WESTER ROSS FISHERIES TRUST








REVIEW May 2016

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REVIEW

by

Peter Cunningham, Isabel Moore, Peter Jarosz and Matthew Zietz

May 2016

Cover photos (all photos in this report © WRFT unless stated otherwise)**:**

From top right *(clockwise):*

(1) *Two mature male trout from the River Torridon fyke net, November 2015. The fish at the top is a sea trout of 410mm in length which from scale reading had gone to sea as a 3 year old smolt, and then had three successive summers in the sea; so altogether 5+ years old. The fish below is a brown trout aged at 10+ years old: an old warrior that had spent its entire life (based on scale reading) in freshwater! The two fish could just about be father (below) and son.*

(2) *Scale of a female trout of 500mm caught in the Torridon estuary in June 2015; our only success with the sweep net there. Scale reading suggests that this trout was at least 9 years old and was spending a 6th or 7th summer in the river estuary or sea.*

(3) *This sea trout of 295mm, taken in the estuary of the River Balgy in May 2015, had at least 475 lice on it. Sea lice levels on salmon farms within Loch Torridon in the first few months of 2015 were many times higher than the industry's Code of Good Practice [CoGP] treatment threshold levels. See Part 3.*

(4) *Wilbur Rundle stem-injecting a Japanese knotweed plant, by Inverboom, August 2015. WRFT facilitated a collaborative project funded by the Landfill Communities Fund and local landowners aimed at eradicating Japanese knotweed from the River Broom catchment, See Part 6. (photo © John Parrott, Coille Alba).*

(5) *Peter Cunningham and Dr Steve Kett electro-fishing for early-returned sea trout, Flowerdale River, July 2015. Several heavily infested and fin damaged sea trout were caught nearby. (photo by Andy Vicks).*

(6) *NTS staff and volunteers sweep netting for sea trout at the mouth of the Balmacara burn, May 2015. The net became so clogged up with filamentous algae that we were unable to move it until much of the algae had been removed. Although no sea trout were caught, 49 fish of 6 different species and several shrimp were recorded. Thanks everyone!*

(7) *Dr Steve Kett and Middlesex University student, Nick Oliver, by a green knoll (or hummock) by the footpath to Loch na h' Oichdhe, July 2015. Nick had just collected a bird (possibly raven) pellet for his project from the knoll. In April 2016, the 'Refertilising Wester Ross' meeting considered how animals influence fertility & biodiversity levels on these green knolls.*

(8 - centre) *A salmon smolt of 168mm from the Tournaig trap in April 2016. The salmon smolts that left the Tournaig system in 2016 were considerably larger on average than those which migrated to sea in 2007. See Box 2.1. (photo by Ben Rushbrooke).*

The WRFT has the right to use information it has collected and analysed in order to meet its aims and objectives. Since the WRFT is funded in part by income from the public sector, this information may be passed on to other public or charitable bodies involved in fisheries management. It is not the WRFT's right or intention to use this information for commercial gain

Colin Simpson recording juvenile fish survey results by the Allt Beith, 18th August 2016. Later, on the same day, salmon fry were found further upstream by the 'Goose Loch' outflow above the old Drumchork fish ladder, for the first time since 2010.

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Preface

The past 15 months have been a particularly busy period for Trust staff and volunteers . . .

During the past year, Henry Dalgety stood down from the Board of Trustees. We would like to thank Henry, an enthusiastic angler, for making a considerable and valuable contribution to the Trust over several years; and we look forward to keeping in touch in the future. We were delighted to welcome Dr James Close to the board of Trustees in 2015. James is the new Biology teacher at Gairloch High School and already there are exciting plans for new initiatives for schools projects.

It was with much sadness that we learned of the untimely death of Kenny Nelson in June 2015. Kenny worked for the Trust as a habitat surveyor during the early years of the Trust, recording field data for several rivers including the Gruinard River, before moving on to work for Scottish Natural Heritage. Kenny remained an enthusiastic supporter of the Trust and of wildlife and wild fisheries, and was always willing and happy to provide support and help out with Trust activities including open days at the Loch Maree Hotel. He is missed by many people within and beyond the local community.

The Trust has once again worked in close collaboration with Wester Ross Area Salmon Fishery Board. Clerk, Peter Jarosz and Chairman, Bill Whyte have worked tirelessly in support of wild fish and wild fisheries interests, attending meetings on behalf of both organisations across Scotland. The Trust has been called upon by WRASFB to provide information and comment on a range of issues, including responses to planning applications for new salmon farms and for a spate of new hydro-power projects. This largely unfunded and unseen extra work for the Board and the Trust has at times stretched our resources somewhat further than anticipated.

The Trust has also continued to work closely with the Skye Fisheries Trust. After carefully consideration of the pros and cons of merger by both sides, the two Trusts have decided to amalgamate, as many of the issues facing wild fisheries on the mainland and on the Isle of Skye are shared, including those in surrounding coastal waters. Formal amalgamation is likely to take place later in 2016.

One of the reasons why amalgamation makes sense at this point in time is that the Scottish Government is pressing ahead with wild fisheries reform. New legislation is anticipated within the next year which will abolish district salmon fishery boards and replace them with a smaller number of Fisheries Management Organisations [FMOs]. These new FMOs will cover a larger geographic area than the existing boards and will have a slightly broader remit to include all fish species (including eel, arctic charr and brown trout) and also a remit for education. At the time of writing there is still some discussion regarding the geographic boundaries of the FMOs and how they will be funded.

Our hope is that the new FMO for our area will be able to operate with the future Skye and Wester Ross Fisheries Trust in much the same way as in the past, and that existing Trust members and volunteers will be able to continue to support the various activities of the new Trust for the benefit of wild fisheries within the area. To all who have supported the Trust over the past 15 months, either financially or as willing volunteers, thank you very much.

pp. Prof Dave Barclay, May 2016

Part 1 **Introduction**

This final Wester Ross Fisheries Trust review covers the period from February 2015 to April 2016, and presents a summary of activities carried out during the 2015 field season.

From the outset, a focus of much of our activity was in relation to a sea louse 'epizootic' associated with salmon farms which affected wild fish in and around Loch Torridon. The parasitic sea louse, *Lepeophtheirus salmonis,* infects both wild salmon and sea trout, and farmed salmon. As the open cage salmon farming industry has grown larger within the coastal waters of Wester Ross, the sea louse problem has not been resolved.

Rod catch figures for salmon presented in Part 2 show somewhat contrasting fortunes for anglers. Following some good early season fishing for 2SW fish in many rivers in 2015, very few grilse were caught in the River Carron and River Ling (in contrast to Gruinard River, River Ewe and Tournaig trap where figures for grilse catches were comparable to those for other recent years).

The pattern of grilse vs. multi sea-winter salmon catches for the River Carron over the past eight years is consistent with an interpretation that during the second years of the salmon farm production cycle in nearby waters, salmon smolts emigrating from the River Carron suffered higher levels of mortality than during intervening years when the farms were in the 1st year of the production cycle.

One of the first sea trout sampled in May 2015, right in front of our office here in Gairloch, carried an estimated 500 lice (see Part 3). Heavily infested sea trout were subsequently caught from around Loch Torridon to Loch Ewe and in the River Ewe. However, despite high levels of infestation of sea trout by sea lice, some fish were able to shed their lice, grow larger and mature: as demonstrated by catches of sea trout in the autumn.

We struggled to catch any sea trout around Loch Broom and Little Loch Broom in the estuaries where lice-infested fish have 'traditionally' congregated over the past 20+ years. In contrast to salmon farms in the south of our area, salmon farms in the 'Two Brooms' area were successful in achieving near zero levels of sea lice on their fish by operating at relatively low on-farm biomass and by clever use of wrasse to remove parasites (see Box 3.1).

The development of new hydropower projects within the area reached unprecedented levels over the past year. In addition to routine monitoring, some of our juvenile fish survey work was associated with proposals for new projects. Much time was also spent reading and responding to HP development proposals, and visiting sites.

This review also presents a summary of work by the Skye Fisheries Trust (Part 6); an update on the Wester Ross Marine Protected Area (Part 7); and activities carried out to raise awareness of and control invasive non-native species within our area (Part 8), and much else. We hope that you will continue to support our work in the years ahead as part of the new Skye and Wester Ross Fisheries Trust.

The WRFT sea trout sweep netting 'A' team, by Boor Bay, at around 8pm on the 4th June 2015.

(left to right): Jim Buchanan, Katherine Vine, Ben Rushbrooke (with the biggest sea trout), Peter Cunningham, Gary Bulmer and Prof Dave Barclay.

We caught over 40 trout on that occasion despite an occasional midge or two . . .

(Photo by Jeremy Fenton).

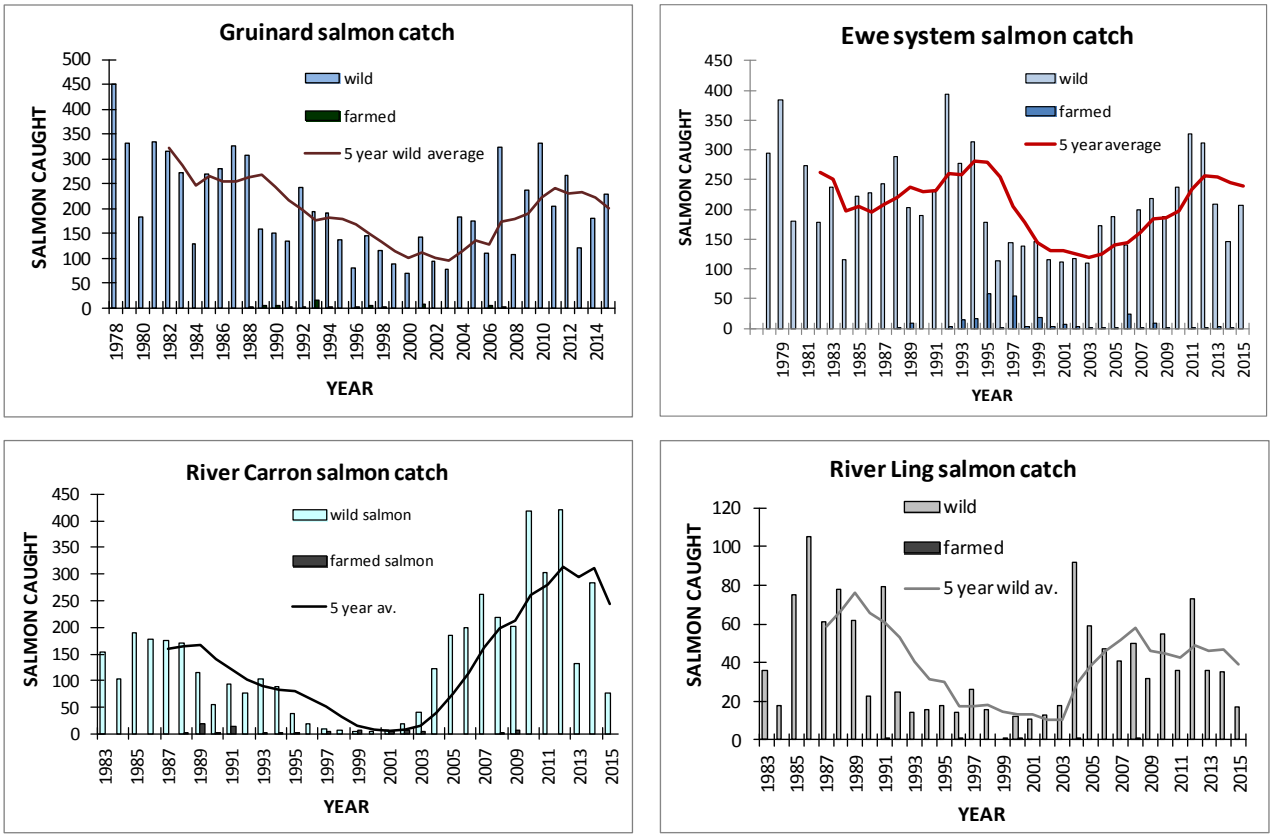
Part 2 **Salmon and sea trout stocks**

2.1 Rod catches

Salmon

Reports from rivers within the WRFT area reflect mixed catches of salmon and grilse in 2015. Graphs for rod catches of salmon for the rivers Gruinard, Ewe, Carron and Ling are shown in Figure 2.1.

Figure 2.1 Rod catches of salmon for the rivers Gruinard, Ewe, Carron and Ling



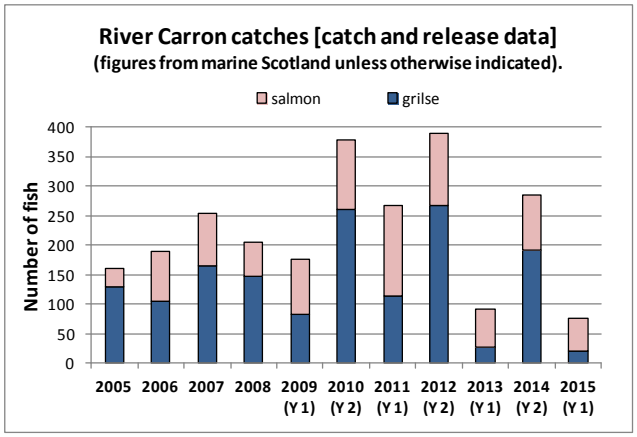
Both the Gruinard River and River Ewe ended the season with catch totals for 2015 higher than for 2014, and close to 5 year averages. However, further south the 2015 season was not a good one. Following an excellent spring and early summer on the River Carron including 23 fish of 10lb or more, the end of season totals for both the River Carron and River Ling were the lowest recorded since 2003; and well down on 2014 catches. This was partly explained by a lack of water and poor fishing conditions for much of the summer. However, during the times when water levels rose, anglers on the Ling reported that 'few fish were seen'.

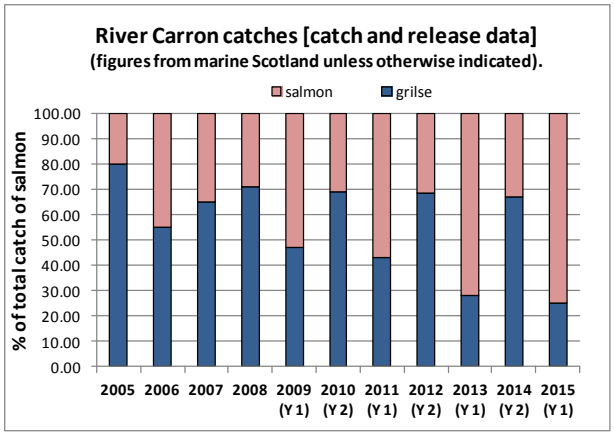
The largest salmon reported caught in 2015 was a 28lb from the Kinlochewe fishery. A very small male grilse of 43cm was taken from the Tournaig upstream trap at the end of the season (in December).

(left) Ronald Sinclair with his 1st salmon, Dundonnell River, July 2015. Photo by Alasdair MacDonald.

Figure 2.2 shows how the proportion of grilse in the total catch of salmon in the River Carron has varied. Over the past 7 years, catches of grilse have been high every second year with much lower catches in intervening years. As discussed in the WRFT Review 2015, catches correlate with the salmon farm production cycle in the nearby Loch Carron & Loch Kishorn fish health management area and also with farms in the Loch Alsh-Duich and east of Skye areas all of which operated the same 2- year synchronized farm salmon production cycle during this period.

Figure 2.2 (left) Numbers of salmon and grilse caught and released in the River Carron system 2005-2015, vs. the salmon farm production cycle in nearby sea lochs. (right) The relative proportions of grilse vs. multi-sea winter salmon in catches during the period 2005-2015.





If the inter-annual fluctuation in grilse catches relates primarily to variation in mortality of emigrating salmon smolts associated with infestation by sea lice from salmon farms within the area, there is considerable cause for concern. In the spring of 2015, high numbers of adult female sea lice were reported by the SSPO for the Loch Torridon ('Badachro to Applecross') salmon farming area (see Part 3). Salmon smolts migrating north past the mouth of Loch Torridon may have encountered elevated levels of infective sea lice.

In contrast to Loch Torridon, lice levels on salmon farms in the Loch Broom area were low in 2015. Will WRFT 'northern' rivers outperform 'southern' rivers for rod caught salmon again in 2016?

