Skye & Wester Ross Fisheries Trust

Newsletter, February 2019

Introduction

by Ian Lindsay

Following our amalgamation, 2018 has been an important year for the Skye and Wester Ross Fisheries Trust. Perhaps most significantly it has allowed us to integrate and expand our scientific monitoring across a much wider number of rivers to provide our Salmon Fishery Boards, Government Agencies and others with authoritative, science - based guidance on the factors affecting their productivity.

Amongst the factors that underlie the declines of salmon and sea trout stocks in our area are the impacts from an expanding aquaculture industry and these impacts probably remain the greatest concern to river owners, anglers and ecologists. To date, at an extensive level, studies of sea lice distribution and infection amongst wild fish have provided credible hypothesis suggesting direct effects but it is at the level of individual rivers and adjacent fish farm sites where such impacts urgently need to be better understood to underwrite improved management and decision-making processes by the industry and government. As an example, in this newsletter and elsewhere Peter Cunningham's on-going work now strongly suggests synchrony between farm lice levels and subsequent grilse returns on adjacent rivers.

We hope the strengthening of our annual monitoring programme across significantly more rivers will shed further light on this and other possible impacts, together with providing better understanding of issues of freshwater habitat quality, predation and other factors which are likely to be limiting our fish stocks. To make this possible we plan to employ a second fisheries biologist in 2019.

More generally, amalgamation of two of Scotland's smaller, adjacent fisheries Trusts has seemed a logical step and has provided a far more cost effective "critical mass" to coordinate our administration, fundraising, education and other activities. Equally, at the level of our fish stocks, the majority of the rivers in our area effectively share a common population, facing similar challenges, on either side of a fairly narrow migratory channel.

In all of our activities perhaps the greatest asset enjoyed by the Trust is the level of volunteer support that we receive from our sweep netting and fieldwork teams, the input of our Salmon Fishery Boards as well as the support of our Trustees. Amongst other things this support allows us to minimise our administration costs and to prioritise our delivery of "core" activity – the monitoring and better management of our fish stocks.

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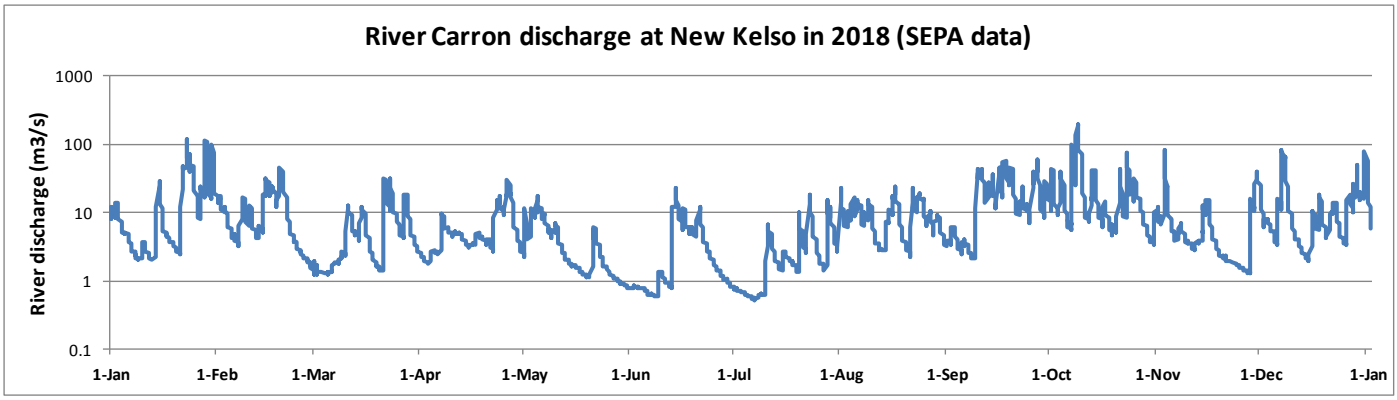
Weather conditions and water levels

Following a cold and late spring in 2018, water levels were low in some streams at the end of April and in early May when salmon and sea trout smolts were migrating to sea. However, in late May, a small spate enabled late smolts to find their way to sea, two weeks behind schedule for some fish. High temperatures and a lack of water in late June and early July delayed adult salmon from entering many rivers and may have contributed to sea lice infestation of sea trout in some sea lochs.

(left) Little Gruinard River on 26th June 2018. Water levels were low enough to electro-fish a main channel site here, with support from the Marine Scotland Science team.

In mid-July, water levels rose following much needed rainfall. Smiles returned to riverbanks as fresh fish entered from the sea. In August, following the dry spell, we were pleasantly surprised with the results of electro-fishing surveys of salmon fry and parr for some sites. Many rivers continued to rise; by September most were too high for some of the planned field work. October was cool and wet; plenty of water for spawning sea trout. November was unusually dry and sunny, good conditions for watching salmon spawning behaviour in places where fish had congregated. However by the end of November many rivers and tributary streams were unusually shallow restricting access by salmon to some spawning areas.

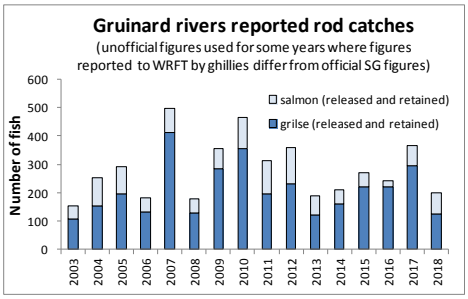
(below) River Carron water discharge graph for 2018. Note the logarithmic scale for river discharge; and that flows varied between less than 1 m^3/sec to over 100m^3/sec. Thank you to SEPA for providing the data for this graph.

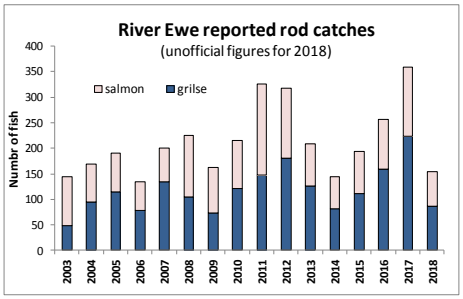


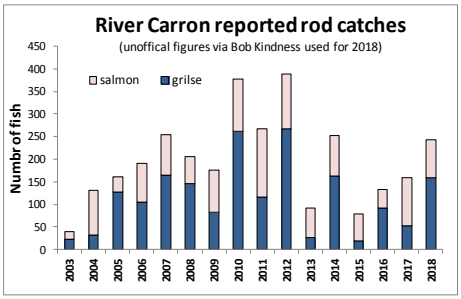
(right) An October spate at Tournaig. When water levels are as high as this, salmon are able to ascend these falls, by-passing the fish ladder and fish trap (photos by Ben Rushbrooke).

Rod catches of salmon and sea trout: the River Carron bucks a downward trend

Catch figures received to date indicate that the number of salmon and grilse caught in 2018 was considerably less for most rivers than in 2017. The graphs below are based on unofficial figures provided by local estates for some years. Please note that these may differ slightly from figures published by the Scottish Government later in the year.





