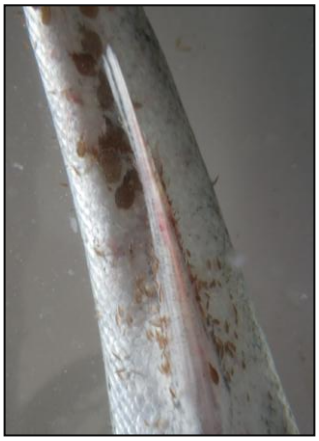
WRFT Sea Trout Monitoring Report for 2012

On the occurrence of larger sea trout in Wester Ross



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Cover photos:

(top) The largest sea trout recorded in the WRFT area in 2012, a male trout of 530mm, 1826g, condition factor 1.23, taken in a fyke net at the mouth of the Dundonnell River in August 2012 with only two lice. Note the raw, louse damaged dorsal fin indicative of heavy louse infection earlier in the summer (photo A. MacDonald/Sally Clements). (top inset) A sprat trapped in the fyke net at Dundonnell on 25th July 2012 (A. MacDonald/S.Clements).

(right) Carron sea trout 395mm, 5th June 2012 (J. Tosney). The field data sheet recorded 200+ chalimus lice and 40+ adult and pre-adult lice; examination of photos suggested there were 700+ lice on the fish.

(bottom right) 'Squaretail', a male sea trout taken several times between 2011 & 2012 in Loch Gairloch recovering in the Flowerdale river estuary on 17th September 2012.

(lower left) Sea trout of 251mm taken from Boor Bay, Loch Ewe on 4th July 2012, and sandeels that were inside the fish's stomach.

(middle left) The WRFT sweep netting team at Mungasdale Bay on 23rd May 2012; and inset, the only sea trout caught – a fish that was also caught at the same location in June 2011.

1. Summary

This report presents the results of sea trout sampling in 2012 by WRFT. It also considers rates of growth and marine survival of sea trout within the WRFT area in comparison to some other areas in the West of Scotland during the past ten years (to 2012). The report has been prepared primarily to inform local fisheries proprietors and managers, ghillies, anglers, salmon farmers and others who are interested in wild sea trout and sea lice management in Wester Ross.

The samples of sea trout reported here were caught using a sweep net in the River Kanaird estuary, Gruinard Bay, Loch Ewe, Loch Gairloch and the River Carron estuary; using a fyke net in the Dundonnell River estuary, and with rod and line in the sea pool of the River Ewe. In 2012, WRFT collected data from 383 trout (details in Appendix 1). Samples taken at all sites in May and June were dominated by post-smolt sea trout of less than 250mm. In addition to catching these wee post-smolt sea trout (subject of the 2012 RAFTS post-smolt report) many larger sea trout were caught.

To learn about rates of survival (mortality) of sea trout in different parts of the area, subsamples of larger sea trout (fish of 310mm and larger) were treated separately. This size category was chosen in order to minimise sampling bias on the assumption that fish in this size class would be more evenly represented in sweep net catches relative to their actual abundance within respective sea trout populations than in samples including smaller fish; and also to allow comparison with samples taken in 1980 (Walker, 1980) and the 1920s (Nall, 1926 & 1938), and those from samples taken elsewhere.

For samples taken during the years 2007-2012, the subsample of these larger sea trout in Loch Gairloch was proportionality much larger relative to the total sample of sea trout taken than at the other sampling locations. However in Loch Gairloch, many sea trout were sampled during the winter, early spring and autumn: at times when other areas were not sampled.

Of the respective subsamples of sea trout of 310mm in length and larger, 25% of the fish were of 410mm or more in length in the Kanaird, Dundonnell and Loch Gairloch subsamples. Only 11% of the Loch Ewe subsample and 8% of the River Carron subsample of sea trout of 310mm in length and larger were over 410mm in length. Sea trout of between 500mm and 600mm in length were caught in the Kanaird estuary, in Gruinard Bay and in Loch Gairloch but not at the other sampling locations (Dundonnell, Loch Ewe, Carron estuary). In contrast of a rod caught sample of sea trout of 310mm and larger taken in 1980, 58% were of 410mm or more and 4.3% were of 600mm or more (Walker, 1980). Sea trout of over 500mm in length were taken at only a minority of sweep netting sites elsewhere in the West of Scotland during the period 1999-2009.

These differences are considered in relation to sea trout survival/mortality rates, and are discussed in relation to levels of sea lice infection, salmon farm location, feeding opportunities, predation, and the movements of sea trout within respective freshwater – marine systems. The findings in this report support the contention that rates of survival of sea trout in areas with salmon farms in the West of Scotland during the period 2000 up to 2012 were inadequate to support traditional sea trout fisheries. Although there were many small post-smolts in some areas, very few of them survived to reach a size of 1kg (2.2lb); in some areas (e.g. Shieldaig river system, Loch Torridon) possibly none at all. Records of larger trout, including rod caught fish, should be analysed further.

2. Introduction

2.1 Background information

This report presents the results of sea trout sampling by Wester Ross Fisheries Trust in 2012. The sampling programme was part-funded by the Scottish Government via Rivers and Fisheries Trusts Scotland [RAFTS], to collect data for the Managing Interactions with Aquaculture Project [MIAP]'s Sea trout Post-Smolt Monitoring Project. This project involved sampling sea trout post-smolts (sea trout of less than 25cm in length) at specific sites within the west of Scotland between May and June (inclusive), and focused on further investigating relationships between the occurrence of parasitic sea lice (*Lepeophtheirus salmonis* and *Caligus elongatus*) on post-smolt sea trout in relation to the proximity of salmon farms (Middlemas *et al* 2012). Sampling sites were located throughout the west of Scotland and Western Isles, and participating fishery trusts comprised Argyll Fisheries Trust, Lochaber Fisheries Trust, Wester Ross Fisheries Trust, West Sutherland Fisheries Trust and the Outer Hebrides Fisheries Trusts. At the end of each year, the results of the post-smolt monitoring project are presented in a report which can be found at http://www.rafts.org.uk/wp-content/uploads/2013/01/RAFTS-Regional-Monitoring-Report-2012.pdf

In addition to data on post-smolt sea trout sampled as part of the RAFTS project, much data has been collected on older and larger sea trout. Sea trout populations and fisheries are sustained by larger sea trout; fish which have reached maturity and spawn for the first time usually after spending two summers in the sea. Where were larger fish found, and why were there not more of them?

This report follows earlier WRFT sea trout monitoring or 'wild trout' reports for earlier years, each of which, in addition to presenting data for all fish sampled by WRFT, has focussed on a different aspect of sea trout ecology. The Wester Ross sea lice monitoring Report 2007 – 2008 considers associations with salmon farming. Relationships between lice levels on sea trout and salmon farming in the West of Scotland have subsequently been investigated more fully by Middlemas *et al* 2012 , and the on-going RAFTS post-smolt monitoring project referred to above.

The WRFT Sea trout monitoring report 2009 – 2010 contrasts the condition of sea trout sampled in 2009 (when sea trout were remarkably fat during early summer) with those sampled in 2010; and provides information about some of the other marine parasites of sea trout in the Wester Ross area. The WRFT Wild Trout monitoring report for 2011 presents information from both sea trout sampling in the marine environment and from sampling trout in spawning streams considered to be accessible to sea trout within the WRFT area. This report also included an appendix with many photographs of trout and their corresponding trout scales to complement an existing on-line WRFT Sea Trout Scale Reading Catalogue.

2.2 Aims and objectives

As in previous years, the primary aim of sampling sea trout was to learn about levels of parasitic sea lice infection on sea trout. An additional purpose of this year's report, which is intended to complement the annual RAFTS post-smolt monitoring report referred to above, is to review some of the information about larger sea trout caught at sampling sites within Wester Ross, and see what can be learned about the growth and rates of marine survival of sea trout in different parts of Wester Ross in comparison to other areas in the West of Scotland.

2.3 WRFT sampling sites in Wester Ross

Information on **River Kanaird** sea trout comes from sweep net sampling in 2011 and 2012. Samples were taken between May and July.

For **Loch Ewe** sea trout, in addition to sweep net sampling at Boor Bay, samples of sea trout were taken using rod and line from the River Ewe and from Loch Maree in 2011 and 2012. [Loch Ewe has several small systems which produce sea trout smolts in addition to the River Ewe – Loch Maree system. WRFT has sampled sea trout (in addition to salmon) using an upstream – downstream trap at **Tournaig** since 1999. Samples of sea trout, including smolts and adult fish have been recorded using fyke nets set in the River Sguod system, and a follow up report for the Loch Ewe area will include data from these study areas.]

At **Loch Gairloch**, sampling in 2012 was carried monthly from March to October in the estuary of the Flowerdale burn, adjacent to the WRFT office out; and additional information was gathered from a brief electro-fishing expedition to sample the nearby Flowerdale Burn following a sweep net session in October 2012.

At the **Dundonnell River**, a fyke net was used in the estuary to target early returned sea trout in June 2012. Data is also presented from sweep net sampling in **Gruinard Bay** and in the **River Carron** estuary.

3. Methods

3.1 Sampling

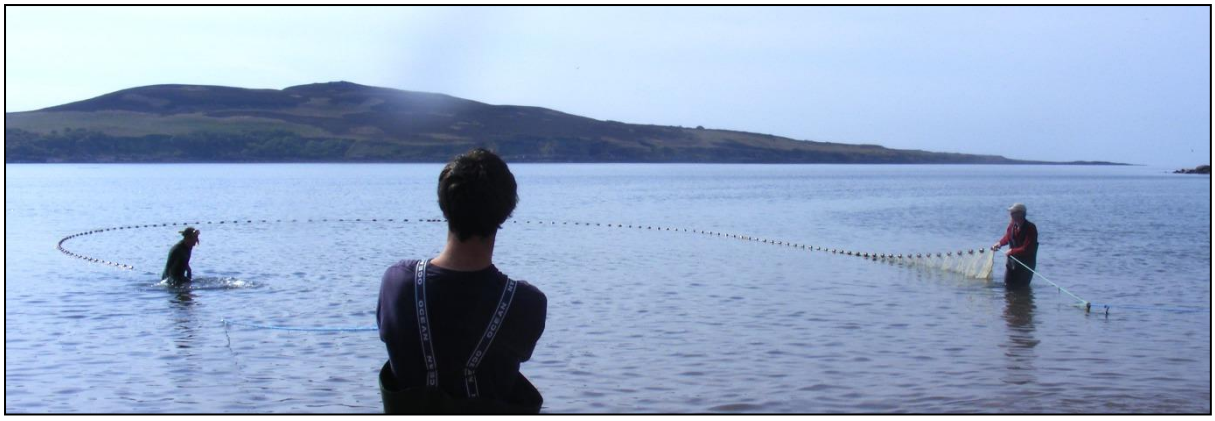
3.1.1 Sampling in the sea and tidal waters of Wester Ross

Samples of sea trout were taken using a sweep net, from north to south, in the River Kanaird estuary, Gruinard Bay, Loch Ewe, Loch Gairloch and the River Carron estuary. At the mouth of the Dundonnell River, a fyke net was used as in previous years. Sea trout were also taken using rod and line from the Sea Pool of the River Ewe in July 2012.

The methods used for catching fish and recording sea lice data follows the protocol adopted by the Scottish Fisheries Co-ordination Centre. Successful sweep netting is dependent on there being a suitable site where sea trout congregate over a shallow-shelving substrate without too many snags to catch the leadline of the net as it is pulled in. Some sites where sea trout have been successfully caught are in the estuary pools of rivers where fish gather as the tide goes out (e.g. River Carron sea pool). In contrast, several beaches further from river mouths have produced reliable, if usually somewhat smaller samples of sea trout, along with sandeels, sprats, wrasse and juvenile gadids (mostly pollack, coalfish and cod). Boor Bay and the Inverasdale shore (Loch Ewe), and Kerry Bay (Loch Gairloch) are examples of such sites. Supplementary samples of sea trout were taken using rod and line from lower pools of rivers (particularly the River Ewe) during the summer.

Following capture, fish were anaesthetised, measured, weighed and lice were counted by holding the immobilised fish underwater in a light coloured basin. Details of parasite infection (by the sea louse, *Lepeophthierus salmonis* and *Caligus* spp., and trematode fluke, *Cryptocotyle lingua*) were recorded, and many fish were photographed.

The sweep net being pulled in at Mungasdale on 23 May 2012.



3.1.2 Sampling in freshwater

The trout that were caught in freshwater using a fyke net or rod and line were processed in the same way as those caught in the sea.

3.2 Condition factor

This is a measure of the relationship between the length and weight of a fish. The formula used for samples of fish collected by WRFT is:

Condition factor = (weight [in grams] x 100) / (length [in cm]^3)

At the end of the winter, sea trout are usually thin, and typically have a condition factor of less than 0.90. After entering the sea they may grow quickly if there is abundant food.

Unusually plump sea trout with a condition factor of over 1.40 were recorded in July 2009.

Nall, 1926 also considers the condition factor of sea trout sampled in Loch Maree. Prior to the adoption of metric units, condition factor 'K', was based on the formula:

Condition factor (K) = (weight [in lbs] / (length [in inches]^3)) / 0.000427

For the purposes of comparing the condition factor of sea trout then with those caught in more recent years, the relationship between the 'imperial' condition factor and 'metric' condition factor is as follows [PS: this analyses will be included in a follow up report]:

Condition factor (metric) = Condition factor (imperial) 1.181952*

3.3 Specific growth rate

In 2012, several sea trout were recaptured within the WRFT area one or more times. For the purposes of comparing rates of growth of sea trout within the Wester Ross area at different times of year, and with those of sea trout taken elsewhere in the West of Scotland, the following formula was used to calculate the Specific Growth Rate [SGR]:

*SGR = ((ln(final weight [grams]) – ln(initial weight [grams]))*100)/time [days]*

3.4 Scale reading

Trout scales were read to determine the ages of respective fish. Trout scales were read by projecting their image onto a screen using an EyeCom3000 microfiche reader. Photographs of some scales were taken and are included in this report [Clearer pictures could be taken if required]. The on-line Sea Trout Scale Catalogue provides additional photographs of projected images of scales together with photographs of the fish they were taken from; follow links here. Otherwise, the method of reading scales follows that of Nall 1930, Walker 1980, and Cunningham 2011.

4. Results

4.1 Results of trout sampling in 2012

In total, 383 trout were processed from samples caught in the sea or in river estuaries in Wester Ross by WRFT in 2012. Appendix 1 provides details of all of these fish, including measurements and parasitic lice numbers.

Table 4.1 provides a chronological (first to last) summary of all the samples of sea trout taken by WRFT as part of its sea trout monitoring programme. Figure 4.1 shows freshwater levels recorded at the Tournaig trap by Loch Ewe in 2012. Table 4.2 presents the same data as in Table 1, but in geographic rather than chronological order, with the most northerly site at the top of the table.

Table 4.1 Summary information for sea trout sampled in coastal or estuarine waters around Wester Ross in 2012, in chronological order.

Date [2012]	Location	Method	Sample size (no. of fish)	Number of infected fish	Abundance (= average number of lice per fish)	Average number of copepodid & chalimus	Average number of preadults & adults	Prevalence (% of sample infected with sea lice)	Intensity (= average no. of lice per infected fish)	Note
11-Apr	Flowerdale	sweep	45	38	6.56	5.49	1.07	84.44	7.77	
9-May	Carron	sweep	5	4	78.00	43.60	34.40	80.00	97.50	
22-May	Flowerdale	sweep	40	7	1.35	0.35	1.00	17.50	7.71	
23-May	Mungasdale	sweep	1	1	27.00	10.00	17.00	100.00	27.00	
5-Jun	Kanaird	sweep	54	50	70.59	69.06	1.53	92.59	76.24	164 other trout caught
5-Jun	Carron	sweep	2	2	149.50	107.00	42.50	100.00	149.50	minimum estimate of lice
19-Jun	Inverasdale	sweep	2	2	11.50	4.00	7.50	100.00	11.50	
22-Jun	Flowerdale	sweep	2	2	12.00	8.50	3.50	100.00	12.00	
Jun - Jul	Dundonnell	fyke	76	71	41.92	37.20	4.75	93.42	44.87	lice total nos only for some fish
4-Jul	Boor	sweep	5	5	16.00	12.00	4.00	100.00	16.00	
5-Jul	Boor	sweep	4	4	9.25	8.00	1.25	100.00	9.25	
11-Jul	Ewe	r&l	15	14	25.00	11.50	13.50	93.33	26.79	Caligus av. 4.8/fish
12-Jul	Carron	sweep	9	9	34.78	21.11	13.67	100.00	34.78	all fish with fin damage
17-Jul	Kanaird	sweep	49	39	11.47	9.27	2.20	79.59	14.41	
20-Jul	Ewe	r&l	15	12	7.30	3.60	3.70	80.00	9.13	Caligus av. 0.5/fish
20-Jul	Flowerdale	sweep	10	10	41.90	26.20	15.70	100.00	41.90	
21-Aug	Flowerdale	sweep	1	1	4.00	0.00	4.00	100.00	4.00	
Aug	Dundonnell	fyke	22	16	5.77	4.30	1.46	72.73	7.93	
17-Sep	Flowerdale	sweep	8	7	4.38	0.00	4.38	87.50	5.00	
15-Oct	Flowerdale	sweep	14	4	0.57	0.00	0.57	28.57	2.00	

Figure 4.1 Water levels at the Tournaig trap by Loch Ewe in 2012

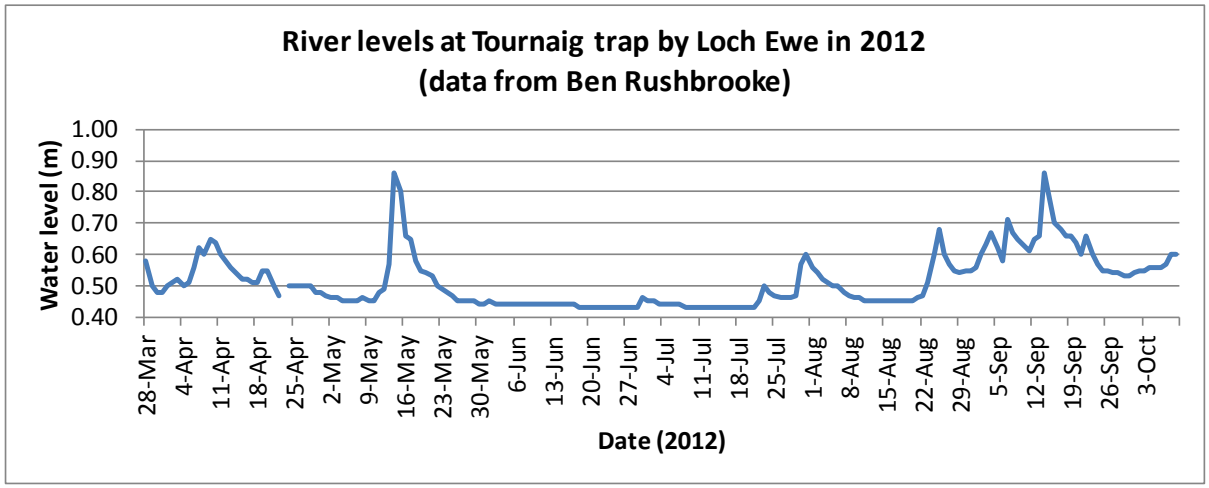


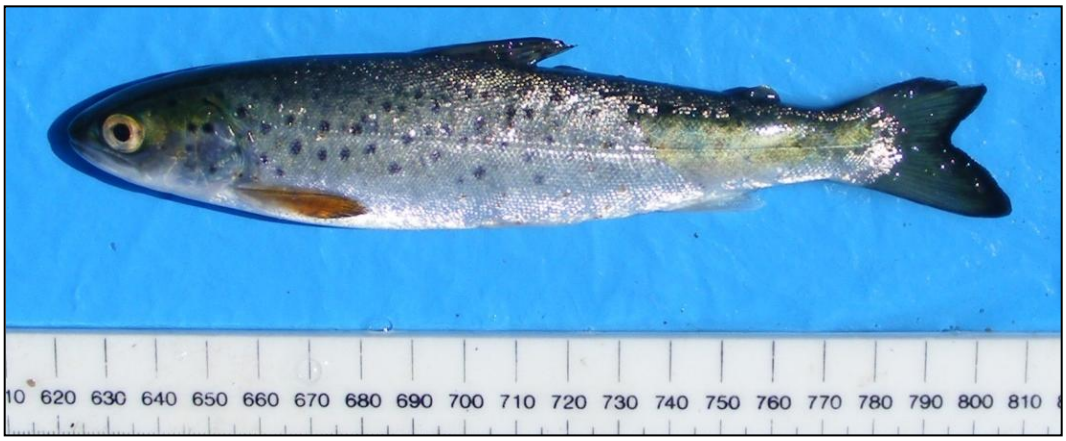
Table 4.2 Summary information for sea trout sampled in coastal or estuarine waters around Wester Ross in 2012, in geographic (north to south) order.

Date [2012]	Location	Method	Sample size (no. of fish)	Number of infected fish	Abundance (= average number of lice per fish)	Average number of copepodid & chalimus	Average number of preadults & adults	Prevalence (% of sample infected with sea lice)	Intensity (= average no. of lice per infected fish)	Note
5-Jun	Kanaird	sweep	54	50	70.59	69.06	1.53	92.59	76.24	164 other trout caught
17-Jul	Kanaird	sweep	49	39	11.47	9.27	2.20	79.59	14.41	
Jun - Jul	Dundonnell	fyke	76	71	41.92	37.20	4.75	93.42	44.87	lice total nos only for some fish
Aug	Dundonnell	fyke	22	16	5.77	4.30	1.46	72.73	7.93	
23-May	Mungasdale	sweep	1	1	27.00	10.00	17.00	100.00	27.00	
4-Jul	Boor	sweep	5	5	16.00	12.00	4.00	100.00	16.00	
5-Jul	Boor	sweep	4	4	9.25	8.00	1.25	100.00	9.25	
19-Jun	Inverasdale	sweep	2	2	11.50	4.00	7.50	100.00	11.50	
11-Jul	Ewe	r&l	15	14	25.00	11.50	13.50	93.33	26.79	Caligus av. 4.8/fish
20-Jul	Ewe	r&l	15	12	7.30	3.60	3.70	80.00	9.13	Caligus av. 0.5/fish
11-Apr	Flowerdale	sweep	45	38	6.56	5.49	1.07	84.44	7.77	
22-May	Flowerdale	sweep	40	7	1.35	0.35	1.00	17.50	7.71	
22-Jun	Flowerdale	sweep	2	2	12.00	8.50	3.50	100.00	12.00	
20-Jul	Flowerdale	sweep	10	10	41.90	26.20	15.70	100.00	41.90	
21-Aug	Flowerdale	sweep	1	1	4.00	0.00	4.00	100.00	4.00	
17-Sep	Flowerdale	sweep	8	7	4.38	0.00	4.38	87.50	5.00	
15-Oct	Flowerdale	sweep	14	4	0.57	0.00	0.57	28.57	2.00	
9-May	Carron	sweep	5	4	78.00	43.60	34.40	80.00	97.50	
5-Jun	Carron	sweep	2	2	149.50	107.00	42.50	100.00	149.50	minimum estimate of lice
12-Jul	Carron	sweep	9	9	34.78	21.11	13.67	100	34.78	all fish with fin damage

Sea trout sampled in the River Carron estuary in May and June 2012 carried the highest number of lice with an average of over 100 lice / fish for the six infected fish sampled. Sea trout carrying over 100 lice were caught in the Kanaird estuary, Dundonnell river estuary, River Ewe, Flowerdale (Loch Gairloch) and the River Carron estuary. All samples with high average numbers of lice were taken during periods when there was little freshwater entering sea lochs; the month of June and early July were particularly dry. Larval lice are assumed to have originated mainly on nearby salmon farms.

The lousiest fish of the year was a sea trout of 395mm taken in the estuary of the River Carron on 5th June 2012, with an estimated 700+ *Lepeophtheirus salmonis* lice. In terms of number of lice per unit body weight, 18 of the top 20 fish with the highest number of lice per gram of sea trout were taken in the Kanaird sweep on 5th June 2012; the other two were taken in the Dundonnell sweep net in June.

This post-smolt sea trout taken at River Kanaird estuary on 5th June had 170 small attached lice on it. At only 49g, it had the highest number of lice per unit weight of any sea trout sampled by WRFT in 2012. Note the loss of scales and tail damage associated with a bird attack.



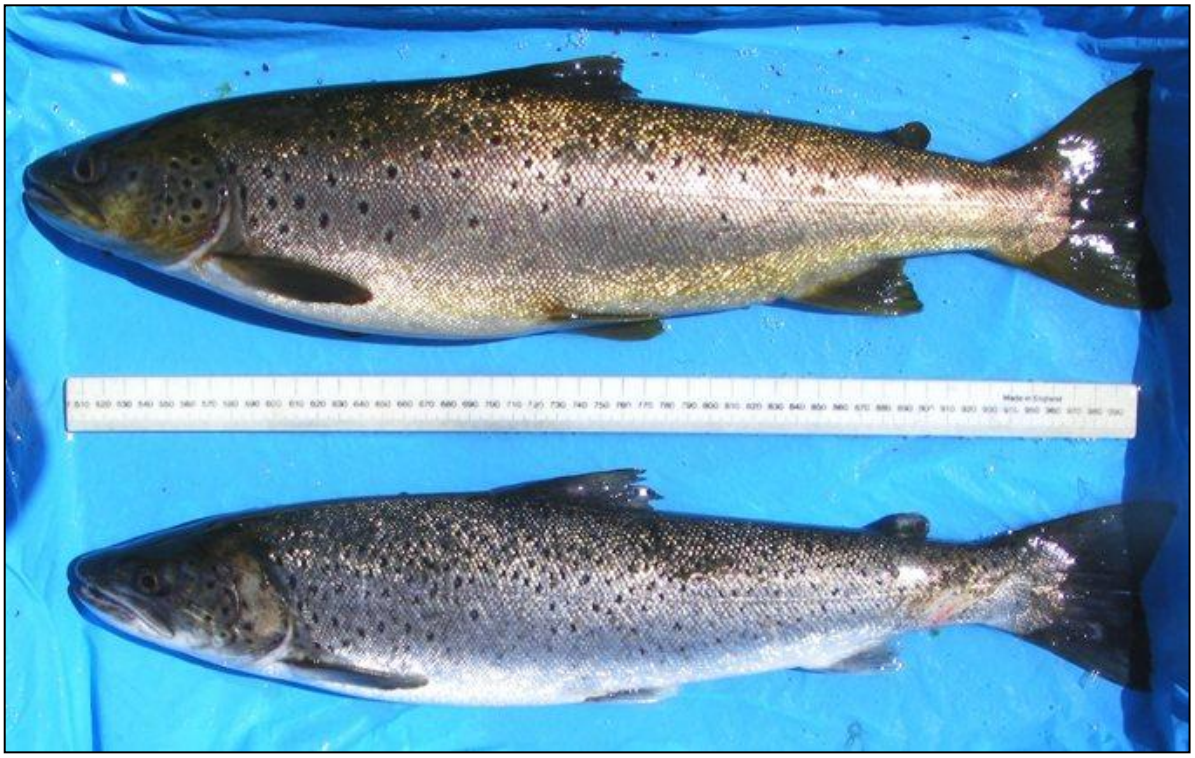
4.2 Site specific summaries

4.2.1 Kanaird

On the 5th June 2012, 218 sea trout were caught in the sweep net. Most of these fish were heavily infected with early stage *Lepeophtheirus salmonis* lice (salmon lice) indicative of infection by larval lice in nearby waters. A subsample of 39 fish of below 250mm in length (average length 174mm, average weight 56g) carried an average of 62 lice per fish. Larger fish of up to 520mm were caught; the heaviest fish *(in top of picture below)* had no lice on it, and was the fattest of the larger sea trout in the samples.

Sweep netting team at Kanaird river estuary on 5th June 2012.

