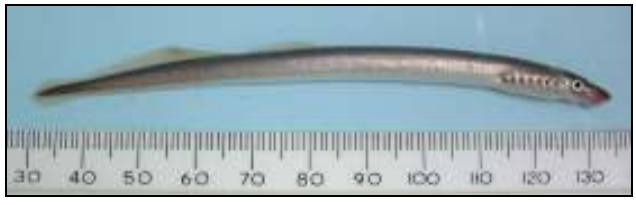
WESTER ROSS FISHERIES TRUST

REVIEW MAY 2006



 Registered Charity Number SCO24787

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REVIEW

by

Peter Cunningham, Dr Lorna Brown & Ben Rushbrooke

May 2006

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Wild salmon parr habitat, on the lower slopes of Beinn Eighe. *(Peter Cunningham)*

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Part 1 **Chairman's preface**

It gives me great pleasure to write another preface to the Wester Ross Fisheries Trust's Annual Review. The over-riding message – and a very welcome one – is that the improvement in the numbers of wild salmon returning to Wester Ross rivers in 2004, which was highlighted in last year's Review was generally maintained in 2005. The sea-trout picture was more mixed, with some rivers doing better than others and with more finnock around than mature spawning fish.

A particularly welcome feature in the marine environment was the very low level of sea-lice in the sea lochs, in what was the second year of production on most of the fish farms. While there are no grounds for complacency, there is evidence that the work by the fish farming companies to improve their site management, to make full use of 'SLICE' and reduce the risk of escapes is starting to pay dividends for wild fish stocks. And with four Area Management Groups now operating in the Trust area, the level of co-operative working between wild and farmed fish interests is substantial.

This Review makes fascinating reading on the question of whether and how to restore rivers by restocking. But be warned, there are no simple answers; the message remains one of the need for continuing care and vigilance. At one end of the spectrum, Bob Kindness reports on the accumulating evidence of success with his large scale stocking programme on the Carron. At the other is the evidence from Ben Rushbrooke's work at the Tournaig trap that small river systems which are devoid of salmon can be repopulated by stray fish from neighbouring rivers. The Ullapool River with its remarkable catch records going back 100 years shows a switch from spring to summer and autumn fish which occurred from about 1950 that may be partly the result of restocking.

Other aspects of the Review show the tremendous amount of work which Peter Cunningham and his colleagues carried out during the year. The work on Loch Maree highlights the wide distribution of minnows in the loch which well may have played a part in displacing juvenile trout. The introduction by visiting anglers of a species which is not native to the area underlines the importance of the proposed new controls on the movements of fish in the Aquaculture and Fisheries Bill. While the Trust remains focused on its core work concerning salmon and sea-trout, it is expanding its research on other fish. The Trust's research on wild brown trout in Wester Ross's hill lochs continues and we hope to find out more about our populations of the elusive Arctic charr, which may be a much more significant local species than we currently appreciate.

Finally the Review shows how the Trust's work with schools is growing. Particular credit is due to Dr Lorna Brown for taking salmon and trout into the classrooms of even more primary schools during 2005 and 2006.

Brenda Kerrison joined the Trust as our administrator during 2005 and Veronica Mullaney took over the book-keeping and management accounts. They have made big improvements in these areas and enabled Peter and Lorna to concentrate on their scientific work.

The accounts at the back of the Review show how the Trust's financial position is strengthening and on behalf of the Trustees I should like to thank all those who have helped to make this possible. Small charities like ours with a high proportion of fixed outgoings and uncertain and variable incomes are notoriously fragile and my colleagues and I never take for granted the generosity of those who enable us to keep our work going.