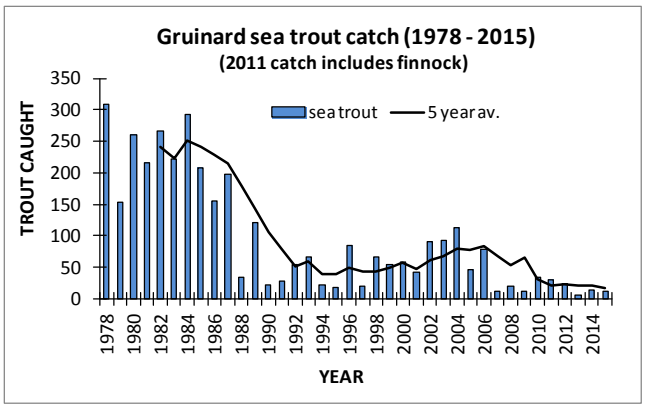
Aware of the need to protect stocks of wild fish, salmon anglers in Wester Ross have routinely practiced 'catch and release' in recent years. From April 1st 2016, new Scottish Government conservation measures to protect wild salmon populations will take effect. Following analyses of available information by Marine Scotland scientists, all rivers within the WRFT area except the Gruinard river, Little Gruinard river and River Carron have been given Grade 3 status, meaning that it is likely that numbers of surviving adult salmon have been inadequate in some years to reach respective 'spawning targets' for egg deposition with a consequent reduction in production of juvenile salmon in recent years from parts of these systems. A mandatory 'catch and release' policy will be enforced on all Grade 3 rivers in 2016 to enable Marine Scotland scientists in collaboration with the WRFT Biologist to review the status of salmon populations in respective rivers.

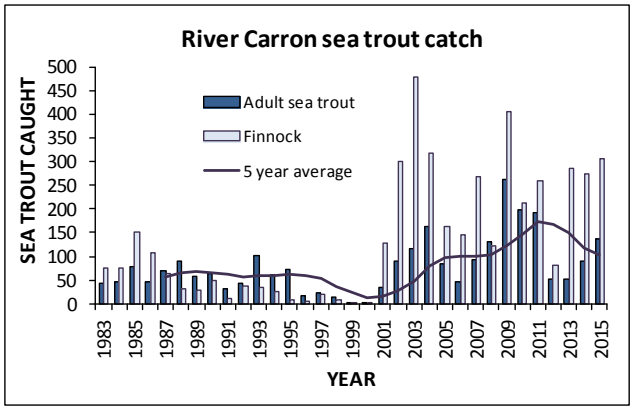
Three rivers were judged to have had adequate numbers of returning female fish: the Gruinard, Little Gruinard and the River Carron, so were given Grade 2 status. The Little Gruinard and River Carron have adopted a 100% 'catch and release' policy for over 15 years (since 1990 for the Little Gruinard). That leaves the big Gruinard River as the only river within the WRFT area where a salmon may be killed in 2016. However, even here a mandatory 'catch and release' policy will be adopted (see also Part 4).

Sea trout

In contrast to salmon, the reported sea trout catch from the River Carron was the best since 2011. Good numbers of sea trout were also taken from the estuary of the River Ling with fish of up to 3lb caught and released. However, despite little evidence of sea louse problems in nearby waters in 2015, the Gruinard River reported only 11 sea trout for the season (Figure 2.3).

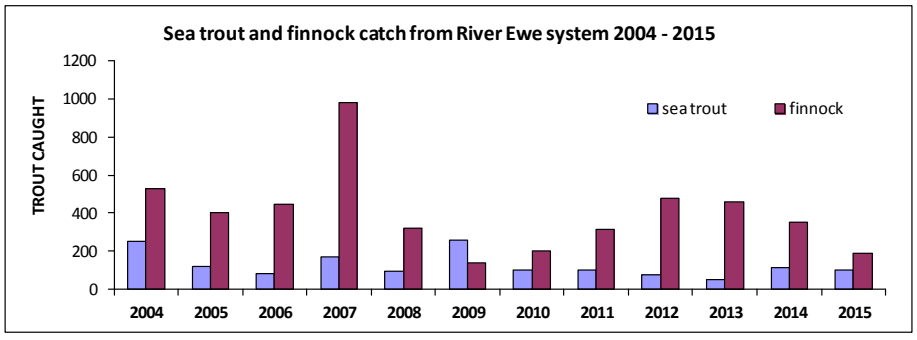
Figure 2.3 Rod catches of sea trout in the Gruinard River (left) and River Carron (right)



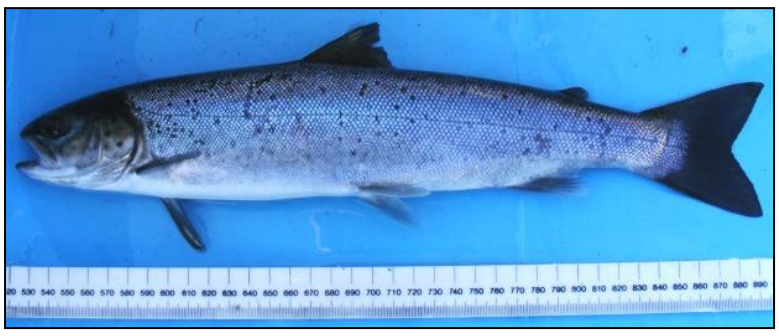


The River Ewe - Loch Maree system sea trout catch in 2015 was just 99 fish: comparable to previous recent years (Figure 2.4). Loch Maree was only lightly fished with rarely more than one or two boats fishing the loch on any day; one Loch Maree boat recorded 22 sea trout (to 2.5lb), 26 finnock and 46 brown trout (to 4lb). The largest sea trout was a fish of 3.5lb caught and released near the head of Loch Maree.

Figure 2.4 Rod catches of sea trout and finnock from the River Ewe – Loch Maree system



Given continued low catches and problems associated with high on-farm adult sea louse counts in nearby waters, the WRFT Biologist recommends continued catch and release policy for all sea trout within the WRFT area for 2016.



A rather thin sea trout of 360mm from the River Ewe on 17th July 2015. The fish had a louse-damaged dorsal fin; and may have returned to freshwater to delouse a few weeks before being caught. Lice infested finnock carrying up to 261 lice were sampled from the River Ewe nearby on 7th July.

2.2 Juvenile fish surveys

supported by WRASFB & river proprietors

In recent years, electro-fishing surveys have been carried out primarily to gather information about the distribution and relative abundance of juvenile salmon within the WRFT area. Our aim has been to visit all the major river systems within the WRFT every two years to assess the health of respective salmon populations.

In some situations, juvenile salmon have been absent, year classes have been missing (i.e. only fry or only parr were found) or juvenile salmon have been present at very low Catch Per Unit Effort [CPUE] particularly in some of the smaller rivers and 'marginal' headwater streams.

Our thinking (supported by the findings of electro-fishing surveys over many years) is that for the Wester Ross area, these marginal habitat areas are most sensitive to changes in the relative abundance of adult salmon; so our approach has been to focus on these marginal areas to learn about the health of respective salmon populations.

Many of the main river systems in the WRFT area were surveyed in 2014 (please see WRFT Review January 2015). During the summer of 2015, other field work took priority, including some contract work on local rivers. The following section provides a summary of the results from some of the river systems surveyed together with notes relating to other observations of relevance to fisheries management.

Results

Table 2.1 defines the Catch Per Unit Effort (CPUE) grades used in the following text.

Table 2.1 Definition of Catch per Unit effort grades as used in the following text.

CPUE	**Grade**
0	Absent
0.1 – 0.5 fish per minute	Very low
0.6 – 1.0 fish per minute	Low
1.1 – 2.0 fish per minute	Moderate
> 2 fish per minute	High

The main findings were as follows. Salmon fry and parr were found in the core areas of all the major river systems surveyed. However, juvenile salmon were absent or some year classes (usually fry or 1+ parr) were missing from some marginal headwater areas and from some of the smaller coastal streams where juvenile salmon were recorded in 2010 or other recent years.

Following the major stream channel modifying spate associated with 'Hurricane Bertha' in August 2014, our surveys suggested depleted parr populations in some areas. This is further discussed under section 2.3 (Tournaig project).

Ullapool River

The Ullapool River was formerly noted as one of the main 'spring' salmon rivers in the Wester Ross area. Adult salmon have to ascend the Ness Falls to reach Loch Achall and the Rhidorroch River, the main spawning stream above the loch. One hypothesis is that the presence of the Ness falls, as a barrier to salmon except at high flows, contributed to the development of the 'spring running' characteristic of salmon[1].

Sites above Loch Achall were surveyed on 2nd September 2015. Water levels were low. Salmon fry and parr were present at low CPUE in the river at East Rhidorroch, by the mouth of Allt a' Bheum; and in the Allt Coire Cronaidh (trout fry were present here at high CPUE). In the Rhidorroch House burn, in 8 minutes fishing just two salmon fry and two parr were recorded plus 30 trout fry.

An unusually large trout of length 370mm was caught at the top e-fishing site *(left)*. In previous years smaller trout than this one were dissected and found to have salmon parr in their stomachs! We wondered how many 100s of salmon parr are eaten by piscivorous trout in the Rhidorroch River and in Loch Achall each year?

Sites were surveyed below Loch Achall on 5th November during a period of mild weather when water levels were low. In contrast to sites above the loch, salmon fry were present at the Loch Achall outflow at high CPUE (3.3 fish per minute) and the fry were relatively large for their age compared to those in the Rhidorroch River, demonstrating good feeding below the loch. Large (115mm-122mm) 1+ year old salmon parr were also recorded here at low CPUE (the habitat was better suited to fry). Juvenile salmon were recorded at medium to high CPUE at sites further downstream – with the highest CPUE for salmon parr (and apparent parr density) at the lowest site near the sports fields where the streambed is relatively stable and the water more fertile and productive than further upstream.

(right) The Ness Falls on 5th November 2015. Sea trout have rarely been caught above this waterfall. (inset) Colin Simpson collecting salmon scales from rocks below the falls, where an otter had eaten a fish.

In summary, juvenile salmon were found at all sites surveyed; however in the Rhidorroch River their numbers were again very low (as when last surveyed in 2012) compared to sites below the loch in the Ullapool River.

To monitor changes in the fragile salmon population in the upper part of the Ullapool River system, we also discussed possibilities of setting up a fish counter in the river. The owners are keen to support such an initiative. The outflow of Loch Achall would be a suitable location for fence counter to record smolt migration from the upper part of the system, and also adult fish entering the loch from the river below.

[1] Historic salmon catches and run timing are discussed in detail in the Ullapool River Fishery Management plan http://www.wrft.org.uk/files/Ullapool%20FMP%202006.pdf

Gruinard system (9th September 2015)

To reach Loch Ghiubhsachain from the Gruinard River, adult salmon and sea trout have to ascend through a high gradient gorge section in which there are several bouldery waterfalls. After the spate associated with 'Hurricane Bertha' on 11th August 2014, local keepers Brian Fraser and Bill Whyte reported that there had been extensive erosion and movement of sediment in the lower part of the Allt Loch Ghuibhsachain. So our first question was to find out how this had affected juvenile salmon populations? At our first electro-fishing site below the gorge, only 300m upstream from the confluence with the main Gruinard River, we recorded small salmon fry (37mm - 54mm) at over 4 per minute; high CPUE. Parr were also present but only at low CPUE.

After a long walk up the hill, we reached our second site at an altitude of about 215m. Here we recorded larger salmon fry (44mm - 57mm) at medium CPUE; and also found a few parr, including an unusually large one of 137mm. In terms of altitude, these are some of the highest salmon recorded in the WRFT area to date. There are no further obstacles above this location that would prevent an adult salmon from reaching Loch Ghuibhsachain. However as on previous surveys, no juvenile salmon were recorded in the inflowing burn above the loch; just juvenile trout here.

So similar findings to a previous survey in 2011: plenty of salmon fry in the main Gruinard River valley; salmon present above the gorge at lower (sub-optimal) densities; salmon absent from the river above the loch. Parr numbers were possibly reduced due to the 'Bertha spate.

Colin Simpson, Prof Dave Barclay and Ben Rushbrooke at the far end of Loch Ghiubhsachain on 9th Sept 2015. The day was memorable for light winds, many midges, many smallish brown trout (caught on fly) and for hearing the first roaring red deer stag of the 2015 rutting season.

It will be useful to monitor the Allt Loch Ghuibhsachain above the gorge in future years to see whether salmon are still able to ascend the gorge section following Hurricane Bertha in 2014.

Allt Beith *Aultbea River* (19th August 2015)

On 19th August we surveyed four sites in the system. At the lowest site by Forbes's Garage (about 100m above the tidal limit), salmon fry (47-57mm) and large parr were recorded at moderated CPUE, plus an assortment of trout. At the bottom of the Drumchork fish ladder we found salmon parr at moderate CPUE but no salmon fry. However, at the top of the fish ladder and further upstream at the 'Goose Loch' (Loch a' Bhaid Luachraich) outflow we found a few large salmon fry (67-72mm) at low CPUE. To find out if juvenile salmon are present in any of the burns flowing into the Goose Loch, another expedition is required.

Local residents recollect days when the burns below Drumchork had many salmon and sea trout towards the end of the year. This little river system has the potential to become a more interesting place for everyone to enjoy. WRFT would be happy to support any local initiatives to improve the river and its fishery.

Inverianvie River (September 2015)

This is another of the smaller rivers within the WRFT area and is located between the big Gruinard River and the Little Gruinard River. A juvenile fish survey was carried out as part of a contract to provide information about fish populations. The area of water accessible to anadromous fish (salmon and sea trout) in the Inverianvie is limited to only a 1500m length of river between the sea and the Eas Dubh a' Ghlinne waterfall *(left).* Most of river downstream from the waterfall pool to the sea is of riffle-run-glide type habitat over a streambed dominated by boulders and cobble-sized stones.

At the initial electro-fishing site to find out if there were any juvenile salmon in the Inverianvie system, we fished for several minutes before the first salmon turned up! So, to obtain the requested density estimates for juvenile salmon, a rather larger than usual area was surveyed (*right*). Using a downstream stop net, an area of 357m^2 was surveyed (a record area for a WRFT e-fish survey site!). 'Zippin' estimates for juvenile fish densities based on our catches over 3 runs are as follows (in numbers of fish per 100m^2): salmon fry 2.12, parr 3.88; trout fry 3.41, older trout 9.69. The juvenile salmon densities were particularly low; however, for their age the fish were large. Salmon fry were 70mm to 77mm in length (that's huge for Wester Ross!); and the 1+ parr *(shown below)* were 111mm to 132mm in length: big and well fed.

The area of habitat available to salmon may be too small to sustain a discrete wild salmon population. So based on what we know from the Tournaig project and elsewhere, it seems likely that juvenile salmon production is sustained by occasional fish straying into the Inverianvie from other rivers, most obviously, from the Little Gruinard. Indeed it is even possible that some of the juvenile salmon originate from spawning areas in the Little Gruinard River and after being swept downstream into the sea during high flows, sought freshwater and ended up in the Inverianvie.

The higher densities of juvenile trout (compared to salmon) and capture of one adult sea trout suggest that the Inverianvie is more of a sea trout spawning and nursery stream, perhaps capable of producing 300 to 400 sea trout smolts per year (based on density estimates of larger trout) and sustaining its own sea trout population.

(right) This male sea trout of 388mm was taken from a slightly deeper section of the Inverianvie river. The juvenile trout population in this part of the Inverianvie river may be sustained primarily by sea trout.

River Ewe system

On the 21st August, some of the smaller burns above Loch Maree were surveyed. Salmon fry were found in only one of the two small burns in Beinn Eighe NNR above the road above Loch Bharranch; parr were present at medium CPUE in one of the burns. The lack of salmon fry may have partly been a consequence of inadequate water levels at spawning time in 2014. For much of November 2014, water levels were very low and salmon were seen spawning below Loch Bharranch. Closer to Loch Maree, salmon parr were found beneath the Pony Path bridge in Beinn Eighe NNR (not so far from the visitor centre) suggesting that salmon had spawned in the Taagan burn in 2013. However no fry were recorded here. In the burn by the Beinn Eighe NNR 'Trails' car park salmon fry were recorded at low CPUE in addition to trout fry and a few salmon parr.

On 11th September, in the Slattadale burn below the footbridge (not far from the Loch Maree side car park), salmon fry were greatly out-numbered by juvenile trout (over 5 trout fry per minute). In early November, adult trout were videoed jumping over a brash dam waterfall (*left*); and subsequently sampled from this burn (see *below*, and Part 7 'Education and Awareness'). In late November, a pair of grilse was seen spawning nearby. Riparian habitat along this burn has greatly improved over the past 15 years following clearance of over-shading plantation conifers as part of a project supported by the Hugh Fraser Foundation, Dulverton Trust and Forestry Commission Scotland. It was good to find that adult sea trout are using this burn as a spawning stream.