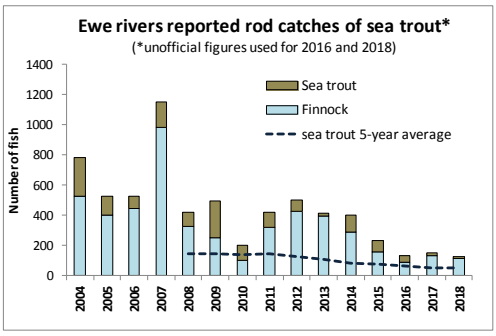


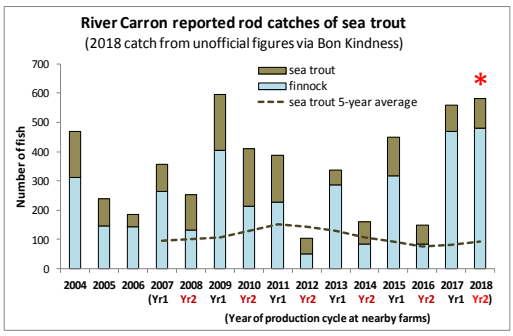
Both the Gruinard Rivers (big Gruinard and Little Gruinard rivers) struggled with a lack of water preventing fish from entering from the sea during the early part of the summer; most fish were caught during the second half of July and August when water levels were higher. Fishing effort in October was minimal on both rivers as in previous years. For the River Ewe system July and August were also the most productive months. For the River Carron, the 2018 combined catch was the highest since 2014; grilse numbers were much higher than in 2017. Autumn months were productive.

Bob Kindness with one of the first salmon of the year, a magnificent spring salmon taken on 27th April 2018. Well done Bob! Photo by Roddy Maclennan.

For sea trout the picture was mixed. Most rivers reported a lower total catch for 2018 than for other recent years. The River Ewe system and Gruinard river systems again reported very few sea trout and show no signs of recovery. The Loch Maree sea trout catch for 2018 was the lowest on record, with just four sea trout reported. In contrast, the River Carron reported the largest combined catch of finnock and sea trout since 2009.

Sea trout in excess of 4lb+ were taken from several rivers around the Wester Ross MPA. Some of the larger fish were said to be in good condition, others were reported to be sea louse damaged. Please send in pictures of any notable fish!





* Earlier fallow period than in previous production cycles. All salmon farms in Lochs Carron – Kishorn area completed production cycle by end February 2018.

A workshop focussing on the conservation and management of wild trout and the fisheries they support is planned for the 30th of April 2019. It will focus on the results of recent genetic work, tracking studies, stocking, and sampling of sea trout in the sea; and how recent findings can inform conservation and management decisions. For more information, please contact Peter Cunningham at info@swrft.org.uk .

Wild salmon spawn above a new HP scheme in the River Ewe headwaters

The Bruachaig River joins the Kinlochewe River, the most productive nursery stream for juvenile salmon production in the River Ewe system. On 20th November 2018, a pair of adult salmon was seen spawning in the upper Bruachaig River above the complex waterfalls and a new HP intake weir between Incheril and the Heights of Kinlochewe.

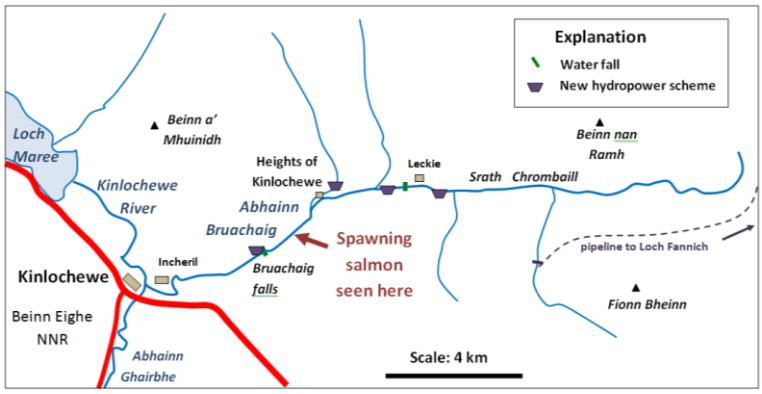
Until the early 1990s, wild salmon were regularly caught by anglers above the Bruachaig falls. However, from 1996 to early 2000s, electro-fishing surveys failed to find any juvenile salmon above the falls. So a stock restoration programme was initiated. Each year from 2008 to 2014, salmon fry (progeny of wild salmon from below the falls) were stocked into the river above the falls. The aim of the stocking programme was to restore a smolt run from above the falls and ultimately to revive a self-sustaining wild salmon population within this part of the River Ewe system.

Female salmon cutting a redd here

From 2015 until 2017, when four new hydropower generation schemes were under construction within the Bruachaig River catchment including a new run-of-the-river scheme over the main falls, no juvenile salmon were stocked above the falls. We were uncertain about the outcome of the earlier initiative. So in July 2018, when a visiting angler reported catching a salmon parr in the pool above the new intake weir for the Bruachaig Falls HP project, the SWRFT e-fishing team set off to investigate.

Not only were salmon parr found above the falls (particularly around the Heights of Kinlochewe), salmon fry (young of the year) were also recorded. The parents of these fish must have used the temporary diversion channel around the intake weir construction site to ascend prior to spawning in 2016 and 2017, because the main river channel was dewatered during this period! It is also possible that the parent fish included some of the salmon stocked as fry in earlier years, and that after their epic oceanic journey, perhaps travelling as far as Greenland, they had returned 'home' to where they had come from.

In 2017, a fish pass was fitted over the intake weir for the new Bruachaig Falls HP scheme. The diversion channel was then in-filled and the river restored to its former path through the top of the falls. The discovery of adult salmon above the intake weir in November 2018 is evidence that adult salmon are able to ascend both the falls and the intake weir via the new fish pass, thereby gaining access to a large area of good spawning and nursery habitat further upstream. The discovery of spawning salmon above the new HP intake demonstrates a successful outcome for both HP generation and for wild salmon: a 'win-win' solution.



Thank you to many people who helped with the stocking programme in previous years: especially Franki Kalinowski (Kinlochewe Estate) who also witnessed the salmon spawning on 20th November; Neil Morrison and Simon Stewart (Coulin Estate); Dr John Ogle family and friends (on holiday at Kinlochewe Lodge) including Ben Partridge for reporting the parr above the falls; SNH Beinn Eighe NNR volunteers, and Bob Kindness. The stock restoration project in earlier years was funded by River Ewe system fisheries proprietors, Wester Ross Area Salmon Fishery Board, Scottish and Southern Energy, and the Scottish Government.

Towards a national assessment of juvenile salmon

The main task for SWRFT electro-fishing teams during the 2018 field season was to survey a series of new sites in rivers across our region as part of the new collaborative National Electrofishing Programme for Scotland [NEPS][1]. The ultimate aim of the programme is to be able to obtain data sets describing juvenile salmon abundance from which the conservation status of wild salmon across Scotland can be better assessed. The new data will complement the Scottish Government's published rod catch statistics for adult salmon and information from fish counters. As the data collected from the NEPS survey is also of much value for local fisheries management purposes, the Trust has remained very supportive of this new Scottish Government led initiative.

However, the new electrofishing programme presented several new challenges for our field teams. Survey sites selected in the Wester Ross area (all randomly chosen) included river channels that were wider and deeper than those that had been fished in previous years. So in addition to the use of traditional 'back-pack' electrofishing equipment, more powerful generator-powered bank-side electro-fishing equipment from Marine Scotland was borrowed and new waste waders purchased to be able to survey effectively in water of more than 50cm deep.