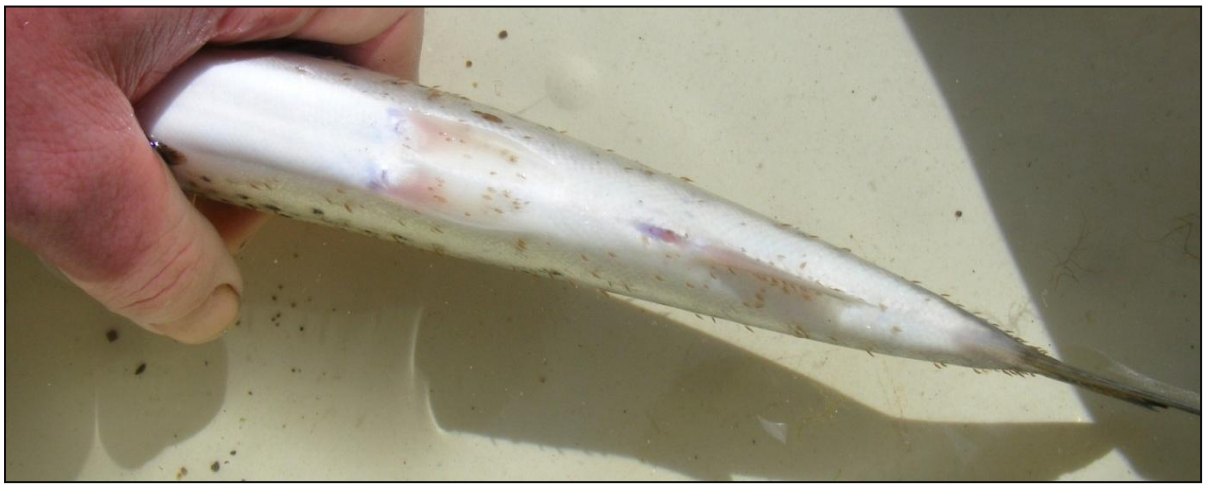
The two longest trout taken 5th June 2012. Note the difference in colouration and condition. The top fish was in much better condition (cf. 1.18), and had no sea lice on it; it may have been an estuarine trout. The lower silvery fish was thin (cf. 0.92), carried 78 lice and had a louse-damaged dorsal fin.



Two of the most heavily liced fish in the sample taken on 5th June 2012 are shown below.

Kanaird 5th June 2012: Sea trout 250mm, 240 lice counted & parasite in vent (Acanthocephalus sp.)

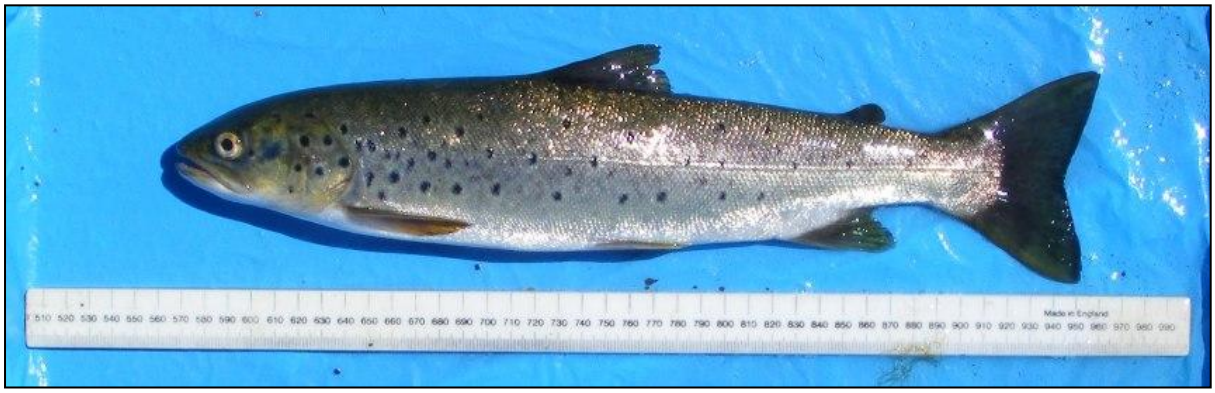
Kanaird 5th June 2012: Sea trout 263mm, 180 lice recorded.



On the 17th July 2012, 49 sea trout were taken in the sweep. 32 of these fish were less than 250mm in length. This sub-sample of fish was of average length 209mm and had an average lice count of 6.9 lice per fish. Nearly all the fish had black spotting indicative of earlier infection by small lice.

The average weight of fish in this subsample of post-smolt sized fish, at 100.5g, was almost twice that of the 5th June subsample. Six of the fish taken on 17th July had condition factors of over 1.2; none of the fish taken on 5th June were as fat as this. That some of the fish had grown and lost many of the sea lice that had infected them between the 5th of June and 17th July is confirmed by the recapture of a larger sea trout, shown below; it can be recognised by its spot pattern.

Sea trout, fish K1, of 375mm, 532g (cf. 1.01) taken in the Kanaird sweep on 5th June 2012 with 120 chalimus lice.



The same sea trout, K1, taken in the Kanaird sweep on 17th July 2012, now 390mm and 640g (cf 1.08), with only 10 lice.

One of the fish taken on 5th June 2012 regurgitated a sandeel as it was being processed. The occurrence of sandeels may have provided infected sea trout attempting to rid themselves of sea lice in freshwater in or near the river estuary with feeding opportunities.

4.2.2 Dundonnell

The Dundonnell fyke net trap was set in the sea pool of the Dundonnell River at its usual place *(below)* by Alasdair MacDonald of Dundonnell Estate assisted by Sally Clements from early June 2012, and checked each day (Monday – Saturday; the trap was lifted on Saturday night so as not to fish on Sunday). Samples of fish were also taken using the trap in July and August.

Between 6th June and 27th June, the trap caught 74 sea trout. The average number of lice on sea trout in June was 50.4 lice per fish, of which an average of 44.1 lice were copepodid and chalimus stage. 32 of the sea trout were between 130mm and 247mm in length, of post-smolt size. These fish carried an average of 39.2 *Lepeophtheirus salmonis* lice. Most of the lice were copepodid and chalimus stage with an average of 35.1 lice per fish (range 0 to 187).

Larger sea trout ranged in size from 279mm to 490mm in June. In August a sea trout of 530mm *(below)* was caught. This was the largest sea trout taken in the WRFT area during the sampling programme in 2012. The dorsal fins especially of larger fish were badly damaged by sea lice *(above),* with an average dorsal fin damage score (on scale of 0 to 3[where no fin remains]) of 1.3 for fish of 310mm or larger. However, despite high numbers of lice, many of the sea trout were fat with condition factors of up to 1.36. The average condition factor of larger fish of 310mm+, at 1.12, is indicative of good feeding. This is considered further in part 4.3.2.

The largest sea trout recorded in the WRFT area in 2012, a male trout of 530mm, 1826g, condition factor 1.23, with only two lice. Note however, the raw, louse damaged dorsal fin indicative of heavy louse infection earlier in the summer.

4.2.3 Gruinard

Three sweep netting expeditions were undertaken at Gruinard Bay in 2012. The first of these at Mungasdale Bay at low tide on 23rd May was the only successful one for sea trout; one sea trout was caught, a fish of 520mm with 27 *Lepeophtheirus salmonis* lice and 2 *Caligus elongatus* lice. From its spot pattern, this fish was recognised as one of those taken in June 2011 at the same site *(shown below).*

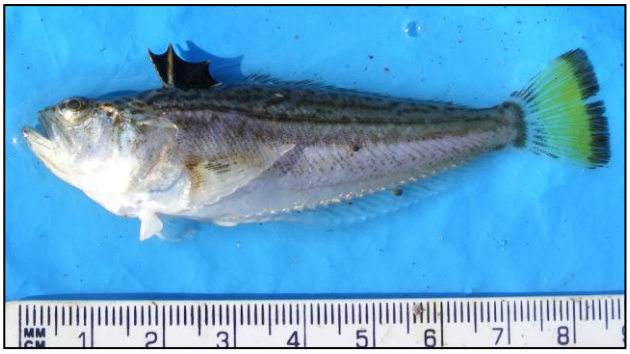
Sea trout, fish G1, 465mm, 1016g (cf. 1.01), taken at Mungasdale Bay on 15th June 2011. This fish had 31 lice: (0 chalimus, 14 pre-adult and adult lice and 17 ovigerous females).

The same sea trout, G1, caught at Mungasdale Bay on 23rd May 2012, 520mm, 1167g; condition factor 0.83 (still rather thin) with 27 Lepeophtheirus salmonis lice (10 chalimus, 7 adults and pre-adults, 10 ovigerous females) and 2 Caligus elongatus.

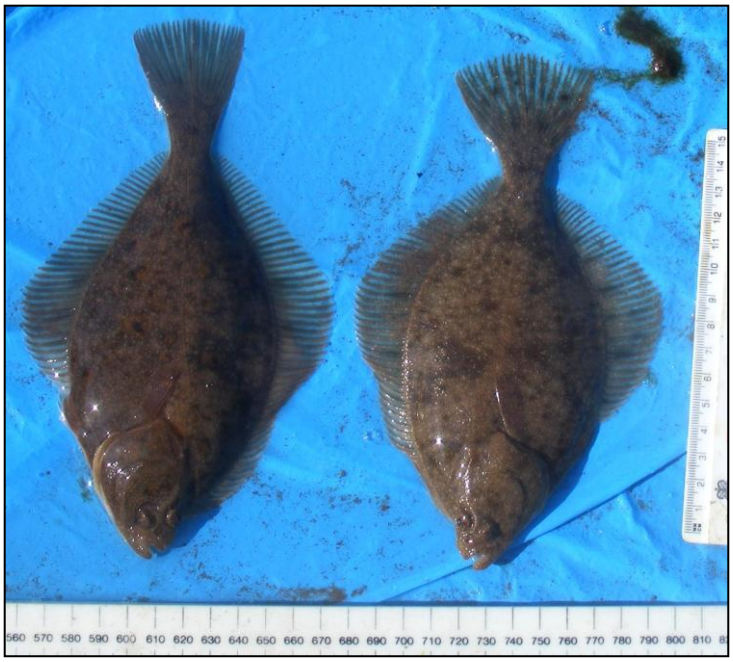
Much effort went into sweep netting that day, and on a subsequent sampling expedition to Mungasdale Bay at high tide on 6th July (no sea trout were caught); and Inverianvie Bay on 12th June 2012, when 4 sweeps were taken of the mouth of the Inverianvie River over high tide in difficult conditions with an onshore wind (again without catching a sea trout).

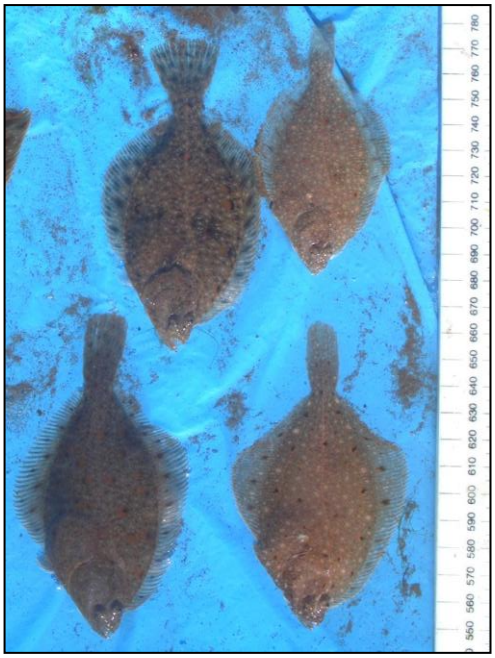
Conclusions: low tide and light winds are best for sampling at Mungasdale. PC proposes to explore other parts of the Gruinard Bay shore with kayak prior to sweep netting in 2013.

In addition to the one sea trout, the catch on 23rd May comprised: sandeels (one of 115mm measured; many others seen escaping through holes in net); 3-spined stickleback; juvenile coalfish; and 4 lesser weever fish – one of which is shown below (note dorsal fin which has poisonous spine).



Twenty five juvenile flatfish were also caught, ranging in size from 32mm to 235mm. These varied in markings. All but one were 'right-eyed'; the 'left-eyed' flatfish is shown together with a right-eyed flatfish *(below).* Most of these fish were thought to be juvenile plaice; though some may have been juvenile flounder or plaice-flounder hybrids . . . . (?)





The sweep netting team by Mungasdale on 6th July 2012. No trout were caught on that occasion, just juvenile flounders / plaice.

4.2.4 Loch Ewe

Three sweep net sessions took place at **Boor Bay** in 2012.

On 6th June, 2012, seven sweeps of the beach were made over high tide without the capture of a sea trout. One sea trout was seen jumping within 30m of the net. No sandeels were seen, 3 corkwing wrasse were caught.

On 4th July 2012, 7 sea trout were caught, ranging in length from 181mm to 251mm. There were few lice on these fish, except the fish of 251mm which carried 61 *Lepeophtheirus salmonis* lice, and 4 *Caligus elongatus*.

This fish was killed and dissected: 15 small sandeels were found in its stomach *(left).*

On 5th July, the beach was swept 7 times. Four sea trout were caught, ranging in size from 166mm to 197mm. The smallest fish carried 20 *L. salmonis* and 3 *Caligus elongatus* lice. Other fish had less than 10 lice each. A salmon of about 8lb was also caught and released (too big for our buckets!).

Around the spit at **Inverasdale** on **19th June 2012**, two sea trout were caught, of 181mm and 280mm. The larger fish carried 20 *L. salmonis* and 5 *C. elongatus* lice; the smaller fish carried 3 *L. salmonis* and 3 *C. elongatus*. A shoal of larger 20cm long sandeels was seen, and other fish taken in the net included small coalfish of less than 10cm long, and a large 20cm sea scorpion.

The sweep netting team, and Tournaig Estate's all terrain vehicle on the Inverasdale spit. Thank you to Hugo van Vredenberg for use of this vehicle over many years, and volunteers Andy Hollis (left of Garry B and Roger M), and Rob and Mike from the Nineveh Trust (not in picture) for help on 19/6.

River Ewe

Early returned finnock carrying high numbers of sea lice were reported by keeper Ray Dingwall in the Sea Pool in the first week of June 2012.

On 4th June, two sea trout were caught with rod and line. The largest fish was 305mm, 322g and carried 12 *L. salmonis* lice (including 7 pre-adults and adults); the other, a finnock: 285mm, 240g; 100 chalimus lice; 2 pre-adult and adult lice; with an eroded dorsal fin *(below).*

Post-finnock of 285mm, 240g with 102 L. salmonis lice taken in the sea pool of the R. Ewe on 4th June 2012 using rod and line.

On 11th July, 15 sea trout were caught in the Sea Pool, ranging in length from 218mm to 273mm. These early finnock had fed at sea, though with an average condition factor of only 1.06 (range 0.87 – 1.23), they were thin for the time of year. They carried an average of 27 *L. salmonis* lice per fish (range 0 to 123) and six of them had damaged dorsal fins. Some of these fish also carried *Caligus elongatus* lice; mostly 1 – 3 lice per fish. However on a sea trout of 230mm, 28 *Caligus elongatus* lice were seen together with 15 *L. salmonis*. This is the first sea trout sampled by WRFT which has carried a higher number of *C. elongatus* than *L. salmonis*.

On 20th July, another 15 sea trout were caught in the Sea Pool, ranging in length from 224mm to 271mm. These fish were fatter than those taken 9 days earlier, with an average condition factor of 1.15 (range 1.01 – 1.43). Lice levels were lower on these fish than on the sample taken earlier in July, with an average of 9 *L. salmonis* per fish (range 0 to 20).

Loch Ewe & River Ewe summary

Lice levels on some of the sea trout sampled at Boor Bay and in the River Ewe in June and early July 2012 were high enough to adversely affect the health of sea trout. However, the size range of finnock taken in the River Ewe in the 2nd and 3rd week of July demonstrated reasonable growth of post-smolts. As in some previous years, it is not clear whether the fish taken in the River Ewe in July were genuine 'early' returns, or the normal finnock runs. Of the sample taken on the 20th July, the larger average size and higher average condition factor compared to the sample taken on 11th July suggests that these were not the same fish that had been sampled 9 days earlier, but were more recent arrivals from the sea into the River Ewe that had fed a better and experienced lower sea lice infection pressure.

4.2.5 Loch Gairloch

In 2012 samples of sea trout were taken with the sweep net in Flowerdale Bay on 11 April, 22 May, 22 June, 20th July, 21st August, 17th September and 15th October. An earlier sweep in March was unsuccessful, possibly due to the net being set a little too late in the tide (after the sea trout had left the netting area). The seasonal pattern of catches was similar to previous years; many over-wintered sea trout were taken in the April sweep and most of these were over-wintered finnock (i.e. sea trout which had gone to sea for the first time in 2011); in May small post-smolt sea trout dominated the catch; in June and July and August only a handful of sea trout were caught, then in September and October, larger numbers of fish were taken including both immature and maturing sea trout.

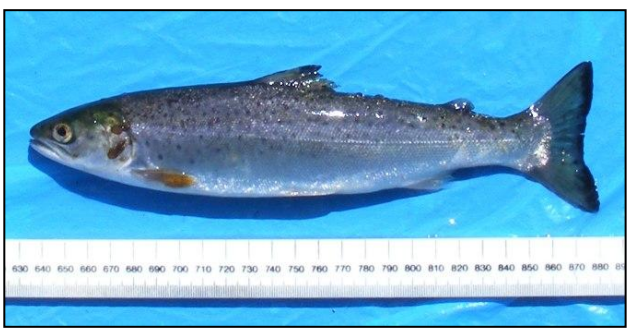
On **11th April 2012**, 46 sea trout were processed from a catch of 62 fish. The largest of the 46 fish processed was 465mm in length (a recaptured trout) and the smallest, a fish of 201mm (an overwintered finnock). Sea trout were thin with an average condition factor of 0.85. Of interest, the best conditioned fish was the largest, recaptured 'fish B' with a condition factor of 1.05 [see later]. The thinnest fish had a condition factor of only 0.65.

The average number of lice per fish was 6.56 (range 0 to 35 lice per fish). 21 of the 46 fish had dorsal fin damage associated with sea lice infection; indicative of higher levels of louse infection in 2011. These included both 1+ (over-wintered finnock) and older fish.

On 22nd May, 90 sea trout were caught of which 40 were retained for processing. The 50 fish that were returned were mostly small post-smolts. Of the 40 that were retained, all except 3 were post-smolts of less than 20cm. Only 12 fish carried sea lice; the largest fish, 'Fish B' carried 34 lice of which 30 were pre-adults and adults. None of the other fish carried more than 10 lice; and most of the post-smolt sea trout carried no lice. Only 13 fish had *Cryptocotyle ligua* spots indicative of residence within the sea. As in previous years it was concluded that a majority of the post-smolt sea trout had migrated down to the sea from the Flowerdale burn only a few days earlier.

On 26th June, only two trout were caught, however one of them was the large male trout recaptured (see 'growth of Squaretail'). This fish carried 17 *L. salmonis,* including 4 ovigerous females, and also 4 *Caligus elongatus*.

On 20th July, ten trout were caught. All fish were heavily infected with *L. salmonis* lice, and the average lice count was 41.9 per fish. Seven of these fish were small post-smolt sea trout of less than 200mm; if these are grouped together with the fish of 245mm, the subsample of post-smolts has an average lice count of 27.8 lice per fish. The largest fish, 'Fish B', recaptured for the 5th time, carried 104 lice (82 chalimus, 20 pre-adults and adults, and 2 ovigerous females). This sample was taken following a prolonged drought.



Flowerdale sea trout of 245mm, 148g, with 88 L. salmonis lice (53 chalimus, 34 pre-adult and adult, 1 ovigerous female). Note the tatty, louse-damaged dorsal fin.

On **21st August 2012,** only one sea trout was taken; this fish carried only 4 lice.

On **17th September,** ten trout were taken. These fish ranged in size from 169mm to 520mm. One maturing male fish ('Squaretail' recaptured again!), and three other female trout of 420mm, 430mm and 495mm were in pre-spawning colouration. Eight of the nine sea trout carried sea lice; in contrast to the July sample the average was only 4.86 *L. salmonis* lice per infected fish. The four largest trout had dorsal fin damage associated with sea lice infection, indicating higher lice levels earlier in the summer before the autumn rains. In addition to the sea trout, two adult salmon were taken: these were too big for our buckets so were returned following scale sampling.

The two salmon caught at the mouth of the Flowerdale burn on 17th September 2012. Both fish are hen salmon of estimated lengths 700mm & 725mm. Both fish are 2 sea winter fish, with eroded scale margins; one was a ?three year old smolt. Salmon fry were recorded in the Flowerdale burn in 2008; an electrofishing survey in 2013 may confirm whether salmon spawned in the burn 2012.

On **15th October 2012**, 14 sea trout were caught with the sweep net in the Flowerdale estuary. Fish ranged in length from 253mm to 432mm. The three largest female trout were in spawning condition, and were 393mm, 410mm and 432mm in length respectively. However a trout of 396mm was not noted to be in spawning condition although slightly bronze in colour. Subsequently she has been recognised as a recaptured fish, previously taken on 11th April 2012 as a 265mm over-wintered finnock. This fish, 'Fish F', in the subsequent section on recaptured trout *(Box 4.1)* is the fastest growing of all the Flowerdale sea trout that have been recaptured to date (see part 4.3)

During the afternoon of 15th of October 2012, electro-fishing equipment was used to find out if any sea trout were present in the nearby Flowerdale burn. The first sea trout encountered was 'fish B', now 495mm, recaptured for the 7th time, and about to spawn. Two other mature sea trout and a finnock were also recorded in the lower part of the burn, including another fish, 'fish E', which was subsequently recognised as one of those taken in the estuary earlier in the year.

Female sea trout and mature male brown trout from the Flowerdale burn on 15 October 2012. These fish spawn together.

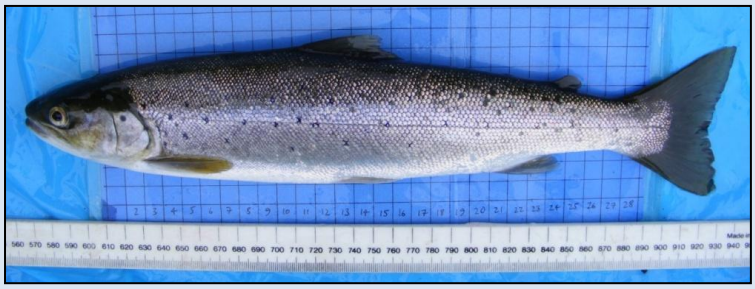
Thus, we've been able to confirm that at least some of the largest sea trout that are caught by the sweep net in the Flowerdale estuary do indeed enter the Flowerdale burn in spawning condition, and are therefore part of a trout population which is comprised of both brown trout and sea trout.

Tidying up after a sweep netting session at Flowerdale estuary, 22 June 2012.

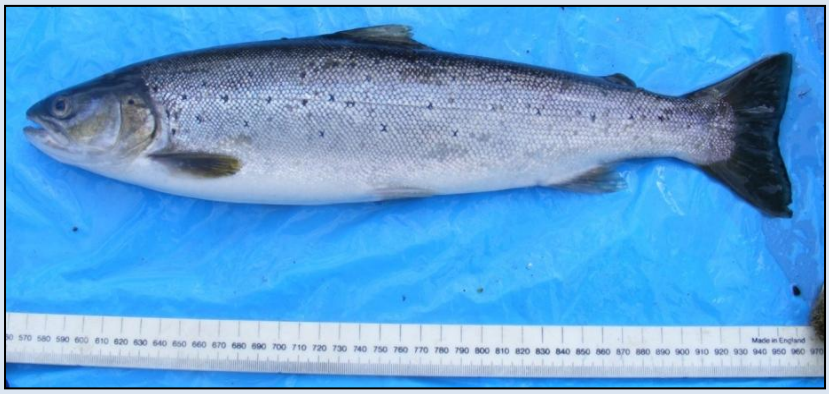
Box 4.1 Growth of some recaptured Loch Gairloch Sea trout

Growth of Fish B, a female sea trout in Loch Gairloch

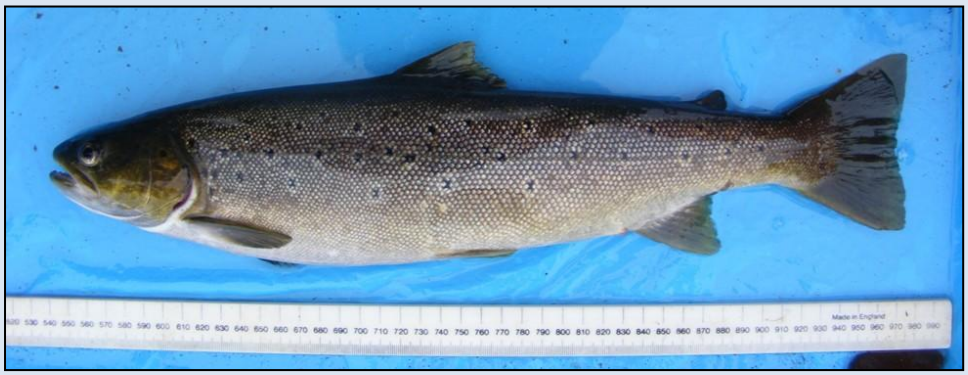
Flowerdale estuary, 18th March 2011: 350mm, 416g, condition factor 0.97.



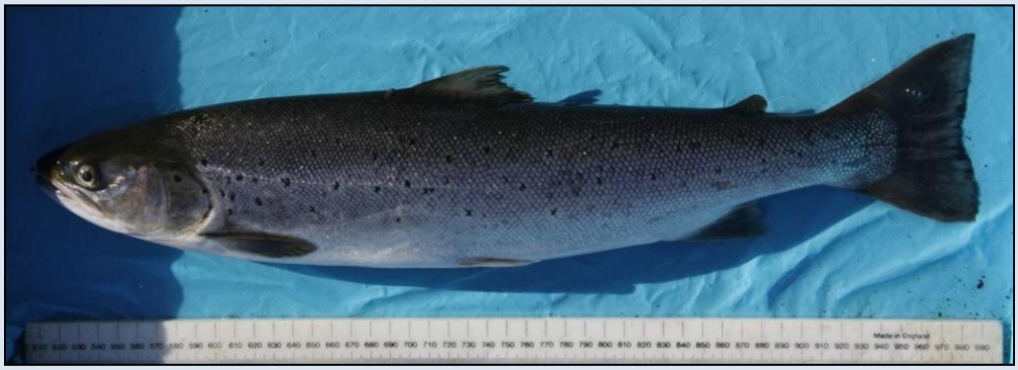
Flowerdale estuary, 14th June 2011: 382mm, 622g, condition factor 1.03 (photo P. Maguire).



Flowerdale estuary, 27th September 2011: 425mm, 828g, condition factor 1.08, in spawning colours.



Flowerdale estuary, 11th April 2012: 465mm, 1060g, condition factor 1.05.



Box 4.1 (continued)

Growth of Fish B (continued)

Flowerdale estuary, 22nd May 2012: 485mm, 1070g, condition factor 0.94 (5th time of capture).

Flowerdale estuary, 20th July 2012: 495mm, 1205g, Condition factor 0.99; 82 chalimus lice, 20 pre-adults and adults; 2 ovigerous females; lice damage to dorsal fin score 0.5.

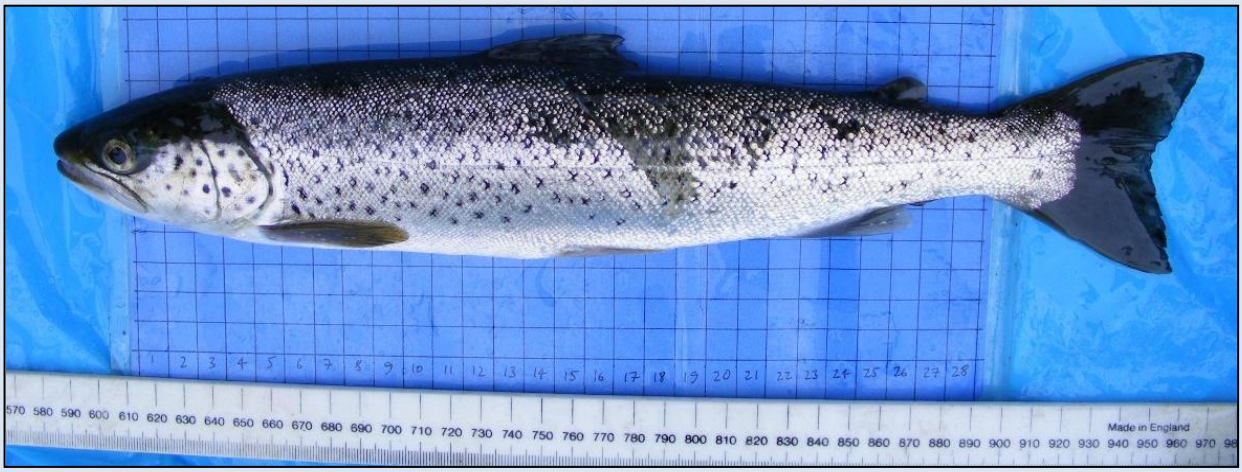
Flowerdale burn, 15th October 2012: 495mm, 1318g; condition factor 1.09. No sea lice.