Loch Maree trout at spawning time: male brown trout (top) and female sea trout (below) taken in the Slattadale Burn on 11th November 2016. These fish, sampled to confirm that sea trout were indeed present in the burn (and not just loch trout), were returned to the river after recovering from anaesthesia.

Note: In February 2015 and again in February 2016, 80,000 salmon eggs from the Kinlochewe River captive salmon broodstock (reared by Bob Kindness) were stocked into the lower Bruachaig, Docherty Burn and (only in 2015) the A' Ghairbhe near Cromasaig, to supplement progeny of wild spawned fish. The original intention (in 2009) had been to stock areas above the falls in the Bruachaig as part of a restoration programme; however by 2015 circumstances had changed which meant that alternative stocking arrangements were required.

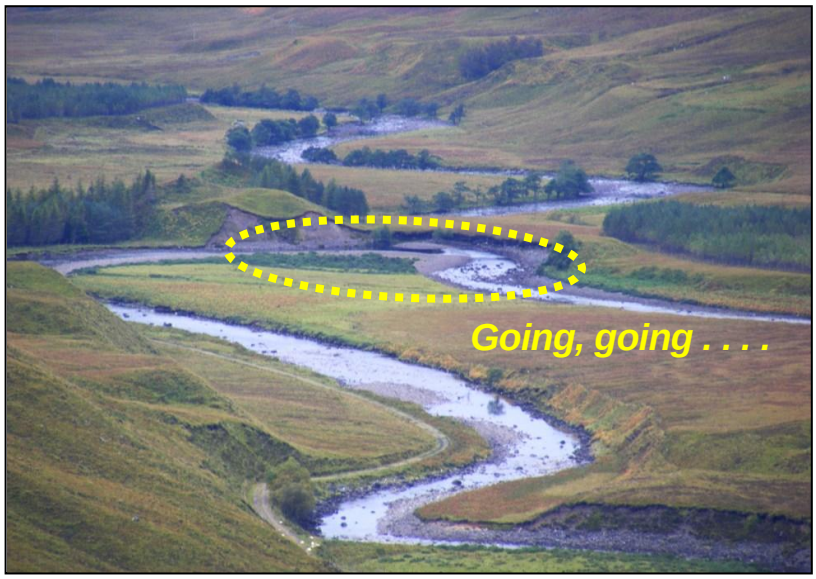
River Ling (6th October 2015)

This is one of two substantial salmon rivers which flow into the sea at the head of Loch Long in the south of the WRFT area. Salmon have to ascend a series of waterfalls to reach their main spawning grounds. This river, like the Ullapool River, also has a history of producing early-running 2SW fish. At the first site we surveyed in the Allt Gleann a' Choire Dhomhain (near the end of the vehicle track) fry were present at moderate CPUE, and parr at high CPUE (the habitat is more suitable for parr). At the highest site in the main River Ling, just below the confluence of the two main rivers, salmon fry and parr were recorded at moderate CPUE. In the main river about 100m upstream from the 'memorial', salmon fry and 1+ year old parr were recorded at low – moderate CPUE and were very small for their age (fry: 34mm – 45mm; 1+ parr: 61mm - 79mm) reflecting a lack of food for the hungry wee fish.

(right) 4 year classes of juvenile salmon from the River Ling, 6th October 2015.

In terms of salmon smolt production, the Ling would be more productive if attention was directed towards the restoration of a more fertile riparian corridor. However, our principle current concern for the future of the salmon population and the fishery it supports is the continuing erosion of the river bank by the Goblet Pool, as outlined in the photo below. A very large spate of the magnitude experienced in Cumbria or Aberdeenshire in December 2015 could cause the River Ling to flood over the bank here, forming a new higher gradient channel.

Not only will this cut off about 1km of productive salmon habitat; such an event would cause movement of many thousands of tonnes of sediment.



Given that the drop in altitude from the Goblet Pool to the river below the loop is over 10m over a distance of only ~100m, it is possible that a new, impassable (for salmon) waterfall will form here. This would block access for salmon to over half of the existing productive area within the River Ling.

For those with an interest in hydrogeomorphology and the formation of new waterfalls, such an event could provide a fascinating once-in-a-lifetime study opportunity. However, for those with an interest in sustaining a rather special wild salmon population capable of supporting a productive fishery; please take note!

Recommendation: given current trends in the intensity of rainfall events associated with a changing climate (e.g. 'Storm Frank'), wild fisheries interests might like to seek specialist advice to identify whether appropriate mitigation measures are needed to protect their salmon river as a matter of some urgency. I'd recommend a plan to remove a large amount of the sediment that has settled on the inside of the bend, to reduce the pressure on the opposite bank of the river.

2.3 Tournaig trap project

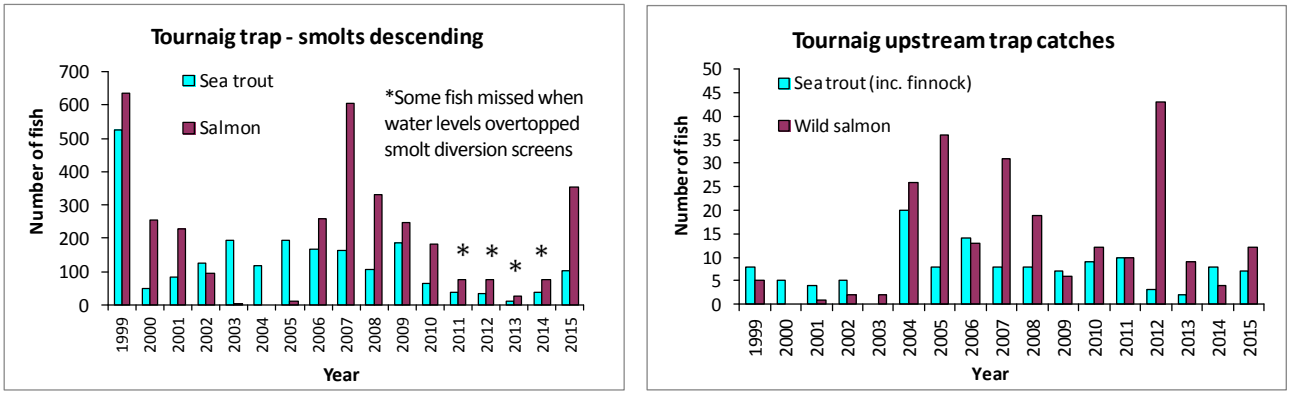
Supported by Marine Harvest (Scotland)

The little Tournaig river system is one of the smallest within the WRFT area to support a wild salmon population. An upstream – downstream trap was installed within an old fish ladder near the mouth of the river in 1999. Since then it has been operated each year from the spring to the autumn to record smolts migrating out to sea and adult fish entering the system from the sea. In addition, an annual electro-fishing survey has been carried out in early August primarily to find out about the distribution of juvenile salmon in the principle spawning burn above Loch nan Dailthean. The project has provided much of interest in terms of improving our understanding of many of the challenges facing wild fish within the WRFT area.

In contrast to the Shieldaig River system (Loch Torridon) where there is also an upstream – downstream trap project managed by Marine Scotland Science [MSS] and where sea trout stocking programmes are on-going, the Tournaig system has not been stocked with either trout or salmon over the past 12 years (other than one smolt release in 2000); so the performance of both wild salmon and wild trout (and sea trout) populations, including variations in juvenile fish production, is more natural than at the Shieldaig River system.

In 2015, traps were once again operated by Ben Rushbrooke of Tournaig Garden Cottage Nursery. Graphs for the recorded numbers of smolts descending and adult fish entering the system are shown in Figure 2.5.

Figure 2.5 Trap catches at Tournaig 1999-2015.



For emigrating **salmon smolts**, the 2015 total of 354 smolts heading for the sea was the third highest on record. Also, for the first year since 2010, during the period when the smolts were migrating to sea, the screens to divert smolts into the trap were not over-topped by high water during the smolt run period, so our smolt count is thought to be what the system produced. Scale reading has confirmed that the majority of these smolts were S2s (two winters in freshwater after hatching) and therefore were mostly progeny of the many salmon which entered the system and spawned in 2012.

Tournaig salmon runs and understanding Conservation Limits

The Scottish Government has recently categorized salmon rivers in Scotland following an assessment of the need for conservation measures[2] for respective rivers. Individual rivers or fishery areas have been categorized according to whether or not recorded rod catches indicate adequate numbers of adult salmon entering

[2] http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/status

respective rivers to fully restock available nursery habitat with juvenile fish. Our findings at Tournaig can help to inform future discussions so far as setting more refined conservation measures for local rivers, as they help to provide a clearer understanding of how the number of adult salmon (particularly hen fish) entering the system influences subsequent salmon fry distribution and production of emigrating salmon smolts.

After a record upstream count of 43 adult salmon entering the Tournaig system in 2012 we initially anticipated a 'record' smolt run in 2015. Through annual electro-fishing surveys in 2013 and 2014, we were able to follow the progress of the 2013 salmon fry year class within the system following years; in 2013 salmon fry were found at 5 out of 6 electro-fishing sites at the highest average CPUE on record; in 2014, 1+ parr CPUE figures were also encouraging however not quite at the 'record' high levels of the previous year.

In 2015 salmon smolt total run was only just over 50% of the record salmon smolt run in 2007 (607 smolts), so not quite as high as anticipated. Several factors are thought to have influenced subsequent smolt production including a record spate associated with 'Hurricane Bertha' in August 2014 (just 2 days after our e-fishing survey in 2014), which is thought to have led to the mortality of some of the salmon parr which would otherwise have become smolts in 2015. This was explored by investigating smolt ages via scale reading (Box 2.1).

So in addition to the number of adult salmon entering the system each year (which has varied between 0 and over 40 per year since 1999), weather and river conditions can make a big (+/- 50%) difference in determining the subsequent production of salmon smolts from the system.

For **sea trout**, the number of smolts migrating to sea was the highest total since 2009; however still well down on the 500 smolts recorded in 1999. There is a large brown trout population in the system; understanding the relationship between numbers of adult sea trout entering the system and subsequent sea trout smolt production is more complex than for salmon. The largest sea trout taken in the upstream trap in 2015 was a fish of 513mm; a trap record. The same fish was caught entering the trap in 2014 as shown below. The fish had grown by 6cm in length between the two years; not a lot! See Part 3 for Loch Ewe sea louse monitoring results.

Match the spots: Sea trout 459mm, Tournaig upstream trap 5th August 2014. (Photo by Ben Rushbrooke).

Sea trout 513mm, 1220g; Tournaig upstream trap 19th July 2015; same fish as above. (Photo by Ben Rushbrooke)

Box 2.1 ***Tournaig salmon smolt scales: a comparison between two prolific years***

The most basic objective of scale reading is to be able to tell the age of a fish. The scales of both salmon and trout grow in such a way that a series of small ridges known as 'circuli' form at intervals, the spacing of which relates to how fast the fish has been growing. Widely spaced circuli are indicative of fast growth; closely spaced circuli are indicative of slow growth. As fish are cold blooded, they tend to grow faster in the summer time when the water temperature is higher and there is more daylight, than in the winter.

At Tournaig, we collect a scale sample from approximately every 5th smolt, minimising handling of all the other fish. Tournaig salmon smolt scales have proved to be rather more challenging to interpret age than scales from fish in some of the other river systems in the area, as their growth is highly variable! Despite the relative small size of the Tournaig system, juvenile salmon may: live in the stream above Loch nan Dailthean (Allt na Coille) growing relatively slowly until they smoltify; spend one year in the stream above the loch growing slowly then drop down into the loch where (if able to avoid becoming a meal for a trout) they may grow faster; or spend one or more years in the burn below the loch where growth rates are much faster (see for example Box 2.2 in the WRFT Review, January 2015[3]). Our scale reading results enable estimation of the proportions of 1 year, 2 year, 3 year and even 4 year old fish in each smolt-length class.

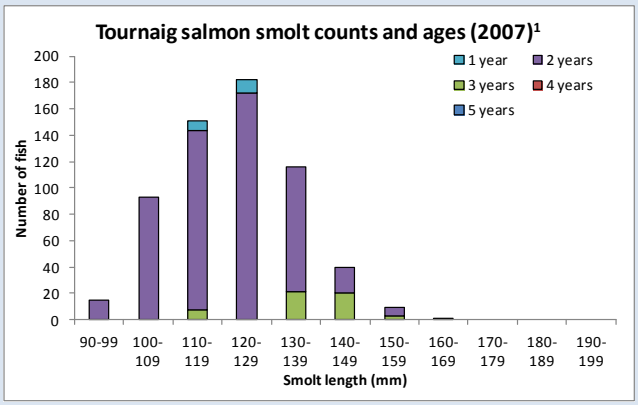
Tournaig smolts: (below left) Thin salmon smolt of 131mm taken on 11th May 2007, and aged as a 2 year old – with typical 'burn' growth. (right) Large salmon smolt of 172mm taken on 11th May 2015. This fish was aged as a ?3 year old smolt, with steady 'loch' growth. Respective scales both display spring 'smolt' growth circuli. Note the difference in head vs. fish proportions. Which fish is in better condition for life at sea?

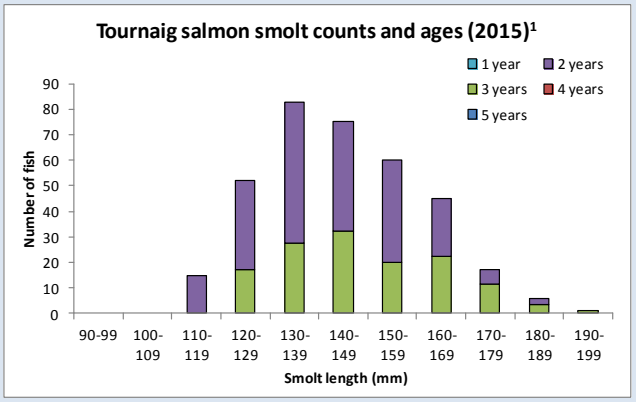
Photos by Ben Rushbrooke. Those of the scales are of projections of scales using our ex-library microfiche reader.

[3] WRFT Review January 2015 http://www.wrft.org.uk/files/WRFT%20Review%20Jan%202015%20for%20webv3.pdf

Figure 2.6 compares the size and growth of smolts recorded in the downstream trap in 2007 with those from 2015. In 2007, we recorded a record salmon smolt run of 607 fish leaving the system. However, the majority of these were small fish which had spent 2 years in freshwater, growing relatively slowly. We interpreted their growth as mostly 'stream growth', and assume they were mostly from the burn above the loch. In 2015 we recorded 354 smolts leaving the system. Their average size was much larger than in 2007, and there was a higher proportion of 3 year old fish according to our readings. Some of the 2 year old fish had relatively fast growth, which could either indicate they had spent a year in the loch or in the more fertile outflow burn below the loch. The scarcity of smaller smolts may be a consequence of the large spate associated with 'Hurricane Bertha' in autumn 2014 washing out many of the juvenile salmon in the less fertile burn above the loch; some of these fish may have survived and grown on in and below the loch.

Figure 2.6 Contrasting years: salmon smolt runs compared. The 2007 smolt run of 607 is the maximum number of salmon smolts so far produced in the Tournaig system since the trap was set up in 1999. In 2015, 354 smolts were recorded.





1. *Smolt ages are based on readings of scales from sub-samples of smolts in respective years.*

When the estimated total weight of smolts leaving the system in respective years is compared, the difference between the two years is much smaller than the difference between the totals for the respective numbers of smolts. In 2007, an estimated 11,290g of salmon smolts went to sea; in 2015, an estimated 10,873g of smolts (based on length-weight relationship of smolts recorded at nearby Sguod system).

Larger smolts are able to swim faster and if a bit fatter can travel further prior to having to find a meal. So in terms of marine survival, one might anticipate that the prospects for the 2015 smolt year class could be rather better than for the 2007 smolt year class. How many adult salmon will return to the Tournaig system in 2016?

Ben transferring a smolt from the downstream fish trap at Tournaig in April 2015.

Look out for the forthcoming Tournaig salmon scale catalogue on the WRFT website.

2.4 Kanaird Screw trap

Supported by WRASFB, Keanchulish Estate and the Atlantic Salmon Trust

At the request of the WRASFB, a rotary screw trap was set up in the River Kanaird to gather data on the migration of smolts from the River Kanaird system. The primary aims of the project were to assess the feasibility of operating a screw trap in the Kaianrd to gather data on smolt migration, and to gather baseline data on the numbers of smolts migrating to sea from the Kanaird river system, as a part of a developing programme of monitoring wild fish populations in relation to salmon farming activities in nearby waters.