NEPS sites were surveyed in the following river systems in 2018: Kanaird, Ullapool, Dundonnell, upper Gruinard, Little Gruinard (with help from Marine Scotland Science), Ewe, Kerry, Torridon, Balgy, Applecross, Elchaig, Shiel, Glenmore and Glenbeag. Unfortunately, even with the new equipment, flows remained too high and strong to safely undertake surveys of some of the designated NEPS sites in the Little Gruinard River and big Gruinard River systems.

SNH volunteers from Beinn Eighe NNR helping with measuring salmon parr in the Bruachaig River by Heights of Kinlochewe on 20th July 2018.

In addition to the NEPS sites surveyed, additional electrofishing data was collected from sites surveyed in the Inverianvie river, Allt Beith, Tournaig river and Sguod river systems and from several smaller streams around the Loch Maree catchment area especially when larger rivers were too high to survey.

Ben Rushbrooke and Colin Simpson by a NEPS site in the headwaters of the Gruinard River, October 2018.

[1] http://marine.gov.scot/information/national-electrofishing-programme-scotland-2018-site-locations

Preliminary results demonstrate the widespread distribution of juvenile salmon within most rivers despite very low flows during the late spring and early summer of 2018. The highest wild salmon fry density recorded was at a site in the River Kerry, estimated at 180 fish per 100m^2. Estimated densities of over 30 fry per 100m^2 were also recorded at sites in the upper Gruinard, lower Glenbeag and lower Glenmore rivers. Higher numbers of salmon fry and parr were recorded at sites in the Rhidorroch river (headwaters of the Ullapool River) and in the Tournaig river system than in most previous surveys since the year 2000. However, in contrast, the absence of juvenile salmon at sites accessible to adult salmon in the upper Balgy (above Loch Damph) and Applecross Rivers requires further consideration.

Salmon parr (top), trout parr (bottom), and putative trout x salmon hybrid from the River Elchaig headwater (photo by David Holland)

Fry were typically larger at the locations where densities were low. For example, in August salmon fry of over 60mm average length were recorded in the upper Glenbeag river, but at estimated densities of only 10 fish per 100m^2 or less. In contrast salmon fry of similar age at a site in the Torridon River were very small, on average less than 45mm in length, but present at an estimated density of around 30 fry per 100m^2. The Glenmore and Glenbeag rivers also flow through relatively fertile valleys and are lined with mature riparian alder trees in contrast to the Torridon River which drains a catchment area with thin, infertile soils, much peat and only a few riparian trees.

For juvenile trout, the survey again demonstrated that smaller burns tend to support the highest trout fry densities, especially where juvenile salmon are absent. The highest catch per unit effort figures for wild trout fry in 2018 were recorded in burns flowing into Loch Sguod and in the 'Pony Path' burn by the Beinn Eighe NNR Visitor Centre (estimated densities of over 40 fish per 100m^2). These may have included progeny of both sea trout and brown trout which had not been to sea. Juvenile trout tend to be displaced from larger, wider streams by juvenile salmon; and so at most NEPS sites, typically on larger channels, juvenile trout were usually outnumbered by juvenile salmon.

Fish sorting by the Dundonnell River, August 2018.

In addition to our own surveys, the SEPA electro-fishing team fished sites in the Balgy and River Ling during the summer of 2018, as part of an investigation to learn about salmon populations around salmon farming areas. NEPS data collected by SWRFT is being analysed by Marine Scotland Science and will be more fully reported later in 2019.

The SWRFT electrofishing team of Peter Cunningham and Colin Simpson, was assisted by Ben Rushbrooke, Finn Simpson, Gary Bulmer, David Holland, Peter Davison, Janet Davison, Mark Williams, Alasdair MacDonald, Dr Steve Kett and Dr Andy Vicks, Dr James Close, Denis Bosner and Charlie Hill helping at sites where three or more people were required (especially some of the deeper water NEPS sites). Thank you also to many other helpers including friends and family of some of the above, SNH Beinn Eighe NNR staff and volunteers, and for transport, Dave Richards and family, Alan and Billy MacKenzie (Eileanreach Estate), Gary Ross (Gruinard Estate); and Ian and Stuart Allison (Eilean Darach estate) including boat to otherwise inaccessible site. Thank you very much to Karen Millidine, Ross Glover and other colleagues at Marine Scotland Science and to Fraser Wilson for loan of bank-side generator powered electrofishing equipment. Electrofishing surveys were funded by the Scottish Government and WRASFB, with support from Fisheries Management Scotland and the Scottish Fisheries Coordination Centre. Thank you to SEPA for sharing their data.

Sea lice infestation remains a problem for wild sea trout in some areas

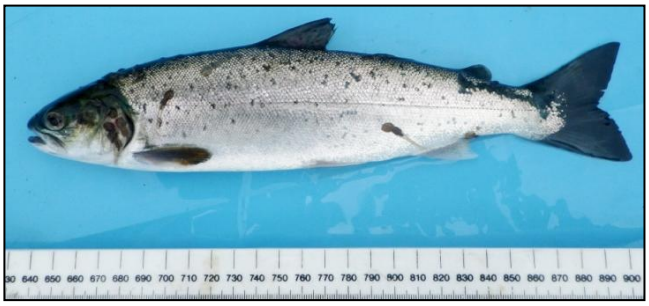
During the spring and summer of 2018, sea trout were sampled using the sweep net in the Kanaird river estuary, Boor Bay (Loch Ewe), Flowerdale (Loch Gairloch); at new sites in the Applecross river estuary, at Achintraid (by Kishorn), in the Glenmore River estuary (by Glenelg), and at sites around the Isle of Skye (see later).

(left) Preparing the net at Flowerdale, 28th June 2018.

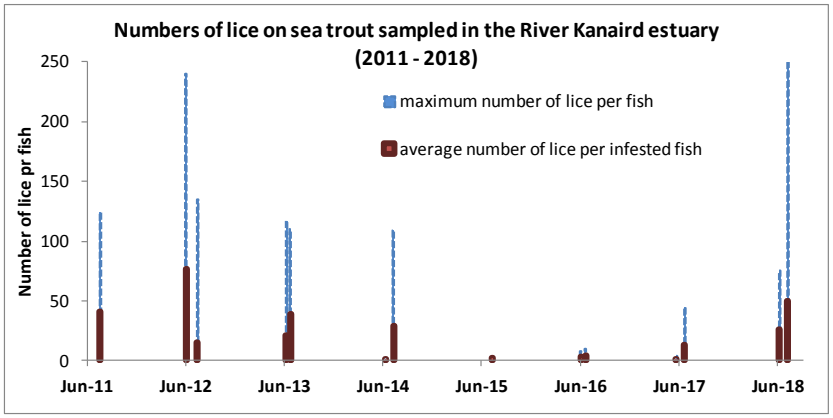
(right) The sweep netting team processing fish at the Glenmore River estuary, Glenelg on 18th June 2018.

In terms of the numbers of trout caught, success varied from over 30 fish at the River Kanaird on 13th July, to just one at Achintraid on the 19th of June. As in previous years, sites closest to or within estuaries were the most productive.