Box 4.1 (continued)

Growth of Fish D, 'Squaretail', a male sea trout caught 5 times by the WRFT sweep netting team in Loch Gairloch, from March 2011 to September 2012 [updated from news item on www.wrft.org.uk]

The following pictures are of a wild sea trout that was caught five times with the WRFT sweep net in Loch Gairloch. Each time the fish was caught, it was anaesthetised, a scale sample was taken, a photograph was taken, and the fish was returned to the water following recovery. The fish was recognised by its spot pattern. When first caught in April 2011, the fish had a damaged pectoral fin and other predator damage ('beak' mark), and dorsal fin damage associated with earlier sea lice infection. The trout survived for at least another 16 months following its initial capture, growing from less than 1lb (455g) in weight to over 3lb (1365g) during this period. The fish suffered further predator damage to its tail between September 2011 and April 2012. Note the seasonal changes in colouration from silvery during the spring and early summer to bronze (spawning colouration) by September in both years.

18 Mar 2011: *355mm, 380g; deformed right pectoral fin; note scale loss attributed to beak damage. Lepeophtheirus salmonis lice counts: 3 copepodid & chalimus, 5 preadult & adult, 3 ovigerous female; dorsal fin slightly eroded. The scale reading suggests that the trout had already spawned twice (see page 25).*



27 Sept 2011: *455mm, 933g; Lepeophtheirus salmonis: 0 c&c, 2 pa&a, 0 of.*

Box 4.1 (continued)

Growth of Fish D, 'Squaretail', a male sea trout caught 5 times by the WRFT sweep netting team in Loch Gairloch, from March 2011 to September 2012 (continued)

11 Apr 2012: *465mm, 948g; Lepeophtheirus salmonis: 2 c&c, 0 pa&a, 0 of.*

22 June 2012: *487mm, 1154g; Lepeophtheirus salmonis: 10c&c, 3 pa&a, 4 of; 4 Caligus*

17 Sept 2012: *520mm, 1512g; Lepeophtheirus salmonis: 0 c&c, 4 pa&a, 6 of.*

Box 4.1 (continued)

Growth of Fish D, 'Squaretail', a male sea trout caught 5 times by the WRFT sweep netting team in Loch Gairloch, from March 2011 to September 2012 (continued)

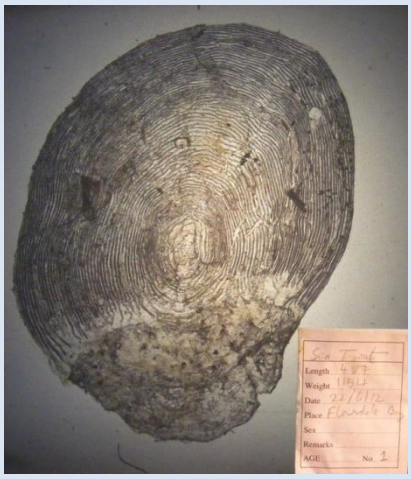
Scale reading

Scale samples from Fish D were taken on each of the occasions when the fish was caught. However, some of the scales are 'replacements'. Only three samples have produced a scale from which the life history following an initially migration to the sea can be deduced; and none of the samples have circuli dating back to when the trout was a fry. I think two spawning marks can be seen on the scale for 18th March, following one good summer at sea (or possibly two summers at sea). If the trout was a three year-old smolt when it went to sea for the first time, I suggest it hatched from an egg during the winter of 2006, went to the sea for the first time in 2009 and spawned in the autumn of that year, and again in 2010 and 2011.

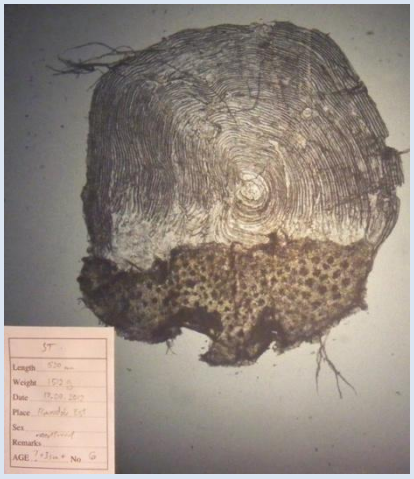
To see the annuli, zoom to 400% and let me know what you think (at info@wrft.org.uk).

18 March 2011

22 June 2012



17th September 2012



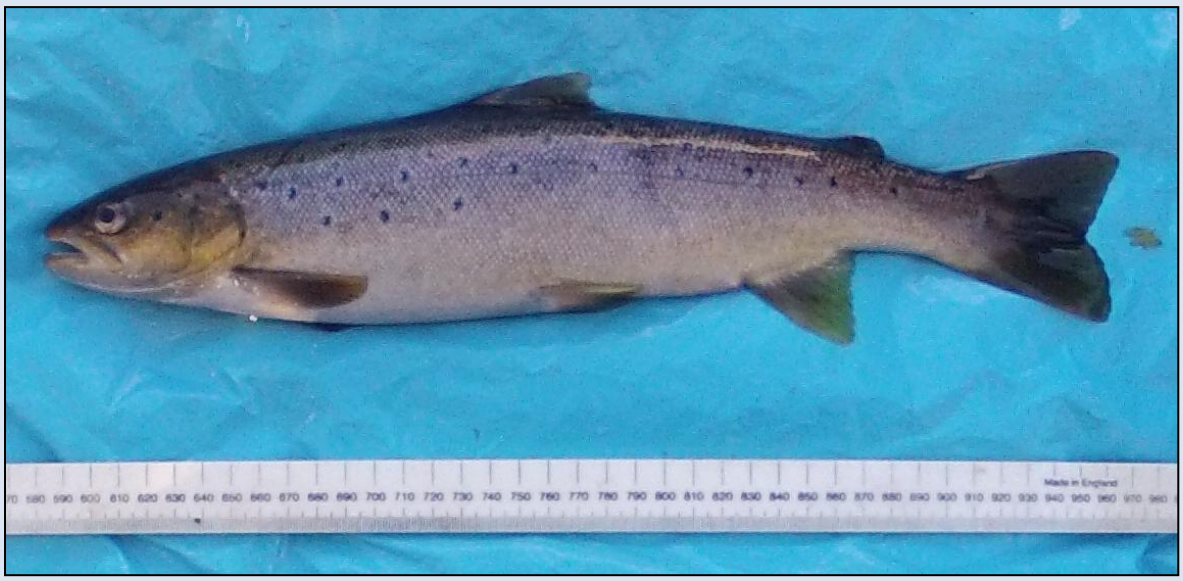
'Squaretail' recovering in the sea following its fifth capture on 17th September 2012.

Box 4.1 (continued)

Growth of 'Fish E', a female sea trout from the Flowerdale burn

Flowerdale estuary, 27 September 2011: 270mm, 185g, 0.94, just 2 ovigerous L. salmonis lice

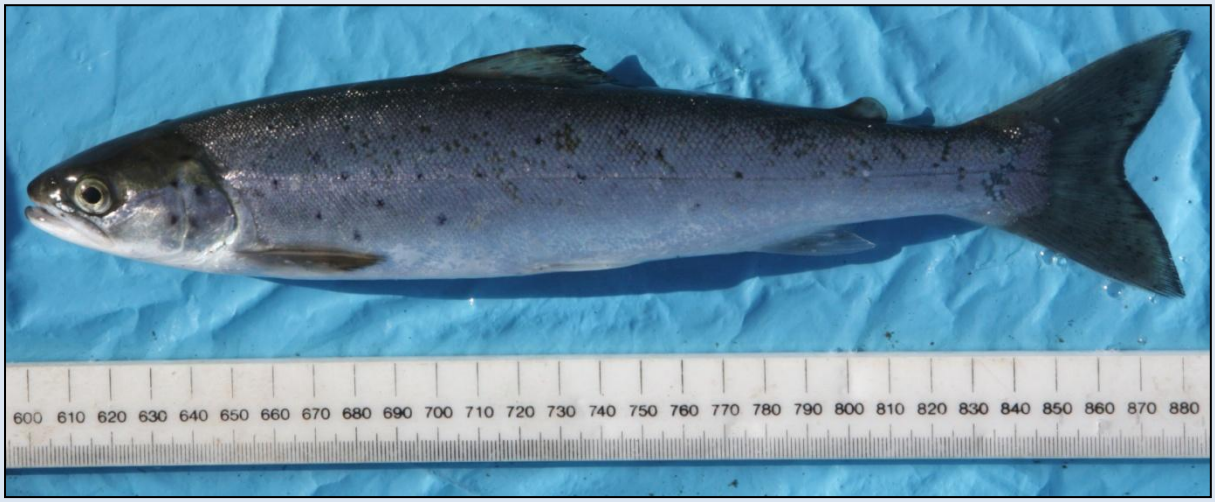
Flowerdale burn, 15 October 2012: 370mm, 395g, condition factor 0.78 [p.s. looks fatter than that- the scales must have been wobbly!], 1 adult L. salmonis sea louse.



Box 4.1 (continued)

Growth of 'Fish F', female sea trout from the Flowerdale estuary

***F**lowerdale estuary, 11th April 2012, 265mm, 168g; condition factor 0.90; 10 chalimus lice; 8 C. lingua spots/cm^2 tail.*

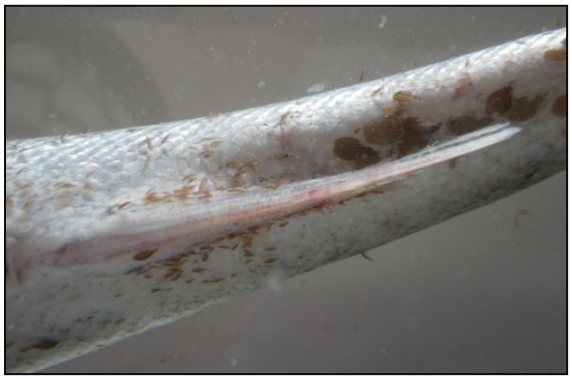


Flowerdale estuary, 15th October 2012, 396mm, 656g, cf. 1.06; dorsal fin damage 1; 10 C. lingua spots/cm^2 of tail. Initially the fish was recorded as a male; from the photograph I think it is an immature female. This is the fastest growing recaptured sea trout so far recorded in the WRFT area, with a Specific Growth Rate of 0.732 over the 186 days since it was first captured.

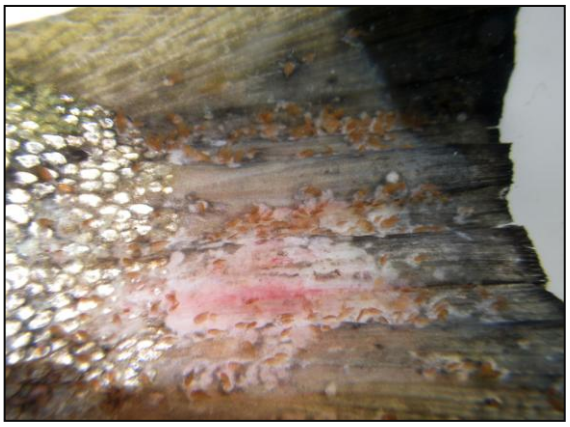
4.2.6 River Carron estuary

On 9th May 2012, five sea trout were caught, and on **5th June** 2 sea trout were caught with the sweep net in the sea pool of the River Carron. Although numbers of fish were small, the fish sampled were more heavily infected with sea lice than those at any other sites sampled in 2012 (see Table 4.1). The most heavily infected fish is shown below. The high lice numbers on these fish are indicative of high sea lice infection pressures in nearby waters in April and early May 2012.

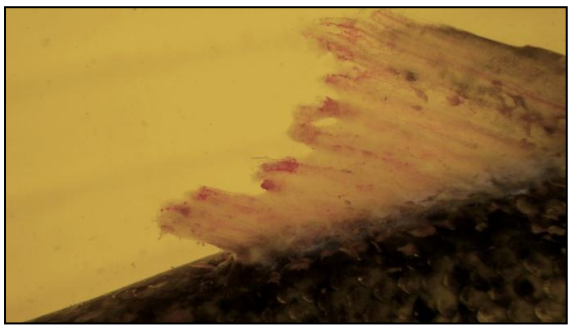
Carron sea trout 395mm 5th June 2012 (pictures by J. Tosney). The field data sheet recorded 200+ chalimus lice and 40+ adult and pre-adult lice.



Picture 1 (zoom to view): part of the underside of this fish (including around the ventral fin). I can count over 100 chalimus & copepodid (attached stage) lice and 10 pre-adult lice in this picture.



Picture 2: one side of the tail. ~200 attached lice (chalimi or copepodids) can be seen.



Picture 3: part of the dorsal fin. There are at least 40 small chalimus lice in the picture . . .

Conservative total lice estimate for whole fish based on these photographs: 700+ copepodid and chalimus lice; 30+ pre-adult and adult lice. Therefore, 730+ lice in total, the most heavily louse-infected sea trout recorded by WRFT to date.

On 12th July, 9 sea trout were caught in the Carron sweep, ranging in size from 209mm to 425mm. Lice numbers varied from 2 lice (on the largest fish) to 85 lice per fish. Both of the two largest fish (of 310mm and 425mm) had a dorsal fin damage score of 3, indicating that over 2/3 of the dorsal fin was louse damaged.

4.3 Factors affecting sea lice occurrence and sea trout growth in Wester Ross in 2012

4.3.1 Sea lice occurrence on sea trout

Sea trout at sampling sites in the **Kanaird and Dundonnell river estuaries** carried high numbers of early stage *L. salmonis* chalimus lice in June 2012, indicative of recent infection in nearby waters.

Wester Ross Fisheries Ardmair and Ardessie salmon farms are within 5km of the Kanaird and Dundonnell river estuaries respectively. Farmed salmon were transferred from Ardmair fish farm to Ardessie salmon farm in late April 2012 (Cunningham, 2012[1]). Prior to transfer, a small sample of these fish taken at Ardmair fish farm on 20th April 2012 had 0.6 ovigerous female lice per fish. On 11th July, a sample of these salmon at the Ardessie salmon farm had an average of 0.8 ovigerous female lice per fish (Cunningham, 2012[2]). Although these figures are close to the Code of Good Practice thresholds for recommended sea louse treatment and therefore not of great concern to the welfare of farmed salmon, given the total number of farmed salmon [estimated number of farmed salmon at Ardmair and Ardessie farms in April – May 2012: more than 250,000 fish] the infection pressure from larval lice emanating from farmed fish would have been one or more orders of magnitude higher than from larval lice from wild fish [based on an estimated population of wild salmon and sea trout carrying lice in the Loch Broom area in April – May 2012 of less than 5,000 fish]. Other salmon farms in the area (WRF Corry, and Scottish Sea Farms Summer Isles farms) were in the first year of the production cycle in spring 2012, and visits to these farms (20th April and 18th June respectively) indicated very low levels of *L. salmonis* on farmed salmon at these farms. The ovigerous louse population on farmed salmon at Ardmair and Ardessie is therefore considered to be the most likely source of larval lice which infected the sea trout sampled at Kanaird and Dundonnell in 2012.

Sea trout, 365mm, 538g, cf. 1.11, with 72 L. salmonis lice and lice-damaged dorsal fin, at Dundonnell on 21 June 2012 (S. Clements)

Some of the sea lice on sea trout recorded on sea trout in **Loch Ewe** and on early returned finnock in the **River Ewe** from early June may have originated out with the loch. The Marine Harvest Isle Ewe salmon farm was in the first year of the farmed salmon production cycle, and although *Caligus* lice were seen on farmed salmon on a visit to the farm on 15th June, no *L. salmonis* were seen. One possibility is that some of the lice on wild sea trout in Loch Ewe area originated from the Loch Broom area.

The high numbers of sea lice, both attached and mobile lice, on sea trout taken in **Loch Gairloch** on 20th July is less easily explained. Lice may have originated from areas several 10s of km away Loch Gairloch. The nearest salmon farms in Loch Torridon were in the first year of the production cycle.

The sea trout carrying very high lice numbers in the **River Carron** estuary in May and June are indicative of high infection pressure in nearby waters. The nearest salmon farm operated by the Scottish Salmon Company is at mid-Strome. Lice figures have not been seen. The WRFT biologist was unable to visit the farm. At the Scottish Sea Farms sites in Loch Kishorn, lice figures release under FoI indicated that adult female lice numbers were close to or slightly above Code of Good Practice levels up to February 2012.

Early May 2012 was the wettest on record at Tournaig, with large amounts of freshwater entering Loch Ewe. However, in late May and early June there was little rainfall, and by the end of the month, drought conditions prevailed across Wester Ross making it increasingly difficult for sea trout to evade infectious lice by remaining largely within freshwater within sea lochs.

4.3.2 Food and feeding

Despite high levels of sea lice on sea trout in some areas, many sea trout fed well during the summer of 2012. Sandeels were regurgitated from small sea trout sampled in June in Loch Ewe and at the mouth of the River Kanaird estuary. Larger sandeels were seen by the snorkeler at Mungasdale (Gruinard Bay) in late May, and from Inverasdale beach and Boor Bay (Loch Ewe) in June and July.

The fattest sea trout were recorded at the mouth of the Dundonnell River in Loch Broom in July 2012 with condition factors of some fish of over 1.3. One explanation for the high condition factor of these fish, despite high sea louse infection, was the occurrence of large shoals of sprats in Little Loch Broom. Sprats were seen caught by the gills in salmon cage nets at Ardessie on 11th July, and were caught in the fyke net at Dundonnell on 25th July and photographed by Alasdair and Sally (see below). The sprats were pursued by large shoals of mackerel; pods of common dolphins were also seen in Little Loch Broom where they were thought to be mainly pursuing mackerel shoals.

An abundance of sprats and sandeels in shallow margins and at the head of sea lochs has been associated with mackerel shoals in previous years. In July 2009, some of the fattest sea trout seen to date by WRFT biologist were caught in a sweep at Kerry Bay (Loch Gairloch) together with some of the mackerel. Mackerel shoals may be of importance for Wester Ross sea trout so far as driving food fish into shallow and brackish parts of the sea lochs where sea trout are able to feed without venturing too far from freshwater or kelp beds. The sea trout of Little Loch Broom have been known for their relatively fast growth for many years (e.g. Butler, 2002); and in 2012 there was clearly a large amount of food fish in the loch.

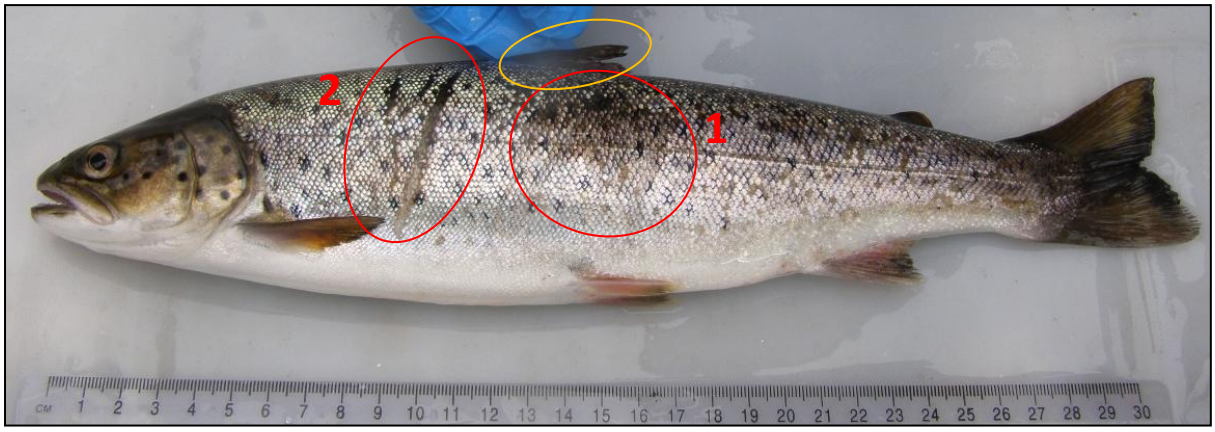
A sprat that was trapped in the fyke net at Dundonnell on 25th July 2012. (A. MacDonald/S. Clements)

4.3.3 Predation

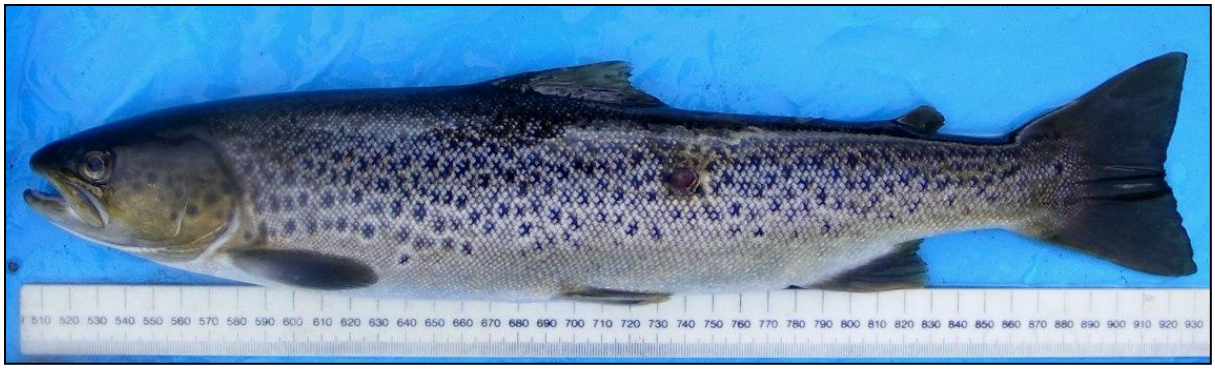
Potential predators of sea trout in the sea or river estuaries include Common Seal, Grey Seal, Otter, possibly the Common Dolphins seen in Little Loch Broom (they were present to within 100m of the shore), and birds of which Cormorant, Red-breasted Merganser, Heron and Herring Gull are considered most likely to take sea trout. Predation by other fish species (e.g. Pollack) is less well known.

Predator damage was recorded on many trout. At Dundonnell predator marks were noted on 11 of 74 sea trout caught in June 2012, and for 16 of 22 sea trout taken in August (mostly fish recovering from earlier sea lice infection). However, no correlations were found between the presence and absence of predator marks and fish length, condition factor or sea lice burdens. Sample sizes were small however.

This plump Dundonnell sea trout taken in June 2012 has been subject to predator attack on more than one occasion: in red: 1, scales are regrowing from a damaged area in the middle flank of the fish; 2, more recent damage which looks like beak marks. Note also, outlined in yellow the eroded, lice damaged dorsal fin.



Sea trout taken at Flowerdale on 17th September 2012, with mark thought to be bite mark by a seal.



Further consideration of relationships between predation rates, and sea trout condition, presence of alternative prey, and sea lice burdens are beyond the scope of this report.

5. On the occurrence of larger sea trout in Wester Ross & beyond . . .

5.1 Where have larger sea trout been recorded?

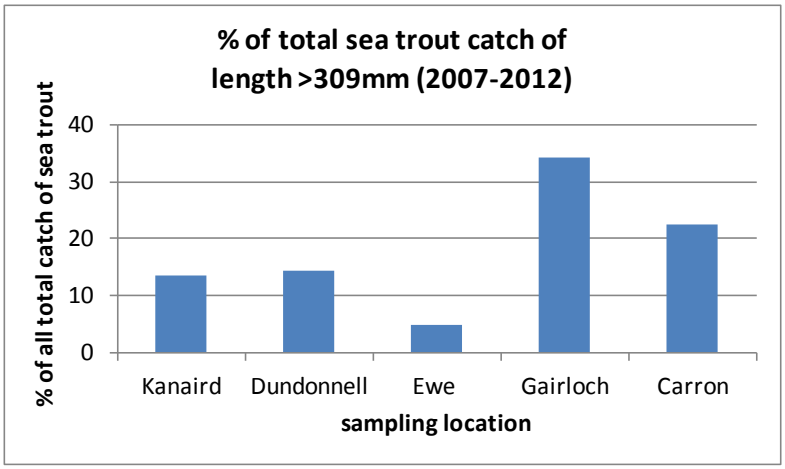
5.1.1 Larger sea trout in Wester Ross

In addition to post-smolt sea trout, many larger sea trout were caught by WRFT in sweep net samples during the period 2007-2012. To learn about the survival of sea trout in different areas and at different times, consideration of the occurrence of larger fish can provide useful information.

For the purposes of this section of the report, 'larger sea trout' are those fish of 310mm or more in length. This size was chosen for two reasons: firstly, during the spring and summer, few sea trout post-smolts reach a length of 310mm; sea trout that are larger than this are almost always fish which have spent at least one full summer in the sea and survived. Secondly, this size cut-off enables comparison with Walker 1980's analyses of sea trout taken by rod and line from lochs Maree, Clair, and Coulin in 1980.

Figure 5.1 shows the proportion of sea trout of over 309mm in total catches of sea trout taken during sampling by WRFT at sampling sites in Wester Ross during the period 2007 to 2012.

Figure 5.1 The proportion of sea trout of over 309mm in length in total catches of sea trout taken at sampling sites in Wester Ross during sampling by WRFT over the period 2007 to 2012.

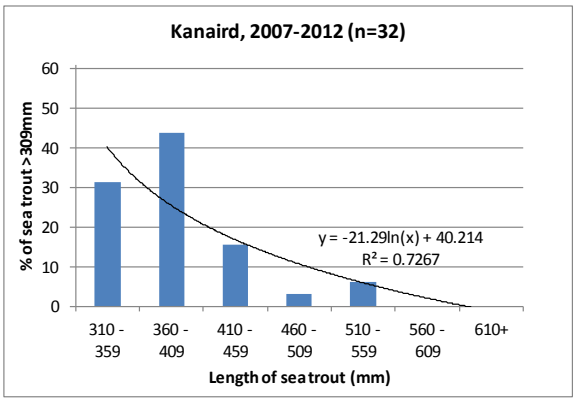


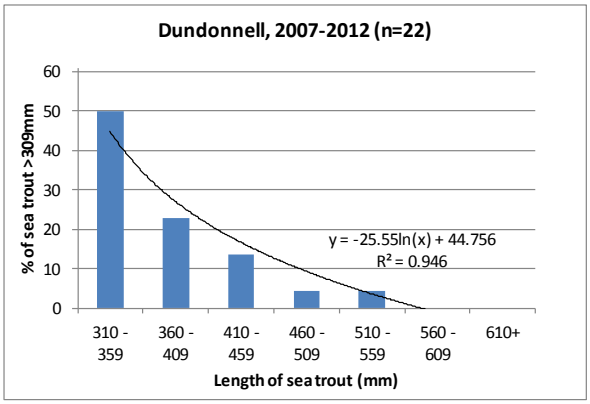
Within Wester Ross, the combined sample of sea trout taken from Loch Gairloch had a higher proportion of this larger size category of sea trout than samples taken at other sites. There are two possible reasons for this. Firstly, the proportion of larger sea trout in the Loch Gairloch population may indeed have been higher than at other sampling sites, reflecting higher rates of marine survival. Alternatively (or additionally) sweep netting in Loch Gairloch took place in the autumn, winter and early spring in addition to in the summer in places where larger fish had gathered; whereas in contrast, sampling of Ewe, Kaniard and Dundonnell sites was mainly during May, June and July, and focussed on sites where a higher proportion of post-smolt sea trout were present. So sampling bias may partly or largely explain differences observed here (in Figure 5.1). Note however (from the previous section), that a few larger sea trout were also taken in Loch Gairloch in May, June and July.

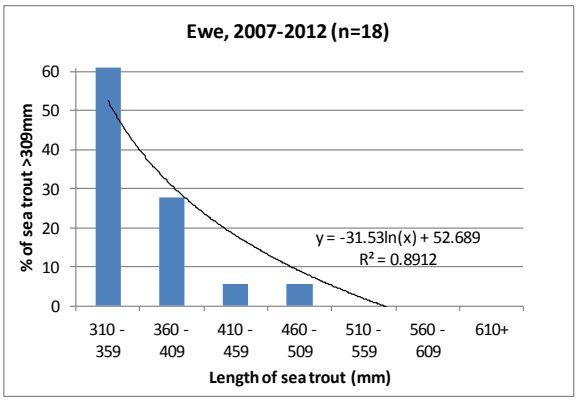
To consider this further, the relative proportions of 'larger sea trout' of different size classes above 309mm in samples was investigated on the assumption that any month to month or site to site sampling bias towards fish in different length classes above the 310mm threshold would be smaller.