The trap was set up on 7th April *(left)* and operated until the 3rd of May. Altogether 989 salmon and 124 sea trout smolts were recorded passing through the trap during this period.

The proportion of smolts heading downstream that a screw trap of this sort is able to catch varies according to river levels and discharge rates. Very crude estimates (using pine cones) on a day when the flow was at a medium level indicated that between 50% and 80% of 'passive' objects moving close to the surface of the river would have been intercepted by the smolt trap. At high flows a smaller proportion of fish would have been intercepted by the trap. Using these figures the minimum numbers of smolts migrating to sea during the period when the trap was in operation can be estimated at between 1000 and 2000 salmon, and 150 to 250 sea trout smolts. The smolt run is likely to have peaked in the week or two thereafter.

One problem encountered was that a proportion of the fish caught was recorded as 'scale damaged'. This was thought to be due to turbulence in the fish trap; and a decision was made to partly raise the drum as a temporary measure to prevent further damage to smolts as they migrated out to sea.

If the trap is to be operated in future, another location will be required, possibly lower down the same pool where the current is less strong. This would mean intercepting smaller proportions of emigrating smolts, and thus more error in estimates of actual smolt numbers. Other sources of data (e.g. from juvenile fish surveys) provide an alternative measure for the health of the salmon population.

Thank you very much to Keanchulish Estate for permission to operate the trap. The project would not have been possible without much commitment of keeper Arran Matheson who together with local volunteer Nigel Carr *(right),* put in many hours of work to look after the trap, process fish, and record data. Thank you also to Bob Kindness, Bill Whyte and other helpers for getting the trap set up.

Part 3 **Sea trout & sea lice monitoring**

Supported by WRASFB and The Scottish Government via RAFTS

3.1 Sweep netting and other sea trout sampling in 2015

After spawning in freshwater, sea trout kelts return to estuaries and to coastal waters during the winter months and early spring where they are joined by over-wintered finnock, and in April and May, by sea trout smolts entering saltwater for the first time. To learn about the growth, survival and parasite burdens of sea trout in the marine environment, a 50m long 'sweep' net (or beach seine net) operated by a team of six or more people, was used to attempt to obtain samples of fish.

In 2015, WRFT sweep netting was carried out in the River Kanaird estuary, at the head of Little Loch Broom, in Loch Ewe, Loch Gairloch, Loch Torridon and at the mouth of the Balmacara burn (Loch Alsh). Samples of sea trout were also obtained using a fyke net in the Dundonnell River estuary and Torridon River, and from freshwater using rod and line and using electro-fishing equipment.

Results

Table 3.1 provides a summary of the results from our sea trout monitoring in 2015, approximately in geographic order (north to south). Note much variation in outcome: at some sites many fish were caught; at others we failed to catch any sea trout.

Table 3.1 Summary results of sweep netting and other coastal monitoring of sea trout in 2015

Location	Method	Date	Number of sea trout in sample		Condition factor	*Lepeophtheirus salmonis* all stages			Fish with >0.3lice / gram		Distance (km) to nearest farm
			Total	Infected	average	Abundance	Prevalence	Intensity	number	%	in 2nd year
Kanaird	sweep	17-Jun-15	3	0	1.00	0.00	0.00	0.00	0	0	2km
Kanaird	sweep	14-Jul-15	6	1	1.09	0.3	16.67	2	0	0	2km
Dundonnell	fyke	June 2015	1	1	nr	3	100	3	0	0	5km
Little L. Broom	sweep	3-Aug-15	1	1	1.16	14	100	14	0	0	5km
Boor, L. Ewe	sweep	4-Jun-15	41	13	0.98	12.46	32	39.62	1	2.4	8km
Boor, L. Ewe	sweep	2-Jul-15	3	2	1.13	9.33	66.66	14	0	0	8km
River Ewe	rod & line	7-Jul-15	21	17	1.07	49.81	89.95	61.53	5	23.8	8km
River Ewe	rod & line	17-Jul-15	8	6	1.04	11.63	75	15.5	0	0	8km
Sand	e-fish	26-May-15	8	0	thin	na	na	na	0	0	25km
Sand	e-fish	1-Jul-15	10	5	1.00	29.7	50	59.5	5	50	24km
Flowerdale	sweep	20-Apr-15	0	na	na	na	na	na	0	0	25km
Flowerdale	sweep	19-May-15	8	8	nr	89.13	100	89.13	6	75	25km
Flowerdale	sweep	18-Jun-15	4	3	0.92	11.5	75	15.33	0	0	25km
Flowerdale	e-fish	6-Jul-15	7	7	0.99	53	100	53	5	71.4	25km
Flowerdale	e-fish	1-Sep-15	2	2	1.18	7	100	7	0	0	25km
Flowerdale	sweep	1-Oct-15	23	87	1.00	5.78	87	6.65	0	0	>30km
Torridon	sweep	15-Jun-15	1	0	0.86	na	na	na	0	0	5km
Torridon	sweep	16-Jul-15	0	na	na	na	na	na	0	0	5km
Balgy	rod & line	25-May-15	8	2	0.76	62.5	25	250	1	12.5	3km
Balgy	rod & line	25-Jun-15	6	72.5	1.00	72.5	100	72.5	4	66.7	3km
Inverbain	e-fish	25-Jun-15	3	2	0.95	69.33	66.67	104	2	66.7	2km
Balmacara	sweep	4-May-15	0	na	na	na	na	na	0	0	>30km

Note: 'Condition factor' K = (weight of fish in grams x 10^5)/(length of fish in mm)^3; 'Abundance' is the average number of lice per sea trout in the sample; 'Prevalence' is the % of sea trout in the sample carrying sea lice; and 'Intensity' is the average number of lice on the sea trout that carry sea lice. Sea trout carrying > 0.3 lice per g weight are in Taranger et al 2015's '100% return prematurely to freshwater' category.

In 2015, relatively few sea trout were caught in Loch Broom – Little Loch Broom area compared to previous years, and those seen carried few sea lice. In contrast, lice levels on some of the sea trout seen in Loch Ewe, Loch Gairloch (Flowerdale) and around Loch Torridon were the amongst the highest on record. The following section provides further details.

Kanaird estuary

As in previous years, we carried out two sweep netting sessions of the sea pool as the tide was falling, on 17th June and 14th July. In previous years, this has been one of our most successful sites in terms of numbers of trout caught. However in 2015 few sea trout were caught. On 17th June 3 'silvery' trout were caught in two sweeps along with 6 'estuarine' trout, and a selection of small pollack, cod, coalfish, viviparous blenny, sea scorpion, flounder and sticklebacks (3- & 15-spined). None of the trout carried lice. On 14th July, we recorded 6 'sea trout', only one of which carried sea lice: a fish of 243mm with 2 lice. Other fish included small viviparous blenny, cod, rockling, coalfish, juvenile ?plaice, sea scorpion and a 3-spined stickleback.

The sweep netting team at the Kanaird estuary on the 14th July 2015. Thank you to Arran, Colin, Nigel and especially work experience student, Kathryn Kinloch, for enthusiastic support.

Dundonnell & Little Loch Broom

The Dundonnell fyke net fished for over 20 tides during June and early July. However, in contrast to some previous years, only one sea trout was recorded; a fish which got stuck in the wing of the net which carried 3 lice. So on 3rd August we had a go in the sea nearby using the sweep new, assisted by a large team of enthusiastic helpers *(below).* Only one sea trout was caught; a reasonable plump finnock of 250mm carrying 14 chalimus lice. We also caught and rescued many sprats and other small fishes.

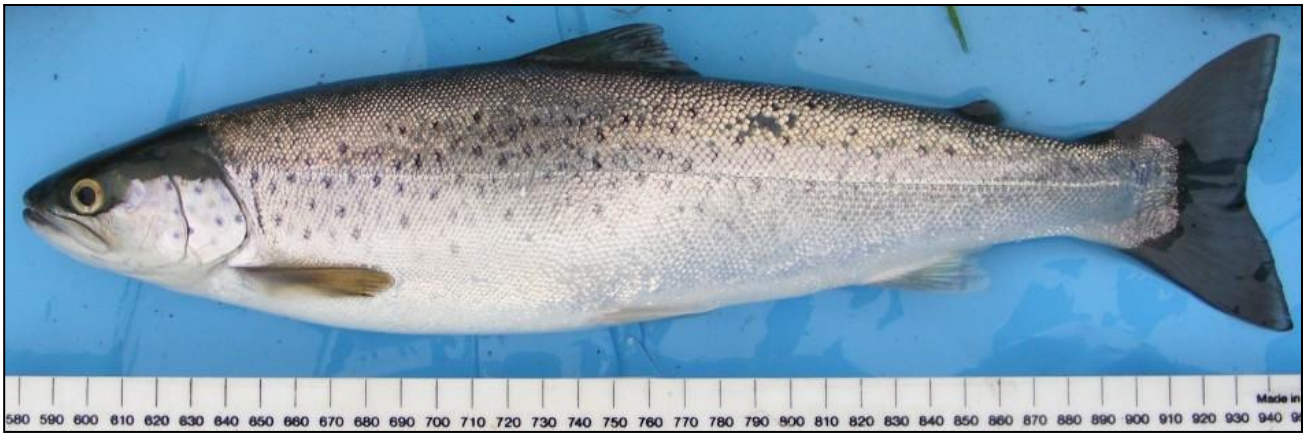
The sweep netting team by Little Loch Broom, 3rd August 2015. There was no shortage of energy and enthusiasm nor of wee fish (mostly sprats), however only one sea trout was caught. Thank you to everyone!

Loch Ewe and River Ewe

At our sweep netting site at Boor Bay in Loch Ewe we caught 41 fish on 4th June, a very good sample for this site. Most of the fish were post-smolt sea trout of around 200mm in length; with very few lice on them: most likely the majority of these fish had been in the sea for only a short period of time. However there were also 4 larger, older sea trout between 295mm – 362mm in length. One of these fish carried 412 small chalimus lice; a record number of lice for a sea trout at this site. The largest fish was in good condition and carried just 10 lice *(below).*

Sea trout of 295mm taken at Boor Bay on 4th June 2015, carrying an estimated 412 lice. Note lice-damaged dorsal fin. Inset: area around ventral fin enlarged to show the lice.

Sea trout of 362mm taken in the same sweep net sample as the fish above. This fish was 'fat' and carried just 10 lice. Some sea trout of this size were seen in spawning burns in the River Ewe system headwaters later in the year.



On 2nd July we caught only 3 small sea trout at Boor. However a few days later on 7th July, 21 sea trout were taken using rod and line from the nearby River Ewe. Most of these were large post-smolts of between 200mm and 250mm in length; all carried sea lice or had fin damage associated with sea lice infection. The most heavily infested fish carried 261 sea lice; several others carried potentially lethal numbers of lice. On 17th July, 8 sea trout were caught in the river, including a thin fish of 360mm (just 440g) which carried few lice but had scarring.

In summary: our sampling demonstrated that many sea trout were or had been infested with damaging numbers of sea lice in the Loch Ewe area during the summer of 2015.

Loch Gairloch & Loch Torridon area

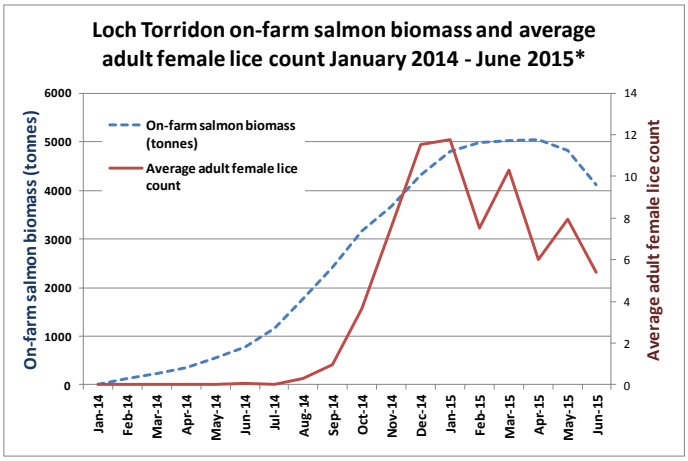
Following reports of exceptionally high concentrations of parasitic sea lice (*Lepeophtheirus salmonis*) on salmon farms within the Loch Torridon area during the first six months of 2015, samples of sea trout were collected around Loch Gairloch and Loch Torridon to address two questions:

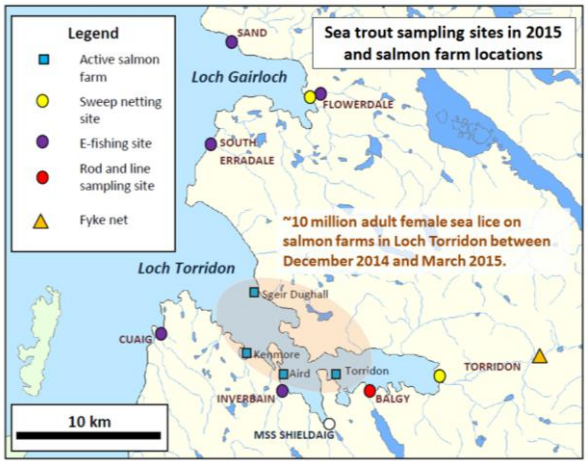
1. What was the distribution of heavily lice-infested sea trout within and beyond the Loch Torridon area?
2. What was the impact of the sea louse epizootic on sea trout populations around Loch Torridon?

Our findings are summarised in the section below; they are presented in more detail in the Torridon Sea Trout Report January 2016 which can be found on the WRFT website[4].

Figure 3.1 shows the location of sea trout sampling sites, in relation to the locations of active salmon farms in the Loch Torridon area in the first half of 2015. The estimate of '10 million adult female lice' on salmon farms in the area is a conservative estimate for the sea louse population on salmon farms in the area at its highest, based on fish farm biomass figures published on the Scotland's Aquaculture website[5], an estimate of average individual fish weight; and average sea lice figures published in SSPO fish health management reports[6] for salmon farms in the area. Marine Scotland Science recorded high counts of lice in plankton samples taken at Shieldaig during the winter of 2014-2015 (see Scottish Government's Shieldaig Project website).

Figure 3.1 Too many lice! The graph on the left has been produced from published figures (see text). The map on the right shows the location of sea trout sampling sites in 2015 in relation to the locations of the Loch Torridon salmon farms associated with the very high sea lice population.





Occurrence of heavily lice infested sea trout in May – July 2015

Sea trout carrying high or very high sea lice burdens (100 lice to 400+ lice per fish) were sampled by WRFT from the Flowerdale River estuary, River Balgy sea pool, Inverbain river estuary, and Sand (by Gairloch) river estuary; and by Marine Scotland Science in the Shieldaig river estuary (Marine Scotland, *pers comm.).* The most heavily infested fish were between 250mm and 350mm in length and were caught between late May and early July. The majority of lice on heavily infested fish were small 'chalimus' (juvenile) stage lice; indicative of nearby infestation.

[4] Loch Torridon Sea trout report http://www.wrft.org.uk/files/Torridon%20sea%20trout%20report%20Jan%202016.pdf
[5] Scotland's Aquaculture http://aquaculture.scotland.gov.uk/
[6] SSPO Fish Health Management reports http://scottishsalmon.co.uk/tag/report/

Some samples included thin post-smolt sea trout carrying no lice or very few lice. Some of these samples may have included trout that had remained in brackish water and not been exposed to the high lice infestation pressures experienced by other trout in respective samples. They may have also included sea trout which by returning 'early' to freshwater shortly after becoming infested, had been able to rid themselves of lice before significant external physiological damage associated with lice infestation had occurred.

Flowerdale, 19th May 2015. (Main picture) Pulling the sweep net in. (Inset) Our catch included this sea trout of 281mm taken in the sweep net; this fish carried an estimated 500 mostly chalimus stag lice. Note the descaled area below the dorsal fin associated with a bird attack (photos by James Merryweather).

Levels of lice infestation on some of the sea trout in some samples were far in excess of potentially lethal threshold levels described in published literature[7]. The marine survival rate, especially of smaller trout in systems such as the River Balgy, may have been reduced by 50% or more as a result of sea lice infestation.

Occurrence of maturing sea trout August – October 2015

However, despite much evidence of early returned sea trout with high numbers of lice and associated fin damage, evidence was also gathered that some trout which experienced damaging levels of sea lice infestation had shed their lice and recovered.