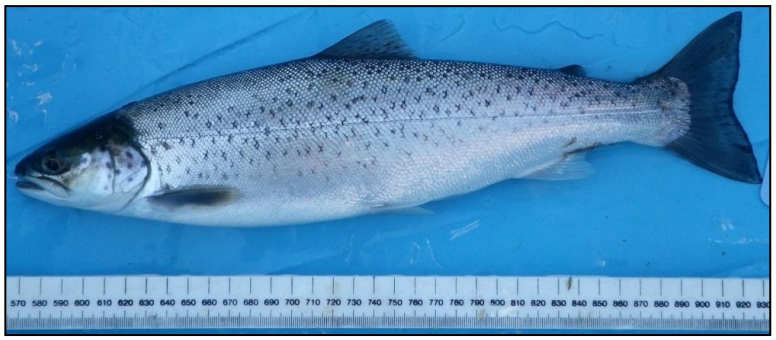
Most of the fish caught were small post-smolt sea trout that had recently entered the sea from freshwater. However some larger, older trout were also taken. Levels of sea lice infestation varied. The 21 small sea trout and estuarine taken at Glenelg on 18th June carried very few lice. In contrast 29 larger sea trout from the Kanaird estuary on 13th July 2018 carried high numbers of lice averaging 50.2 lice per fish. 30% of these fish carried more than 0.3 lice per gram bodyweight of fish, a level considered to be potentially lethal (e.g. Taranger 2014).



The sample taken by the netting team at the mouth of the River Kanaird on 13th July 2018 (below left) included this fish (right) carrying over 200 lice. Levels of sea louse infestation on sea trout taken at the mouth of the River Kanaird in 2018 were much higher than in other recent years (below right).



Samples taken from Little Loch Broom and Loch Ewe were too small to be able to provide useful assessments of fish health. However, the three sea trout taken on 27th June at Boor Bay, Loch Ewe, were all in good condition indicating good feeding at sea during the late spring and early part of the summer at least.



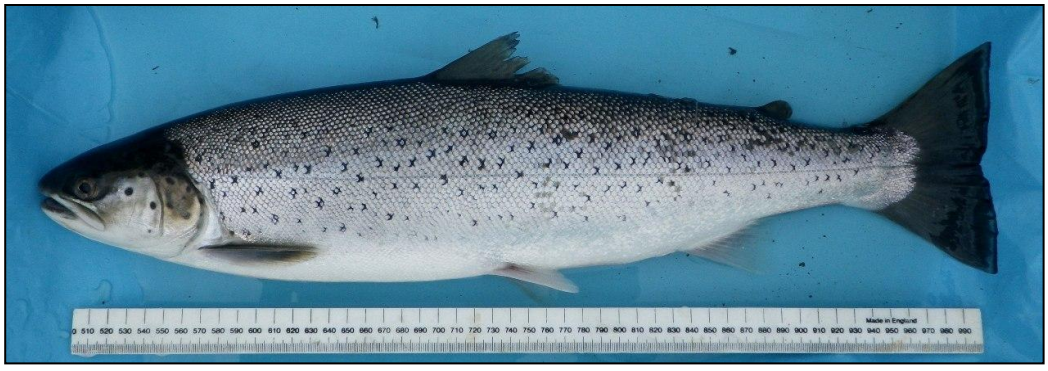
Sea trout of 365mm, 610g, carrying a total of 45 lice: 15 Caligus elongatus and 30 Lepeophthierus salmonis, taken at Boor Bay on 27th June. Caligus lice are smaller than 'Lep's' and have not been seen on wild sea trout in the SWRFT area at levels considered to be of concern to fish health to date.

At Flowerdale, Loch Gairloch, after a successful sweep in April, only two sea trout were caught in June and none thereafter. The planned sweep netting sessions in September and early October were abandoned because of high winds. That's the first year since 2011 that we have failed to sample sea trout in the autumn at Flowerdale. To learn more about the health of the sea trout population in Loch Gairloch, we are planning to sample sea trout in the Flowerdale estuary during the winter or early spring of 2019. Please let us know if you would like to help; with a warm wetsuit or dry suit it can be quite comfortable and always interesting!

Of the new sampling sites visited in 2018, the most successful was at the mouth of the Applecross River on the 18th of July, largely thanks to local estate manager David Abraham and volunteer helpers on holiday: Dr Malcolm Stewart (Peter C's fishing buddy from schooldays!), Malcolm's wife Helen, and sister Barbara Richards and family.

The sweep netting 'A' team at the mouth of the Applecross River, 18th July 2018 (photo by Barbara Richards).

Seventeen trout were caught that day, mostly post-smolts, but including a much larger sea trout of 525mm, 1824g *(below).* Lice levels were mostly below 10 lice per fish. The post-smolts were a bit thin for the time of year; however the big fish was in good condition other than for a slightly tatty dorsal fin (below).



The biggest sea trout of the sweep netting season in 2018: 525mm, 1824g, taken at the mouth of the Applecross River on 18th July. Note the eroded dorsal fin indicative of previous lice infestation.

Sweep netting in 2018 was supported by the Scottish Government, the Wester Ross Area Salmon Fishery Board, local estates, fish farm staff, angling club members and many other volunteers: thank you to everyone who helped . . . too many people to name here!

Update from the Isle of Skye

by Isabel Moore

This brief review contains information regarding the fisheries management activities carried out on the Isle of Skye over the 2018 calendar year.

National Monitoring Electrofishing Survey and other electrofishing surveys on Skye

The Scottish Government released sites for their new National Monitoring Electrofishing Survey in 2018, which included seven sites on Skye. The main purpose of this new programme is to gather information about the densities of young salmon in rivers around Scotland, but additional data were collected on trout, eels, and other fish species that were present.

The randomly computer generated sites were found on the Snizort (three sites), Sligachan (one site), Ose, (one site), Varagill (one site), and the Broadford (one site). Due to heavy rains in August, the electrofishing was spread out over several weeks because access to sites was limited and dependent on river levels. Salmonids were found at all sites except for the Sligachan and the Ose.

The data from this sampling was handed over to the Scottish Government and will be analysed and published by them in the coming years.

Isabel Moore and Matt Curran (UHI-Rivers and Lochs Institute) processing fish on the banks of the River Snizort as part of the National Monitoring Survey.

In addition to the National Monitoring programme, large scale, timed electrofishing surveys were carried out in the Sligachan, Snizort, and Strathmor systems with the help of the University of Glasgow as part of a monitoring programme sponsored by Marine Harvest. Each system had between 7 and 10 sites that were sampled in August. The data from this sampling will be analysed and shared in the future, but preliminary information shows that the Snizort is home to the most robust salmonid populations of any of the rivers sampled in 2018. Sampling from both the Sligachan and Strathmor generated lower fish numbers.

Electrofishing of these river catchments and several additional ones will be carried out in 2019.

Sea trout and salmon lice monitoring around the Isle of Skye

In 2018, the monitoring of sea trout populations and salmon lice densities using seine nets continued in several sea lochs around the island. Lochs Slapin, Sligachan, and Snizort were each sampled in May and August. Small numbers of fish were caught at all three sites in May, however, very few fish were infected with lice. The highest densities of lice were found on fish captured in Loch Snizort, with an average of 7.3 lice/fish.

Dr. Hannele Honkanen setting up the sampling station at Loch Slapin in May, with Blaven in the background.

Loch Sligachan was netted for the first time in recent memory and a handful of newly smolted sea trout were captured, a promising sign for the river system. None of these smolts were infected with salmon lice.