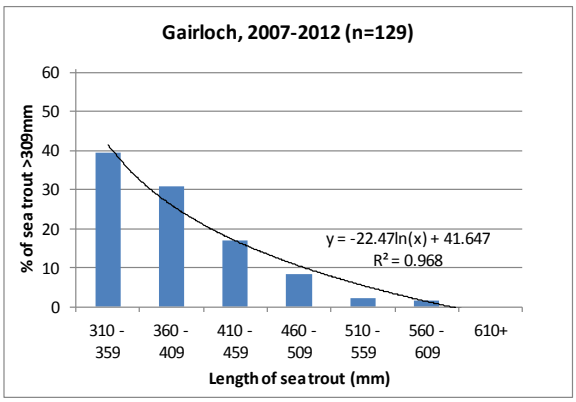
Figure 5.2 shows the relative proportions of sea trout in each size class within respective subsamples of sea trout of 310mm or longer taken at respective sites from 2007-2012.

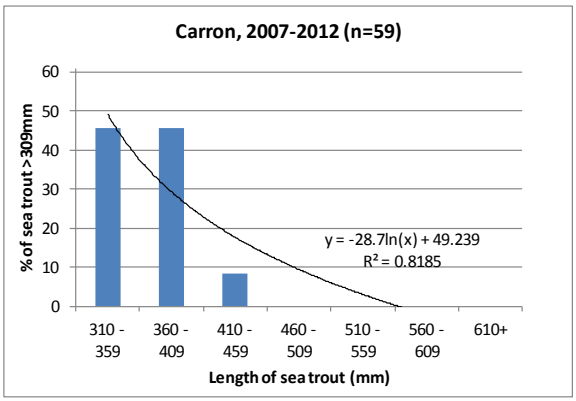
Figure 5.2 Relative proportions of sea trout in each size class within respective subsamples of sea trout of over 309mm in length taken at respective sites from 2007-2012. 'n' is the number of fish in the subsample. The Dundonnell fish were caught in a fyke net in June and July; other fish were taken by WRFT in sweep net samples. Data from Walker 1980 is also presented for purposes of comparison.

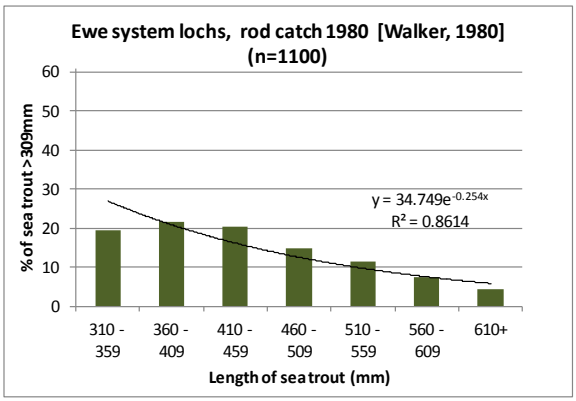








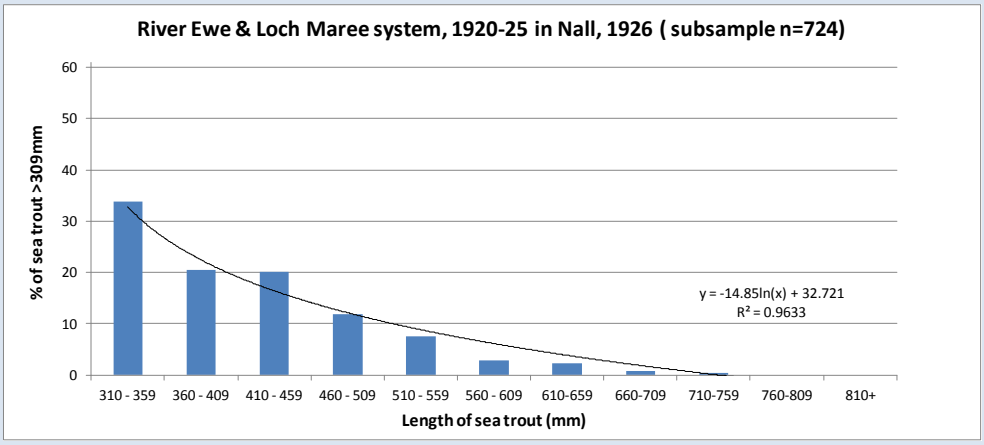


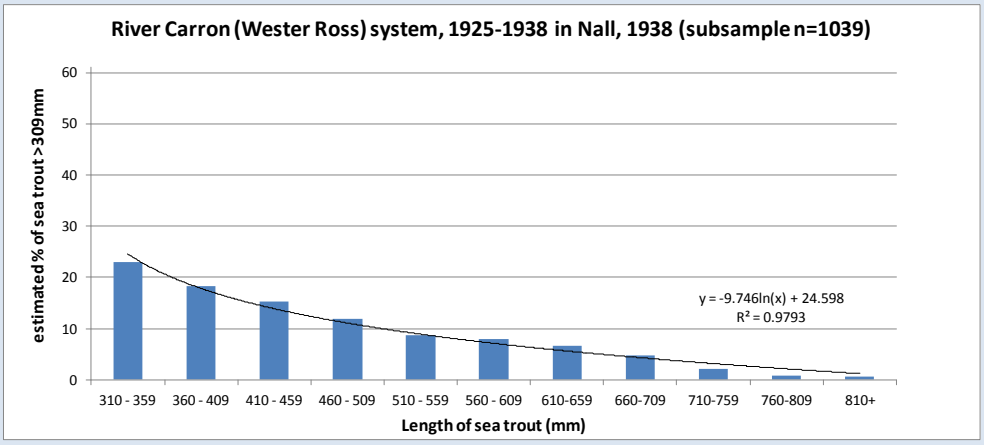


Box 5.1 Sea trout in the River Ewe-Loch Maree system and the River Carron system in the early 20th Century.

In the 1920s and 30s, Herbert Nall assisted by Mr P. R. C. Macfarlane (both working for the Fishery Board of Scotland) obtained collections of sea trout scales from sea trout caught by sweep netting mainly in the freshwater lochs of the River Ewe system and the River Carron system in Wester Ross. Collections were supplemented by samples provided by local fishery proprietors, ghillies and anglers; and together provide a record of some remarkable sea trout populations of the area at that time.

The graphs below show estimated relative proportions of sea trout in each size class within respective subsamples of sea trout of over 309mm in length. For the River Ewe system, Nall 1926's collection amounted to 1512 good sets of scales; of these a subsample of 724 (48%) were from sea trout of over 12 inches in length. The graph below has been put together on basis that 2 inches is approximately equal to 5cm. For the River Carron system, the collection amounted to 1811 sets of scales; of these an estimated subsample of 1039 (57%) were from sea trout of over 309mm in length. For the Carron fish, Nall 1938 does not divide the sample into the size categories used here: the number of fish in some of the size categories has therefore been partly estimated (for example, in Table 1 of the report, where there are 45 fish ranging in length from 49.5mm to 33.5mm with an average length of 42.5mm, I've split the subsample to 5 fish between 310-359mm; 18 fish 306-409mm, 20 fish 410-459mm and 2 fish 460mm-509mm). For the larger size categories, less guess work is involved: most of the larger fish were in much smaller samples of two or three fish where individual fish lengths are given in the report. Note that many Carron fish were particularly large.





Several points can be made here about larger sea trout in Wester Ross during the period 2007-2012:

1. The largest sea trout taken during this period by WRFT were recorded in the Kanaird estuary, Dundonnell estuary and in Loch Gairloch.
2. The proportion of larger trout of 410mm or more relative to smaller trout of less than 410mm in length was higher at Dundonnell, Kanaird and Loch Gairloch than at Loch Ewe or Loch Carron.
3. All samples taken by WRFT during the period 2007 – 2012 show a much steeper drop off in sea trout size-class towards larger fish than in the rod caught sample of Ewe system sea trout recorded by Walker in 1980, or Nall in the 1920s and 1930s (see Box 5.1)

The latter point could also relate to sampling bias, with a tendency towards a relatively higher proportion of larger fish being caught or recorded by rod and line than using the sweep net. Fish in the 310mm-359mm category appear to be underrepresented in Walker's 1980 rod and line sample. However, at least for fish above 359mm this is considered to be less of a problem. Even taking this into account, it is hard to escape the conclusion that the survival of sea trout from one size class to the next during the period 2007-2012 in Wester Ross is much less than recorded by Walker 1980. Indeed, from regression lines on Figure 5.2, survival of sea trout from one 50mm size class to the next may be less than 30% at all sites than for Ewe system sea trout in 1980 and in the 1920s.

Figure 5.2 suggests that during the period 2007-2012 none of the sampling areas within the WRFT area, not even Loch Gairloch, were likely to have had more than a very rare sea trout of 600mm or more in length during the sampling period. In contrast 4% of Walker's subsample of rod caught sea trout from Ewe system lochs in 1980 were of fish in this size class. During the period 2007-2012, the largest sea trout reported to WRFT from a Wester Ross river was a fish of 6lb from the River Carron in 2009 (~60-62cm in length – *see below*).

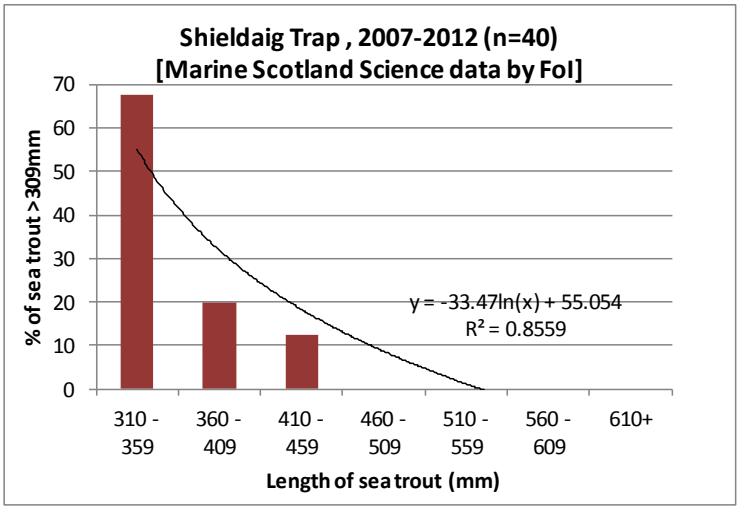
Sea trout of ~6lb caught in the River Carron in August 2009 by Donald MacKenzie (photo via Bob Kindness). This may be the largest sea trout taken in the WRFT area in the past 10+ years.

Shieldaig, Loch Torridon

Since starting this report, sampling data has been circulated to WRFT and various other organisations for sea trout that have returned to the Shieldaig trap, Loch Torridon (operated by Marine Science Scotland) for the period 2007 to 2012 (following a FoI request by a third party . . .). Observations at Shieldaig can be compared with those at sites elsewhere in Wester Ross sampled by WRFT. Note however that the Shieldaig fish are those which returned to the fish trap in the river, whereas WRFT sweep net samples were mostly taken in estuaries or in the sea.

13.9% of the sea trout in the Shieldaig trap sample were of 310mm or more in length. This figure is close to that for the Kanaird and Dundonnell sample in Fig 5.1. Figure 5.3 presents a size class graph of these 'larger sea trout' that entered the upstream trap at Shieldaig during the period 2007-2012.

Figure 5.3 Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at the MSS Shieldaig trap, Loch Torridon during the period 2007 to 2012. Marine Scotland Science data distributed following FoI request. This data is Crown copyright and is covered by the terms of the Open Government Licence.



Note that the trend line declines slightly more steeply than for sweep netting samples of sea trout taken at sites elsewhere in Wester Ross. There is an absence of sea trout of over 460mm. The biggest sea trout taken in the Shieldaig trap during the period 2007 – 2012 was an untagged fish of 433mm in length, taken in 2008. In contrast, during the period 2010 – 2012 in Loch Gairloch (at sites approximately 35km by sea from the Shieldaig River), 22 sea trout of more than 433mm in length were caught in sweep net samples by WRFT. So think it's reasonable to conclude that the Flowerdale (Loch Gairloch) sea trout population included larger fish than at Shieldaig (Loch Torridon).

One difference between the two sites is proximity to salmon farms from where larval sea lice emanate (Penston, 2004). The Shieldaig River is within 10km of three salmon farms. The nearest salmon farm to Loch Gairloch as a fish swims is about 25km away. Sea lice data collected by MSS in Loch Torridon demonstrated that louse infection pressures correlate with production cycles at nearby salmon farms (e.g. Raffell *et al* 2007). This was explored further by Middlemas *et al* 2012.

5.1.2 Large sea trout elsewhere in the West of Scotland

Figure 5.4 and Figure 5.5 show the proportions of sea trout of over 309mm in length in a set of samples of sea trout taken in the West of Scotland mainly during the period 1999 - 2009. These samples were taken by local fisheries trusts mostly in May, June and July and post-smolt sea trout were the target, unless stated otherwise.

*Figure 5.4 The proportions of sea trout of over 309mm in length in samples of sea trout taken in the West of Scotland. All samples were taken using a sweep net, unless stated otherwise. *denotes sites where some fish were also taken in winter, early spring & or autumn. Data from various sources, released by the Scottish Government following a Freedom of Information request.*

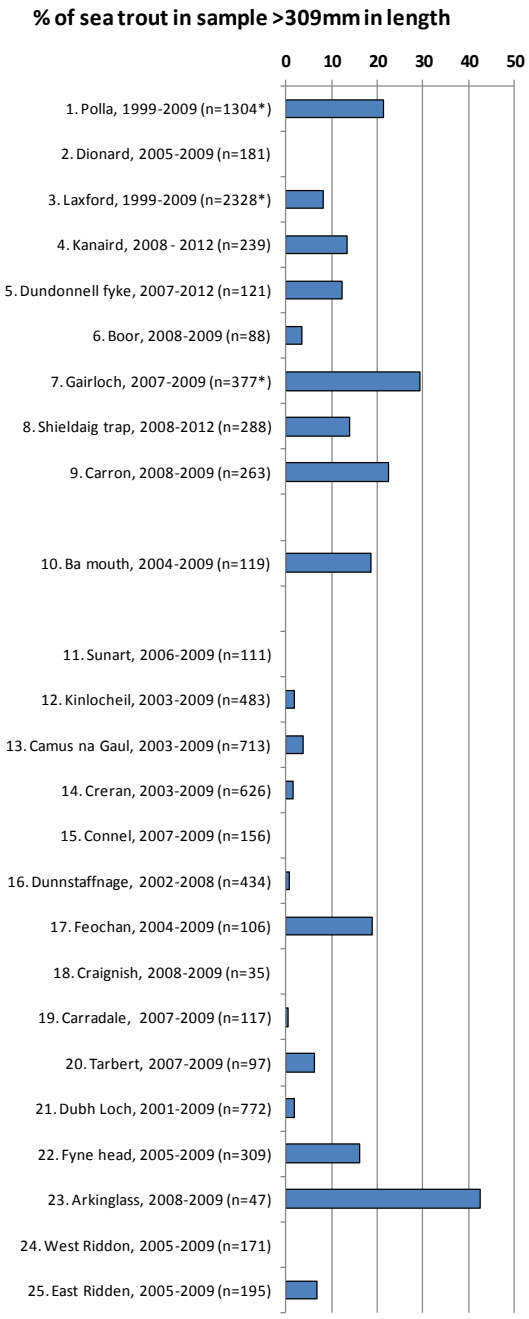
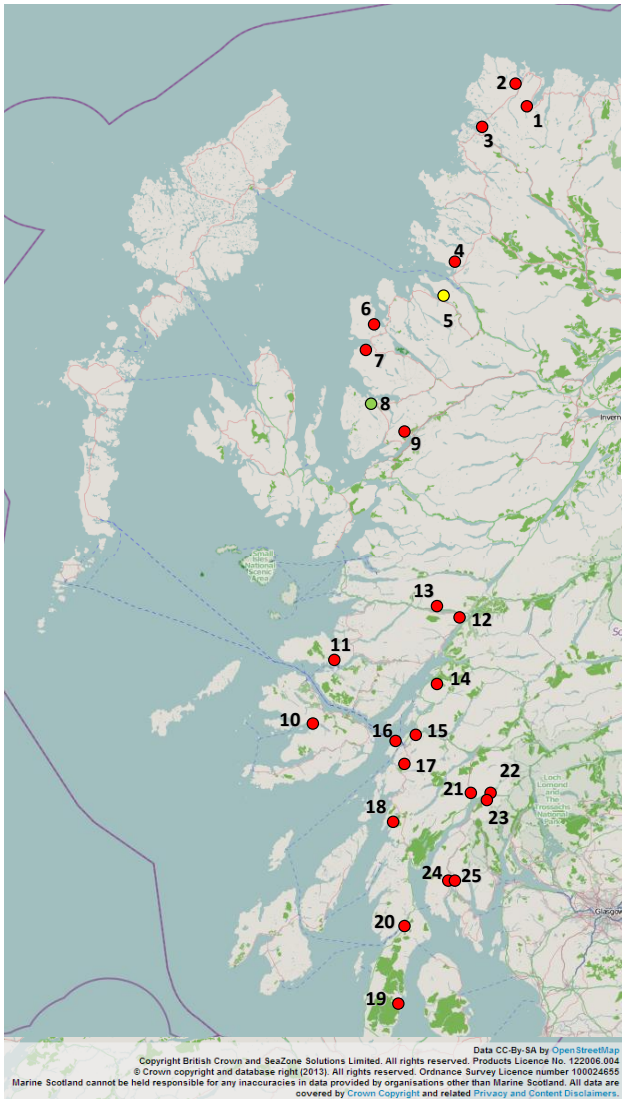
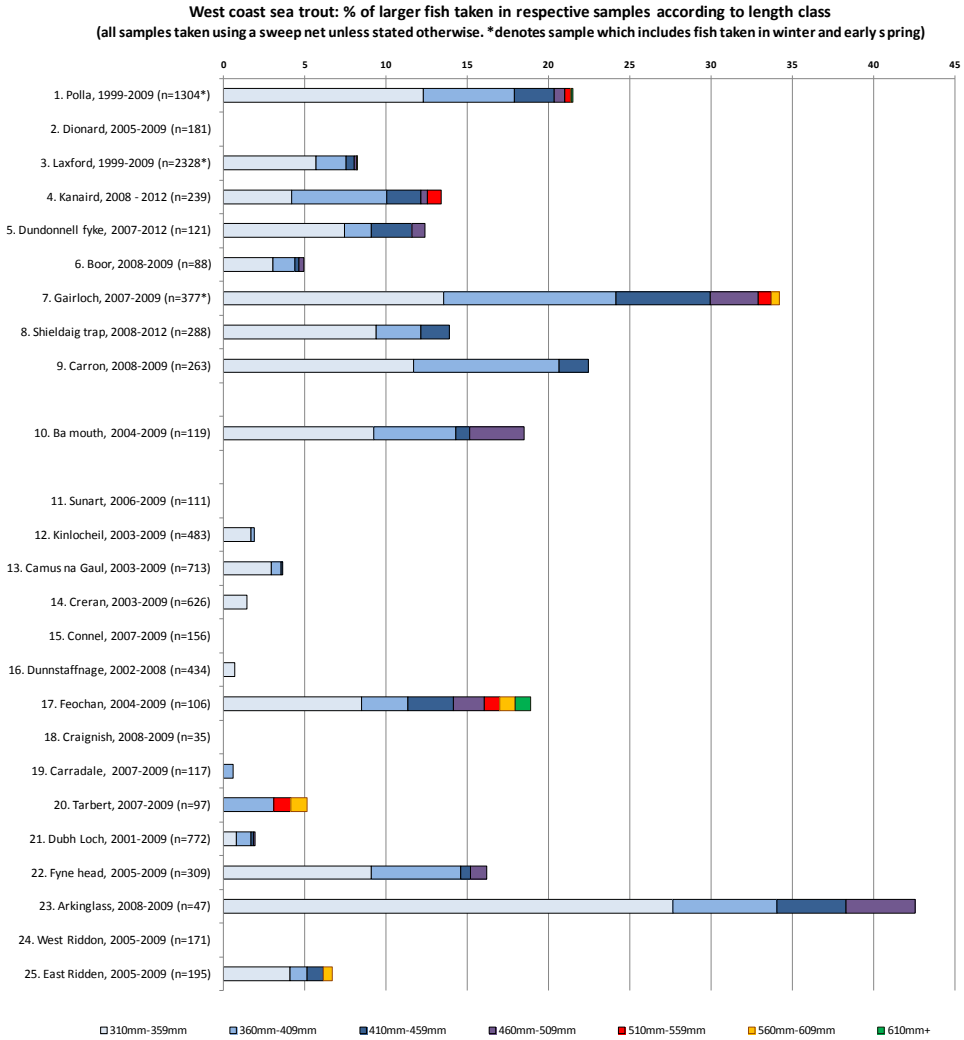


Figure 5.5 The occurrence of larger sea trout in samples taken in the west of Scotland during the period 1999 – 2012. Data from various sources released following a FoI, and used with permission of respective fishery trusts (except MSS data for Shieldaig trap) see text for further details.





Of the 25 sites* where samples were taken, from an area extending from the River Polla estuary in the far north, to the Carradale estuary in the Mull of Kintyre and to the River Ba estuary in Mull, sea trout of 310mm or more in length were recorded in samples taken at 20 sites; sea trout of 410mm or more were recorded at 15 sites; sea trout of 510mm or more were recorded at 7 sites (Polla, Laxford, Kanaird, Gairloch, Feochan, Tarbert and east Riddon); and sea trout of 610mm or more were recorded at only 3 sites (one fish each at Polla, Laxford, and Feochan).

[*consideration of samples from sites in the Outer Hebrides which were included in an earlier version of this report have been removed from this analyses, as some of the larger fish taken in sweep net samples aimed at catching post-smolt sea trout were not recorded. As the purpose of sweep netting was to catch post-smolt sea trout, on some occasions not all larger fish could be retained for processing. At some sampling sites, notably Borve, the local biologist reports that on some occasions there were many larger sea trout in the sweep net sample which were unrecorded].

There was geographic spread in the distribution of sites with relatively high proportions of larger fish. The Arkinglass (near head of Loch Fyne) sample, though relatively small in number (n=47) had the highest proportion of fish of over 309mm; other sites where over 20% of the sample was of fish of over 309mm were Polla, Gairloch, Carron, Gress, Ba Mouth, Feochan and Fyne Head. In contrast, at 11 sites the proportion of sea trout of over 309mm was less than 5% of the total sample; these were: Dionard, Sunart, Kinlocheil, Camus na Gaul, Creran, Connel, Dunstaffnage, Craginish, Carradale, Dubh Loch and West Ridden.

For some of the sites where larger sea trout were scarce, larger fish may simply have been excluded where the sampling objective was to catch post-smolt sea trout. Alternatively, or additionally, these sites may have been chosen primarily to target smaller post-smolt sea trout, so sampling bias could disproportionally have favoured catching smaller fish relative to the larger sea trout in the local population.

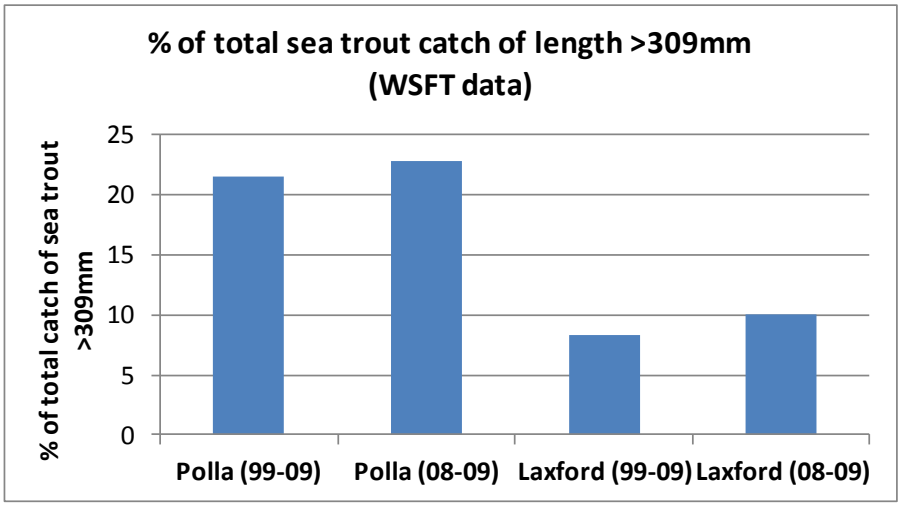
To consider this further (as for the analyses of Wester Ross sea trout in part 5.1.1), the relative proportions of ‘larger sea trout’ of different size classes above 309mm in samples was investigated on the assumption that any site to site sampling bias towards fish in different size classes above the 310mm threshold would be much smaller than for smaller post-smolt and finnock sized sea trout (of less than 300mm) vs. larger fish.

The following section summarises the findings of this investigation.

5.1.2.1 West Sutherland

Figure 5.6 shows the proportions of sea trout of over 309mm in length in total catches of sea trout taken at sweep net sampling sites in the estuaries of the rivers Polla and Laxford in West Sutherland.

Figure 5.6 The proportions of sea trout of over 309mm in length in total catches of sea trout taken at sweep net sampling sites in the estuaries of the rivers Polla and Laxford in West Sutherland. This data was collected by the West Sutherland Fisheries Trust and used with their permission following release by the Scottish Government under FoI.

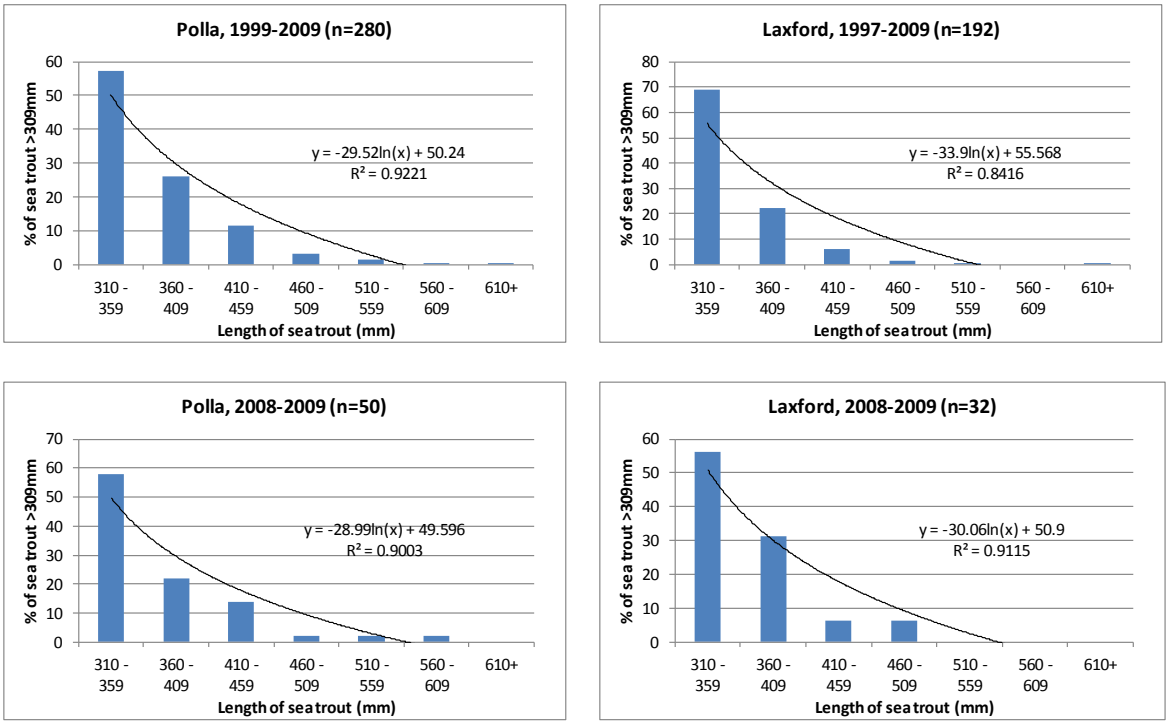


In comparison to the Wester Ross sites in terms of the proportions of larger fish in samples (Fig 5.1), the proportion of larger sea trout in the samples for the Polla at between 20% and 25% is closest to that of Loch Gairloch; the Laxford samples are between those for Ewe sample and the Kanaird and Dundonnell sample. Note that monthly sweep net sampling for sea trout in West Sutherland began in March, so in terms of sampling bias, samples were most similar to those taken in Loch Gairloch.