In August, three maturing female sea trout with damaged but healing dorsal fins were taken in the South Erradale River. This was our first record of sea trout in this small coastal burn; so much excitement! In September, two sea trout with damaged but healing dorsal fins were taken in the Flowerdale river estuary; one of these trout had a condition factor of >1.3 and was the fattest trout sampled during the 2015 season. On 1st October, 23 sea trout (including both maturing female trout and finnock) were taken in the sweep net in the Flowerdale estuary, including a maturing hen fish of 432mm; most of these fish had damaged but healing dorsal fins associated with earlier sea lice infestation.

[7] For example, Taranger et al, 2015 http://brage.bibsys.no/xmlui/bitstream/id/332219/997.full.pdf

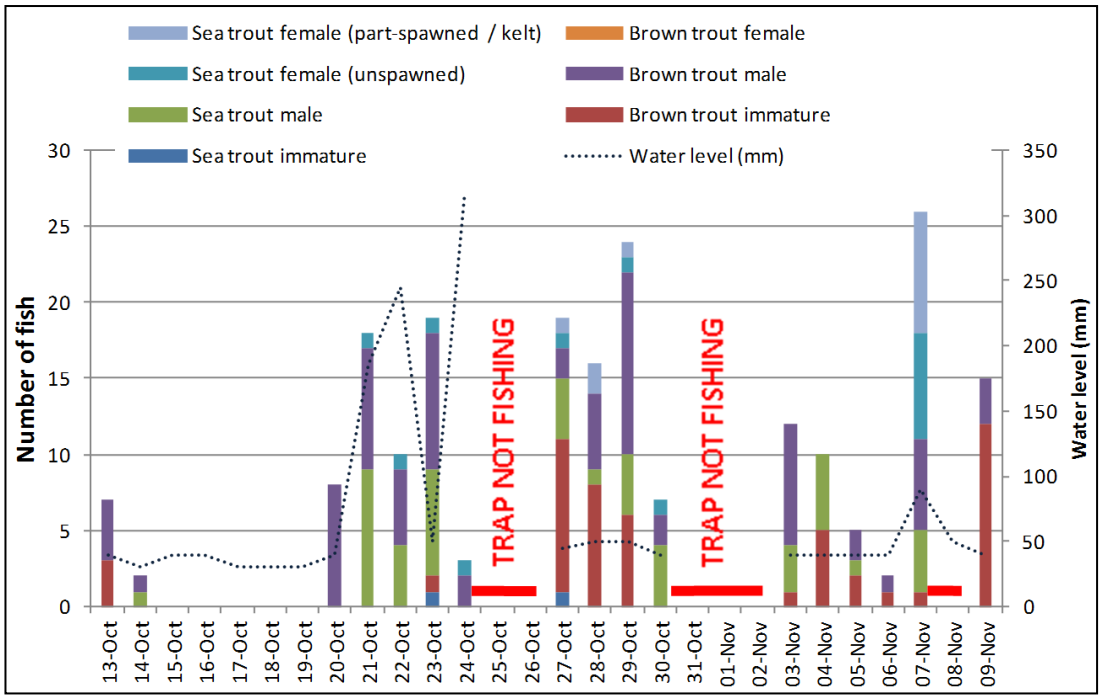
The River Torridon fyke net project

Following the high numbers of lice recorded on farmed salmon and wild sea trout in and around Loch Torridon earlier in the year, a fyke net trap was set in a trout spawning burn in the headwaters of the Torridon River after obtaining special licences and permissions from relevant authorities. The trap was fitted with an otter guard and operated from mid October into early November 2015 by Les Bates, Colin Blyth and Charlie Hill under the guidance of the WRFT Biologist. The project aimed to gather information about the composition of the adult trout population; and especially to find out whether any mature sea trout were present.

There were 212 captures of trout in the trap. Of these 76 were recorded as sea trout, and the remainder were brown trout. Five of the sea trout were identified as 'recaptured fish' (i.e. taken more than once in the fyke trap); several male brown trout were also recaptured (a few other recaptured trout may have been overlooked). 42 of the sea trout were mature males (260mm – 488mm); 26 were females (300mm – 520mm); and 3 were immature 'finnock' (245mm – 260mm). 76 of the brown trout were mature male fish 'running milt' (115mm – 352mm); the remainder were immature or were males that were not identified as such (64mm – 157mm). No mature female brown trout were recorded. Several other large trout were seen but not captured; the otter guard may also have deterred or prevented some large trout from entering the fyke.

Most of the sea trout were fish which had returned to freshwater after their second summer at sea and were between 310mm and 340mm in length. The oldest sea trout was a 9+ (or 10+) year old female fish of 520mm in length which had returned to freshwater after a 6th (or possibly 7th) summer in the sea. In contrast (r. size), the oldest brown trout, aged at 10+ years, was a fish of only 352mm in length. No mature female brown trout were recorded. Figure 3.2 presents a graph of fish catches vs. water levels at the trap site.

Figure 3.2 Timing of capture of trout in the Torridon river fyke net. The trap was lifted when water levels were too high, so the recorded total catch represents only a sample of the total spawning trout population in the burn.



The occurrence of many mature sea trout in the Torridon River fyke net trap in October and November 2015, despite close proximity to sources of larval sea lice (i.e. nearby salmon farms) earlier in the year, was an interesting and encouraging result. Some of these fish were older and larger than any of the sea trout sampled during the period 2007 – 2015 in the nearby River Shieldaig system where the largest mature trout in 2015 was only 343mm (Marine Scotland Science, *pers comm*.).

(right) Mature male and female sea trout from the fyke net on 27th October 2015. The male trout was 405mm long and had spent 3 summers at sea.

So, together with other information, the project demonstrated that in some situations some sea trout populations are able to persist despite very high sea lice infestation levels in nearby waters.

The results suggest that the overall impact of the Loch Torridon sea lice infestation in 2015 on sea trout populations around and beyond Loch Torridon varied according to geographic factors. The extensive intertidal area and west facing characteristics of the Torridon River estuary may provide River Torridon 'sea trout[8]' with better prospects of survival than sea trout entering the sea from some other nearby stream systems (e.g. sea trout from the Shieldaig River).

In conclusion, this study suggests that the consequences of a severe sea lice infestation (associated with salmon farming) on wild trout populations varies according to whether or not sea trout from respective river systems have opportunities for finding fresh or brackish water areas where they can evade or rid themselves of parasitic sea lice, find food, and evade capture by seals and other potential predators of lice-infested fish.

Charlie, Les and Colin with male sea trout (from the anaesthetic bucket). Thanks everyone!

[8] One might argue that some of the Torridon river trout would be better described as estuarine or 'slob' trout rather than sea trout. However, their appearance and scale growth (following smoltification) was characteristic of sea trout sampled elsewhere.

3.2 Sea lice and salmon farming

Figures for on-farm farmed salmon biomass are now routinely published by the Scottish Government and can be found via links on the Scotland's Aquaculture Website. Figures for the average number of adult female sea lice within respective fish health management areas are also published by the Scottish Salmon Producers Association in fish health management reports which are published once every three months.

Table 3.2 presents figures for sea lice population indices for respective SSPO 'Fish Health Management Areas' in and around the WRFT area. Because actual populations of adult female sea lice relate to the number of farmed fish within a fish health management area in addition to the average number of sea lice on each fish, it is necessary to consider both sources of information to obtain an indication of the actual on farm sea louse population within any area.

2014 and 2015 were years of contrasting success for sea louse management on salmon farms within and around the WRFT area. In the north of the WRFT area (salmon farms in the Loch Broom and Little Loch Broom area), lice levels were very low during both years, in contrast to earlier years. The WRFT visited the Tanera Mor, Loch Kanaird (Ardmair), Ardessie and Corry farms during this period; met fish farm staff and viewed farm salmon. Nearly all of the farmed salmon, including those at the point of harvest (at the end of the two year production cycle), were lice free on these farms. This represents a big improvement in sea louse management within this area. Much of this improved success is attributed to the skillful use of wrasse as cleaner fish within salmon pens on all farms within this area (see Box 3.1).

However, in the Loch Alsh-Duich area, north (& east) Skye area and Loch Alsh – Duich area, sea lice populations rose to unprecedented high levels. Salmon farmers were unable to keep levels of sea lice on their farms to anywhere near the industry's own Code of Good Practice (CoGP) sea lice treatment threshold figures. In effect, farms lost control of sea louse populations in these areas despite utilizing all the consented sea louse pesticides available to them, and also using cleaner fish (wrasse). Too many farmed fish and too many lice!

Published literature suggests that larval sea lice may be able to move up to 100km from source depending upon currents and wind direction (e.g. Boxaspen *et al*, 2004[9]). As the respective 'fire break' distances between the nearest farms in the Loch Alsh-Duich area and East of Skye area; the East of Skye area and Loch Torridon; the East of Skye area and Loch Alsh-Duich area and Loch Carron-Kishorn area are respectively all less than 40km, it seems more than likely that salmon farms within all these areas have been infecting each other with sea lice. In other words, once one salmon farm lost control of lice, then the infection pressure on all the other farms within this area increased, and other farms lost control of sea lice populations. Dominos!

Of greatest concern to wild fisheries interests, is the cumulative impact of high sea lice levels on salmon farms throughout this area. The correlation between rod catches of grilse vs. MSW salmon in the River Carron and Ling and salmon farming production cycles in the Loch Alsh – Duch, east of Skye and Loch Carron-Kishorn is statistically more significant than in 2014, following very low rod catches of grilse in 2015 (see section 2.1).

The unprecedented high adult sea louse populations follow unprecedented increases in on-farm biomass on salmon farms in the Loch Alsh-Duich area in recent years and a new salmon farm in Loch Torridon (Sgeir Dughall). In Table 3.2 note how there appears to be a relationship between on-farm biomass within a production area and adult female sea louse averages; note how average adult female lice levels rose almost exponentially when the farm salmon biomass with respective farming areas rose to levels in excess of 2000 tonnes.

Table 3.2 Sea lice population indices for the SSPO fish health management areas around the WRFT area. Figure shaded in pink are where the index exceeded 10,000 (representing 2 million+ adult female lice). Sea lice indices in excess of 50,000 indicate an estimated 10 million+ adult female lice on farmed salmon.

	Two Brooms			Loch Ewe			Loch Torridon			Loch Carron & Loch Kishorn			East of Skye			Loch Alsh & Loch Duich		
	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index	Farm salmon biomass (tonnes)	Adult female sea lice average	Sea lice population index
consented	***4372***			***1369***			***6626***			***9812***			***7972***			***6625***		
Jan-13	2567	4.19	10,756	1257	0	0	3006	0.92	2,766	604	0	0	618	0.07	43	0 F		0
Feb-13	2081	4.61	9,593	1322	0	0	4600	0.57	2,622	782	0	0	753	0.16	120	47 F		0
Mar-13	1895	4.57	8,660	1265	0	0	4424	0.31	1,371	1030	0	0	1236	0.01	12	75	0	0
Apr-13	2171	2.27	4,928	1256	0	0	4502	0.24	1,080	1253	0	0	1450	0.02	29	220	0	0
May-13	1357	2.56	3,474	1116	0	0	4630	0.61	2,824	1566	0	0	1756	0.02	35	347	0	0
Jun-13	1133	2.09	2,368	852	0.01	9	4464	0.7	3,125	1883	0	0	2147	0.02	43	530	0	0
Jul-13	1096	3.13	3,430	384	0.04	15	4858	0.92	4,469	2458	0.01	25	2506	0.04	100	889	0.01	9
Aug-13	712	4.8	3,418	0 F		0	4300	2.24	9,632	3222	0.01	32	2933	0.2	587	1507	0.01	15
Sep-13	724	9.26	6,704	0 F		0	2889	12.1	**34,957**	3578	0.18	644	3550	0.59	2,095	2382	0.16	381
Oct-13	770	10.27	7,908	0 F		0	1024	5.18	5,304	3786	0.43	1,628	4311	1.02	4,397	3153	0.25	788
Nov-13	598	4.87	2,912	0 F		0	482	12.6	6,073	4117	0.99	4,076	4637	1.44	6,677	4018	0.78	3,134
Dec-13	556	5.11	2,841	69 F		0	0 F		0	3871	0.97	3,755	5243	1.11	5,820	4755	1.58	7,513
Jan-14	434	2.76	1,198	88	0	0	0 F		0	3670	2.86	10,496	4915	1.68	8,257	5428	0.96	5,211
Feb-14	515	2.22	1,143	131	0	0	134	0	0	2693	2.09	5,628	5221	2.17	11,330	5856	1.03	6,032
Mar-14	590	1.5	885	173	0	0	222	0	0	1757	0.45	791	5398	3.15	17,004	6377	1.21	7,716
Apr-14	698	1.15	803	217	0	0	356	0	0	596 F		0	5267	2.33	12,272	6435	1.74	11,197
May-14	882	0.74	653	272	0	0	554	0.01	6	89 F		0	4922	5.35	**26,333**	5934	3.39	**20,116**
Jun-14	1106	0.88	973	345	0	0	741	0.08	59	0 F		0	3453	7.95	**27,451**	5744	7.1	**40,782**
Jul-14	1329	0.65	864	488	0	0	1161	0.04	46	0 F		0	2481	7.73	19,178	4576	11.94	**54,637**
Aug-14	1585	1.39	2,203	690	0	0	1772	0.32	567	19	0	0	709	14.26	10,110	3468	17.99	**62,389**
Sep-14	1661	1.81	3,006	887	0.02	18	2421	0.97	2,348	108	0	0	109 F		0	1476	41.7	**61,549**
Oct-14	1888	1.95	3,682	1063	0.04	43	3169	3.66	11,599	255	0	0	375	0	0	0 F		0
Nov-14	1927	0.85	1,638	1113	0.02	22	3672	7.57	**27,797**	517	0	0	715	0	0	0 F		0
Dec-14	1912	0.8	1,530	1071	0.05	54	4321	11.55	**49,908**	770	0	0	1130	0	0	0 F		0
Jan-15	1932	0.52	1,005	1208	0.04	48	4794	11.76	**56,377**	1099	0	0	1557	0	0	0 F		0
Feb-15	2047	0.16	328	1335	0.77	1,028	4976	7.53	**37,469**	1432	0.01	14	1903	0	0	278 F		0
Mar-15	1772	0.12	213	1371	1.44	1,974	5017	10.3	**51,675**	1747	0	0	2500	0	0	426	0	0
Apr-15	1100	0.12	132	1447	1.61	2,330	5045	6.02	**30,371**	2197	0	0	2961	0	0	665	0	0
May-15	926	0.08	74	1221	1.29	1,575	4815	7.96	**38,327**	2574	0	0	3524	0	0	999	0	0
Jun-15	861	0.13	112	1094	0.8	875	4118	5.41	22,278	2863	0	0	4386	0.01	44	1363	0.01	14
Jul-15	826	0.04	33	781 F		?	2932	4.32	12,666	3117	0.01	31	5602	0	0	1938	0	0
Aug-15	741	0.02	15	0 F		0	2326	5.62	13,072	3486	0.01	35	7057	0.05	353	2871	0.06	172
Sep-15	812	0	0	12 F		?	568 F		?	3800	0.14	532	7088	0.25	1,772	4117	0.16	659
Oct-15	916	0	0	71 F		?	0 F		0	3373	0.47	1,585	7315	0.67	4,901	5106	1.24	6,331
Nov-15	981	0	0	120	0	0	154 F		?	2091	0.85	1,777	6695	2.24	14,997	5864	4.48	**26,271**
Dec-15	1027	0	0	166	0	0	254	0	0	2097	0.89	1,866	4213	3.96	16,683	6018	6.78	**40,802**

Figures for biomass from Scotlands Aquaculture website http://aquaculture.scotland.gov.uk/

Figures for adult female louse averages from SSPO Fish Health reports http://scottishsalmon.co.uk/tag/fish-health-management/

The sea lice population index is the farm salmon biomass x adult female sea lice average.

Conservative estimates of actual adult female sea lice populations for respective areas & months can be obtained by multiplying the sea lice population index by 200 (assumes average weight of salmon is 5kg).