The sweep neting team at Loch Snizort in May with one of the captured sea trout of the day.

Loch Pooltiel was also sampled in June with the help of Peter Cunningham. Over 30 sea trout were caught and only two fish out of those sampled were infected with lice.

In August, Lochs Slapin, Sligachan and Snizort were netted again, but unfortunately very few fish were captured. No sea trout were caught in Loch Slapin or Loch Sligachan, and only three in Loch Slapin. It is thought that the unusually dry weather during June and July of 2018 followed by a very wet August might have had an impact on the movement of the fish in the sea lochs and either forced the fish to move into deeper, cooler water further from the coast, or encouraged the fish to migrate upstream quickly when the rivers went into spate in August.

Sampling will continue in 2019 at these sites, as well as at several new sites around the island.

Our work on the Isle of Skye was carried out with the help of numerous volunteers and the financial assistance of the University of Glasgow, the Scottish Government, Grieg Seafood, Marine Harvest Scotland, John Muir Trust, the Rivers and Lochs Institute-UHI, the Portree Angling Association, and Kames Fish Farm. Special thanks to Prof Colin Adams, Dr. Hannele Honkanen, Dr. Matt Newton, Ally Macaskill, and the "Sweepnetting Gang" for their tireless assistance during the summer field season. Please contact Isabel Moore if you have any further questions or would like to volunteer with us in the future isabelmoore89@gmail.com .

Expedition to the Isle of Rum

Peter Cunningham and Colin Simpson returned to the Isle of Rum during the first week of July 2018 with the aim of sampling sea trout around the island ahead of a new Marine Harvest salmon farm. On 2nd and 3rd July, despite much energetic help from an enthusiastic sweep netting team including the Goddard family *(below)*, and capture of many small flatfish, juvenile gadoids (coalfish mostly) and other fish, no sea trout were caught in Loch Scresort. The weather was unusually warm and sunny, we think that any sea trout may have retreated to deeper water. Thank you to all helpers; the expedition was financed by Marine Harvest. *Photos by Isle of Rum Ranger, Trudi Clarke.*

Farm salmon production, sea lice emissions and wild fish populations

Over the past 30 years wild fisheries concerns have focussed primarily on the collapse of iconic sea trout populations and the important fisheries they supported such as that of Loch Maree on the mainland and Camasunary on the Isle of Skye. From numerous studies in Scotland, Ireland and Norway, including work we have undertaken with colleagues in Marine Scotland Science, there is now much evidence that high numbers of sea lice associated with farm salmon production have been a factor contributing to reduced survival of sea trout and to the loss of mature sea trout and consequent reduction in sea trout egg deposition[2]. The Loch Maree sea trout fishery still shows no sign of sustained recovery after another poor season in 2018.

There is also increasing evidence of an impact to wild salmon populations in areas where post-smolt salmon must migrate to the open ocean passing a series of salmon farms. Analyses presented in the SWRFT Review February 2018 highlighted the correlation between grilse catches from rivers in the Loch Alsh – Loch Carron area with sea lice levels on salmon farms in the area[3]. Following years when sea lice populations were high (during every second year of the fish farm production cycle in the area) the number of grilse caught in nearby rivers was much lower than in intervening years.

There was little evidence of an improvement in sea louse control within the area[4]. In 2018, the performance of many farms including some newer ones with a 2000+ tonne biomass consents during the 2nd year of the production cycle was particularly unsatisfactory from the point of view of protecting wild fish populations (e.g. Loch Duich fish farm, Loch Snizort East fish farm, Isle of Muck fish farm)[ibid].

The fish farm map on the next page was updated at the request of the WRASFB in response to a planning application for another new 2000+ tonne biomass open cage salmon farm at West Strome in Loch Carron (circled with dotted red line). The proposed new farm is in addition to several other very large recently consented fish farms from which emissions of larval sea lice may infect salmon post-smolts migrating between the Isle of Skye and the mainland of Scotland (a likely migration route for River Carron smolts is shown by the red dotted line). In April 2018, planning permissions were granted for two new Organic Sea Harvest farms to the north of Portree with 2,500 tonne biomass consent. These farms are located closer to Loch Torridon than other farms in the east of Skye so may act as 'stepping stones' for cross infection of sea lice between existing salmon farming areas. At the time of writing, a planning application has been submitted by Marine Harvest (now Mowi) for a 2,500 tonne open cage farm by the Isle of Scalpay north of Broadford. Unless these new farms achieve much tighter control of sea lice than other similar-sized farms have achieved to date, sea lice infestation pressures on already depleted wild fish populations and for other fish farms in the area will increase further.

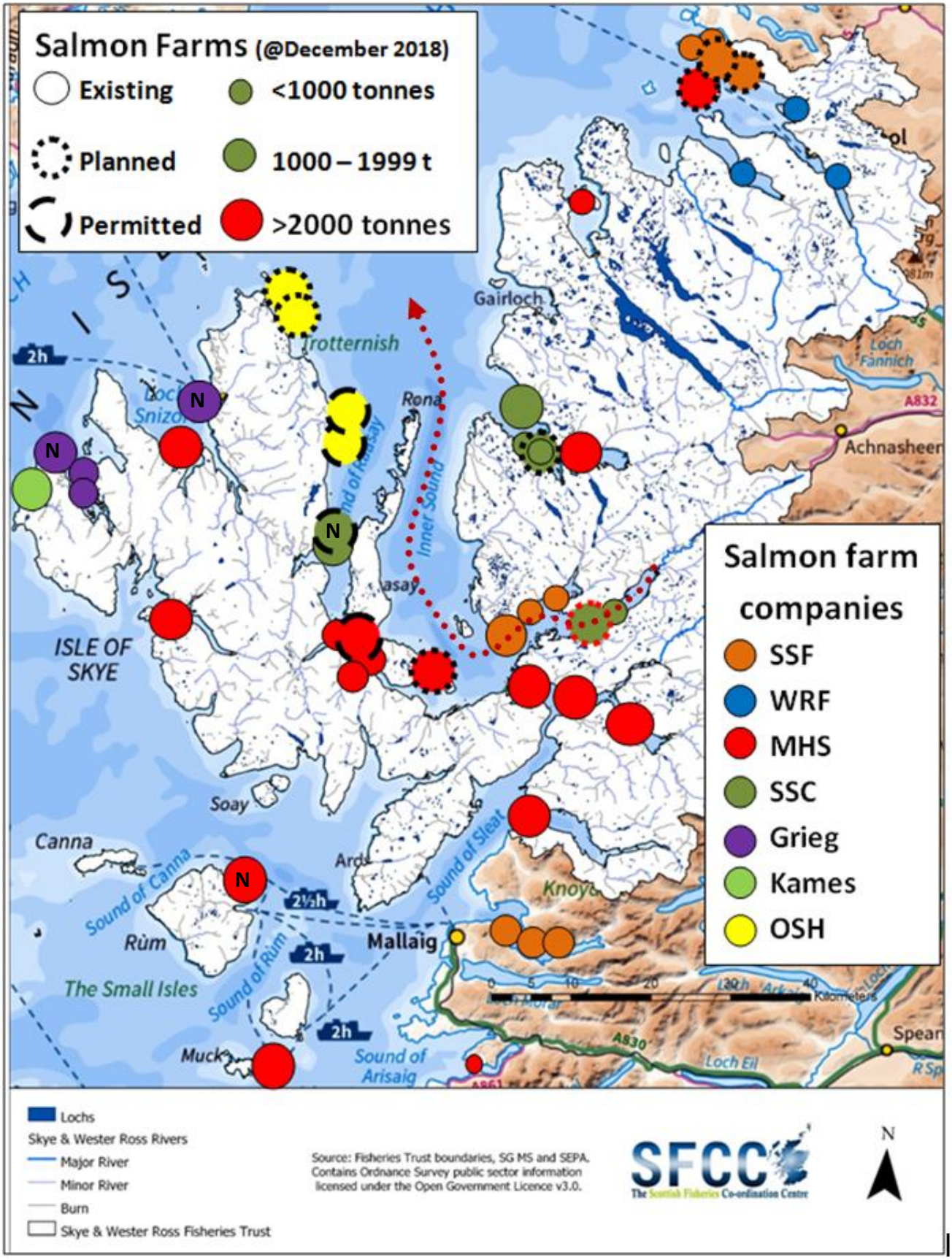
Recognising the threat to wild salmon and sea trout populations and fisheries in mainland rivers from many of these new farms, the Wester Ross Area Salmon Fishery Board and the Skye District Salmon Fishery Board have responded robustly to a series of planning applications and CAR licence applications.