Sea trout of 750mm, estimated weight 9.5lb from the estuary of the River Polla, taken on 13th June 2007. This is thought to be the largest sea trout taken by a fisheries trust in a sweep net sample in the West of Scotland to date. Photo by A. Marsham published in the WSFT Review 2008.

Figure 5.5 shows the relative proportions of sea trout in each size class within subsamples of larger sea trout (of over 309mm in length) taken at sweep net sampling sites in the estuaries of the rivers Polla and Laxford in West Sutherland [I may revise this to 1999-2007 & 2008-2009].

Figure 5.5 Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at sweep net sampling sites in the estuaries of the rivers Polla and Laxford in West Sutherland. This data was collected by the West Sutherland Fisheries Trust and released by the Scottish Government following a freedom of information request.

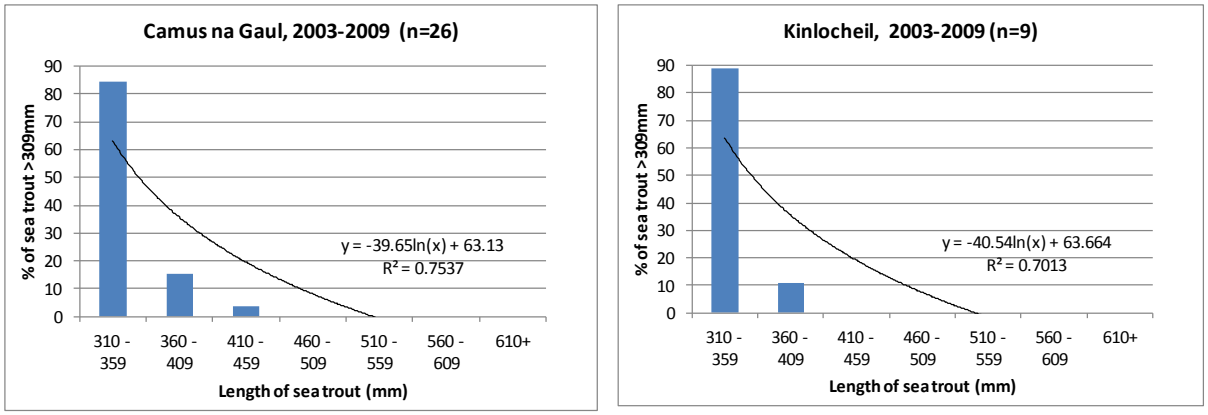


There were slightly higher proportions of larger sea trout taken in the Polla subsamples than in the Loch Laxford subsamples, particularly of fish larger than 510mm. Neither site had as big a proportion of sea trout of 410mm or larger in the subsample as in the Loch Gairloch subsample.

5.1.2.2 Lochaber

Lochaber Fisheries Trust collected samples of sea trout from three sites using a sweep net. At Camus na Gaul at the head of Loch Eil (2003-2009), 713 sea trout were caught of which 26 were over 309mm in length; at Kinlocheil (2003-2009) 483 sea trout were caught of which 9 were over 309mm in length; and at Sunart (2006-2009) 111 sea trout were caught, none of which were over 309mm. Figure 5.6 shows the relative proportions of sea trout in each size class within subsamples of larger sea trout (of over 309mm in length) taken at the two sites where fish >309mm were caught.

Figure 5.6 Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at sweep net sampling sites at Camus na Gaul and Kinlocheil (2003-2009). This data was collected by the Lochaber Fisheries Trust and is used with their permission following release by the Scottish Government following a freedom of information request.



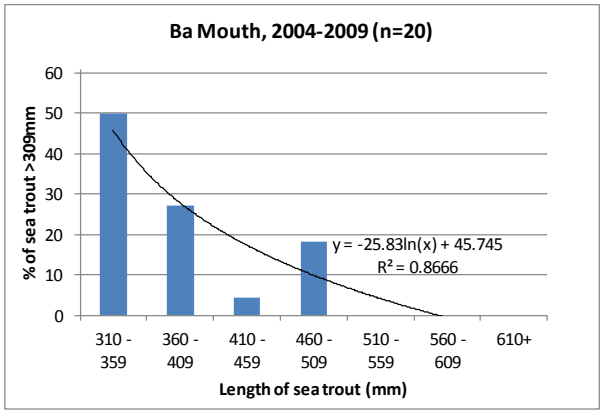
Neither sample had fish of over 460mm in length. Note that the trend line declines steeply for both sites. Either larger fish were very scarce in Loch Eil or the sampling sites were biased towards catching smaller sea trout in the local sea trout population.

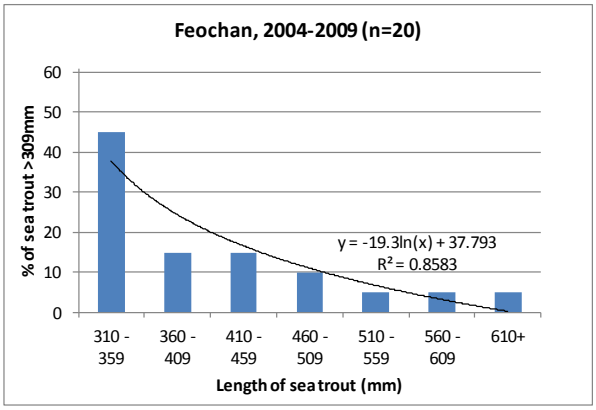
Note that in gill net samples taken at Kinlocheil during the years 1999-2001 (presumably using a small 22mm mesh size to target post-smolts?) 3 sea trout out of the 60 caught were over 400mm, the largest a sea trout of 498mm taken in 2000.

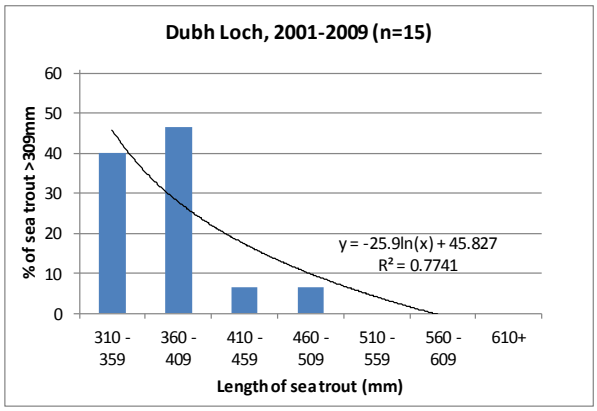
5.1.2.3 Argyll

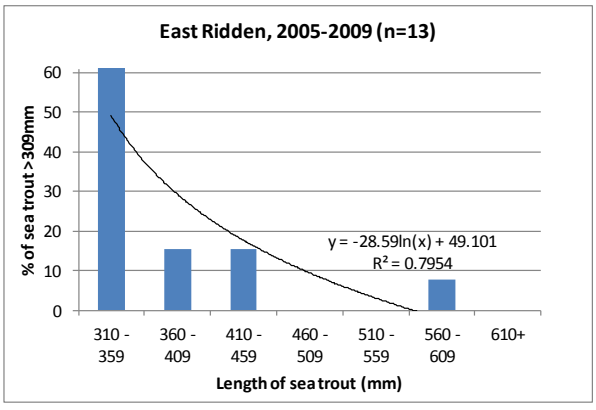
Samples of sea trout from 12 netting sites within Argyll were considered here. Figure 7 shows the relative proportions of larger trout at the sample sites where larger fish were caught. Overall, there was much variation in the relative proportion of larger sea trout, with very few taken at some sites (e.g. Creran, Conne, Craignish and Dunstaffnage), and fish of over 410mm at Feochan, West Loch Tarbert, Fyne Head, Arkinglass and Loch Ridden.

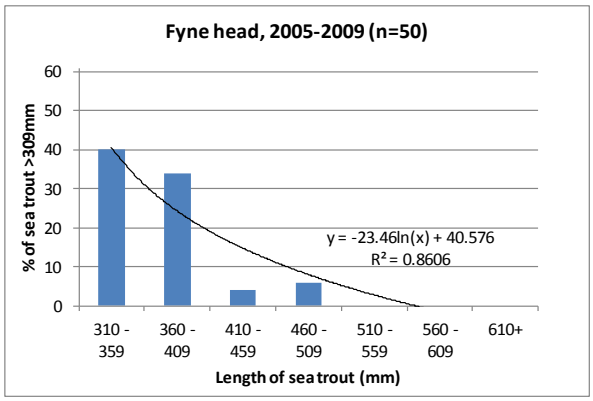
Figure 5.7 Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at sweep net sampling sites at the mouth of the Ba River on the Isle of Mull, Loch Feochan, Dubh Loch (near Inveraray), East Loch Ridden, and at Arkinglass and Fyne head (sites close together). This data was collected by Argyll Fisheries Trust and is used with their permission following release by the Scottish Government following a freedom of information request.

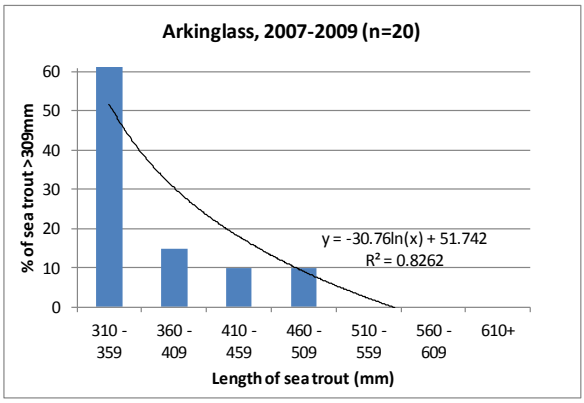












Of the Argyll samples, Loch Feochan had the biggest sea trout, followed by the other five sites. Note that subsample sizes of 'larger sea trout' were small for most sites.

5.1.2.4 Western Isles

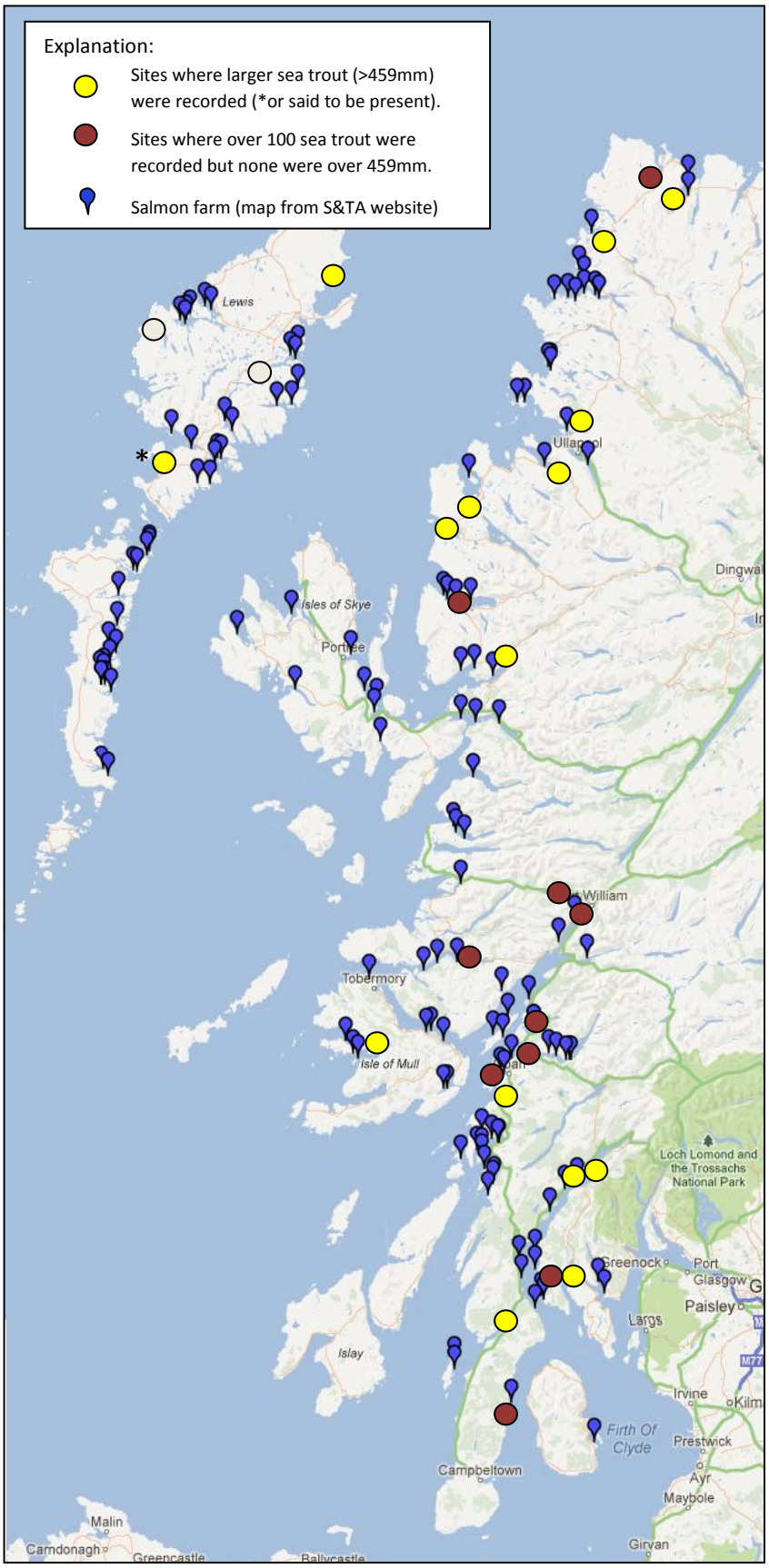
Sweep net data collected by the Outer Hebrides Fisheries Trust as part of the sea-trout post-smolt monitoring project has not always included complete data for the larger sea trout caught in respective sweeps. On some occasions, because there have been so many fish, some of the larger fish have been returned to the sea prior to being recorded and measured. So the proportions of larger fish recorded in sweep net data for Outer Hebrides sites underestimates the proportions of larger fish present in the sweep net catch. For this reason, this report has been revised with the removal of OHFT data from the analyses of larger sea trout occurrence.

5.1.2.5 What influenced the distribution of larger sea trout in the West of Scotland in 1999-2009?

Middlemas *et al* 2012 (using the same dataset) demonstrated that there is a relationship between sea lice levels on sea trout and fish farm activity in western Scotland. The proportion of sea trout with louse burdens above a critical level was positively related to the weight of salmon on the nearest fish farm and negatively related to the distance to that farm. Beyond about 31km (95% limits 13-149km) to the nearest farm this relationship broke down. To what extent is there a relationship between sea trout size and fish farm activity in western Scotland? This requires analyses beyond the purpose of this report. However, some general observations can be made (refer to Figure 5.9)

- in **Sutherland**, larger sea trout were recorded at both sites within 10km of an active farm.
- in **Wester Ross**, the largest sea trout were at the site furthest from a marine salmon farm, but also at Kanaird, Dundonnell and Carron, within 5km of an active salmon farm.
- in the **Wester Isles** the larger sea trout were said to be present in sweep net catches at some sites, notably at Borve where prior to being measured and recorded they were sometimes selected out and returned as there were too many to retain and process.
- in **Argyll – Lochaber** area, larger sea trout were recorded where present in catches, but were virtually absent from samples in the Loch Linnhe area. However, larger sea trout were taken from Feochan and at the head of Loch Fyne, both <15km of an active fish farm. Large volumes of freshwater in sea lochs may have helped to counter sea lice infection pressures in these areas. . . ?

Figure 5.9 Map of salmon farms in the West of Scotland, from Salmon and Trout Association's [Stand up for wild Salmon website], showing sea trout sampling sites where larger (>459mm) sea trout were caught, and sites where sea trout of over 459mm were absent in a sample of >100 fish.



5.2 Growth rates of sea trout

5.2.1 Interpreting growth rates from scale reading

Rates of growth of sea trout can be estimated from scale reading using the method described by Nall 1930 which assumes that the length and growth of the scale is proportional to the length and growth of the fish. Using this method, the scale is projected and the image measured. An estimate of the length of the trout at age 'x' is obtained using the formula:

$$\text{Estimated length of trout at age } x = (D_x/D_s) * \text{Length of trout}$$

Where

D_s *is the distance from the origin of the projected scale to the margin of the projected scale, and*

D_x *is the distance from the origin of the scale to the growth band at age x.*

To simplify, Nall 1930 used a measuring card and table to calculate fish length at age from a projected scale as shown below (figures reproduced from Nall, 1930).

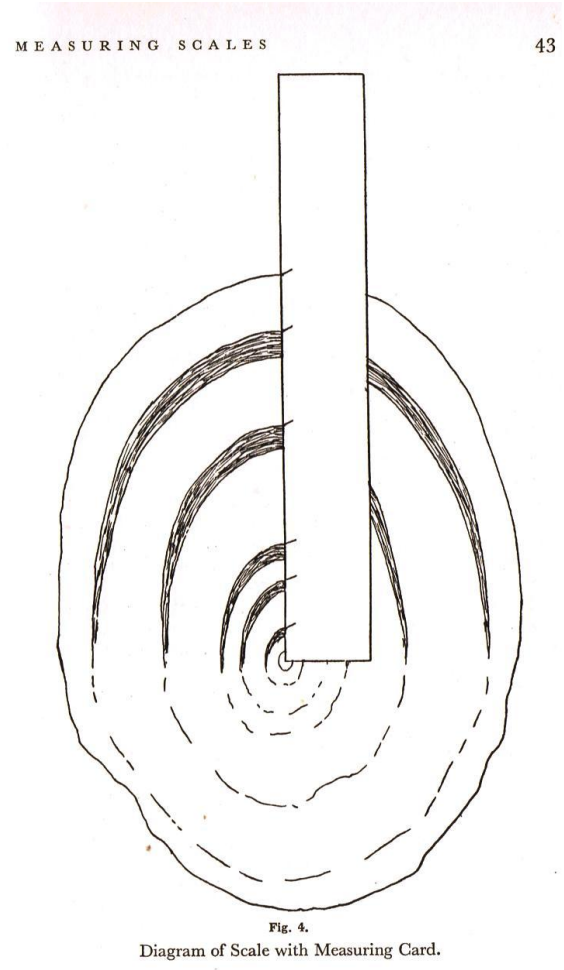


Fig. 4.
Diagram of Scale with Measuring Card.

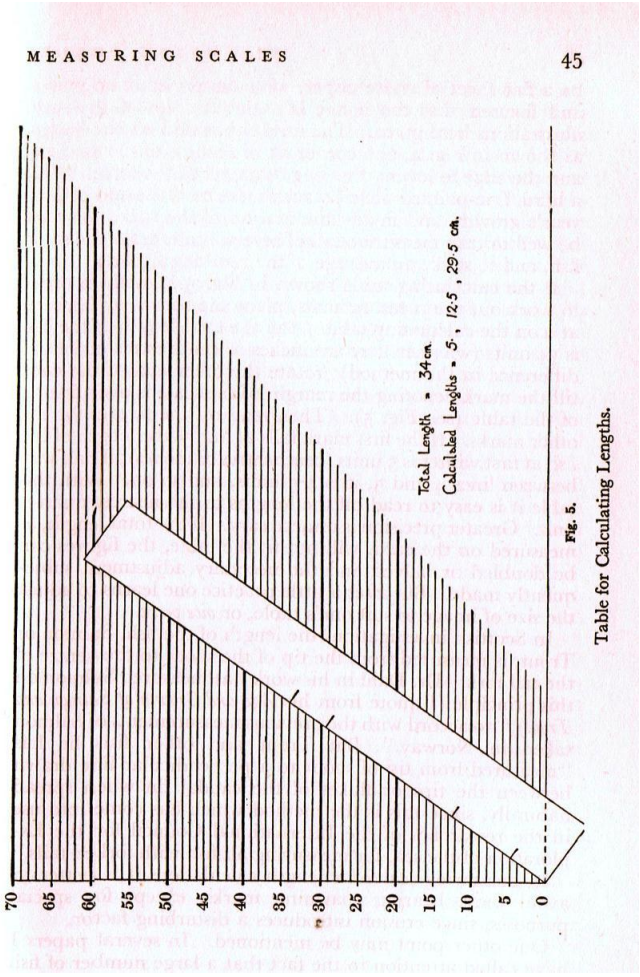


Fig. 5.
Table for Calculating Lengths.

Table 5.1 presents some scale growth data for some of the trout sampled in 2012 in Loch Gairloch, using Nall's method. Some of the scales were a little difficult to read or were 'replacements', and I plan to spend more time on this to develop the method and compare extrapolated fish sizes from scale measurements with actual sizes for recaptured and re sampled trout. Possibly something for next year's wild trout report if this would be useful.

Table 5.1 Extrapolated length estimates for some of the sea trout caught in Loch Gairloch in 2012, based on measurements of projected scales.

Highlighted in blue are extrapolated lengths of smolt size; highlighted in orange are sizes at interpreted spawning marks. Fish highlighted in green are those which have been recaptured. See text below table for further discussion.

estimated fish length (mm) at end of winter from scale measurement (f - winter in freshwater; s - winter after first sea summer)														
No	Date	place	length mm	weight grams	sex	f1	f2	f3	f4	s1	s2	s3	s4	note
1	15/10/2012	Flowerdale burn	220	83		43.28	108.20	140.66		220.00				
2	15/10/2012	Flowerdale burn	390		f	36.71	119.29			279.88	371.65			
3	15/10/2012	Flowerdale burn	370	395	f	31.16	109.05	151.89		249.26	303.79			
4	15/10/2012	Flowerdale burn	495	1318	f	44.20	79.55			265.18	366.83	424.29		fish B
5	11/04/2012	Flowerdale estuary	334	275		?	77.67			167.00	248.56	314.58		
6	11/04/2012	Flowerdale estuary	261	120		41.61	143.74	155.09		261.00				
7	11/04/2012	Flowerdale estuary	372	440		58.52	91.96	121.21		267.51	309.30	338.56		
8	11/04/2012	Flowerdale estuary	255	130			93.10	137.62		202.38				
9	11/04/2012	Flowerdale estuary	283	190		34.30	137.21	175.80		278.71				
10	11/04/2012	Flowerdale estuary	252	129		?	99.85	152.15		252.00				
11	11/04/2012	Flowerdale estuary	415	700		?	130.00			310.00	390.00			
12	11/04/2012	Flowerdale estuary	465	948	m	?	?	?		?	434.00	465.00		square tail
13	11/04/2012	Flowerdale estuary	201	70		0.00	93.32			201.00				
14	11/04/2012	Flowerdale estuary	350	349		35.90	89.74	139.10		282.69	350.00			
15	11/04/2012	Flowerdale estuary	300	255		69.23	133.85			221.54	300.00			
16	11/04/2012	Flowerdale estuary	330	295		?	?	145.20		250.80	330.00			
17	11/04/2012	Flowerdale estuary	267	150		50.06	104.30	158.53		267.00				
18	11/04/2012	Flowerdale estuary	238	122		46.82	93.64			163.87	238.00			
19	11/04/2012	Flowerdale estuary	315	251		?	?			193.85	315.00			
20	11/04/2012	Flowerdale estuary	270	178		54.00	144.00			270.00				
21	11/04/2012	Flowerdale estuary	262	150		75.37	143.56			262.00				
22	11/04/2012	Flowerdale estuary	257	140		?	98.85	135.09		227.35				
23	11/04/2012	Flowerdale estuary	269	165		?	?	125.77		269.00				
24	11/04/2012	Flowerdale estuary	265	168		89.76				205.16	265.00			
25	11/04/2012	Flowerdale estuary	320	290		46.83	113.17			234.15	316.10			
26	11/04/2012	Flowerdale estuary	230	117		52.08	112.83			221.32				
27	11/04/2012	Flowerdale estuary	248	128		57.87	128.13			248.00				
28	11/04/2012	Flowerdale estuary	283	183		46.46	105.60			283.00				
29	11/04/2012	Flowerdale estuary	271	168		56.46	120.44			225.83	271.00			
30	11/04/2012	Flowerdale estuary	261	158		45.85	109.34			176.35	261.00			
31	11/04/2012	Flowerdale estuary	250	139		0.00	98.48			250.00				
32	11/04/2012	Flowerdale estuary	228	102		59.80	119.61			228.00				
33	11/04/2012	Flowerdale estuary	465	1060	f	75.92	156.58			289.44	370.10	417.55	465.00	fish B
34	11/04/2012	Flowerdale estuary	362	425										
35	11/04/2012	Flowerdale estuary	305	265		45.75	76.25	133.44		266.88				
36	11/04/2012	Flowerdale estuary	302	266		59.61	143.05			286.11				
37	11/04/2012	Flowerdale estuary	342	310		?	110.79			274.56	342.00			
38	11/04/2012	Flowerdale estuary	310			47.69	83.46	139.10		310.00				
39	11/04/2012	Flowerdale estuary	357	380		?	119.00			311.23	357.00			
40	11/04/2012	Flowerdale estuary	232	104		57.11	132.06			232.00				
41	11/04/2012	Flowerdale estuary	265	171		59.40	132.50			228.45				
42	11/04/2012	Flowerdale estuary	338	333		?	107.55	138.27	172.84	338.00				
43	11/04/2012	Flowerdale estuary	250	123		66.67	125.00			250.00				
44	11/04/2012	Flowerdale estuary	252	128		42.71	89.69	153.76		252.00				
45	11/04/2012	Flowerdale estuary	253	135		39.26	69.79	126.50		253.00				
46	11/04/2012	Flowerdale estuary	272	151		45.33	109.56	162.44		272.00				
47	11/04/2012	Flowerdale estuary	222	86		61.67	94.56	148.00		222.00				
48	11/04/2012	Flowerdale estuary	242	110		52.43	121.00			242.00				
49	11/04/2012	Flowerdale estuary	245	123		68.91	133.98			245.00				

These interpretations should be made with caution: scale reading is rather subjective. Not all features of importance for interpretation of the life history of the sea trout from which the scale is taken are always easily seen. Where only one or two 'good' scales [i.e. where circuli extend to the centre of the scale] exist in a sample, errors can be made.

For example, in Table 5.1 'fish B' (sea also part 4.2.5) was caught on 11th April and again on 15th October. From the 11th April scale, just two freshwater winters were noted, and the smolt length estimated at 156mm. However a scale from the same fish on 15th October suggested two freshwaters, but a much smaller smolt size of 79mm. 79mm is too small for a sea trout smolt, so is presumably erroneous. There is closer agreement between the two samples for length at the end of respective sea winters: from the scale sample on 11th April, the overwintered finnock length was estimated at 289 mm; from the 15th October scale, it was estimated at 265mm; after the second sea winter the length was estimated at 370mm from 11th April scale; and 367mm from the 15th October scale. However, a spawning mark was noted here on the 15th October scale, but not on the 11th April scale. Of more concern, two further sea winters were noted on the 11th April scale, but only one on the 15th October scale. All rather unsatisfactory!

In conclusion, some measure of quality control (having scales read by two or more people) is required to be able to make best use of sets of sea trout scales and to be able to quantify the levels of confidence that should be given to any interpretation of the life history of a fish based on reading of its scales alone.

5.2.2 Interpreting growth rates based on measurements of recaptured fish

The recapture and re-measurement of a marked fish remains possibly the best and most objective method of interpreting the growth and life history of a sea trout. From examination of markings on photos, recaptured sea trout were identified in samples of Wester Ross sea trout taken in Loch Gairloch, Gruinard Bay and Loch Kanaird. Specific growth rates for the six Gairloch sea trout which feature in Box 4.1 (see part 4.2.5) are shown in Table 5.2.

Note that for these Gairloch sea trout there was much variation in growth rate from fish to fish, and at different times of year. The fastest growing sea trout was 'fish F' which grew from 265mm, 168g on 11th April 2012 to 396mm, 656g on 15th October 2012. Here are picture of scales from this fish taken on 11th April *(left)* and on 15th October 2012 *(right)* (zoom to view).