[9] https://www.researchgate.net/publication/228949018_Modelled_distribution_of_sea_lice_in_a_Norwegian_Fjord

Box 3.1 ***Cleaner fish update from Wester Ross Fisheries***

Editor's comment: There has been much recent interest in the use of wrasse and other species to control sea lice on salmon farms. On visits to salmon farms in the Loch Broom area in 2015, the WRFT biologist noted an almost complete absence of sea lice on farmed salmon, in contrast to some visits in earlier years (and to figures reported for farms in south of WRFT area!). The big improvement in the control of sea lice was said to be due to successful use of wrasse as cleaner fish within the farming system rather than former reliance on in-feed medicines and bath treatments. New WRF Fish Health & Regulatory Compliance Manager, Matthew Zietz, kindly agreed to a request to put together an article for this review with more information. Here's the article (thank you Matt et al):

First described in ca. 1600 the Salmon louse, *Lepeophtheirus salmonis*, remains an important parasite of both wild and farmed Atlantic salmon. Naturally occurring sea lice levels found on returning Atlantic salmon regularly approach 100% prevalence with a highly variable abundance of between 5 and 25 lice per fish (Jackson *et al*., 2013; Todd *et al.,* 2000).

The aim of the salmon farming industry is to manage sea lice numbers on the farm in order to protect the health of fish under their care and to minimise the risk of spreading sea lice from farmed fish to wild salmonids. To this end there is an industry code of good practice [CoGP] voluntary treatment threshold level for sea lice. If this level is exceeded then the farmer must have a treatment strategy in place with the aim of reducing lice levels. This voluntary treatment threshold is an average of 1 adult female louse per farmed fish from August to January, and a reduced level of 0.5 adult female lice per fish between February and July to coincide with the wild salmonid smolt runs.

Much in the same way as charismatic cleaner wrasse remove parasites and dead skin from Manta Rays and sharks atop coral reefs in tropical oceans, their temperate cousins are employed by the Scottish Salmon industry to do the same job for salmon on a commercial basis. There are five main species of common British wrasse that have been shown to be effective lice eaters, with the Ballan wrasse (*Labrus bergylta,* see main picture) being the most voracious of the lot, growing to a good size for farm use.

Two Ballan wrasse (Labrus bergylta). Note the differences in coloration between fish of the same species.
All Ballan wrasse are born female, with some maturing to males during their lifetime.

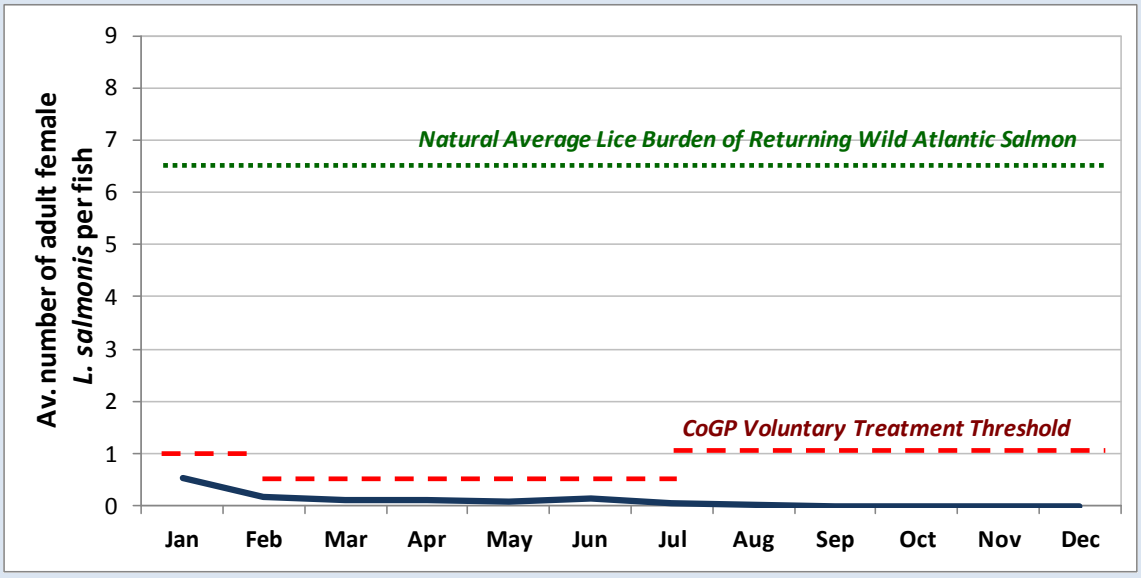
(photo credit: Wester Ross Fisheries)

Wrasse are locally caught by Wester Ross Fisheries staff using selective creel fishing methods to eliminate bycatch of non-target species. Strict minimum and maximum allowable catch size preserves wrasse breeding stocks and helps to continue a sustainable fishery. On-site, wrasse are supplied with refugia within the pens and offered supplementary feed, especially important when lice levels are low. Wrasse fishing, and husbandry on-farm is conducted under the RSPCA Freedom Food welfare standard to ensure optimum fish health and care.

Trials have been conducted to optimise the stocking ratio of wrasse to salmon, facilitating effective sea lice control. Good success has been achieved with very low wrasse stocking densities, meaning the whole salmon production cycle can be protected from sea lice by a relatively small number of cleaner fish.

Wester Ross Fisheries Ltd. has been using wrasse as cleaner fish for the past two years, and we have been achieving some impressive results. Throughout 2015, the average number of adult female *L. salmonis* per fish within the Kennart to Gruinard reporting region has been below the Scottish Salmon Producers Organisation's (SSPO) Code of Good Practice suggested treatment threshold (see Figure 3.3). This is a tremendous result and has only been possible through the knowledge exchange and collaboration between industry partners seeking novel, environmentally sustainable ways to combat sea lice. Industry sea lice data for the whole of Scotland is publically available on the SSPO's website (www.scottishsalmon.co.uk).

Figure 3.3 Average adult female sea lice (L. salmonis) loadings for farmed Atlantic salmon within the SSPO Kennart to Gruinard reporting region (blue line) from January to December 2015. The red line represents the industry's Code of Good Practice voluntary treatment threshold for sea lice. Data collated and published by the Scottish Salmon Producers Organisation (www.scottishsalmon.co.uk). The green line represents the natural background adult female lice burden for returning wild Atlantic Salmon (6.5 adult females per fish) as per. Jackson et al., 2013.



References:

Jackson, D., Kane, F., O'Donohoe, P., Mc Dermott, T., Kelly, S., Drumm, A., & Newell, J. (2013). Sea lice levels on wild Atlantic salmon, *Salmo salar* L., returning to the coast of Ireland. *Journal of fish Diseases,* 36(3), 293-298.

Todd, C. D., Walker, A. M., Hoyle, J. E., Northcott, S. J., Walker, A. F., & Ritchie, M. G. (2000). Infestations of wild adult Atlantic salmon (*Salmo salar* L.) by the ectoparasitic copepod sea louse *Lepeophtheirus salmonis* Krøyer: prevalence, intensity and the spatial distribution of males and [2pt] females on the host fish. *Hydrobiologia*, 429 (1-3), 181-196.

Part 4 **Report by Wester Ross Area Salmon Fishery Board**

supported by the Association of Salmon Fishery Boards [ASFB] and Fish Legal

by Peter Jarosz (Clerk to WRASFB)

The Wester Ross Area Salmon Fishery Board (WRASFB) has continued to work in close co-operation with Wester Ross Fisheries Trust (WRFT) over the past two years in two distinct areas of work:

- **Monitoring of fisheries.** Data collection by WRFT (e.g. from sweep netting and electro-fishing surveys) has added to the data bank that the WRASFB requires in performing its remit as the statutory consultee for wild fish. A summary of these surveys can be seen elsewhere within this document.

- **Responding to planning applications.** WRFT has provided background information for responses to planning applications for both fish farm sites and for run of the river hydro schemes.

The WRASFB has responded to planning applications for run of the river hydro schemes on seven locations within the Board's area over the past 12 months: at Strathcarron, Kishorn, Bruachaig (Upper Falls), Braemore, Achnasheen, Achnashellach and Ardessie. A number of these applications are quite recent and, whilst the Board (following advice from the WRFT biologist) made recommendations on some of these schemes, it remains to be seen if applicants agree to accept the recommendations made by the Board.

As far as aquaculture planning applications are concerned, the past twelve months has seen numerous efforts by the Scottish Salmon Company [SSC], utilizing all the legal processes available to them and employing expensive lawyers, to have the ten-year term at their farm in Torridon (Sgeir Dughall) replaced with permanent planning consent. These legal actions have included the Court of Session and your Board has had no alternative but to seek legal advice from Court of Session experts so that our responses, to these applications by SSC, are both robust and legally accurate. Currently this case is back with the DPEA for a second ruling by a reporter appointed by Scottish Ministers. All this involvement of legal experts as well as the additional time the Clerk of the Board has had to spend working on our responses has depleted the Board's contingency fund (held for just this purpose). There is little doubt that these efforts by SSC to replace the ten-year term with permanent planning consent will be ongoing. In order for the Board to continue responding to these attempts by SSC (and any other aquaculture company) there is an urgent need to replace the monies in the contingency fund and, to this end, WRASFB's board took the decision to raise the levy rate for the first time in five years.

WRASFB, in conjunction with the Argyll District Salmon Fishery Board (ADSFB), made (on behalf of ASFB) the wild fisheries' response to the Independent Consenting Review. This review, commissioned by Marine Scotland and the Crown Estate to examine the current planning application process and report on ways of "stream-lining" the planning procedure for aquaculture, took the form of a document that detailed the current process and asked for comments from aquaculture companies, the local planning authorities and ASFB (representing the wild fish interest). WRASFB/ASFB, in the joint response, made a number of important points/recommendations and, at the same time, listed several failures within the existing planning system.

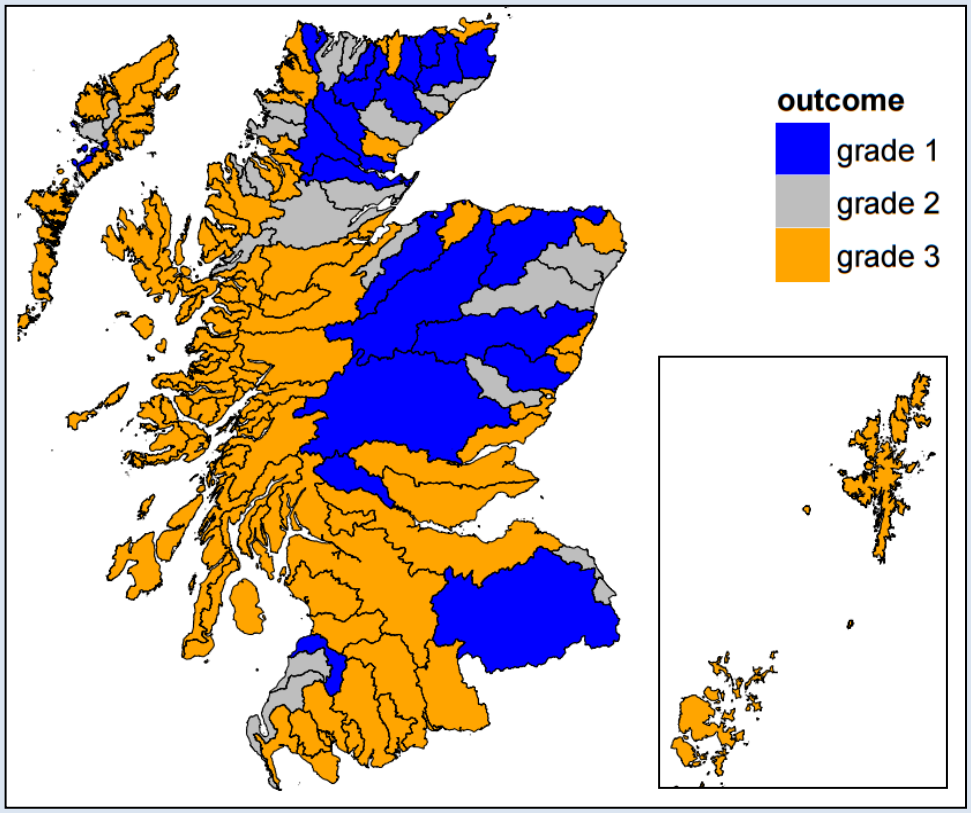
WRASFB also presented strong views to the consultation on the draft "Wild Fisheries (Scotland) Bill 2016''. This is the forerunner to what will become an Act of Parliament in October 2016, the purpose of which is the dissolution of the existing Fishery Boards and their replacement by the new Fishery Management Organisations.

On less political issues, WRASFB has helped to support the educational projects run by the WRFT as part of the Board's public awareness remit.

Further information about WRASFB, including copies of responses to planning applications, can be found on the Board's website at http://wrasfb.dsfb.org.uk/.

Box 4.1 ***New Conservation Measures to Protect Wild Salmon in and around Skye & Wester Ross***

Following a review of Conservation Measures to Control the Killing of Wild Salmon in Scotland[10] *and associated analyses of rod catch and river data, the Scottish Government has categorised fishery districts within the areas covered by the Skye and Wester Ross Fisheries Trusts (and boards) as Category 2 or Category 3 status (below).*



Category (grade) 3 status means that a mandatory catch and release policy for salmon is required and a conservation plan should be produced. Category 2 means that a conservation plan should be produced but mandatory catch and release is not required in the first instance.

The River Carron and Little Gruinard River (both Category 2 rivers) already operate a mandatory catch and release policy. This will not change. The Gruinard River, the only other Category 2 river within the area, has also decided to follow a mandatory catch and release policy for the 2016 season to ensure a consistent approach to the conservation of wild salmon across the area in 2016.

This means that all wild salmon should be carefully released following catch and release guidelines[11] ***wherever they are caught within the Skye and Wester Ross Fisheries Trust areas in 2016.***

[10] Conservation measures to control the killing of wild salmon in Scotland: http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence

[11] Catch and release guidelines: http://www.asfb.org.uk/wp-content/uploads/2013/09/CR-2013.pdf

Part 5 **Consultations and responses**

Over the past year, the WRFT has responded to requests for information from the Wester Ross Area Salmon Fisheries Board and from SEPA to inform planning decisions and Controlled Activities Regulations [CAR] license applications. Some of these requests were in relation to aquaculture (see Part 3.1 and Part 4.1). Others related to a spate of new hydropower [HP] schemes as local landowners hurried to develop and commission new projects before changes to feed-in tariffs and other subsidies come into force that will affect the viability of HP schemes that have not been commissioned before the deadline.

Impacts from HP schemes can include reduced flows affecting access by salmon and sea trout to spawning areas, reduced flows in spawning areas reducing spawning opportunities, and problems associated with both upstream and downstream fish passage over intake weirs and associated structures and past powerhouse outflows. River systems within the WRFT area where HP schemes are currently being developed include the Kanaird, Broom, Badachro, Ewe (tributaries: Garbhaig, Grudie, Bruachaig and Coulin), the river Balgy, Carron, Attadale and Ling. There are also plans for schemes in the Glenmore River catchment and in some smaller coastal burns.

Nearly all these schemes have been designed and agreed, sometimes following much deliberation, to ensure that there will be little or no impact to wild salmon or sea trout populations. Our biggest current concern is with regard to two schemes currently being developed in the mainstem **Bruachaig River** upstream from Kinlochewe. The upper Bruachaig lost its population of wild salmon during the 1990s. Over the past 10 years the WRFT stocked the river with progeny from salmon caught below the falls to try to kick-start recovery; and with support from River Ewe fishery proprietors established a captive broodstock (see previous WRFT reviews).

However, despite much co-operation from project engineers and the consultant to design the best possible fish passage arrangements over the intake weir for lower scheme, this new scheme will make it more difficult for wild salmon to ascend past the falls and re-establish a wild self-sustaining salmon population in a large area of habitat above the falls. Hard pressed SEPA officials, concerned about setting a precedent, were unable to license a small modification to be made to the falls to mitigate for the additional difficulties that abstraction will cause. Furthermore, after expressing concern that wild salmon returning to the upper Bruachaig might threaten the financial viability of the HP schemes, Kinlochewe Estate were unable to grant permission for salmon eggs from the captive broodstock, grown on by Bob Kindness, to be planted out above the falls as intended.

(left) Sometimes things work out well. In October 2015 we watched a 3lb+ female sea trout 'cutting' here in the Coulin River. Her redd was in an area of gravel recently loosened up by crossing machinery, and within 4m of the concrete support in the foreground! The contractors were alerted; an alternative downstream crossing point was subsequently used, and the Bailey bridge completed and rolled into place in November without further disturbance to the riverbed here. In the picture (taken in mid November) the student volunteers on the old bridge were watching spawning salmon as the bridge was being bolted together.

Part 6 **Skye Fisheries Trust review of 2015**

by Isabel Moore

This brief review contains information about the fisheries management activities of the Skye Fisheries Trust (SFT) over the 2015 calendar year.

