shellfish
- Determine behavioural traits of fish with lice burdens
- Determine sea trout habitat use/preference
- Freshwater re-entry behaviour
- Gather predation data where possible

Results can be used to:

- Highlight sensitive areas of importance to sea trout within Loch Laxford
- Highlight sensitive temporal factors such as local migration timings
- Inform local and wider development by informing management strategies in order to better protect sea trout populations in the coastal environment

Project Plan

38 acoustic receivers were strategically positioned throughout Loch Laxford, Badnabay estuary, and the lower river Laxford during early May 2018. The receivers were moored to the sea bed and remained stationary for the duration of the 6 month study. This is known as passive tracking; when a tagged fish swims within range of a receiver, the information is logged and stored within the receiver. The receivers were placed in order to provide coverage of different habitat types, aquaculture facilities, and likely migratory routes.



Map of receiver locations

99 transmitter tags were allocated for the project, to be fitted to sea trout smolts, post-smolts, and adult sea trout, to be captured via the Badnabay smolt trap and Laxford estuary sweep netting site. Battery life of the tags was estimated to be between 3 and 4 months, therefore fish were planned to be tagged in monthly batches from May until July, in order to maximise information of fish movements throughout the study period.

Due to the large number of sea trout captured during the May sweep netting session at Laxford estuary, 60 sea trout post-smolts were fitted with transmitter tags at this time. Subsequently, during late May, a further 14 smolts were tagged during a late run through the Badnabay trap. It was then decided that due to the large sample size already being monitored, the remainder of the tags would be fitted to a single batch of fish to be captured in July in order to study a large sample of fish that could be monitored during mid-summer into autumn.

The receivers were recovered at the end of October, and the data stored within them will be analysed and reported on in due course. This costly project required a lot of careful planning and hard hands on work, only made possible by the huge amount of local support received. West Sutherland Fisheries Trust would like to give thanks to all who have contributed by way of funding donations no matter how big or small, donation of boat time from local businesses, and hands on help from volunteers.

Special thanks to: Reay Forest Estate, Scourie Estate, Rhiconich Estate, Loch Duart Ltd., Loch Laxford Shellfish Ltd., Shorehouse Seafood Restaurant Tarbet, Crown Estate Scotland, Ridgeway Adventure, Barnes Bits and Bikes, Charles Marsham, Simon Jeffreys, Ross Barnes, Rex Onions, Dave Deboer, David Clark, Chris Ambler.

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.

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.

Monitoring of sea trout post-smolts

This work would not be capable of completion without the assistance of the Loch Duart Ltd and Wildland Ltd. Also to the army of volunteers, in particular Ross Barnes, Dave Debour, Rex Onions and Donald Reid for their help in all weather and conditions.

Funding for this work comes from a variety of sources. The North & West District Salmon Fishery Board, estates, individuals and the Trust add value to a grant from the Scottish Government, received through FMS.

Education

The Ghillies Seminar was partly funded by the District Salmon Fishery Board and the kind donations by our speakers of time and travel.

Biosecurity Planning

Funding of the Scottish Invasive Species Initiative by the Heritage Lottery Fund is gratefully acknowledged. Also to Scottish natural Heritage 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
Assynt Estate
Brackloch Trust
Coigach & Assynt Living Landscape
Heritage Lottery Fund
North & West District Salmon Fishery Board
Scottish Government
Scottish Natural Heritage
Westminster Foundation

Business (incl. Fish Farms)
Cargill Ltd
Loch Duart Ltd
Scottish Sea Farms
Wester Ross Fisheries

Estates
John Muir Trust
Rhiconich Estate
Reay Forest Estate
Scourie Estate
Wildland Ltd

Funding has continued to get tighter from Government and competition for charitable grants is always fierce. Many NGOs have whole departments whose sole purpose is to apply for grants so with our limited man power resources it is difficult to compete. Despite this roughly half our income was for restricted grant assisted projects. The other half was from general donations and we have been very fortunate to have received significant sums from local estates and businesses, the list of donors is printed here. Donations are just that and donors understand and respect our duty to be objective and scientific in our reporting. Income is only one aspect of finances and the trustees are fortunate to have Dr Marshall who manages our affairs in a prudent and efficient way. As a result the financial year to April 2019 has resulted in a small credit balance.

This year, rather than publishing an uncertified summary of this year's finances we are directing anyone wishing to see the certified accounts for year ending April 2018 to our website (www.wsft.co.uk)

Tony Rawlings

West Sutherland Fisheries Trust - Membership

Help us in our struggle to restore and maintain the trout and salmon stocks within the west Sutherland area by joining the West Sutherland Fisheries Trust for as little as £10 a year. We are already carrying out research into the salmonid life cycle in local river systems and are maintaining close links with biologists working throughout Scotland to ensure that results are co-ordinated and therefore give as complete a picture as possible. However, as a Charitable Trust (Charity No. SC24426) we are in constant need of financial support.

Contributions: Yearly Membership £25.00: Junior £10.00

Any additional contributions you feel able to make would enable us to be more active within the area. In return you will get the satisfaction of knowing that you are contributing to the effort to save our salmon and trout, a local contact point for exchanging views and information, 2 newsletters a year and an Annual Review to keep you informed about what we are achieving.

Please complete the following form and return to: Gardeners Cottage, Scourie, Sutherland, IV27 4SX

Name: _____ Address: _____

_____

_____

_____

E-mail:_____

Contribution: £ _____ Annual ž Junior ž

I want the West Sutherland Fisheries Trust (A Scottish Registered Charity No. SC24426) to reclaim Tax* on any donation/membership subscription paid from the date of this declaration.

Signature ……. Date ……/……/……

Notes

You must pay an amount of income tax/capital gains tax, at least equal to the tax that the charity reclaims on your donation in the tax year (currently 28p for each £1 you give). Remember to notify us if this no longer applies.

If you pay tax at the higher rate you can claim further tax relief on your self-assessment tax return.

If in the future your circumstances change and you no longer pay tax on your income and capital gains equal to the tax that the charity reclaims you can cancel this declaration at any time by notifying us.

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Banker's Order
(Annual Membership)

To the Manager of_____

Address _____

Please pay to the Royal Bank of Scotland, 11 Argyle Street, Ullapool, IV26 2UD (Account No. 00145607, Sort Code 83-28-01) the sum of £_____ on:- _____ and annually thereafter on the same date.

Signed: _____ Name: _____

Address:_____

_____

Account No: _____ Sort Code: _____

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).