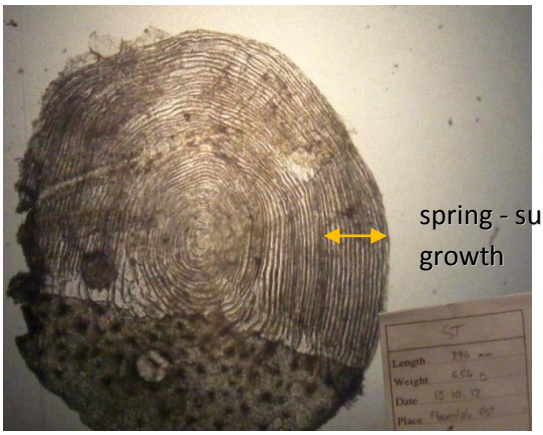


Table 5.2 Growth rates of six recaptured Loch Gairloch sea trout (see part 4.2.5 for pictures of these fish [except fish A and fish C which appear in WRFT Wild trout report 2011]

Fish A: Kerry mouth (initial capture); recaptured Flowerdale estuary

initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	note
21-Feb-11	471	04-Aug-11	1230	164	0.585312	1.22	12	
04-Aug-11	1230	27-Sep-11	1075	54	-0.24943	1.02	1	

Fish B: Flowerdale estuary

initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	
18-Mar-11	416	14-Jun-11	622	88	0.457108	1.03	15	
14-Jun-11	622	27-Sep-11	828	105	0.272451	1.08	9	
27-Sep-11	828	11-Apr-12	1060	197	0.125386	1.05	6	
11-Apr-12	1060	22-May-12	1070	41	0.022902	0.94	34	
22-May-12	1070	20-Jul-12	1205	59	0.201391	0.99	104	
20-Jul-12	1205	15-Oct-12	1318	87	0.10303	1.09	0	recaptured in Flowerdale burn

Fish C: Flowerdale estuary

initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	
01-Feb-10	490	23-Sep-10	845	234	0.232877			estimated weight
23-Sep-10	845	04-Aug-11	1132	315	0.092827	1.01	221	
04-Aug-11	1132	27-Sep-11	1000	54	-0.2296	0.85	80	

Fish D (Squaretail): Flowerdale estuary

initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	
18-Mar-11	355	27-Sep-11	933	193	0.500667	1.06	2	
27-Sep-11	933	11-Apr-12	948	197	0.008096	0.94	2	
11-Apr-12	948	22-Jun-12	1154	72	0.273104	1	17	
22-Jun-12	1154	17-Sep-12	1512	87	0.310574	1.08	4	

Fish E: Flowerdale estuary

initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	
27-Sep-11	185	15-Oct-12	395	384	0.197534	0.78	1	recaptured Flowerdale burn

Fish F: Flowerdale estuary

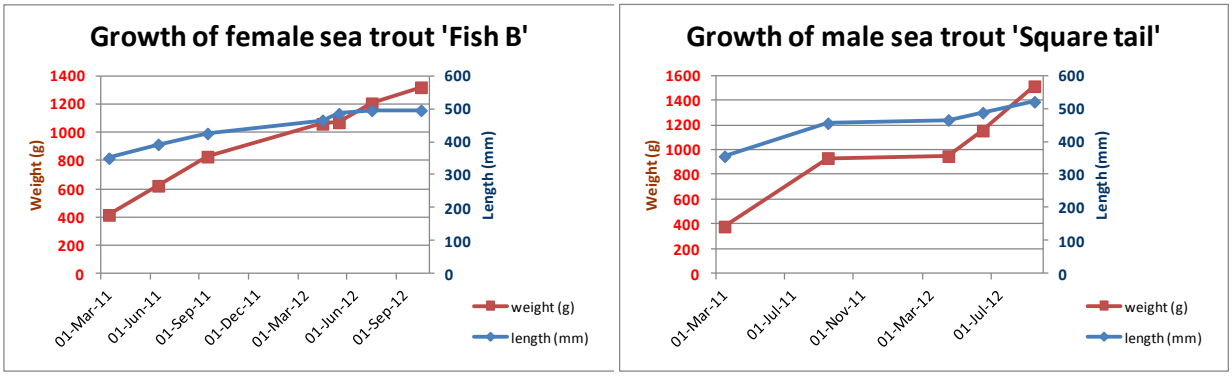
initial date	initial weight (g)	final date	final weight (g)	inter-vening days	specific growth rate	final condition factor	final lice count	
11-Apr-12	168	15-Oct-12	656	187	0.728447	1.06	4	

Average initial weight of recaptured Gairloch sea trout = 788g

Average specific growth rate of recaptured Gairloch sea trout = 0.21

Other Gairloch fish which grew rather quickly (SGR >0.5) were 'fish A' between February and August, 2011 (see WRFT Wild Trout Report for 2011); and 'fish D' ('Squaretail') between March and September 2011. Figure 5.10 shows how the growth of two mature Loch Gairloch sea trout, 'fish B' and 'fish D' ('Squaretail') varied seasonally between March 2011 and autumn 2012. Note that growth was faster during spring and summer then slowed during the autumn – winter period.

Figure 5.10 The growth of two sea trout recaptured on several occasions in Loch Gairloch between March 2011 and October 2012.



In contrast, two Gairloch sea trout lost weight between the time of first and second capture. These fish were both maturing female trout, 'fish A' and 'fish C', losing weight between August and September 2011. Fish which were caught in the autumn, then recaptured in the spring also grew very slowly: 'fish B' and 'fish D'. The fish with the slowest growth over a whole year was 'fish C' which was 845g on 23rd Sept 2010, and only 1000g on 27th Sept 2011. 'Fish C' was also the most heavily loused fish in the sample, with 221 lice recorded on 4th August 2011.

Table 5.3 provides growth data for two sea trout recaptured by WRFT elsewhere in Wester Ross. Fish 'Kanaird K1' has already been discussed under part 4.2.4. Note that it grew at quite a respectable rate of SGR 0.44 between the time of first capture on 5 June 2012 and second capture on 17 July 2012. In contrast, fish 'Gruinard G1' (see also under part 4.2.5) grew from only 1016g to 1167g between 15 June 2011 and 23rd May 2012. This fish was not unusually heavily infected with sea lice at either time of capture, and its dorsal fin was not noted as being badly louse-damaged.

Table 5.3 Specific Growth Rates of two recaptured Wester Ross sea trout (see part 4.2.5 for pictures of these fish).

	initial capture date	initial length (mm)	initial weight (g)	initial condition factor	initial sea lice count	final capture date	final length (mm)	final weight (g)	final condition factor	inter-vening days	specific growth rate	final sea lice count
Kanaird K1	05-Jun-12	375	532	1.01	120	17-Jul-12	390	640	1.08	42	0.44	10
Gruinard G1	15-Jun-11	465	1016	1.01	31	23-May-12	520	1167	0.83	343	0.04	21

Elsewhere in Wester Ross, some of the fish returning to the Shieldaig River (Loch Torridon) have been recaptured more than once. These fish were tagged as smolts when they left the system: growth rates during their first summer at sea are subject to on-going MSS studies (published elsewhere).

For the purposes of comparison with larger sea trout elsewhere in Wester Ross, Specific Growth Rates for some of the larger fish (those that have returned to the trap for a second time) are presented in Table 5.4.

Table 5.4 Specific Growth Rates of sea trout recaptured for second time at the MSS Shieldaig trap in Loch Torridon (Marine Scotland Science data released following FoI request by third party). This data is Crown copyright and is covered by the terms of the Open Government Licence.

fish number	initial capture date	initial length (mm)	initial weight (g)	initial condition factor	initial sea lice count	re-capture date	final length (mm)	final weight (g)	final condition factor	inter-vening days	specific growth rate	final sea lice count
96FB574	21/7/09	234	136	1.06	56	28/07/10	290	226.5	0.93	372	0.14	0
96FB4CC	29/9/09	261	189	1.06	0	20/09/10	340	372	0.95	356	0.19	0
96FB48D	30/10/09	250	141.5	0.91	40	20/09/10	318	282	0.88	325	0.21	0
96FB405	29/9/09	254	159	0.97	0	18/10/10	337	357	0.93	384	0.21	0
96FB1BB	29/9/09	255	172	1.04	5	13/09/10	356	456	1.01	349	0.28	4
96FA800	21/9/09	262	177	0.98	0	28/07/10	326	361	1.04	310	0.23	0
6CE502D	24/8/10	263	184	1.01	0	30/07/12	410	706	1.02	706	0.19	2
696B100	24/8/10	328	363	1.03	16	10/08/11	356	316	0.70	351	-0.04	0

The fastest growing of the Shieldaig fish, fish no 96FB1BB grew from 255mm, 172g to 356mm, 456g in just under one year. This is faster than some of the Gairloch fish, but not as fast as Gairloch 'fish F', which grew from 168g to 656g in 187 days. Note that over a year, one of the Shieldaig sea trout 696B100 lost weight, and was the most emaciated of the fish in the sample with a condition factor of only 0.7 when last caught [had this fish been heavily infected with sea lice?].

Much other information about sea trout survival and growth at the Shieldaig project can be found on line via various links on line including at:
http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/Science
[are there more recent published reports of results at Shieldaig?]

West Sutherland

West Sutherland Fisheries Trust has tagged and recaptured many sea trout in the River Polla estuary and River Laxford estuary over many years. Table 5.5 has been compiled from data presented in WSFT Annual Reviews which can be found on line at http://home.btconnect.com/wsft/Publications.html.

Table 5.5a Sea trout tagged and recaptured in the estuary of the River Polla by WSFT.

Tag no.	Location	initial date	initial length (mm)	initial weight (g)	initial condition factor	final date	final length (mm)	final weight (g)	final condition factor	inter-vening days	specific growth rate
J01	Polla	28-Mar-05	266	188	1.00	16-Apr-07	391	612	1.02	749	0.16
J19	Polla	23-May-05	180	57	0.98	16-Apr-07	424	688	0.90	693	0.36
K56	Polla	19-Aug-05	267	236	1.24	16-Apr-07	418	730	1.00	605	0.19
L97	Polla	25-May-06	230	139	1.14	16-Apr-07	336	338	0.89	326	0.27
I71	Polla	03-Aug-04	214	112	1.14	16-May-07	431	796	0.99	1016	0.19
O50	Polla	16-Apr-07	338	340	0.88	16-May-07	350	406	0.95	30	0.59
P09	Polla	23-Aug-06	264	200	1.09	16-May-07	338	444	1.15	266	0.30
X74	Polla	16-Jun-03	252	185	1.16	16-May-07	412	993	1.42	1430	0.12
O52	Polla	16-Apr-07	296	267	1.03	13-Jun-07	355	573	1.28	58	1.32
P09	Polla	16-May-07	338	444	1.15	13-Jun-07	365	577	1.19	28	0.94
P02	Polla	25-Jul-06	209	101	1.11	22-Apr-08	449	988	1.09	637	0.36
M36	Polla	22-Apr-08	280	228	1.04	5-May-08	286	235	1.00	13	0.23
M61	Polla	22-Apr-08	247	168	1.11	5-May-08	258	185	1.08	13	0.74
M51	Polla	22-Apr-08	270	230	1.17	3-Jun-08	304	340	1.21	42	0.93
M45	Polla	22-Apr-08	318	314	0.98	18-Jul-08		450		87	0.41
M62	Polla	22-Apr-08	270	200	1.02	31-Jul-08	341	390	0.98	100	0.67
I20	Polla	21-Jul-09	372	359	0.70	15-Apr-10	396	597	0.96	268	0.19
I70	Polla	18-Sep-09	316	373	1.18	15-Apr-10	374	571	1.09	209	0.20
I87	Polla	21-Sep-09	221	107	0.99	15-Apr-10	294	247	0.97	206	0.41
I20	Polla	15-Apr-10	396	597	0.96	14-Jun-10	406	663	0.99	60	0.17
J01	Polla	16-Apr-07	391	612	1.02	14-Jun-10	460	980	1.01	1155	0.04
M54	Polla	15-Apr-10	212	96	1.01	14-Jun-10	242	144	1.02	60	0.68
M62b	Polla	15-Apr-10	282	215	0.96	14-Jun-10	305	285	1.00	60	0.47
I20	Polla	14-Jun-10	406	663	0.99	14-Jul-10	407	600	0.89	30	-0.33
M61b	Polla	15-Apr-10	215	100	1.01	14-Jul-10	259	171	0.98	90	0.60
M62b	Polla	14-Jun-10	305	285	1.00	14-Jul-10	313	321	1.05	30	0.40
K56	Polla	16-Apr-07	418	730	1.00	4-Aug-10		2160		1206	0.09
I82	Polla	18-Sep-09	253	193	1.19	10-Sep-10	331	385	1.06	357	0.19
M61b	Polla	14-Jul-10	259	171	0.98	10-Sep-10	273	210	1.03	58	0.35
C79	Polla	10-Sep-10	182	66	1.09	27-Jun-11	246	165	1.11	290	0.32
D27	Polla	14-Jun-10	228	118	1.00	27-Jun-11	386	595	1.03	378	0.43
I67	Polla	18-Sep-09	264	211	1.15	27-Jun-11	390	686	1.16	647	0.18
I82	Polla	10-Sep-10	331	385	1.06	18-Aug-11	400	600	0.94	342	0.13

Average weight of tagged sea trout = 263g

Average weight of recaptured sea trout = 549g

Average specific growth rate of tagged and recaptured sea trout 2007-2011 = 0.37

Table 5.5b Sea trout tagged and recaptured in the estuary of the River Laxford by WSFT.

Tag no.	Location	initial date	initial length (mm)	initial weight (g)	initial condition factor	final date	final length (mm)	final weight (g)	final condition factor	inter-vening days	specific growth rate
J28	Laxford	23-May-05	161	46	1.10	18-Apr-07	290	210	0.86	695	0.22
J64	Laxford	23-May-05	169	50	1.04	17-May-07	295	220	0.86	724	0.20
P27	Laxford	25-Aug-06	246	152	1.02	17-May-07	278	200	0.93	265	0.10
P86	Laxford	25-Aug-06	252	163	1.02	17-May-07	261	169	0.95	265	0.01
R32	Laxford	27-Jun-06	196	88	1.17	17-May-07	278	200	0.93	324	0.25
O95	Laxford	18-Apr-07	178	70	1.24	14-Jun-07	203	98	1.17	57	0.59
N32	Laxford	17-May-05	179	53	0.92	17-Jul-07	236	141	1.07	791	0.12
N93	Laxford	17-Jul-07	220	80	0.75	6-May-08	260	172	0.98	294	0.26
P33	Laxford	25-Aug-06	279	248	1.14	6-May-08	382	575	1.03	620	0.14
M98	Laxford	06-May-08	256	178	1.06	2-Jun-08	261	192	1.08	27	0.28
M93	Laxford	06-May-08	252	152	0.95	4-Aug-08	288	254	1.06	90	0.57
N41	Laxford	02-Jul-08	173		0.00	2-Sep-08	190	56	0.82	62	
N72	Laxford	04-Aug-08	245	153	1.04	2-Sep-08	248	122	0.80	29	-0.78
oN38	Laxford	02-Jul-08	159		0.00	27-Apr-09	213	85	0.88	299	
rN79	Laxford	14-Jun-07	436	837	1.01	27-Apr-09	497	1125	0.92	683	0.04
H12	Laxford	27-Apr-09	453	1010	1.09	25-May-09	462	620	0.63	28	-1.74
A11	Laxford	25-May-09	148	35	1.08	22-Jun-09	171	50	1.00	28	1.27
rN26	Laxford	17-May-07	150	38	1.13	27-Nov-09	343		0.00	925	
A15	Laxford	25-May-09	159	39	0.97	14-Apr-10	316	299	0.95	324	0.63
A77	Laxford	22-Jun-09	149	26	0.79	14-Apr-10	231	115	0.93	296	0.50
H45	Laxford	27-Apr-09	154	39	1.07	14-Apr-10	253	155	0.96	352	0.39
H57	Laxford	25-May-09	176	42	0.77	14-Apr-10	266	170	0.90	324	0.43
H62	Laxford	25-May-09	188	60	0.90	14-Apr-10	260	149	0.85	324	0.28
H68	Laxford	25-May-09	187	57	0.87	14-Apr-10	305	270	0.95	324	0.48
H86	Laxford	25-May-09	166	42	0.92	14-Apr-10	297	227	0.87	324	0.52
H98	Laxford	25-May-09	204	77	0.91	14-Apr-10	288	222	0.93	324	0.33
I40	Laxford	23-Jul-09	205	91	1.06	14-Apr-10	279	242	1.11	265	0.37
A15	Laxford	14-Apr-10	316	299	0.95	12-May-10	332	326	0.89	28	0.31
I40	Laxford	14-Apr-10	279	242	1.11	12-May-10	281	234	1.05	28	-0.12
I85	Laxford	21-Sep-09	287	251	1.06	12-May-10	304	251	0.89	233	0.00
M26	Laxford	14-Apr-10	272	193	0.96	12-May-10	273	193	0.95	28	0.00
M42	Laxford	14-Apr-10	263	180	0.99	12-May-10	264	180	0.98	28	0.00
N27	Laxford	02-Jul-08	190		0.00	12-May-10	338	364	0.94	679	
K80	Laxford	11-Jun-10	175	60	1.12	13-Jul-10	190	80	1.17	32	0.90
A77	Laxford	14-Apr-10	231	115	0.93	9-Sep-10	257	183	1.08	148	0.31
A82	Laxford	22-Jun-09	196	80	1.06	9-Sep-10	311	303	1.01	444	0.30
D00	Laxford	11-Jun-10	217	106	1.04	9-Sep-10	234	123	0.96	90	0.17
D04	Laxford	11-Jun-10	183	70	1.14	9-Sep-10	211	114	1.21	90	0.54
D24	Laxford	11-Jun-10	193	65	0.90	9-Sep-10	224	107	0.95	90	0.55
D53	Laxford	13-Jul-10	208	99	1.10	9-Sep-10	224	112	1.00	58	0.21
D68	Laxford	13-Jul-10	186	60	0.93	9-Sep-10	212	110	1.15	58	1.05
K80	Laxford	13-Jul-10	190	80	1.17	9-Sep-10	207	93	1.05	58	0.26
M06	Laxford	14-Apr-10	313	282	0.92	9-Sep-10	344	400	0.98	148	0.24
N24	Laxford	02-Jul-08	242		0.00	9-Sep-10	295	228	0.89	799	
C01	Laxford	09-Sep-10	225	112	0.98	16-Apr-11	241	132	0.94	219	0.08
C18	Laxford	09-Sep-10	240	152	1.10	16-Apr-11	259	175	1.01	219	0.06
C30	Laxford	09-Sep-10	190	69	1.01	16-Apr-11	200	69	0.86	219	0.00
D61	Laxford	13-Jul-10	205	90	1.04	16-Apr-11	228	104	0.88	277	0.05
D68	Laxford	9-Sep-10	212	110	1.15	16-Apr-11	221	76	0.70	219	-0.17
H31	Laxford	27-Apr-09	175	50	0.93	16-Apr-11	303	217	0.78	719	0.20
K96	Laxford	11-Jun-10	175	51	0.95	16-Apr-11	213	81	0.84	309	0.15
H68	Laxford	25-May-09	187	57	0.87	15-Jul-11	368	545	1.09	781	0.29
D05	Laxford	11-Jun-10	160	46	1.12	16-Apr-13	206	88	1.01	1040	0.06

Average initial weight of tagged Laxford sea trout = 137.6g

Average final weight of tagged Laxford sea trout = 215.8g

Average specific growth rate of tagged Laxford sea trout = 0.23

Some of the West Sutherland fish grew particularly fast during April, May, June and July. On average, the Polla fish grew faster than Laxford fish; they were also a bit larger to start with. The fastest growth was of a Polla sea trout, Q52, of 296mm, 267g that was tagged on 16th April 2007, and recaptured on 13th June 07 at 355mm, 573g with a condition factor of 1.28, and Specific Growth Rate of 1.32. Of the Laxford fish, the fast growth was of a sea trout, A11, tagged on 25th May 2009 at 148mm, 35g which was recaptured on 22 June 2009 at 171g, 50g, with a condition factor of only 1.00 but a specific growth rate of 1.27.

In contrast, fish caught in the autumn then recaptured in the spring had low +ve or –ve specific growth rates, reflecting the period of time when sea trout feed less. In the early spring, West Sutherland sea trout, like those in Loch Gairloch were particularly thin, with condition factors of around 0.9 or 0.8 or sometimes less.

Overall, the growth rates of fish tagged in West Sutherland varied widely. They are comparable to those for sea trout recaptured in Loch Gairloch. They demonstrate the growth potential of sea trout during the months when sunlight hours are longest, and also the variability of growth at different time of the year.

The sample sizes of recaptured West Sutherland sea trout are possibly not large enough to say very much about differences between years in terms of growth rates, as there is much variation in the timing of capture and recapture. For the purposes of contrasting feeding opportunities and growth from year to year, comparison of the condition factors of larger samples of sea trout taken at a particular time of year provides a complimentary indicator.

WSFT data on sea lice burdens for sea trout caught in the Polla and Laxford has also been released by the Scottish Government via FoI; however it is beyond the scope or intention of this report to investigate this in detail at present.

6. Some Conclusions and recommendations

1. Parasitic *Lepeophtheirus salmonis* lice remained a major issue of concern for sea trout within Wester Ross in 2012. Heavily infected (>100 lice / fish) and fin-damaged sea trout were recorded at all sampling sites. Lice problems in 2012 may have been exacerbated by a dry period through June and into July; however at some sites (Loch Carron, Dundonnell and Kanaird), heavily infected fish were recorded in the first half of June, only a few weeks into the drought after a period of heavy rain in early May.

2. There is no indication of any significant long-term reduction in sea lice infection pressure for sea trout within Wester Ross.

3. The most heavily infected sea trout were sampled in areas where nearby salmon farms were in the second year of the production cycle (Loch Broom and Loch Carron - Kishorn). These and other observations strongly support the contention that lice levels on some nearby farms were too high to safeguard sea trout populations within the Wester Ross area.

4. Given the size of some farms and the number of farmed fish within them, Code of Good Practice guidelines for sea lice burdens are inadequate to prevent damage to sea trout in nearby waters. Farming areas may need to achieve a total on-farm *L. salmonis* ovigerous lice population of no more than a few thousand lice on farmed fish for sea trout fisheries to be revived in nearby waters. Where there are many farmed salmon in an area (1,000,000+), this may mean 0.02 ovigerous *L. salmonis* lice per farmed fish or less if nearby sea trout fisheries are to be revived to historic levels of productivity.

5. However, despite heavy burdens of sea lice, a few large (>450mm) well-fed sea trout were recorded at several sites, notably at Dundonnell, and Loch Gairloch where several larger fish were recaptured. Some of the recaptured fish shed lice burdens between the time of first capture and subsequent recapture and had grown. This may demonstrate an ability of sea trout to find food close to freshwater. At Dundonnell, this was illustrated by sprats being driven into the upper tidal pools of the river estuary, probably by mackerel shoals which were seen in the loch over much of the summer.

6. Recapture information supports the view that most of the larger sea trout in Wester Ross have been sedentary in their behaviour in recent years, moving only a few km from their source river. In Flowerdale Bay (Loch Gairloch), several sea trout were caught in the same place on more than one occasion in 2012. The only sea trout taken at Mungasdale (Gruinard Bay) in 2012 was identified as a recapture. Whether a sedentary lifestyle has always been the norm for Wester Ross sea trout, or has simply become the most successful life-strategy in recent years, given sea louse infection pressures around the coast, is possibly worthy of further consideration. From mark-recapture records, we know that in the past some sea trout from the Gruinard River have travelled as far as the Dundonnell river mouth (Butler 2000), [?a sea trout from Shieldaig (Loch Torridon) was recaptured in Applecross (ref. . . .)].

7. Analyses of the relative proportions of different sizes of sea trout in samples suggests that sea trout survival in Loch Gairloch is higher than at other sites in Wester Ross. However, this conclusion should be treated with caution as the Gairloch sample may have included disproportionately high numbers of larger sea trout relative to the local population compared to other WRFT sampling sites in Wester Ross, due to sampling time (samples were taken in winter and early spring only in Gairloch) and site characteristics.

8. Less easy to refute is the conclusion that Flowerdale Burn (Loch Gairloch) sea trout grew larger and lived longer than those that returned to the Shieldaig River (Loch Torridon). This may be associated with sea lice and proximity to salmon farms; however, there is also the possibility that local geographic characteristics of respective estuaries and predation pressure influenced survival. [The presence of a fish farm discharge pipe at the mouth of the River Kerry 2km from sampling site, through which waste feed some of which may be SLICE treated is available for sea trout to feed on, may also be a factor . . .]

9. At many of the sweep netting sites elsewhere in the West of Scotland, sea trout of 310mm or larger were rarely recorded (or not at all) during the period 1999 – 2009. The biggest sea trout caught in a sweep net in the West of Scotland during this period is thought to be a fish of 750mm taken in the River Polla estuary (Loch Eriboll) in 2007.

10. Sites where the largest sea trout (>459mm in length) were recorded tended to be located in sea lochs where there was an estuary or other area with nearby freshwater (as at Polla, Kanaird, Dundonnell, Carron, Feochan and head of Loch Fyne) and / or more than 10km away from salmon farms (e.g. Gairloch, Gress). This could be explored further via comparison of sea trout size with salinity measurements at a range of sites and times around respective sampling locations.

11. In contrast, sites where larger sea trout were particularly scarce or absent tended to be associated with areas with less nearby freshwater input and / or closer proximity to salmon farms. In particular, few larger sea trout were recorded in samples taken at sites to the north of Oban in Loch Linnhe, an area where there are many farmed salmon. These and other relationships could be explored further by incorporating data sets for 2009 – 2012 in the analyses, and also by analysing rod catch data for active sea trout fisheries in the west of Scotland (e.g. Loch Hope, Amhuinnsuidhe [Harris], Loch Lomond).

12. Specific Growth Rates were highest for sea trout captured then recaptured between April and July, and close to zero during winter months. This tallies with the findings of Nall, 1926. To assess whether inadequate feeding during the summer months in some areas may be subsequently contributing to higher mortality associated with emaciation during the winter or in the early spring, further consideration of sea trout condition in winter months in relation to their condition during the summer may be worthwhile.

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The MSS Shieldaig Sea trout data set and sea trout sampling data sets for West Sutherland, Lochaber, Argyll and Outer Hebrides areas were distributed to various parties by Don Staniford following a FoI request to the Scottish Government. So I thought I'd make use of them! Data sets for West Sutherland, Lochaber, Argyll and Outer Hebrides are used with the permission of respective Fishery Trusts to enable a comparison of sea trout sampled by WRFT in Wester Ross with those of other areas in the West of Scotland.