6.1 Sea trout and sea lice monitoring

Over the years, and with the help of the Wester Ross Fisheries Trust, SFT has intermittently carried out government funded sweep netting in selected sea lochs in order to monitor sea trout smolt numbers and sea lice densities. Previous sites have included Lochs Slapin, Harport, and Portree. In 2015, sweep netting was carried out in Lochs Slapin and Portree, although sampling efforts were often deterred by inclement weather.

Table 5.1 Results of sweep netting for sea trout on Skye in 2015

Date	Location	Sample Size [1]	No. of infested fish	Sea lice abundance[2]	Sea lice prevalence[3]	Sea lice intensity[4]	No. of Personnel	Comments
30-May-15	**Slapin**	3	1	0.3	33.3	1	8	
26-Jun-15	**Portree**	0	0	0	0	0	7	inclement weather
1-Jul-15	**Slapin**	10	0	0	0	0	7	
13-Jul-15	**Portree**	0	0	0	0	0	10	inclement weather
17-Jul-15	**Slapin**	9	3	0.9	33.3	2.7	7	
24-Jul-15	**Portree**	3	3	4	100	4	11	
31-Jul-15	**Slapin**	0	0	0	0	0	4	inclement weather
2-Sep-15	**Portree**	8	0	0	0	0	8	

Notes: [1] The number of sea trout caught
[2] Average number of lice per fish in sample
[3] % of fish in sample infested with sea lice
[4] Average number of lice on infested fish

There was a significant decline in sea lice numbers in Loch Slapin between 2014 and 2015, with the average intensity decreasing from 15.0 sea lice per infected fish in 2014 to just 1.2 in 2015. The overall average catch per sweep netting session also declined, with an average of 8.8 fish being caught in 2014, but that number dropping to 5.5 fish in 2015.

Although sea lice monitoring did not occur in Loch Portree during 2014, a 2013 study reported an average sea lice intensity of 35.5 lice per infected fish, while data from 2015 reported an average intensity value of 0.4 lice per infected fish. While the overall average catch per sweep netting session in Loch Portree seemed to be low in 2015, this could be explained by several factors, the first of which is simply user error. Several different places within the Loch Portree estuary were sampled at different tides and some proved to be more viable than others.

As a result, SFT plans to sample the more productive areas of the estuary in 2016 in hopes that future sampling will produce more accurate results.

Another factor that might have influenced the lower catch numbers during the start of the season in both sea lochs is the relatively cold spring and early summer that Skye experienced in 2015. These colder temperatures might have slowed parr growth rates and potentially delayed the smolting process that must occur before young sea trout can successfully transition into salt water, resulting in lower numbers of smolts in the estuaries.

Scheduled sweep netting around the island is going to increase significantly in 2016 to cover a wider range of estuaries that have a variety of different environmental and anthropogenic influences.

(right) Sweep netting at Loch Slapin on a rare sunny day in 2015. Many thanks to our wonderful volunteers who continue to come out and help with the sweep netting despite the frustrations with bad weather and midges!

6.2 Consulting work

SFT completed a post-development survey in the Loch Buidhe system above Broadford in September 2015 for Scottish Water (SW). Earlier, a pre-development assessment was completed jointly by SFT and WRFT in 2014 before SW began the construction of an impoundment structure at the mouth of the largest loch within the system. Trout fry, parr, and eels were discovered throughout Loch Buidhe in 2014 using electrofishing techniques, and a historic spawning ground was identified downstream from the largest loch. As well as the impoundment structure, SW also built a fish pass that would allow fish to bypass the obstruction and travel between the lochs and the historic spawning ground. Construction was completed in 2014.

The visual survey that was carried out in 2015 did not include electrofishing, however, several fish were seen feeding at the surface of the lochs and a few parr were identified in the shallows. No fish were observed in the historic spawning grounds. It has been recommended to SW that an electrofishing survey takes place in 2016 to gather more detailed information about the reproductive success of the brown trout population within the system and how much of an impact the construction had.

(left) Isabel Moore labels trout eggs after collection from the Strathmore River in January 2016. The sampling expedition was part of her PhD studentship to learn more about trout populations on the Isle of Skye (see Part 6.4).

6.3 Living Lochs

The MacRobert Trust

SFT began to increase their educational outreach in 2015 at Plockton High School in November. A condensed version of the Living Lochs programme, designed by WRFT's Dr. Lorna Brown, was carried out for the school's S1 students and was met with much success. Topics included the food webs and biodiversity of freshwater lochs, as well as different types of native fish and the importance of sustainable fishing. Macroinvertebrate samples from local lochs were brought into the class for the students to observe and identify. Groups of students were asked to present information about their most interesting invertebrate to the class.

SFT is hoping to continue and expand these outreach programmes into more local schools throughout Skye and Wester Ross in 2016 in collaboration with Dr Brown (WRFT). Thank you to The MacRobert Trust for supporting this project.

(left) Students from Plockton High School search for macroinvertebrates in samples from local lochs in 2015, as part of the 'Living Lochs' project.

6.4 PhD Studentship

Grieg Seafood University of Glasgow

Supported by Grieg Seafood and the University of Glasgow

In 2015, SFT procured funding from Grieg Seafood Ltd. for a 3-year, peer-reviewed, PhD program that will investigate the distributions of brown trout populations around the island in five different river catchments and highlight any environmental or anthropogenic factors that could be restricting the densities of wild fish stocks. Isabel Moore, SFT's fisheries biologist, will be heading up the project under the guidance of Dr. Colin Adams at the University of Glasgow.

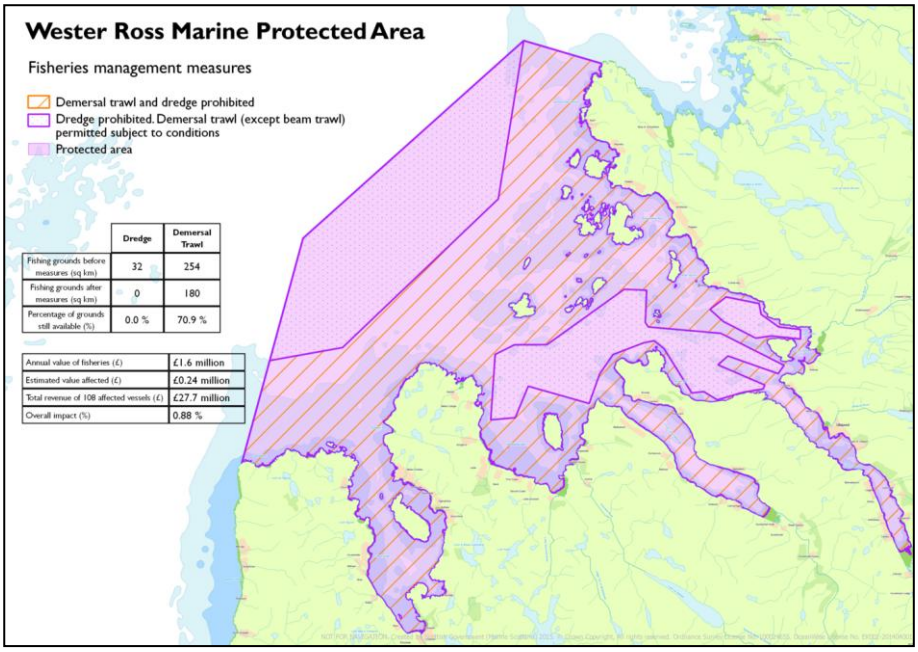
Research will include a broad range of sampling techniques including electrofishing in freshwater habitats to examine fry and parr densities, and sweep netting in estuarine sea lochs to determine smolt numbers. Close attention will be paid to the infection levels of sea lice on smolts to determine any correlations between the number of parasites and the overall health of the fish.

Another aspect of the project will include redd identification and the collection of a small number of brown trout eggs that will be tested to reveal the spawning distribution of anadromous sea trout and non-anadromous residential trout using stable isotope analysis. Some initial fieldwork for this particular part of the project was carried out in January 2016 in the Strathmore River catchment with the invaluable help of Peter Cunningham (WRFT) and Ally Macaskill (JMT). Two redd sites were found on the first day, but it was thought that after a season of heavy spates in the high gradient river, the characteristic redd mounds would have been flattened, making it difficult to identify them, if not completely washed out. As a result, future redd mapping will occur at the end of the year (November-December) as the trout begin to return upstream and before heavy rain can eliminate traces of their spawning grounds.

If you have any questions about SFT's work or would like to get involved with our projects as a volunteer please contact Isabel Moore by email (isabelmoore89@gmail.com) or phone (07825 567765).

Part 7 **Wester Ross Marine Protected Area**

In March 2016, the Wester Ross Marine Conservation Order[12] came into force, after much deliberation by Government agencies, NGOs, fishermen and other local stakeholders including many local people actively concerned about the long-term future of the area. WRFT submitted responses at several stages during the consultation process (please see WRFT website). Our view is that improved protection of marine habitats around Wester Ross will support the recovery of many of the wild fish populations that have declined in the past ~30 years (including sea trout), creating potential for higher levels of related employment.



To protect firm ground seabed habitats within the Wester Ross MPA, scallop dredgers are now prohibited throughout the MPA *(left).* This management measure aims to protect maerl beds and other fragile seabed habitats. To protect the deeper 'burrowed mud' habitat, demersal trawling will be excluded from some parts of the MPA, including sea lochs. Creeling, scallop diving and line fishing will be permitted as before.

To extend knowledge of the seabed within the Wester Ross MPA, snorkel surveys were carried out by WRFT Biologist in Gruinard Bay in January and August 2015. Extensive previously undocumented seagrass *(Zostera marina)* beds were recorded. However in August, much of the seagrass was covered in epiphytic filamentous algae, like brown cotton wool, restricting the amount of light reaching the seagrass fronds.

In February 2016, Peter was joined by Noel Hawkins (SWT Living Seas project officer), and local enthusiasts Sue Pomeroy and Fiona Mackenzie for a memorable expedition. Both maerl and sea grass were recorded growing in close proximity to each other *(right).* Large parts of the sea bed within the Wester Ross MPA remain inadequately surveyed; so there are plenty of opportunities for further discoveries over the years ahead.

[12] Wester Ross MPA Conservation Order http://www.gov.scot/Resource/0049/00493554.pdf

Part 8 **Invasive species**

Scottish Mink Initiative
Working with Communities to Protect Native Wildlife

RAFTS

8.1 Mink monitoring and control in Wester Ross

In 2015, non-native American mink were seen near Loch Broom, by Gruinard Bay, Loch Ewe, Loch Gairloch and to the south of the area covered by the Scottish Mink Initiative (see WRFT Review January 2015). There were several reports of sightings on or close to roads, by croft land or by the sea.

Clay foot print pads on rafts or tracking tunnels remained set in several areas, and were routinely checked by a small number of dedicated volunteers. During the three years of the project, there were no reports of mink footprints in any of the tracking tunnels with the area that WRFT covers. However, several mink were caught by local gamekeepers or crofters around Gruinard Bay and on the Isle of Ewe. These were retained and transferred to scientists working at Aberdeen University for laboratory analyses.

Despite growing awareness and continued active support for monitoring and control of non-native North American mink in Wester Ross and other parts of Scotland, funding via RAFTS to employ a national SMI project officer to co-ordinate and support local volunteers and to cover some administrative time for WRFT staff came to an end in the autumn of 2015.

Thank you very much to SMI project officer, Ann-Marie MacMaster, and to all the gamekeepers and other volunteers who have supported this project over the past few years.

So far in 2016, mink have been reported from the Loch Broom area, Gairloch area and Torridon area. At the time of writing, mink are likely to be breeding within the area. Their potential impact to native wildlife in Wester Ross remains uncertain[13]. Please continue to contact WRFT if you see a mink or have any other questions relating to the occurrence of mink within the area.

Red-throated divers: parents with two nearly fledged chicks on a lochan not so far from Gruinard Bay in July 2015. The photograph was taken by Jim Henderson, who also kept an eye on another Red-throated diver family on another lochan not so far away; and also photographed a family of Shelduck at Laide. Thank you very much to Jim for photos and reports: it's good to know that some ground nesting birds are able to breed successfully in areas where pine marten and a few mink may also be present.

[13] North American mink are a threat to water voles and to ground nesting birds especially on offshore islands where other mammalian predators are not present. Within Wester Ross, pine martens are widespread and occur around coasts, around human settlements and in the hills far from trees or human settlement. Anecdotes suggest that pine martens, otters and White-tailed eagles may kill mink, preventing numbers from increasing to levels where they present a significant additional threat to other native wildlife (e.g. http://www.ncbi.nlm.nih.gov/pubmed/18624744). So far as I know, no objective study of interaction between these three predatory species has been carried out in Scotland?

8.2 River Broom Japanese Knotweed control programme

Supported by Landfill Tax fund and local landowners

In 2015, WRFT facilitated a collaborative initiative to clear invasive Japanese knotweed [JK] from the banks of the River Broom. Many people, especially local landowners, were involved with setting up this project, and WRFT's role was primarily to put together and administer a funding package in collaboration with the Highland Council and the National Trust for Scotland. This enabled John Parrott of Coille Alba to complete a survey of JK in the River Broom catchment, and to initiate a two-year treatment programme.

For the first year of control, it was decided to stem-inject Japanese and Giant knotweed. This was intended to maximise 'first hit' kills, and minimise the problem of distorted re-growth in subsequent years. Before work commenced, contact was made with all owners of affected holdings to secure their permission to treat knotweed. Consent was also sought from SEPA for "Non-aerial herbicide in or near water", and a site meeting was held with Scottish Water. Contact was maintained with riparian owners as work progressed.

Using Coille Alba technicians and local contractors, all injectable JK and GK stands were stem-injected during August and September 2015 using a using Nomix Stem Master. Over 60,000 stems were injected. Himalayan knotweed stands were sprayed with a Berthoud knapsack sprayer. The 'hit rate' for injectable stems on the first round of treatment was estimated to be 98-99% *(right).* Funding has recently been secured for a second year of treatment in 2016.

8.3 Earthworm and New Zealand flatworm workshop

Supported by Open Air Laboratories http://www.opalexplorenature.org/

In some parts of Wester Ross, earthworm populations have been greatly reduced as a result of predation by the invasive non-native New Zealand flatworm. Moles have recently disappeared from some areas further contributing to problems associated with poor soil aeration and drainage. In March 2016, we were very fortunate to be able to welcome Dr Keith Marshall and Dr Annie Robinson *(left)* from Aberdeen University to Gairloch to lead a two-day Open Air Laboratories [OPAL] workshop to train volunteers to identify earthworms and New Zealand flatworms.

The workshop, held in Gairloch, was attended by crofters, countryside rangers, gardeners, and other people interested in learning more. In Flowerdale, three different species of earthworm were found beneath birch trees. However, in similar habitat nearby where New Zealand flatworms were recorded, no earthworms were found despite much searching.

Part 9 **Refertilising Wester Ross**

With in-kind support from:

SRUC, The James Hutton Institute, Game & Wildlife Conservation Trust, Ben Damph Estate, Cromarty Fisheries, Scottish Natural Heritage, the National Trust for Scotland, Forestry Commission Scotland

This three-day meeting addressed the issue of sustaining the fertility and productivity of the land and freshwaters in Wester Ross. Much of the area covered by the WRFT is underlain by hard, unyielding metamorphic and sedimentary rocks, and is naturally 'oligotrophic': biological production (including that of agriculture, wildlife and fish) is limited by the availability of nutrient, particularly that of phosphorus (P).

The meeting attracted much interest and addressed two main questions:

1. To what extent have human impacts associated with land use affected the fertility of the area?
2. Are there opportunities for actions to better manage and restore fertility?

This report provides a brief summary of the meeting[14].

Thursday 7th April 2016: Field trip to Beinn Eighe NNR and Glen Torridon

NNR manager **Peter Duncan** welcomed everyone, outlined long-term NNR management objectives, and summarised progress. Then, after a group photo *(right),* we set off on foot to explore the ground by the side of the Pony Path to the west of the Visitor Centre. Soils underlain by glacial deposits derived from Cambrian quartzite are particularly infertile in this area. The vegetation is generally patchy. Many small pine trees are stunted; Kenneth Knott (FCS) explained how they adapt to nutrient stress.

We looked at the hummocks where soils and vegetation tends to be thicker. Plants such as blaeberry and bearberry were found together with mosses, lichens and bushier heather. We considered the extent to which bird and animal droppings affect the fertility of these 'green knolls'; and what this tells us in terms of understanding the fertility of the whole nature reserve. To what extend have wildfires (before the NNR was designated), grazing pressure and continued export of deer carcasses from the reserve depleted the fertility of the area?