Examples of responses to recent planning applications including proposed salmon farms at West Strome (Loch Carron) and Isle of Scalpay (near Broadford), and proposed biomass increases at Aird (Loch Torridon) and Loch Hourn can be found on the Wester Ross Area District Salmon Fishery Board website at:

http://wrasfb.dsfb.org.uk/planning-applications/

[2] For review, Thorstad et al 2015 https://www.int-res.com/articles/aei2015/7/q007p091.pdf
[3] Link to SWRFT Review February 2018 http://www.wrft.org.uk/news/newsitem.cfm?id=213
[4] SSPO sea lice data for individual farms can be found here http://scottishsalmon.co.uk/monthly-sea-lice-reports/

Map of fin fish farms in the SWRFT area, at December 2018. **'N'** *denotes a new farm which was stocked for the first time in 2017 or 2018. The farm with the dotted red line around it is the proposed 2000+ tonne West Strome salmon farm; the dotted arrow is a projected migration path for a wild salmon smolt from the River Carron.*



Continued Success for the River Carron

by Bob Kindness

In this article, Bob describes some of the recent work on the River Carron and offers an explanation for why the River Carron has maintained higher rod catches than many of the other rivers in the area.

The majority of salmon rivers in Scotland, both east and west coast, fared badly in 2018. Generally the dry and hot summer was blamed but in reality there was a scarcity of fish. However, against this background, the River Carron in Wester Ross has been described as "bucking the trend" in 2018 with very respectable catches of salmon, sea trout and finnock. Indeed, while the sea trout and finnock were slightly ahead of the previous season, the salmon catch, and in particular the grilse component, was significantly higher.

In the case of the Carron, in order to answer the question as to why it is currently bucking the trend, we need to consider what has happened to the river over the last 20 years and the effect on catches over the last 15. The stock of both salmon and sea trout was almost completely lost during the 1990's with the probable culprit being a series of consecutive winters when big spates would have moved gravel and washed out eggs. There was no shortage of good habitat but just a severe lack of young stock. A stocking programme based on a captive broodstock derived from Carron stock was established with the first major stocking taking place in 2001.

Bob stripping eggs from a small River Carron grilse.

The first significant increase in salmon rod catches occurred in 2004 corresponding exactly with this first input of young stock. Stocking has continued every year since 2001 with a total of 4.28 million salmon of all stages from eyed ova to smolts, between 1995 and 2018, going into the river. Catches of salmon, although fluctuating between years, have been higher over the last 15 years than at any time in the past prior to the collapse. It is interesting to note that the pre-stocking average for salmon between 1952 and 2003 was 57 while post-stocking from 2004 to 2018 was 92 while the figures for grilse were 23 and 131 respectively. In the absence of any other changes to the river in recent years and the fact that salmon stocks around Scotland have generally been in decline, it seems clear that stocking has had a significant effect on salmon numbers and a huge effect on grilse numbers.

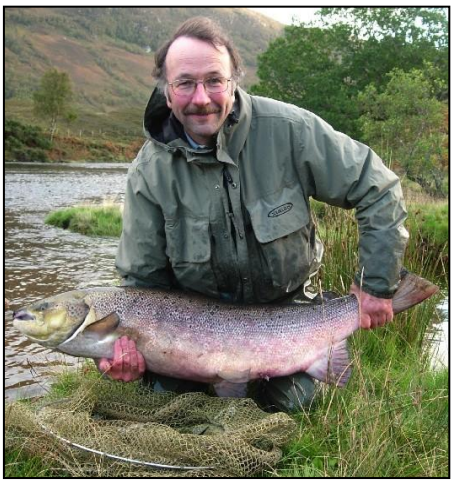
In addition to stocking salmon, 4.43 million sea trout (eyed ova to smolts) have been produced from a captive broodstock and introduced to the Carron since 1995. Although rod catches of sea trout have not been restored to historic levels, their numbers have improved especially for finnock. Of particular interest was the situation regarding sea trout and finnock over the last 2 seasons. In both 2017 and 2018, a sample of over 300 sea trout and finnock caught by rod and line in the sea pools was checked for the presence of sea-lice. Around 90% of the fish were carrying no lice and on the remainder a maximum of 8 lice were counted. This was the case for both years. In addition to the lack of lice on these summer caught fish, there was no evidence from fin condition that these fish had lice earlier in the year corresponding to the time of smolt migration. It seems clear that, whatever the lice situation was on the local farms in 2017 and 2018, it had little or no effect on the sea trout and finnock migrating from and returning to the Carron.

Perhaps this is significant when considering the suggestion that our fluctuating grilse catches are as a result of increased lice levels on the local salmon farms during the second year of the farming cycle. While it is certainly the case that, in recent years, grilse catches have been higher in the even years there is no evidence that this is linked to lice from the salmon cages affecting migrating smolts in the odd years. Although accepting that lice could be having some effect, another plausible reason could be our stocking programme. In the early years of stocking, our stocked fry came from a captive broodstock which was developed from grilse. It is most likely that a large proportion of these fish would have returned to the river as grilse. If large numbers of grilse return in the even years then their offspring will largely return in the even years when considering natural spawning. Therefore good even years will be maintained. On the Carron we do not have poor years for grilse, but tend to alternate between reasonable years and very good years and even the poorer years are better than the historic grilse catches for the river.

Bob checking the River Carron smolt trap in 2008.

Getting back to the original question as to why the Carron is enjoying continued success. The answer is quite simple. Marine survival for all Scottish stocks is poor and I suspect little can be done, at least in the short term, to remedy this. However, what can be done and is being done in the Carron, is that we can greatly increase smolt output through appropriate stocking to a level much higher than the river could naturally produce. This compensates to some extent for poor marine survival. For most salmon rivers, information on the number of smolts successfully migrating into the sea is either non-existent or very limited.