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Appendix 1: Data for trout sampled in the sea and nearby streams by WRFT in 2012 (sweep netting part-funded by the Scottish Government via RAFTS)

									Caligus	*Lepeophtheirus salmonis*						*Cryptocotyle lingua*		
No.	Location	Date	Method	Riv /Est / Beach	Sal/St	Length (mm)	Weight (g)	Condition factor	total	Chalimus	Pre-adult & adult	Ovigerous female	Total	Dorsal damage	Spots	densities (spots /cm^3)	Predator damage?	Comments
1	Flowerdale	11-Apr-12	sweep	estuary	ST	334	275	0.74	0	0	0	0	0	0		0	N	
2	Flowerdale	11-Apr-12	sweep	estuary	ST	261	120	0.67	0	1	0	0	1	0		1	N	
3	Flowerdale	11-Apr-12	sweep	estuary	ST	372	440	0.85	0	0	1	0	1	1		4	N	clipped?
4	Flowerdale	11-Apr-12	sweep	estuary	ST	255	130	0.78	0	0	0	0	0	1		2	N	
5	Flowerdale	11-Apr-12	sweep	estuary	ST	283	190	0.84	0	35	0	0	35	1		0	N	
6	Flowerdale	11-Apr-12	sweep	estuary	ST	252	128	0.80	0	8	0	0	8	0		3	N	
7	Flowerdale	11-Apr-12	sweep	estuary	ST	415	700	0.98	0	1	0	0	1	1		1	Y	
8	Flowerdale	11-Apr-12	sweep	estuary	ST	465	948	0.94	0	2	0	0	2	1		5	?Y	chopped tail fin 'Square tail'
9	Flowerdale	11-Apr-12	sweep	estuary	ST	201	70	0.86	0	3	0	0	3	0		0	N	
10	Flowerdale	11-Apr-12	sweep	estuary	ST	300	255	0.94	0	4	0	0	4	0		3	N	
11	Flowerdale	11-Apr-12	sweep	estuary	ST	350	349	0.81	0	5	2	0	7	0		2	Y	lower tail fin damage
12	Flowerdale	11-Apr-12	sweep	estuary	ST	330	295	0.82	0	6	3	0	9	0		3	N	
13	Flowerdale	11-Apr-12	sweep	estuary	ST	267	150	0.79	0	7	1	0	8	2		1	N	
14	Flowerdale	11-Apr-12	sweep	estuary	ST	238	122	0.90	0	2	0	0	2	0		1	N	
15	Flowerdale	11-Apr-12	sweep	estuary	ST	315	251	0.80	0	3	2	0	5	0		1	N	
16	Flowerdale	11-Apr-12	sweep	estuary	ST	270	179	0.91	0	3	0	0	3	0		3	N	
17	Flowerdale	11-Apr-12	sweep	estuary	ST	262	150	0.83	0	7	9	0	16	1		0	N	
18	Flowerdale	11-Apr-12	sweep	estuary	ST	257	140	0.82	0	4	2	0	6	2		1	N	
19	Flowerdale	11-Apr-12	sweep	estuary	ST	269	165	0.85	0	6	0	0	6	0		5	Y	lump on side
20	Flowerdale	11-Apr-12	sweep	estuary	ST	265	168	0.90	0	10	0	0	10	0		8	N	
21	Flowerdale	11-Apr-12	sweep	estuary	ST	320	290	0.89	0	9	0	0	9	1		4	N	
22	Flowerdale	11-Apr-12	sweep	estuary	ST	230	117	0.96	0	4	0	0	4	0		4	N	
23	Flowerdale	11-Apr-12	sweep	estuary	ST	248	128	0.84	0	0	0	0	0	0		0.2	N	
24	Flowerdale	11-Apr-12	sweep	estuary	ST	293	183	0.73	0	0	2	1	3	0		12	N	
25	Flowerdale	11-Apr-12	sweep	estuary	ST	271	168	0.84	0	2	1	0	3	0		2	N	
26	Flowerdale	11-Apr-12	sweep	estuary	ST	261	158	0.89	0	8	1	0	9	1		0	N	
27	Flowerdale	11-Apr-12	sweep	estuary	ST	250	139	0.89	0	3	0	0	3	1		0	N	
28	Flowerdale	11-Apr-12	sweep	estuary	ST	228	102	0.86	0	4	0	0	4	0		0	N	
29	Flowerdale	11-Apr-12	sweep	estuary	ST	465	1060	1.05	0	4	2	0	6	1		10	N	Fish B
30	Flowerdale	11-Apr-12	sweep	estuary	ST	362	425	0.90	0	9	2	1	12	1		20	N	
31	Flowerdale	11-Apr-12	sweep	estuary	ST	305	265	0.93	0	0	0	0	0	1		1	N	
32	Flowerdale	11-Apr-12	sweep	estuary	ST	302	266	0.97	0	7	12	0	19	2		4	N	trout spotty
33	Flowerdale	11-Apr-12	sweep	estuary	ST	342	310	0.77	0	12	0	0	12	1		1	N	
34	Flowerdale	11-Apr-12	sweep	estuary	ST	310	293	0.98	0	4	0	1	5	1		1	N	
35	Flowerdale	11-Apr-12	sweep	estuary	ST	357	380	0.84	0	10	0	0	10	0		3	N	clipped

36	Flowerdale	11-Apr-12	sweep	estuary	ST	232	104	0.83	0	0	0	0	0	0		3	Y	
37	Flowerdale	11-Apr-12	sweep	estuary	ST	265	171	0.92	0	22	3	0	25	1		2	N	
38	Flowerdale	11-Apr-12	sweep	estuary	ST	338	333	0.86	0	0	0	0	0	0		0	N	
39	Flowerdale	11-Apr-12	sweep	estuary	ST	250	123	0.79	0	4	0	0	4	0		3	N	
40	Flowerdale	11-Apr-12	sweep	estuary	ST	252	128	0.80	0	2	2	0	4	0		2	N	
41	Flowerdale	11-Apr-12	sweep	estuary	ST	253	135	0.83	0	9	0	0	9	1		0	N	
42	Flowerdale	11-Apr-12	sweep	estuary	ST	272	131	0.65	0	7	0	0	7	1		4	N	thin kelt
43	Flowerdale	11-Apr-12	sweep	estuary	ST	222	86	0.79	0	0	0	0	0	0		0	N	
44	Flowerdale	11-Apr-12	sweep	estuary	ST	242	110	0.78	0	14	0	0	14	1		0	N	
45	Flowerdale	11-Apr-12	sweep	estuary	ST	245	123	0.84	0	6	0	0	6	0		2	N	
46	Carron	9-May-12	sweep	estuary	ST	117	nd	nd	0	0	0	0	0	0	0	0	0	smolt
47	Carron	9-May-12	sweep	estuary	ST	260	nd	nd	0	70	52	2	124	3	2	2	0	
48	Carron	9-May-12	sweep	estuary	ST	434	nd	nd	0	1	1	1	3	2	2	1	0	
49	Carron	9-May-12	sweep	estuary	ST	309	nd	nd	0	80	64	4	148	2	1	0	0	copepod count minimum estimate
50	Carron	9-May-12	sweep	estuary	ST	316	nd	nd	0	67	45	3	115	3	3	2	0	
51	Flowerdale	22-May-12	sweep	estuary	ST	485	1070	0.94	0	4	27	3	34	1		20	N	
52	Flowerdale	22-May-12	sweep	estuary	ST	152	32	0.91	0	0	2	0	2	0		0	N	
53	Flowerdale	22-May-12	sweep	estuary	ST	150	nr	nr	0	0	0	0	0	0		0	N	
54	Flowerdale	22-May-12	sweep	estuary	ST	149	nr	nr	0	0	0	0	0	0		0	N	
55	Flowerdale	22-May-12	sweep	estuary	ST	195	66	0.89	0	0	0	0	0	0		0	N	
56	Flowerdale	22-May-12	sweep	estuary	ST	238	137	1.02	0	7	0	0	7	0		0	N	
57	Flowerdale	22-May-12	sweep	estuary	ST	231	96	0.78	0	1	5	1	7	1		2	N	
58	Flowerdale	22-May-12	sweep	estuary	ST	171	46	0.92	0	0	1	1	2	0		0	N	
59	Flowerdale	22-May-12	sweep	estuary	ST	161	37	0.89	0	0	0	0	0	0		0	N	
60	Flowerdale	22-May-12	sweep	estuary	ST	161	40	0.96	0	0	0	0	0	0		0	N	
61	Flowerdale	22-May-12	sweep	estuary	ST	170	49	1.00	0	0	0	0	0	0		3	N	
62	Flowerdale	22-May-12	sweep	estuary	ST	184	50	0.80	0	1	0	0	1	0		0	N	
63	Flowerdale	22-May-12	sweep	estuary	ST	192	59	0.83	0	0	0	0	0	0		0	N	
64	Flowerdale	22-May-12	sweep	estuary	ST	181	45	0.76	0	0	0	0	0	0		1	N	
65	Flowerdale	22-May-12	sweep	estuary	ST	179	45	0.78	0	0	0	0	0	0		0	N	
66	Flowerdale	22-May-12	sweep	estuary	ST	158	27	0.68	0	0	0	0	0	0		0	N	
67	Flowerdale	22-May-12	sweep	estuary	ST	152	35	1.00	0	0	0	0	0	0		0	N	
68	Flowerdale	22-May-12	sweep	estuary	ST	175	41	0.77	0	0	0	0	0	0		0	N	
69	Flowerdale	22-May-12	sweep	estuary	ST	146	30	0.96	0	0	0	0	0	0		0	N	
70	Flowerdale	22-May-12	sweep	estuary	ST	141	25	0.89	0	0	0	0	0	0		0	N	
71	Flowerdale	22-May-12	sweep	estuary	ST	159	29	0.72	0	0	0	0	0	0		1	Y	
72	Flowerdale	22-May-12	sweep	estuary	ST	161	34	0.81	0	0	0	0	0	0		0	N	
73	Flowerdale	22-May-12	sweep	estuary	ST	172	50	0.98	0	0	0	0	0	0		0	N	
74	Flowerdale	22-May-12	sweep	estuary	ST	178	53	0.94	0	0	0	0	0	0		0	N	
75	Flowerdale	22-May-12	sweep	estuary	ST	163	41	0.95	0	0	0	0	0	0		1	N	
76	Flowerdale	22-May-12	sweep	estuary	ST	148	30	0.93	0	0	0	0	0	0		1	N	
77	Flowerdale	22-May-12	sweep	estuary	ST	152	30	0.85	0	0	0	0	0	0		2	N	
78	Flowerdale	22-May-12	sweep	estuary	ST	164	39	0.88	0	0	0	0	0	0		0.5	N	
79	Flowerdale	22-May-12	sweep	estuary	ST	163	42	0.97	0	0	0	0	0	0		0	N	

80	Flowerdale	22-May-12	sweep	estuary	ST	159	36	0.90	0	0	0	0	0	0		0	N	
81	Flowerdale	22-May-12	sweep	estuary	ST	147	33	1.04	0	1	0	0	1	0		2	N	
82	Flowerdale	22-May-12	sweep	estuary	ST	153	32	0.89	0	0	0	0	0	0		0	N	
83	Flowerdale	22-May-12	sweep	estuary	ST	165	38	0.85	0	0	0	0	0	0		0	N	
84	Flowerdale	22-May-12	sweep	estuary	ST	149	35	1.06	0	0	0	0	0	0		0	N	
85	Flowerdale	22-May-12	sweep	estuary	ST	173	48	0.93	0	0	0	0	0	0		8	N	
86	Flowerdale	22-May-12	sweep	estuary	ST	160	28	0.68	0	0	0	0	0	0		0	N	
87	Flowerdale	22-May-12	sweep	estuary	ST	137	18	0.70	0	0	0	0	0	0		0	N	
88	Flowerdale	22-May-12	sweep	estuary	ST	164	31	0.70	0	0	0	0	0	0		0	N	
89	Flowerdale	22-May-12	sweep	estuary	ST	163	25	0.58	0	0	0	0	0	0		1	Y	
90	Flowerdale	22-May-12	sweep	estuary	ST	149	26	0.79	0	0	0	0	0	0		0	N	
91	Mungasdale	23-May-12	sweep	beach	ST	520	1167	0.83	2	10	7	10	27	1	n	0	N	recapture from 2011
92	Kanaird	5-Jun-12	sweep	estuary	ST	520	1655	1.18	0	0	0	0	0	0	n	N	N	?hybrid
93	Kanaird	5-Jun-12	sweep	estuary	ST	510	1225	0.92	0	65	12	1	78	1	y		N	
94	Kanaird	5-Jun-12	sweep	estuary	ST	405	655	0.99	0	100	1	0	101	1			N	
95	Kanaird	5-Jun-12	sweep	estuary	ST	308	312	1.07	0	20	5	0	25				N	
96	Kanaird	5-Jun-12	sweep	estuary	ST	373	475	0.92	0	90	1	0	91				N	
97	Kanaird	5-Jun-12	sweep	estuary	ST	435	840	1.02	0	100	0	0	100	1			N	Orange vent parasite (?Acanthocephalus sp.)
98	Kanaird	5-Jun-12	sweep	estuary	ST	375	532	1.01	0	120	0	0	120				N	
99	Kanaird	5-Jun-12	sweep	estuary	ST	180	66	1.13	0	50	3	0	53				N	Orange vent parasite (?Acanthocephalus sp.)
100	Kanaird	5-Jun-12	sweep	estuary	ST	128	112	5.34	0	60	25	0	85				N	
101	Kanaird	5-Jun-12	sweep	estuary	ST	172	45	0.88	0	5	0	0	5				N	
102	Kanaird	5-Jun-12	sweep	estuary	ST	181	60	1.01	0	128	1	0	129				N	
103	Kanaird	5-Jun-12	sweep	estuary	ST	170	48	0.98	0	28	0	0	28				N	
104	Kanaird	5-Jun-12	sweep	estuary	ST	360	452	0.97	0	102	2	0	104	1			N	
105	Kanaird	5-Jun-12	sweep	estuary	ST	168	48	1.01	0	11	0	0	11				N	
106	Kanaird	5-Jun-12	sweep	estuary	ST	170	38	0.77	0	72	0	0	72				N	
107	Kanaird	5-Jun-12	sweep	estuary	ST	173	43	0.83	0	58	0	0	58				N	
108	Kanaird	5-Jun-12	sweep	estuary	ST	370	430	0.85	0	18	3	0	21	1			N	Orange vent parasite (?Acanthocephalus sp.)
109	Kanaird	5-Jun-12	sweep	estuary	ST	180	61	1.05	0	128	0	0	128				N	
110	Kanaird	5-Jun-12	sweep	estuary	ST	152	30	0.85	0	60	4	0	64				N	
111	Kanaird	5-Jun-12	sweep	estuary	ST	212	94	0.99	0	2	2	0	4				N	
112	Kanaird	5-Jun-12	sweep	estuary	ST	162	50	1.18	0	128	0	0	128				N	
113	Kanaird	5-Jun-12	sweep	estuary	ST	162	43	1.01	0	0	0	0	0				N	
114	Kanaird	5-Jun-12	sweep	estuary	ST	163	45	1.04	0	50	0	0	50				N	
115	Kanaird	5-Jun-12	sweep	estuary	ST	175	62	1.16	0	90	0	0	90				N	
116	Kanaird	5-Jun-12	sweep	estuary	ST	267	220	1.16	0	80	0	0	80				N	
117	Kanaird	5-Jun-12	sweep	estuary	ST	196	59	0.78	0	140	0	0	140				N	
118	Kanaird	5-Jun-12	sweep	estuary	ST	182	65	1.08	0	112	0	0	112				N	
119	Kanaird	5-Jun-12	sweep	estuary	ST	169	49	1.02	0	170	0	0	170				Y	bird pred
120	Kanaird	5-Jun-12	sweep	estuary	ST	295	280	1.09	0	90	0	0	90				N	
121	Kanaird	5-Jun-12	sweep	estuary	ST	290	263	1.08	0	60	0	0	60				N	
122	Kanaird	5-Jun-12	sweep	estuary	ST	182	60	1.00	0	52	0	0	52				N	
123	Kanaird	5-Jun-12	sweep	estuary	ST	190	71	1.04	0	120	10	0	130	1			N	
124	Kanaird	5-Jun-12	sweep	estuary	ST	173	54	1.04	0	16	1	0	17				N	
125	Kanaird	5-Jun-12	sweep	estuary	ST	263	196	1.08	0	180	1	0	181	1			N	

126	Kanaird	5-Jun-12	sweep	estuary	ST	272	220	1.09	0	84	0	0	84				N	Orange vent parasite (?Acanthocephalus sp.)
127	Kanaird	5-Jun-12	sweep	estuary	ST	180	45	0.77	0	120	0	0	120				N	
128	Kanaird	5-Jun-12	sweep	estuary	ST	177	62	1.12	0	82	1	0	83				N	
129	Kanaird	5-Jun-12	sweep	estuary	ST	165	45	1.00	0	84	0	0	84				N	
130	Kanaird	5-Jun-12	sweep	estuary	ST	175	36	0.67	0	78	0	0	78				N	
131	Kanaird	5-Jun-12	sweep	estuary	ST	197	70	0.92	0	86	7	0	93				N	
132	Kanaird	5-Jun-12	sweep	estuary	ST	178	50	0.89	0	86	0	0	86				N	
133	Kanaird	5-Jun-12	sweep	estuary	ST	211	100	1.06	0	2	0	0	2				N	Orange vent parasite (?Acanthocephalus sp.)
134	Kanaird	5-Jun-12	sweep	estuary	ST	160	41	1.00	0	3	0	0	3				N	
135	Kanaird	5-Jun-12	sweep	estuary	ST	238	151	1.12	0	180	0	0	180	1			N	
136	Kanaird	5-Jun-12	sweep	estuary	ST	158	47	1.19	0	10	0	0	10				N	
137	Kanaird	5-Jun-12	sweep	estuary	ST	250	172	1.10	0	240	0	0	240	1			N	
138	Kanaird	5-Jun-12	sweep	estuary	ST	141	25	0.89	0	32	1	0	33				N	
139	Kanaird	5-Jun-12	sweep	estuary	ST	149	29	0.88	0	4	0	0	4				N	
140	Kanaird	5-Jun-12	sweep	estuary	ST	172	54	1.06	0	62	1	0	63				N	
141	Kanaird	5-Jun-12	sweep	estuary	ST	155	30	0.81	0	0	0	0	0				N	
142	Kanaird	5-Jun-12	sweep	estuary	ST	183	62	1.01	0	2	1	0	3				N	
143	Kanaird	5-Jun-12	sweep	estuary	ST	204	67	0.79	0	66	0	0	66				N	
144	Kanaird	5-Jun-12	sweep	estuary	ST	160	38	0.93	0	3	0	0	3				N	
145	Kanaird	5-Jun-12	sweep	estuary	ST	168	37	0.78	0	0	0	0	0				N	
	Kanaird	5-Jun-12	164 other sea trout caught and released following estimates of size and sea lice numbers														N	
146	Carron	5-Jun-12	sweep	estuary	ST	395	nd	nd	0	200+	40	0	240+	3	2	0	0	[photo shows 200+ copepodids on tail . .]
147	Carron	5-Jun-12	sweep	estuary	ST	168	nd	nd	0	4	45	0	49	2	2	1	0	
148	Dundonnell	6-Jun-12	fyke net	est	ST	210	113	1.22	0	135	0	0	135	1			Y	
149	Dundonnell	6-Jun-12	fyke net	est	ST	185	72	1.14	0	72	6	0	78	0			N	
150	Dundonnell	7-Jun-12	fyke net	est	ST	195	88	1.19	0	57	0	0	57	0			N	
151	Dundonnell	7-Jun-12	fyke net	est	ST	240	144	1.04	0	76	5	0	81	1			N	
152	Dundonnell	7-Jun-12	fyke net	est	ST	243	149	1.04	3	85	0	0	85	1			N	
153	Dundonnell	7-Jun-12	fyke net	est	ST	300+	365	nr	0	134	0	0	134	2			N	
154	Dundonnell	7-Jun-12	fyke net	est	ST	300+	505	nr	0	115	6	0	121	2			N	
155	Dundonnell	7-Jun-12	fyke net	est	ST	300+	417	nr	0	25	0	0	25	2			N	heavy damage but lice mostly fallen off
156	Dundonnell	7-Jun-12	fyke net	est	ST	170	62	1.26	7	54	0	0	54	1			N	
157	Dundonnell	7-Jun-12	fyke net	est	ST	140	34	1.24	4	77	0	0	81	1			N	
158	Dundonnell	12-Jun-12	fyke net	est	ST	440	720	0.85	0	50	0	0	50	0			N	
159	Dundonnell	12-Jun-12	fyke net	est	ST	410	681	0.99	0	23	0	0	23	0			N	
160	Dundonnell	12-Jun-12	fyke net	est	ST	205	92	1.07	0	33	0	0	33	0			N	
161	Dundonnell	12-Jun-12	fyke net	est	ST	168	47	0.99	0	53	0	0	53	0			N	
162	Dundonnell	12-Jun-12	fyke net	est	ST	?	25	nr	0	20	0	0	20	0			N	
163	Dundonnell	12-Jun-12	fyke net	est	ST	176	55	1.01	0	43	0	0	43	0			N	
164	Dundonnell	13-Jun-12	fyke net	est	ST	490	1134	0.96	0	52	3	1	56	2			N	
165	Dundonnell	13-Jun-12	fyke net	est	ST	173	55	1.06	0	15	1	0	16	0			Y	
166	Dundonnell	13-Jun-12	fyke net	est	ST	165	50	1.11	0	20	1	0	21	0			N	
167	Dundonnell	13-Jun-12	fyke net	est	ST	170	56	1.14	0	19	3	0	19	0			N	
168	Dundonnell	13-Jun-12	fyke net	est	ST	400	590	0.92	0	49	8	0	57	2			N	
169	Dundonnell	13-Jun-12	fyke net	est	ST	134	27	1.12	0	32	0	0	32	0			N	
170	Dundonnell	13-Jun-12	fyke net	est	ST	275	226	1.09	0	62	7	0	69	1			N	

171	Dundonnell	13-Jun-12	fyke net	est	ST	350	416	0.97	0	8	0	0	8	0			N	
172	Dundonnell	13-Jun-12	fyke net	est	ST	350	385	0.90	0	54	0	0	54	1			N	
173	Dundonnell	13-Jun-12	fyke net	est	ST	310	375	1.26	0	154	5	0	159	1			N	
174	Dundonnell	13-Jun-12	fyke net	est	ST	360	462	0.99	0	12	0	0	12	1			N	
175	Dundonnell	13-Jun-12	fyke net	est	ST	340	444	1.13	0	32	6	1	39	1			N	
176	Dundonnell	13-Jun-12	fyke net	est	ST	150	40	1.19	0	35	1	0	36	0			N	
177	Dundonnell	15-Jun-12	fyke net	est	ST	148	33	1.02		103	0	0	103	1			N	
178	Dundonnell	15-Jun-12	fyke net	est	ST	242	155	1.09		30	15	0	45	2		1	N	
179	Dundonnell	15-Jun-12	fyke net	est	ST	158	43	1.09		29	5	0	34	0		1	Y	
180	Dundonnell	15-Jun-12	fyke net	est	ST	111	17	1.24		0	0	0	0	0		1	N	
181	Dundonnell	18-Jun-12	fyke net	est	ST	149	39	1.18		7	5	0	12	0			N	
182	Dundonnell	18-Jun-12	fyke net	est	ST	125	61	3.12		12	5	0	17	0			N	
183	Dundonnell	18-Jun-12	fyke net	est	ST	162	39	0.92		0	0	0	0	0			N	
184	Dundonnell	18-Jun-12	fyke net	est	ST	155	39	1.05		21	2	0	23	1			N	
185	Dundonnell	18-Jun-12	fyke net	est	ST	145	33	1.08		28	2	0	30	1			N	
186	Dundonnell	18-Jun-12	fyke net	est	ST	190	73	1.06		18	8	0	26	1			N	
187	Dundonnell	18-Jun-12	fyke net	est	ST	145	39	1.28		32	7	0	39	1			N	
188	Dundonnell	18-Jun-12	fyke net	est	ST	158	39	0.99		0	1	0	1	1			N	
189	Dundonnell	18-Jun-12	fyke net	est	ST	175	64	1.19		27	11	0	38	1			N	
190	Dundonnell	18-Jun-12	fyke net	est	ST	155	39	1.05		18	8	0	26	1			N	
191	Inverasdale	19-Jun-12	sweep	beach	ST	280	241	1.10	5	5	9	6	20	0	N	0	N	
192	Inverasdale	19-Jun-12	sweep	beach	ST	181	64	1.08	3	3	0	0	3	0	N	0	N	
193	Dundonnell	20-Jun-12	fyke net	est	ST	160	45	1.10		13	2	0	15	0			N	
194	Dundonnell	21-Jun-12	fyke net	est	ST	?	?			0	0	1	1	1			N	
195	Dundonnell	21-Jun-12	fyke net	est	ST	?	670			1	1	0	2	1			N	
196	Dundonnell	21-Jun-12	fyke net	est	ST	?	585			13	4	0	17	1		2	Y	
197	Dundonnell	21-Jun-12	fyke net	est	ST	180	65	1.11		6	2	0	8	1			Y	
198	Dundonnell	21-Jun-12	fyke net	est	ST	208	92	1.02		23			23	0			N	
199	Dundonnell	21-Jun-12	fyke net	est	ST	194	80	1.10	0	4	2	0	6	3		0	N	
200	Dundonnell	21-Jun-12	fyke net	est	ST	181	64	1.08	0	16	1	0	17	0		0	N	
201	Dundonnell	21-Jun-12	fyke net	est	ST	289	260	1.08	0	57	1	0	58	2		0	N	
202	Dundonnell	21-Jun-12	fyke net	est	ST	335	510	1.36	0	20	12	1	33	2		1	N	
203	Dundonnell	21-Jun-12	fyke net	est	ST	350	522	1.22	0	44	3	1	48	1		10	N	
204	Dundonnell	21-Jun-12	fyke net	est	ST	365	538	1.11	0	65	6	1	72	2		0	N	
205	Dundonnell	21-Jun-12	fyke net	est	ST	310	379	1.27	0	12	6	0	18	0		0	N	
206	Dundonnell	22-Jun-12	fyke net	est	ST	171	55	1.10	0	19	3	0	21	0		0	N	
207	Dundonnell	22-Jun-12	fyke net	est	ST	200	95	1.19	0	29	8	0	37	1		1	Y	
208	Dundonnell	22-Jun-12	fyke net	est	ST	294	299	1.18	0	56	14	1	71	2		0	N	
209	Dundonnell	22-Jun-12	fyke net	est	ST	301	288	1.06	0	2	44	0	46	0		0	N	
210	Dundonnell	22-Jun-12	fyke net	est	ST	335	477	1.27	0	25	24	1	50	1		1	N	
211	Flowerdale	22-Jun-12	sweep	estuary	ST	487	1154	1.00	4	17	3	4	24	0		4	N	Fish 'B' recaptured
212	Flowerdale	22-Jun-12	sweep	estuary	ST	134	20	0.83	0	0	0	0	0	0		3	N	
213	Dundonnell	23-Jun-12	fyke net	est	ST	181	59	0.99	0	48	9	0	57	0		0	Y	
214	Dundonnell	23-Jun-12	fyke net	est	ST	166	48	1.05	0	10	11	0	21	0		0	N	
215	Dundonnell	23-Jun-12	fyke net	est	ST	164	41	0.93	0	0	0	0	0	0		0	N	

216	Dundonnell	23-Jun-12	fyke net	est	ST	169	51	1.06	0	26	10	0	36	0		0	N	
217	Dundonnell	26-Jun-12	fyke net	est	ST	175	50	0.93	0	0	0	0	0	0		0	Y	
218	Dundonnell	26-Jun-12	fyke net	est	ST	172	63	1.24	0	54	18	0	72	0		0	N	
219	Dundonnell	26-Jun-12	fyke net	est	ST	174	55	1.04	0	70	18	0	88	0		0	N	
220	Dundonnell	26-Jun-12	fyke net	est	ST	383	750	1.33	0	17	1	0	18	2		4	Y	
221	Dundonnell	26-Jun-12	fyke net	est	ST	202	86	1.04	0	11	0	0	11	1		4	Y	
222	Dundonnell	27-Jun-12	fyke net	est	ST	188	73	1.10	0	170	17	0	187	0		0	N	
223	Dundonnell	27-Jun-12	fyke net	est	ST	204	90	1.06	0	15	6	0	21	0		0	Y	
224	Dundonnell	27-Jun-12	fyke net	est	ST	194	85	1.16	0	40	5	0	45	0		0	N	
225	Dundonnell	27-Jun-12	fyke net	est	ST	130	23	1.05	0	0	0	0	0	0		0	N	
226	Boor Bay	4-Jul-12	sweep	estuary	ST	187	70	1.07	0	0	1	0	1	0	N	3	N	
227	Boor Bay	4-Jul-12	sweep	estuary	ST	231	141	1.14	1	1	1	0	2	0	N	1	N	
228	Boor Bay	4-Jul-12	sweep	estuary	ST	181	72	1.21	1	0	3	0	3	0	N	1	N	mostly stage 4 chalimus
229	Boor Bay	4-Jul-12	sweep	estuary	ST	197	77	1.01	1	1	2	0	3	0	N	1	?	old damage to lower portion of caudal fin
230	Boor Bay	4-Jul-12	sweep	estuary	ST	251	225	1.42	4	58	12	1	71	0	N	2	N	killed. 15 small sandeels in stomach
231	Boor Bay	5-Jul-12	sweep	estuary	ST	187	69	1.06	0	3	0	0	3	0	N	0	N	
232	Boor Bay	5-Jul-12	sweep	estuary	ST	197	104	1.36	0	9	0	1	10	0	N	0	N	
233	Boor Bay	5-Jul-12	sweep	estuary	ST	166	55	1.20	3	16	4	0	20	0	N	0	N	mostly stage 4 chalimus
234	Boor Bay	5-Jul-12	sweep	estuary	ST	189	83	1.23	0	4	0	0	4	0	N	0	N	
235	Ewe	11-Jul-12	rod	river	ST	245	165	1.12	?	22	11	0	33	1	y			
236	Ewe	11-Jul-12	rod	river	ST	218	96	0.93	0	0	0	0	0	0	0		?bird	
237	Ewe	11-Jul-12	rod	river	ST	240	146	1.06	5	7	4	1	12	0	0			
238	Ewe	11-Jul-12	rod	river	ST	250	161	1.03	0	9	42	1	52	nodules	small			
239	Ewe	11-Jul-12	rod	river	ST	246	183	1.23	?	8	12	0	20					caligus photo
240	Ewe	11-Jul-12	rod	river	ST	249	165	1.07	3	1	15	0	16	0.5				
241	Ewe	11-Jul-12	rod	river	ST	226	101	0.87	0	1	13	1	15	1	low		Y	
242	Ewe	11-Jul-12	rod	river	ST	248	166	1.09	0	7	15	0	22	1	neg			
243	Ewe	11-Jul-12	rod	river	ST	273	213	1.05	0	2	12	0	14	0				
244	Ewe	11-Jul-12	rod	river	ST	275	218	1.05	0	2	22	0	24	1	low			
245	Ewe	11-Jul-12	rod	river	ST	241	154	1.10	6	8	10	1	19	0				
246	Ewe	11-Jul-12	rod	river	ST	221	112	1.04	0	0	3	0	3	0				
247	Ewe	11-Jul-12	rod	river	ST	230	140	1.15	28	0	12	0	12	0.5				28 caligus
248	Ewe	11-Jul-12	rod	river	ST	232	130	1.04	1	106	16	1	123					
249	Ewe	11-Jul-12	rod	river	ST	250	170	1.09	0	0	11	0	11	0.5	very low			
250	Carron	12-Jul-12	sweep	estuary	ST	425	nd	nd	0	0	2	0	2	3	Y	1		
251	Carron	12-Jul-12	sweep	estuary	ST	234	nd	nd	0	0	0	12	12	1	Y	1		
252	Carron	12-Jul-12	sweep	estuary	ST	310	nd	nd	0	60	10	15	85	3	Y	1		
253	Carron	12-Jul-12	sweep	estuary	ST	244	nd	nd	0	8	1	1	10	3	Y	1		
254	Carron	12-Jul-12	sweep	estuary	ST	224	nd	nd	0	30	16	6	52	2	Y	1		
255	Carron	12-Jul-12	sweep	estuary	ST	211	nd	nd	0	8	13	1	22	1	Y	0		
256	Carron	12-Jul-12	sweep	estuary	ST	224	nd	nd	0	35	17	1	53	1	Y	0		
257	Carron	12-Jul-12	sweep	estuary	ST	209	nd	nd	0	32	16	1	49	2	Y	0		