After lunch at the SNH Anancaun Field station / by Kinlochewe, we met at the car park in Glen Torridon opposite Loch an Iasgair at just after 2:30pm. We discussed moor burning, and whether or not it was

[14] A full report from the meeting, including presentations, can be found on the WRFT website at http://www.wrft.org.uk/downloads/files.cfm?id=39

beneficial as a management tool in this area. To the contrary, it was suggested that frequent burning can damage heather which may be replaced by less palatable grasses, with an overall decline in fertility. Some suggested that agricultural advice (e.g. the Scottish Government's muirburn code) was inappropriate or unworkable in the west coast situation. Prof Davy McCracken reminded everyone that the same difficult issues regarding burning are met with in many other parts of the world.

From the road bridge, we looked towards an unsuccessful woodland restoration scheme in a gorge further upstream, then investigated the soils a by a ruined cottage where black-headed earthworms were found. We followed a footpath over a sea trout spawning stream, climbed onto a ridge (glacial moraine primarily composed of Torridonian sandstone) finding signs of pine marten and mice on / in vegetation on a hummock; then descended to looked at the trees (aspen, birch, holly & rowan) and associated flora growing on a crag out of reach of grazing animals and fire. We also noted that there was a small birch tree growing on the island in a lochan as we passed.

Friday 8th April 2016: Refertilising Wester Ross Workshop, Gairloch Community Hall

The meeting was attended by over 40 people including representatives of a range of government and non-government organisations, independent ecologists, land managers, farmers and crofters, and wildlife enthusiasts from near and far.

Chairman **Prof Dave Barclay** welcomed everyone, then **Peter Cunningham** presented an introduction to fertility in Wester Ross. Peter outlined how in areas where underlying bedrocks are unyielding, fertility is largely dependent on ecosystem processes. Peter explained how phosphorus is a limiting nutrient, and introduced the concept of 'ecosystem fertility' where nutrients are recycled through biota above and below the ground. Human impacts (extinction of top predators, deforestation, fire, overgrazing, changes in human settlement and sanitation) had greatly altered the ecology of Wester Ross, greatly affecting the processes responsible for the mosaic of fertility we see within the landscape today. There is a need to develop appropriate strategies for 'ecological refertilisation' to raise levels of productivity of wildlife (including deer and fish), livestock and to enhance biodiversity. Higher biological productivity would also help to support livelihoods especially in fragile crofting communities.

Dr James Merryweather (SLEF) focussed on the importance of understanding mycorrhiza. Almost all higher plants depend upon mycorrhiza (fungus + root) networks to obtain phosphorus to sustain growth. In return, plants provide carbohydrate to nourish the underground networks of mycorrhizal fungi. Ploughing, upheaval, and / or application of fertilizer can destroy mycorrhiza. There are very many different kinds of mycorrhiza. Trees grow much better if they are planted where appropriate mycorrhizal fungi are already present within the soil, than if they are planted far from mycorrhizal fungal sources; hence one reason for the contrasting outcomes of woodland schemes.

Dr Scott Newey (The James Hutton Institute) provided an overview of some of the results of deer carcass placement trials. The practice of leaving deer carcasses on the hill is controversial; some favoured the practice as a means of providing food for wildlife and ensuring nutrient cycles are not broken; others felt it was inappropriate for ethical and land management reasons. Carcasses placed in areas where predator control was practiced tended to take a lot longer to decompose than carcasses placed in areas where there was little predator control. Using trap cameras (and many volunteers to sort through over 2 million photos!) a wide range of animals was recorded scavenging carcasses. Patterns of nitrogen enrichment around carcasses were described.

Dr Adam Smith (GWCT) summarised a study which investigated the relationship between red grouse production and heather quality. The red grouse bag from a moor near Ralia (near A9) declined from over 2000 birds in the 1920s to zero by the mid 1990s. After considering other explanations, attention focussed on the positive correlation between spring grouse abundance and phosphorus content of heather. Other studies showed that red grouse are able to select heather of higher nutritional content. An experiment to investigate the outcome of fertilising grouse moor with NPK was carried out; this demonstrated that chick production could be increased where the nutritional quality of heather was higher as a result of the improved condition of the mother grouse (and her eggs). However GWCT does not advise using fertiliser on grouse moors, as fertilised heather moorland can be replaced by grassland; and high nitrogen levels were associated with damage to heather caused by the heather beetle.

Simon McKelvey (Cromarty FT) explained how Atlantic Salmon deliver marine nutrients to headwater streams in upland areas. Most salmon die after spawning and their carcasses provide a source of food for other wildlife. The decline in salmon runs and loss of trees from headwater areas has led to a nutrient deficit. Earlier studies had demonstrated that placement of salmon carcasses in salmon nursery streams (to mimic natural process) contributed to production of higher numbers of juvenile salmon. However salmon carcasses are difficult to obtain in the quantities required for practical management purposes, and are not pleasant to work with! Instead, trials in collaboration with Glasgow University using specially formulated 'salmon carcass analogue' pellets are about to commence, adapting a methodology devised in North America. It is important to protect and restore riparian woodlands, as in addition to many other benefits for fish and other wildlife, trees and woody debris help to snag and retain salmon carcasses in nursery streams.

Prof Davy McCracken (SRUC) explained how much could be gained in terms of safeguarding agriculture, wildlife populations and rural communities in upland areas by combining different land management objectives and policy. The majority of agricultural land in Scotland is non-arable. Very little is known about what happens in common grazing areas, despite their importance to the long-term viability of farming. Many of the indicators for the health and productivity of upland areas have been in decline, including agricultural output, ground nesting birds, native woodland. To secure viable economic units, support payments should focus more on the development of management where agriculture, sporting interests and wildlife conservation ('high nature value' systems) were integrated. Financial support systems should be geared much more to addressing these issues. For political reasons, it has been difficult for incentive payments to change in ways that will bring about the most useful long-term benefits.

Prof Davy MacCracken summarises the main points from the workshop to discuss the need for changes to the rural subsidy system. Could subsidy systems incentivise fertility restoration and management?

Workshop session

After an entertaining play about how soil was transported by boat from Germany to Dry Island (by Badachro) as ballast in the past, by Iona McWhinney, her mum Jess and little brother Findlay (age <1), the meeting split up into 3 discussion groups.

The practicality of **leaving carcasses on hill** to recycle nutrients depended on land management objectives; there were mixed views. Diverse views were also expressed regarding the desirability of establishing **riparian woodlands** in areas which had not been wooded for thousands of years; and for providing supplementary fertiliser. However, it was generally agreed by the third group that there is a need to change the **subsidy system** to provide greater support for active younger people and for a much wider range of services provided by crofting and upland areas than under current system . . .

It was also generally agreed that there should be a greater emphasis on understanding and supporting natural nutrient recycling processes in upland areas, and addressing long-term nutrient deficits.

Saturday 9th April: Field trip to the Sands Archaeology Trail and 'the place of the oaks'

We gathered by the remains of an ancient roundhouse on the side of the hill above the Sand River *(below left).* The surrounding ground is grassy and relatively fertile, with earthworms and molehills; later in the year bracken grows up. Higher up the ridge the knolls are used by crows and pine martens and surrounded by short-cropped and sheep-grazed greens. By a boulder overlooking the Sand Loch, James Merryweather picked up an otolith, or ear bone, from a fish; we contemplated its origin as a Great skua flew by.

Despite grazing by sheep and cattle, the hillside below the loch supports a mix of plants including hazel, willow, rowan and oak trees. After being battered by salt spray from winter storms, the oak trees struggle, and in some years only produce a few leaves. The burn below the loch is marked on the map as the 'Allt Glac na Daraich'; the soil on the north side of the road is more fertile, as the rock is a sort of 'diorite' which weathers to form a slightly richer soil than elsewhere in the surrounding area. An isolated oak tree on the south side of the burn has managed to survive and grow away from the fertile soils on the north side of the road *(below right).* About 2.5m feet up, there is a horizontal bough which provides a perch for crows and buzzard *(outlined).* As the only big tree on that side of the valley, the ground below the perch may gain just enough bird droppings to provide the additional supplement of nutrients needed to keep the tree alive.

The tree is only a few hundred metres from the Sands Archaeology Trails car park; have a wee look for yourself and see what you think?

Part 10 **Education and student projects**

Supported by: The MacRobert Trust ENTRUST

Over the past year, WRFT has continued to provided enthusiastic support for education activities including schools projects (see Part 5.3), presentations at: a Scottish Book Week event at Gairloch library on theme of 'Atlantic salmon: a literary journey from Sea to Source'; a 'Marine Magic' day at Ullapool Primary school for all the primary school children in the area organized by the RSPB in collaboration with other NGOs and The Highland Council Countrysdie rangers; and several outings and field trips with primary and high school students.

(left) Mr Milner with Rural Skills students from Gairloch High School in November 2015. Perhaps somewhat remarkably, the aneasthetised trout recovered from their ordeal, and were released back into the Slattadale burn where they swam away apparently none the worse . . . .

With new biology teacher Dr James Close, there are plans for several projects in the remainder of 2016, including development of a smartphone app as part of the Landfill Tax Funded 'Angling Information Service' project.

Once again we were delighted to welcome Dr Steve Kett and Vu Dang from Middlesex University along with students, Toby Landeryou and Nick Oliver in July 2015. Vu was studying the genetics of brown trout populations within part of the Wester Ross area, and joined Steve and Andy Vicks on several sampling expeditions. Toby was carrying out genetic studies in relation to parasite infection of brown trout; and Nick learning about DNA in bird pellets.

(right) Toby, Vu and Nick help with sea trout sampling by the Sand River, July 2016.

Meanwhile, Glasgow University IBIS Student, Oliver Hooker published a paper about Arctic charr in Loch Dughaill (River Carron system), following field investigations in 2014[15]. Fellow student Martin Hughes, who collected samples of trout in Wester Ross for his PhD study in 2014 (see WRFT Review January 2015), published his first short paper about the occurrence of *ferox* trout in Scottish Lochs[16]. Both Oliver and Martin were busy 'writing' up during the winter of 2015-16; we wish them and all the other students well.

[15] Hooker, O.E, Barry, J., Van Leeuwen, T.E., Lyle, A., Newton, J., Cunningham, P., Adams, C. 2016. Morphological, ecological and behavioural differentiation of sympatric profundal and pelagic Arctic charr (*Salvelinus alpinus*) in Loch Dughaill Scotland. *Hydrobiologia*.DOI 10.1007/s10750-015-2599-0
http://link.springer.com/article/10.1007%2Fs10750-015-2599-0

[16] Hughes, M.R., Dodd, J.A., Maitland, P.S and Adams, C.E. (2016). Lake bathymetry and species occurrence predict the distribution of a lacustrine apex predator. J. Fish Biology. doi: 10.1111/jfb.12919
http://onlinelibrary.wiley.com/doi/10.1111/jfb.12919/abstract#.VsspRVLUwYM.twitter

Part 11 **Summary**

- After a good start to the 2015 season for multi-sea winter salmon, subsequent grilse catches in the River Carron and River Ling were unusually low (see Part 2). Low water and difficult fishing conditions contributed to poor grilse catches. However, further north in the River Ewe and Gruinard River, grilse numbers were closer to those of other recent years. A correlation between grilse catches and salmon farm production cycles in nearby areas suggests that the inter-annual fluctuation in grilse catches in the River Carron can be explained by higher mortality of emigrating smolts every second year, when sea lice populations in nearby salmon farming areas were high (see also Part 3).

- Catches of sea trout were also mixed in 2015. In contrast to salmon, the River Carron sea trout catch for 2015 was the highest since 2011. Further north, sea trout catches were generally poor in 2015; except for anecdotal reports from some anglers fishing the sea around Loch Broom.

- Juvenile fish surveys were carried out in several major and minor rivers in 2015. Salmon fry were found at nearly all sites where juvenile salmon had been found in previous years. However, figures for salmon parr CPUE were lower than usual at some sites, possibly due to mortality associated with the Hurricane Bertha spate in August 2014.

- Following a record run of adult salmon in 2012, the number of smolts produced in the Tournaig system in 2015 was not quite as high as anticipated. However, the average weight of individual smolts was estimated at over 50% heavier in 2015, than in 2007 when the highest number of smolts was recorded.

- In the winter and spring of 2015, numbers of adult female sea lice reported by SSPO for the Loch Torridon salmon farming area were very high. Many of the sea trout subsequently sampled by WRFT and Marine Scotland around Loch Torridon, Loch Gairloch and Loch Ewe were heavily infested with sea lice (see Part 3). The Torridon fyke net project demonstrated that despite high sea louse infection pressures in nearby waters, in some situations, some sea trout were able to survive to maturity and spawn.

- In contrast to salmon farms further south, salmon farms in the Loch Broom area achieved near 'zero' sea lice levels on their farms in 2014 and 2015 by operating at a relatively low biomass and using wrasse as cleaner fish (Box 3.1).

- WRASFB responded to many salmon farm and hydro-power planning applications and associated appeals, and called upon WRFT to provide information on many occasions (Part 4). WRFT also responded to requests from proprietors, government agencies, contractors, and others for advice regarding possible impacts to wild fish populations associated with proposed developments (Part 5).

- The Skye Fisheries Trust, led by Isabel Moore, carried out sweep net monitoring of sea trout, a schools project, and contract work on Skye. As a PhD student based at Glasgow University, Isabel also began an investigations of brown trout populations (including sea trout) on Skye (Part 6).

- WRFT also responded to consultations regarding management measures for the new Wester Ross Marine Protected Area (Part 7); supported work to monitor and control invasive non-native species (Part 8); held a workshop focussing on the need to restore fertility to much of Wester Ross (Part 9) and supported students and various other education and awareness raising initiatives (Part 10).

Part 12 **Financial Statement**

Because the Trust is a Charity, its accounts are necessarily comprehensive and complex to read without additional explanatory notes. The Trustees have decided therefore in future to provide only a summary statement within the review itself, but to provide a link to the full OSCR accounts.

2016 Financial Statement (pp.) from the Chair

Background

Over the last few years there have been wide variations in the income and expenditure of the Trust. These fluctuations were primarily caused by three factors:

1. A previous commitment to UHI in respect of a second biologist.
2. An increasingly challenging environment for the Charitable Trusts and other grant sources, from which approximately two thirds of our income originates.
3. Greatly reduced funding from the WRASFB.

The effect of those factors was to cause the Trust to incur considerable and unsupportable operating losses during 2012 and 2013, which substantially reduced our reserves.

Present Position

Stringent economy measures over the last 30 months and the welcome re-establishment of the previous levels of funding from the WRASFB have rectified this situation.

Whilst successfully fulfilling all its aims and objectives as planned, at the time of writing (May 2016), the Trust has operated on a better than cost neutral basis throughout the 2015/16 financial year. We further expect to show a small increase in reserves at the end of the 2015/16 financial year.

The full accounts are available via this link: http://www.wrft.org.uk/downloads/files.cfm?id=38

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Middlesex University student, Toby Landeryou, found this common shrew inside this trout. The trout was caught in a small burn in the hills near Gairloch on 9th July 2015. The shrew represents a somewhat larger meal than the size 20 dry fly used by Dr Steve Kett to catch the trout.

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Vu Dang

…and all the other anglers, mink project volunteers, keepers and ghillies, fish farmers, school teachers, schoolchildren and parents, and everybody else who has helped us with our work to support wild fisheries in the Wester Ross area.

The **work programme for 2016** includes excursions to sample trout lochs and streams, electro-fishing surveys of many of the rivers between Ullapool and Knoydart, sweep netting for sea trout, river surveys, an anglers information project and much else which may be of interest. There are many opportunities for becoming actively involved with the work of both Wester Ross and Skye fisheries trusts or for simply coming along for a day in the field to find out what we do. Please contact either of the Biologists at info@wrft.org.uk for further details.

Wester Ross Fisheries Trust was set up in 1996 in response to the collapse of salmon and sea trout populations around Wester Ross and the fisheries they supported such as those of Loch Maree.

This final review of our work, prior to merger with the Skye Fisheries Trust, provides a summary of activities carried out during the 15 months from February 2015 up to the end of April 2016.

The review includes an assessment of the status of wild salmon and sea trout populations and some of the problems they faced, particularly in relation to a severe sea louse infestation in Loch Torridon. There are reports by the Wester Ross Area Salmon Fishery Board and the Skye Fisheries Trust.

Other sections describe actions to monitor and control invasive non-native species, the new Wester Ross Marine Protected Area, the 'Refertilising Wester Ross' workshop and other education and awareness raising activities.

Thank you for your support!