At the lower end of the Carron we have operated a rotary screw trap for more than 10 years during the spring of each year to coincide with the smolt run. Invaluable information has been gathered on the performance of stocked fish and the number and condition of all smolts passing through the trap. During 4 particular years, when low water levels prevailed throughout most of the smolt run allowing efficient trap operation, we were able to estimate the total salmon smolt run at between 30,000 and 40,000. This is at least twice the number that was estimated as being the maximum potential natural output based on riverine habitat (from the Carron Management Plan produced by the WRFT). Given that most of our stocked fish spend at least 18 months in the river before smolting, it demonstrates that the river is capable of producing many more smolts than might be predicted if all parts of the river are utilised. Stocking achieves this.



The message from the Carron, which seems fairly obvious, is to greatly increase smolt output to get more adults returning. It is unlikely that nature can do this alone.

Bob Kindness with a salmon of estimated weight 30lb taken in 2007.

Wild trout studies

Congratulations to Toby Landeryou and Vu Dang of Middlesex University for completion of post-graduate research projects on the genetics of wild trout in the Wester Ross area. Both projects were based upon analyses of samples of wild trout collected from locations in and around the Gairloch and Loch Maree area including those collected by Dr Steve Kett on visits to the area as part of the Loch Maree Wild Trout Project with the support of the Wester Ross Fisheries Trust.

The title of Vu Dang's MSc by Research is '***The phylogeography of wild Scottish brown trout (*Salmo trutta *L. 1758) of Loch Maree, Wester Ross: Spatial genetic structure after population decline'.*** The project builds on earlier genetic studies of trout within the Loch Maree catchment by Dr Kett and adds to our understanding of the diversity of wild trout populations within the area. This is Vu's second study based on sampling in Wester Ross, Vu's undergraduate thesis on the biodiversity of some of the hill lochs in the Gairloch area can be found on the downloads page of the WRFT website, under 'student project'.

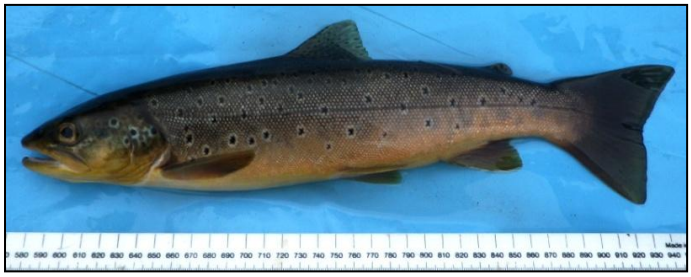
Toby Landeryou has completed a PhD entitled ***'Molecular assessment of parasite infection within UK populations of socio-economically important UK salmonids',*** a study which provides much more information about the diversity of parasites found on wild trout within the Wester Ross area and associated genetic relationships.

(left) Vu Dang and Toby Landeryou on sampling expeditions in Wester Ross in 2015.

As part of Isabel Moore's PhD project, a paper providing further evidence of the impact of sea lice on sea trout around the Isle of Skye was published in 2018 in the Journal of Fish Biology, entitled "***The influence of aquaculture unit proximity on the pattern of Lepeophtheirus salmonis infection of anadromous Salmo trutta populations on the Isle of Skye, Scotland***"[5]. Please contact Isabel isabelmoore89@gmail.com if you would like a copy.

A one-day workshop ***'Wild trout conservation, stocking, and fisheries revival in Skye and Wester Ross: time for rethink?'*** is currently being planned for 30th April 2019 in Kinlochewe Village Hall. The workshop will focus on wild trout diversity with presentations on recent genetic studies, and sea trout in the sea, with reviews of recent sea trout sampling in the sea and tracking studies. Please contact info@swrft.org.uk for more information.

Wester Ross has many isolated wild trout populations living in upland streams and lochs above waterfalls and other barriers to sea trout.



[5] Moore *et al*, 2018 https://onlinelibrary.wiley.com/doi/full/10.1111/jfb.13625

Invasive non-native species monitoring and control in Wester Ross

Invasive non-native species remain a major threat to biodiversity, the productivity of wildlife including wild fish populations, and many other useful things within the SWRFT area. Over the past year the Trust has supported work to control North American mink and other invasive species as part of the on-going Scottish Invasive Species Initiative [SISI] (website https://www.invasivespecies.scot/).

Work in Wester Ross has focussed on supporting a network of volunteers to monitor North American mink as well as raising awareness of and tacking some of the problems associated with the spread on invasive plants.

Learning about mink occurrence at NTS Inverewe

Post-graduate Student, Eden Edmonds from Leeds University spent several months during the summer of 2018 learning about the occurrence of mink at the National Trust for Scotland's [NTS] Inverewe Garden's. Here she describes some of her work:

Hello! I was fortunate enough to spend my summer walking the Inverewe Gardens Estate. I was in search for the American mink, an invasive predator that was released or escaped from fur farms. These ferocious creatures have been shown to be extremely detrimental on water vole populations (Britain's fastest declining mammal!) and seabird colonies. Anecdotally, one mink can wipe out an entire colony of seabirds, killing their prey in surplus.

I wanted to see how mink diets compared to those of otters and pine martens, to try to figure out whether mink are pushed to consuming one type of prey by the larger predators. I'm very happy to say that Inverewe estate has a healthy population of pine martens and otters, therefore it was the perfect place to try to understand the interactions between these species. To do this, I had the unpleasant job of collecting scat samples from the estate. I have a little tip for any budding ecologists: otter poo can smell of jasmine and fish, pine marten can poo smell musty and slightly fruity, and mink poo is just foul!

As well as the scat analysis, I wanted to see the distribution of these animals on the estate. I did this by using trail cameras, recording where scat was collected, foot prints etc. The cameras were a brilliant way to see the animals scamper by during the night, and I was so lucky to have seven of them provided by the Skye and Wester Ross Fisheries Trust and by Inverewe Gardens itself. The most interesting thing, for me, to catch on camera was at a burrow, in which I saw a female mink using throughout the day. Then, that evening, the camera captured an otter popping out of the same burrow! I still have no idea what that meant, but I was very excited to see that.

Mink from trap camera video recorded by Eden Edmonds at NTS Inverewe
https://www.facebook.com/1989761561277851/videos/901267193396961/

Although I have yet to properly analyse the data I collected, I am confident that I can produce some fascinating results that I can hopefully share with you at a later date. I had the most wonderful time in Scotland, and I would like to say, once again, a thank you to all those who helped me with the project.

Mink were also reported from the Loch Ewe, Gairloch, Loch Torridon and Applecross areas. Several animals caught in the Gruinard Bay and Little Loch Broom areas during 2018; to report a sighting, please contact the Trust at info@swrft.org.uk .

Invasive non-native plant control

Many £'000,000s have been spent in the SWRFT area during the past 10 years on projects to control invasive plant species. The Scottish Invasive Species Initiative [SISI] provides support for further volunteer-led actions to tackle problems where they occur, and as part of this programme the SWRFT will continue efforts to control Japanese knotweed and also tackle Himalayan balsam and Skunk cabbage which have escaped from gardens in some part of the mainland.

The SISI programme also provides support for awareness-raising issues. Although most people recognise the threat that the unchecked spread of invasive plants such as Rhododendron ponticum presents to more useful things including native woodlands, wildlife and the usefulness of land; there are still some people who value ponticum and are less than happy to support control measures. This can make the eradication of ponticum almost impossible in some areas, with much waste of money. The long-term benefits of removing ponticum from large areas cannot be realised if there are nearby gardens with ponticum bushes from which the surrounding area can be reseeded.