258	Carron	12-Jul-12	sweep	estuary	ST	203	nd	nd	0	17	10	1	28	1	Y	0		
259	Kanaird	17-Jul-12	sweep	estuary	ST	438	1045	1.24	0	17	8	3	28	2	Y		?N	bashed nose & damaged
260	Kanaird	17-Jul-12	sweep	estuary	ST	400	750	1.17	0	4	10	0	14	2	Y		N	
261	Kanaird	17-Jul-12	sweep	estuary	ST	201	80	0.99	0	0	0	0	0	0	Y		N	
262	Kanaird	17-Jul-12	sweep	estuary	ST	315	365	1.17	0	60	10	0	70	2	Y		N	hookworm
263	Kanaird	17-Jul-12	sweep	estuary	ST	292	285	1.14	0	15	1	0	16	1	Y		N	healing fin
264	Kanaird	17-Jul-12	sweep	estuary	ST	392	690	1.15	0	27	10	0	37	1	Y		N	possible
265	Kanaird	17-Jul-12	sweep	estuary	ST	370	630	1.24	0	2	3	0	5	1	Y		N	
266	Kanaird	17-Jul-12	sweep	estuary	ST	260	220	1.25	0	0	2	0	2	0	Y		N	
267	Kanaird	17-Jul-12	sweep	estuary	ST	261	178	1.00	0	0	0	0	0	0	Y		N	
268	Kanaird	17-Jul-12	sweep	estuary	ST	430	850	1.07	0	37	6	0	43	2	Y		N	
269	Kanaird	17-Jul-12	sweep	estuary	ST	271	241	1.21	0	2	1	0	3	0	Y		N	np
270	Kanaird	17-Jul-12	sweep	estuary	ST	211	105	1.12	0	4	0	0	4	0	Y		N	
271	Kanaird	17-Jul-12	sweep	estuary	ST	231	135	1.10	0	11	1	0	12	0	Y		N	
272	Kanaird	17-Jul-12	sweep	estuary	ST	220	120	1.13	0	0	1	0	1	0	Y		N	
273	Kanaird	17-Jul-12	sweep	estuary	ST	270	224	1.14	0	0	6	3	9	3	Y		N	
274	Kanaird	17-Jul-12	sweep	estuary	ST	355	620	1.39	0	22	2	0	24	0	Y		N	
275	Kanaird	17-Jul-12	sweep	estuary	ST	198	85	1.10	0	0	2	0	2	0	Y		N	
276	Kanaird	17-Jul-12	sweep	estuary	ST	220	133	1.25	0	2	2	0	4	0	Y		N	
277	Kanaird	17-Jul-12	sweep	estuary	ST	279	254	1.17	0	4	4	0	8	0	Y		N	
278	Kanaird	17-Jul-12	sweep	estuary	ST	390	640	1.08	0	9	1	0	10	0	Y		N	split tail
279	Kanaird	17-Jul-12	sweep	estuary	ST	333	440	1.19	0	10	0	0	10	0	Y		N	
280	Kanaird	17-Jul-12	sweep	estuary	ST	225	128	1.12	0	3	1	0	4	0	Y		Y	bite mark
281	Kanaird	17-Jul-12	sweep	estuary	ST	235	145	1.12	0	114	20	1	135	1	Y		N	
282	Kanaird	17-Jul-12	sweep	estuary	ST	185	70	1.11	0	0	0	0	0	0	Y		N	
283	Kanaird	17-Jul-12	sweep	estuary	ST	228	135	1.14	0	7	0	0	7	1	Y		Y	predator damage
284	Kanaird	17-Jul-12	sweep	estuary	ST	206	90	1.03	0	0	1	0	1	0	Y		N	
285	Kanaird	17-Jul-12	sweep	estuary	ST	203	93	1.11	0	0	0	0	0	1	Y		N	
286	Kanaird	17-Jul-12	sweep	estuary	ST	227	126	1.08	0	0	0	0	0	1	Y		N	
287	Kanaird	17-Jul-12	sweep	estuary	ST	216	110	1.09	0	5	0	0	5	0	Y		N	
288	Kanaird	17-Jul-12	sweep	estuary	ST	240	165	1.19	0	1	1	0	2	1	Y		N	
289	Kanaird	17-Jul-12	sweep	estuary	ST	216	110	1.09	0	1	2	0	3	1	Y		N	
290	Kanaird	17-Jul-12	sweep	estuary	ST	302	305	1.11	0	60	0	0	60	1	Y		N	
291	Kanaird	17-Jul-12	sweep	estuary	ST	193	72	1.00	0	2	0	0	2	0	Y		N	
292	Kanaird	17-Jul-12	sweep	estuary	ST	185	54	0.85	0	0	0	0	0	0	Y		N	
293	Kanaird	17-Jul-12	sweep	estuary	ST	208	85	0.94	0	0	0	0	0	0	Y		N	
294	Kanaird	17-Jul-12	sweep	estuary	ST	216	100	0.99	0	1	0	0	1	1	Y		N	
295	Kanaird	17-Jul-12	sweep	estuary	ST	190	60	0.87	0	2	0	0	2	1	Y		Y	tail bitten
296	Kanaird	17-Jul-12	sweep	estuary	ST	249	155	1.00	0	0	0	0	0	0.5	Y		N	lice off
297	Kanaird	17-Jul-12	sweep	estuary	ST	200	79	0.99	0	0	0	0	0	0	Y		N	
298	Kanaird	17-Jul-12	sweep	estuary	ST	167	42	0.90	0	20	0	0	20	1	Y		N	
299	Kanaird	17-Jul-12	sweep	estuary	ST	183	57	0.93	0	0	1	0	1	1	Y		N	

300	Kanaird	17-Jul-12	sweep	estuary	ST	213	98	1.01	0	4	1	0	5	1	Y		N	
301	Kanaird	17-Jul-12	sweep	estuary	ST	210	99	1.07	0	3	0	0	3	0	Y		N	
302	Kanaird	17-Jul-12	sweep	estuary	ST	220	115	1.08	0	1	2	0	3	0	Y		N	
303	Kanaird	17-Jul-12	sweep	estuary	ST	193	78	1.08	0	0	0	0	0	1	Y		N	
304	Kanaird	17-Jul-12	sweep	estuary	ST	260	195	1.11	0	0	2	0	2	0	Y		N	
305	Kanaird	17-Jul-12	sweep	estuary	ST	212	107	1.12	0	3	0	0	3	1	Y		N	
306	Kanaird	17-Jul-12	sweep	estuary	ST	207	100	1.13	0	1	0	0	1	1	Y		N	
307	Kanaird	17-Jul-12	sweep	estuary	ST	193	85	1.18	0	0	0	0	0	0	Y		N	
308	Flowerdale	20-Jul-12	sweep	estuary	ST	350	457	1.07	0	38	47	7	92	2		15	N	bashed nose & damaged
309	Flowerdale	20-Jul-12	sweep	estuary	ST	495	1205	0.99	0	82	20	2	104	2.5		12	N	fishB
310	Flowerdale	20-Jul-12	sweep	estuary	ST	245	148	1.01	0	53	34	1	88	2		9	N	
311	Flowerdale	20-Jul-12	sweep	estuary	ST	174	56	1.06	0	13	11	1	25	0.5		18	N	
312	Flowerdale	20-Jul-12	sweep	estuary	ST	145	25	0.82	0	2	0	0	2	0		2	N	
313	Flowerdale	20-Jul-12	sweep	estuary	ST	150	35	1.04	0	18	2	0	20	1		4	N	
314	Flowerdale	20-Jul-12	sweep	estuary	ST	177	60	1.08	0	28	8	0	36	1.5		7	N	
315	Flowerdale	20-Jul-12	sweep	estuary	ST	176	60	1.10	0	18	16	0	34	1.5		12	N	
316	Flowerdale	20-Jul-12	sweep	estuary	ST	160	45	1.10	0	0	4	0	4	0		0	N	
317	Flowerdale	20-Jul-12	sweep	estuary	ST	153	35	0.98	0	10	4	0	14	0		1	N	
318	Ewe	20-Jul-12	rod	river	ST	271	234	1.18	3	7	13	0	20	0.5	y		n	
319	Ewe	20-Jul-12	rod	river	ST	268	223	1.16	0	6	4	0	10	0		0	n	
320	Ewe	20-Jul-12	rod	river	ST	242	170	1.20	0	0	0	0	0	0			n	
321	Ewe	20-Jul-12	rod	river	ST	235	186	1.43	4	5	9	1	15	0.5		1	n	
322	Ewe	20-Jul-12	rod	river	ST	248	168	1.10	0	0	0	0	0	0			n	
323	Ewe	20-Jul-12	rod	river	ST	235	159	1.23	0	1	2	0	3	0		1	n	
324	Ewe	20-Jul-12	rod	river	ST	264	198	1.08	0	1	0	0	1	0		2	n	
325	Ewe	20-Jul-12	rod	river	ST	244	165	1.14	0	8	2	0	10	0		1	n	
326	Ewe	20-Jul-12	rod	river	ST	224	126	1.12	0	0	0	0	0	0		1	n	
327	Ewe	20-Jul-12	rod	river	ST	247	158	1.05	0	4	1	0	5	0		1	n	
328	Ewe	20-Jul-12	rod	river	ST	267	221	1.16	0	4	15	0	19	1		1	n	
329	Ewe	20-Jul-12	rod	river	ST	244	147	1.01	0	1	1	0	2	0		2	n	
330	Ewe	20-Jul-12	rod	river	ST	234	145	1.13	0	5	2	0	7	0		1	n	
331	Ewe	20-Jul-12	rod	river	ST	232	145	1.16	0	12	4	0	16	1		0	n	
332	Ewe	20-Jul-12	rod	river	ST	234	139	1.08	0	1	1	0	2	0		1	n	
333	Dundonnell	25-Jul-12	fyke net	est	ST	200	87	1.09	0	40	0	0	40	1			N	
334	Dundonnell	25-Jul-12	fyke net	est	ST	270	238	1.21	0	2	0	0	2	1			N	
335	Dundonnell	8-Aug-12	fyke net	est	ST	223	110	0.99	0	10	0	0	10	1			N	
336	Dundonnell	8-Aug-12	fyke net	est	ST	246	180	1.21	0	10	2	0	12	1			N	
337	Dundonnell	8-Aug-12	fyke net	est	ST	245	154	1.05	0	0	0	0	0	0			Y	
338	Dundonnell	8-Aug-12	fyke net	est	ST	209	91	1.00	0	0	0	0	0	0			N	
339	Dundonnell	8-Aug-12	fyke net	est	ST	213	105	1.09	0	1	0	0	1	1		1	Y	
340	Dundonnell	8-Aug-12	fyke net	est	ST	370	593	1.17	0	0	0	0	0	2			Y	
341	Dundonnell	8-Aug-12	fyke net	est	ST	276	209	0.99	0	1	0	0	1	1			Y	

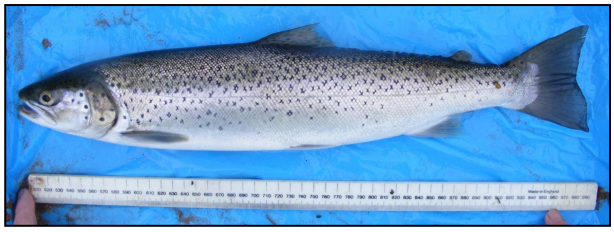
342	Dundonnell	8-Aug-12	fyke net	est	ST	227	114	0.97	0	7	0	0	7	2			n	
343	Dundonnell	8-Aug-12	fyke net	est	ST	244	163	1.12	0	0	0	0	0	0			Y	
344	Dundonnell	8-Aug-12	fyke net	est	ST	266	213	1.13	0	5	2	0	7	1			Y	
345	Dundonnell	9-Aug-12	fyke net	est	ST	220	114	1.07	0	0	0	0	0	1			n	
346	Dundonnell	9-Aug-12	fyke net	est	ST	240	148	1.07	0	2	0	0	2	1			N	
347	Dundonnell	9-Aug-12	fyke net	est	ST	204	97	1.14	0	9	1	0	10	0			Y	
348	Dundonnell	9-Aug-12	fyke net	est	ST	237	132	0.99	0	8	2	0	10	1			Y	
349	Dundonnell	9-Aug-12	fyke net	est	ST	278	231	1.08	0	32	8	2	42	2			Y	
350	Dundonnell	9-Aug-12	fyke net	est	ST	318	382	1.19	0	1	0	0	1	2			Y	
351	Dundonnell	14-Aug-12	fyke net	est	ST	530	1826	1.23	0	0	1	1	2	2			N	all fins ragged
352	Dundonnell	15-Aug-12	fyke net	est	ST	214	98	1.00	0	0	1	0	1	1			Y	
353	Dundonnell	15-Aug-12	fyke net	est	ST	249	159	1.03	0	1	0	0	1	1			Y	
354	Dundonnell	15-Aug-12	fyke net	est	ST	195	65	0.88	0	0	0	0	0	1			Y	
355	Dundonnell	15-Aug-12	fyke net	est	ST	227	107	0.91	0	5	10	0	15	1			Y	
356	Dundonnell	15-Aug-12	fyke net	est	ST	183	65	1.06	0	3	2	0	5	2			Y	
	Flowerdale	21-Aug-12	sweep	estuary	BT	139	26	0.97	0	0	0	0	0	0	Y	3	N	
357	Flowerdale	21-Aug-12	sweep	estuary	ST	415	437	0.61	0	0	4	3	7	1	Y	0	N	
	Flowerdale	17-Sep-12	sweep	estuary	SAL	725	nd	nd	nd	nd	nd	nd	nd	nd			N	released - too big for bucket
	Flowerdale	17-Sep-12	sweep	estuary	SAL	700	nd	nd	nd	nd	nd	nd	nd	nd			N	released - too big for bucket
358	Flowerdale	17-Sep-12	sweep	estuary	ST	395	667	1.08	0	0	3	8	11	1		15	N	recap
359	Flowerdale	17-Sep-12	sweep	estuary	ST	420	692	0.93	0	0	3	0	3	1		8	N	thin
360	Flowerdale	17-Sep-12	sweep	estuary	ST	430	734	0.92	0	0	3	5	8	0.5		1	N	missing pec fin
361	Flowerdale	17-Sep-12	sweep	estuary	ST	520	1512	1.08	0	0	4	6	10	1		0	N	recap
362	Flowerdale	17-Sep-12	sweep	estuary	ST	289	275	1.14	0	0	0	1	1	0		0	N	thin
363	Flowerdale	17-Sep-12	sweep	estuary	ST	222	102	0.93	0	0	1	0	1	0		5	N	
364	Flowerdale	17-Sep-12	sweep	estuary	ST	278	212	0.99	0	0	1	0	1	0		10	N	
365	Flowerdale	17-Sep-12	sweep	estuary	ST	169	30	0.62	0	0	0	0	0	0		nd	N	
366	Flowerdale	15-Oct-12	sweep	estuary	ST	396	656	1.06	0	0	1	3	4	1	0	10	Y	recap
367	Flowerdale	15-Oct-12	sweep	estuary	ST	260	158	0.90	0	0	0	0	0	0	0	0	Y	
368	Flowerdale	15-Oct-12	sweep	estuary	ST	315	306	0.98	0	0	0	0	0	0.5	0	0	N	
369	Flowerdale	15-Oct-12	sweep	estuary	ST	270	183	0.93	0	0	0	0	0	0	0	0	N	
370	Flowerdale	15-Oct-12	sweep	estuary	ST	410	666	0.97	0	0	0	0	0	0	0	0	N	f ?kelt
371	Flowerdale	15-Oct-12	sweep	estuary	ST	432	788	0.98	0	0	1	0	1	0	0	50	N	f ready to spawn
372	Flowerdale	15-Oct-12	sweep	estuary	ST	288	230	0.96	0	0	0	0	0	0	0	4	N	
373	Flowerdale	15-Oct-12	sweep	estuary	ST	262	160	0.89	0	0	0	0	0	0	0	1	N	
374	Flowerdale	15-Oct-12	sweep	estuary	ST	268	188	0.98	0	0	0	0	0	0.5	0	20	N	
375	Flowerdale	15-Oct-12	sweep	estuary	ST	255	150	0.90	0	0	0	0	0	0	0	3	N	
376	Flowerdale	15-Oct-12	sweep	estuary	ST	290	229	0.94	0	0	1	0	1	0	0	3	N	
377	Flowerdale	15-Oct-12	sweep	estuary	ST	263	188	1.03	0	0	2	0	2	1	0	4	N	
378	Flowerdale	15-Oct-12	sweep	estuary	ST	253	150	0.93	0	0	0	0	0	0	0	0	N	
379	Flowerdale	15-Oct-12	sweep	estuary	ST	393	610	1.00	0	0	0	0	0	0	0	0	N	
380	Flowerdale	15-Oct-12	e-fish	estuary	ST	495	1318	1.09	0	0	0	0	0	nr	0	nr	mark	F fish B
381	Flowerdale	15-Oct-12	e-fish	estuary	ST	370	395	0.78	0	0	1	0	0	nr	0	nr		F recap
382	Flowerdale	15-Oct-12	e-fish	estuary	ST	390	400	0.67	0	0	0	0	0	?1.5	0	nr		F ?recap
383	Flowerdale	15-Oct-12	e-fish	estuary	ST	220	83	0.78	0	0	0	0	0	nr	0	nr		immature finnock

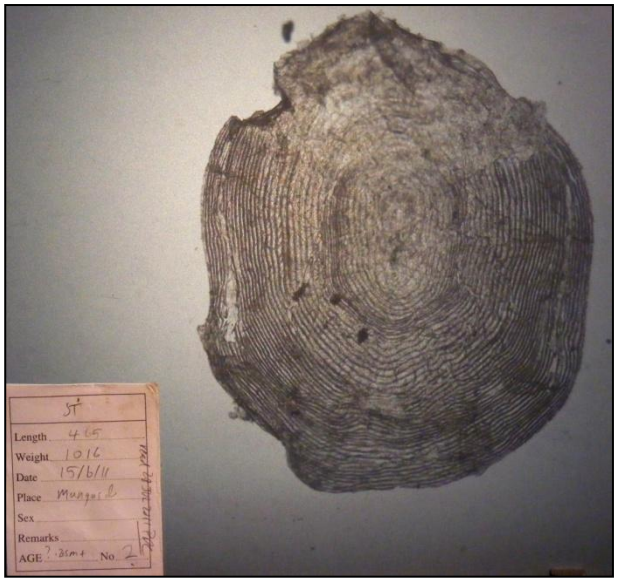
Appendix 2: More sea trout and their scales . . .

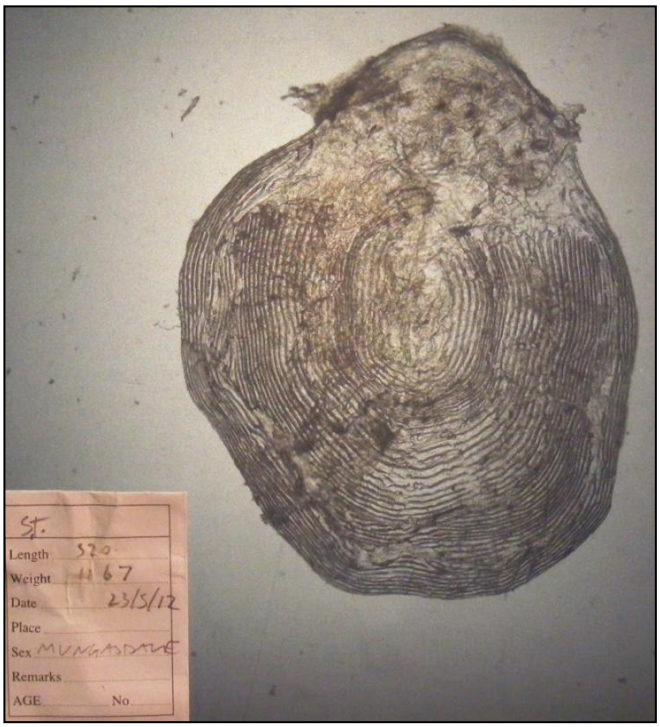
Zoom to page width to see the scales clearly. Scale photos by Alfie Gudgeon.

(left) Sea trout 465mm, 1016g (cf. 1.01), taken at Mungasdale bay on 15th June 2011. This fish had 31 lice: (0 chalimus, 14 pre-adult and adult lice and 17 ovigerous females). The scale shows a spawning mark from the year before

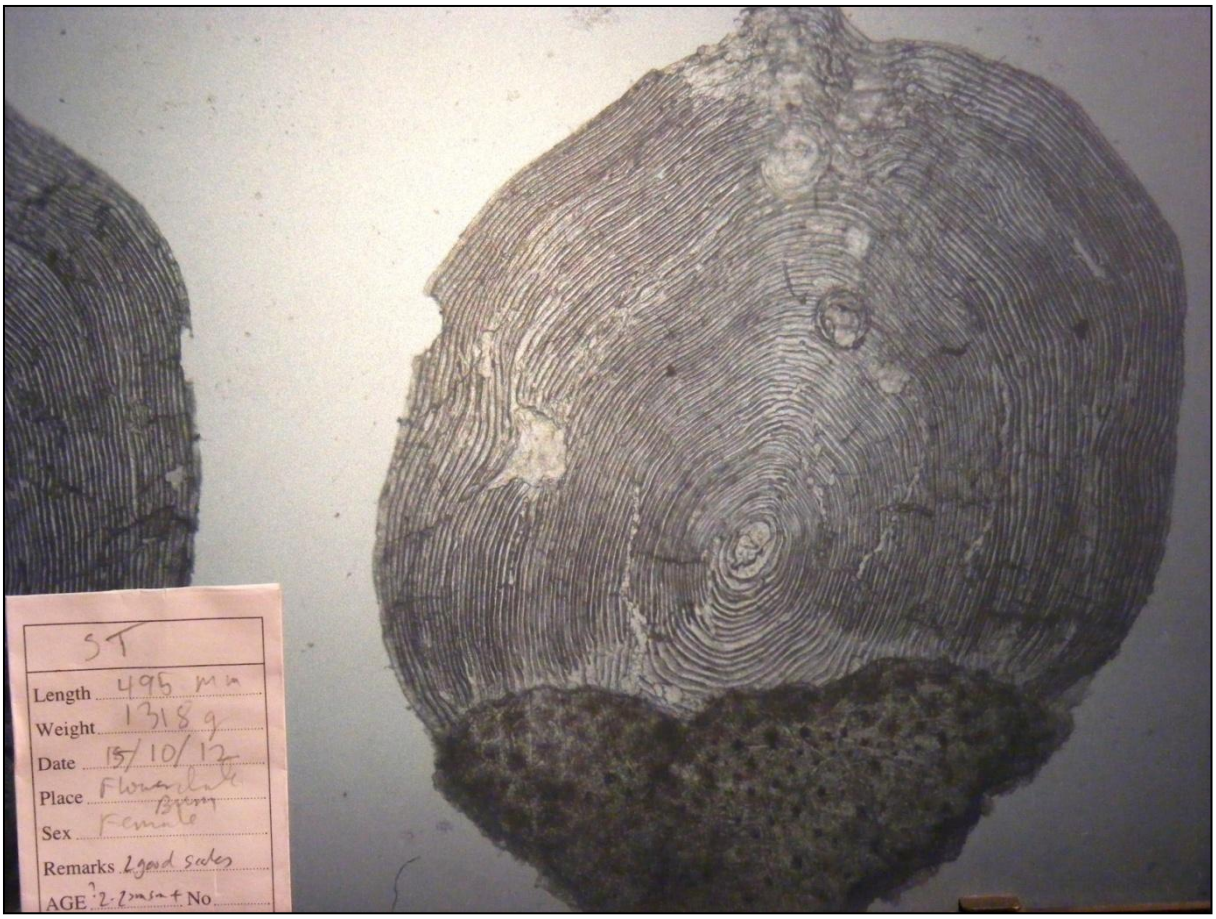
(right) The same sea trout, caught at Mungasdale Bay on 23rd May 2012, 520mm, 1167g; condition factor 0.83 (still rather thin) with 27 Lepeophtheirus salmonis lice (10 chalimus, 7 adults and pre-adults, 10 ovigerous females) and 2 Caligus elongatus. It's not clear from the scale whether there is another spawning mark from 2011, or whether the fish has had a recovery year in 2011 following spawning in 2010 (PC interpretation).







Fish B, caught in the *Flowerdale burn, on 15th October 2012: 495mm, 1318g; condition factor 1.09. No sea lice. This sea trout was caught possibly close to where she would spawn within a few days of capture. The sea trout had been caught 6 times previously in the nearby Flowerdale estuary, and was caught in spawning condition in the on 22nd September 2011 having reached a length of 425mm. This fish was the best conditioned of those caught in the sweep net samples on 18th March 2011, and 11th April 2012; her survival tends to emphasise the advantage of being in good condition. Note the round circular Cryptocotyle lingua marks on the scale; another Loch Gairloch characteristic.*



A Kanaird sea trout and its scales.

Zoom to page width.
This is a fish was taken on two occasions in the sea pool of the River Kanaird:

(left) Sea trout of 375mm, 532g (cf. 1.01) taken on 5th June 2012 with 120 chalimus lice..

(right) The same sea trout taken on 17th July 2012, now 390mm and 640g (cf 1.08), with only 10 lice.

Both scales show rather chequered growth, and it's not obvious how old the fish is or where it has been. Freshwater growth is a bit blurry on both scales: I think the fish was a 2 year old smolt; thereafter there are 4 checks between sea summer growth, each of which could represent a winter. This would be quite slow growth for a sea trout, taking 4 sea summer to reach a length of 375mm. Back calculation of lengths based on the checks on the scale give lengths as follows: 2 (winters freshwater), 174mm (3 winters – including one sea or estuary winter); 225mm (4 winters – including 2 sea or estuary winters); 267mm (5 winters - including 2 sea winters); 340mm (spring 2012: 6 winters – including 4 sea winters).
Alternatively, the first 4 winters are all in freshwater, and the trout went to sea for the first time as a large smolt of 225mm, then after first winter at sea reached a length of only 267mm, and after second sea winter a length of 340mm, and was in its 3rd sea summer at time of capture.
Given the high numbers of lice on sea trout in the Kanaird estuary, sea growth could have been reduced; though note that the fish had gained length and weight during the 6 weeks between first and second capture despite carrying a burden of 120 lice (with dorsal fin damage) when first caught.