In 2018, SWRFT were awarded a grant from the Scottish Landfill Communities Fund to clear ponticum from a large area at Talladale by Loch Maree close to the Slattadale Forest where efforts were undertaken in earlier years by the Forestry Commission. Over the past year Eamonn Flood *(left)* and Channy Abwi of Manta Ecology have been diligently crawling about beneath the bushes to reach and treat all the ponticum plants within the area. Many of the bushes were growing beneath ancient oak woodland, smothering young trees and native ground flora plants. The herbicide stem-injection method was successfully used for most plants, where a hole is drilled into the base of the ponticum plant and a small about of herbicide is applied.

The project area also included a garden where the owners agreed to a 'plant swap': in return for having their ponticum bushes removed, they were given a choice of alternative plants including non-invasive rhododendrons as replacements. There are many attractive non-native flowering evergreen shrubs which are not invasive in addition to many wildlife-friendly native plants which can grow well in local gardens.

So there really is no excuse for not taking action to help to control ponticum! Please support efforts to eradicate this plant and thereby save future taxpayers a lot of money.

Thank you to all those who have supported our work to monitor and control invasive species in 2018. There are plans for workshops in 2019 addressing several issues relating to invasive species; please get in touch with the Trust if you would like to support some of this work.

(left) The face of a water vole; all that was left of the animal, found by the upper Bruachaig River, Srath Chrombuill in May 2018.

(right) Doug Bartholomew & SNH Beinn Eighe NNR reserve team removing ponticum from the banks of the Grudie River near Loch Maree in May 2018.

School projects and field trips

Several activities were organised primarily to provide youngsters with opportunities to learn more about wild fishes, their ecology, and the habitats in which they live.

At the end of May 2018 third year pupils from Gairloch High School, led by biology teacher Dr James Close carried out a two day study of marine wildlife including wild trout, and also learned about micro-plastics and how some animals can be affected. In additional to sampling the sand on the beaches for micro-plastics, pupils were able to learn about plankton sampling using a plankton net, polychaete worms and other wildlife living within the sand, small fish living in the sea around the beach through sampling with small and large beach seine nets, and then some of the larger animals thanks to local fisherman Ian McWhinney who arrive by boat with tubs containing a selection of crabs, lobsters, starfish and an octopus *(below – photos by Dr James Close)*!

On the 26th of November, Gairloch High School 3rd year pupils and science teacher Dr James Close met with the SNH Beinn Eighe Nature Reserve staff and SWRFT Biologist to learn about some of the work at the nature reserve, to plant some trees and to learn about salmon at spawning time and some of the associated wildlife. With guidance from members of the nature reserve team, pupils and teachers planted out a selection of broadleaf trees including birch, alder, aspen and holly in the drier areas between the existing Scots pines near the trails.

Later in the day pupils were able to approach to within a few metres of where salmon were spawning, seeing male salmon chasing each other into shallow water *(below).* The sun shone on a dipper perched on a stone at the edge of the water. Dr Close found a partly-eaten male salmon amongst the grass; there were otter spraints nearby. Salmon eggs were found on the bank indicating that a female salmon had also been taken.

Few salmon survive to spawn a second time; they are food for many animals. Even the eggs and alevins can be an important source of nutrition for wildlife including salmon parr before they migrate to sea, a fact which should be considered when 'spawning targets' for the number of salmon in Wester Ross rivers are calculated.

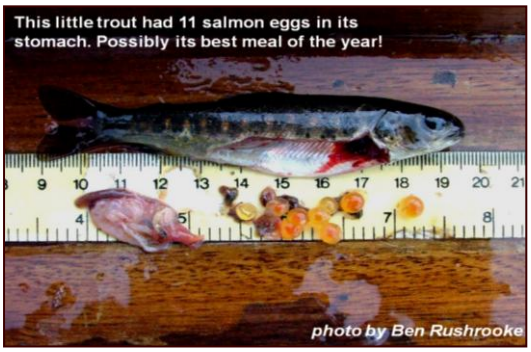
Thank you very much to Doug Bartholomew, Peter Crichton and Jack Ward of SNH and to Coulin Estate for supporting this field excursion!

Other information

- **Provisional Scottish Government Conservation Gradings for Salmon in 2019**

In October 2018, the Scottish Government reviewed its conservation assessments for salmon rivers[6]. The provisional gradings for rivers within the SWRFT area can be found here https://scotland.shinyapps.io/sg-salmon-conservation/. Our main concern is that some rivers which were Grade 3 in 2018 ('mandatory catch and release') are provisionally Grade 1 for 2019 ('exploitation is sustainable'). The explanation for changes in gradings is that, although the model used by the Scottish Government has not changed, the 'egg targets' for individual rivers have changed following analyses of juvenile fish data from electro-fishing surveys. For example, for the River Ewe system an egg target for the 2018 grading of over 5 eggs per m^2 of river habitat was used in the model; for the provisional 2019 grading an egg target of less than 2 eggs per m^2 of river habitat has been used. So the estimate for the number of adult salmon required to provide sufficient egg deposition to keep the River Ewe salmon population healthy for 2019 has gone down to less than half the estimated number of adult salmon needed in the 2018 assessment.

We are concerned. Armstrong *et al* 2018[7] recently demonstrated that larger and fatter (higher body condition) smolts have higher survival than smaller thinner ones. Salmon eggs are an important food in the autumn and winter for salmon parr, perhaps particularly so in the many nutrient deficient streams of the SWRFT area. Alan Youngson (*pers comm.)* has described how parr can eat up to 15 eggs in a single meal; and may eat several such meals during the autumn and winter. This is something that has not been adequately researched.



Earlier in this newsletter, Bob Kindness has highlighted the importance of maintaining numbers of smolts going to sea. To maximise the prospects of smolt surviving to become adult fish, it is also important to ***ensure smolt quality;*** that smolts are as well fed as possible.

Therefore we would strongly recommend that anglers continue to return wild adult salmon to rivers within the SWRFT area as in 2018 until problems such as on-farm sea lice infestation have been solved and there is clear evidence of a sustained recovery in the numbers of adult salmon returning to our rivers.

- **Huge spring spawning herring ground rediscovered to the west of Gairloch**

At the time of writing, plans are being put together to learn more about the locations and extent of herring spawn in March 2019, following the discovery of a large 'carpet' of herring eggs in March 2018 by scallop divers working for Keltic Seafare[8][9]. Weather and sea conditions permitting, we hope to be able to assist survey teams. Herring were not only once a mainstay of the local economy of the SWRFT area, herring are a keystone species providing food for many others including salmon and sea trout. The collapse in west coast herring stocks in the past 30 years needs to be redressed. We are hoping to learn more about the types of habitat upon which herring are able to spawn successfully, and to be able to ensure that herring spawning grounds are properly managed.

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[6] Scottish Government Salmon Conservation Assessment for 2019 https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/status

[7] Armstrong, J.D., S. McKelvey, G.W. Smith, P. Rycroft, and R.J. Fryer. 2018. Effects of individual variation in length, condition and run-time on return rates of wild-reared Atlantic salmon Salmo salar smolts. Journal of Fish Biology 92 (3):569-578. https://www.ncbi.nlm.nih.gov/pubmed/29537092

[8] Spring Spawning Herring rediscovered to the west of Gairloch http://www.wrft.org.uk/news/newsitem.cfm?id=214

[9] Keltic Seafare video of herring eggs on the sea bed https://www.kelticseafare.com/1109-2/