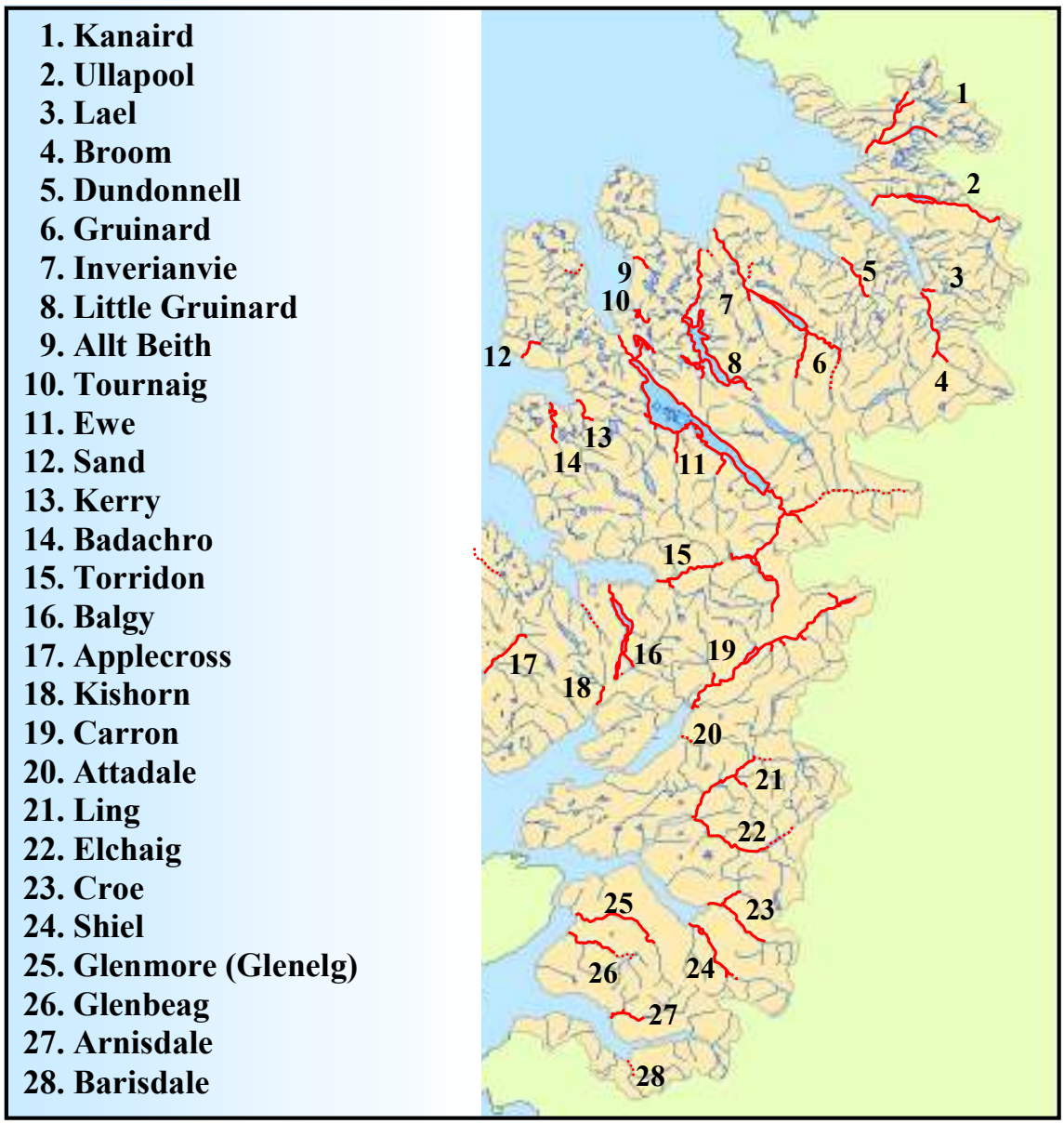
Richard Munday, April 2006

Part 2 **Salmon and Sea trout Stocks**

2.1 Introduction

This section provides a brief overview of juvenile fish population surveys and of catches of adult fish in 2005. Meteorological Office statistics show that the year was warmer and slightly wetter than usual, with seasonal average air temperatures (winter, spring, summer, autumn) 1.6°C, 1.0°C, 0.7°C and 1.4°C higher respectively than for the period 1961-1990, and rainfall (winter-autumn) 148%, 118%, 110% and 106% higher than for the period 1961-1990. Following a severe hurricane on 12th January 2005, the winter was particularly wet. However, conditions for entry of salmon and sea trout and for angling were generally good during the summer. A severe spate on 13th September scoured out many of the burns around the Gairloch – Loch Maree area and water levels remained high through much of the month. Subsequently, January and February 2006 were generally dry.

Figure 2.1: Rivers where wild salmon have been recorded in the WRFT area since 2000. The heavy line depicts the recorded distribution; the dotted lines indicate areas where salmon were formerly present.



2.2 Juvenile fish populations

Electro-fishing survey teams visited the following rivers between July and October 2005: Kanaird, Ullapool, Broom, Dundonnell, Gruinard, Tournaig, parts of the River Ewe system including Loch Maree (see Part 5), Torridon, Balgy, Cuaig, Ling, Shiel, Glenmore (Glenelg) and Arnisdale. For most river systems, the primary aim was to gather data to find out about the occurrence and distribution of juvenile salmon in order to be able to assess the health of respective populations. Nearly all sites were fished using the Scottish Fisheries Co-ordination Centre (SFCC) semi-quantitative protocol, where numbers of fish are recorded in relation to the time spent fishing. This method is relatively fast, enabling more sites to be fished in a day; and provides an index of fish density according to conditions on the day of survey. As in previous years, the distribution and relative abundance of juvenile salmon and trout varied from river to river and within rivers from site to site.

Northern rivers

The survey of the **Kanaird** was carried out on the 4th and 5th August. Sites above the falls on both the Kanaird and the Runie were surveyed to investigate the distribution of salmon spawning in 2004. Salmon fry were found for the first time since 1997 above the Langwell Falls, confirming spawning in 2004. Fry were relatively large (54mm average length) and infrequently captured (0.3 fish per minute) suggesting sub-optimal densities. Water levels were too high for fully quantitative surveying. In the upper Runie, fry were recorded at 5 out of 8 sites. Some of these sites were stocked, so it is not possible to confirm that salmon spawned near all of them. However, fry densities were particularly high in the middle Runie (2.1 fish per minute), ~3km below the stocked area suggesting that wild fish had spawned. Fry were also much smaller (average length 42mm) at this site than at the upper Kanaird site. Salmon parr were recorded at reasonable densities (0.9-1.8 fish per minute) at sites within both the Kanaird and the Runie. Because both tributaries were stocked in 2003 and 2004, it is not possible to be sure whether these fish were of wild or stocked origin or both.

Wild salmon fry!
Father, son, grandsons and friends with a bucket of little fish from the upper River Kanaird.

The **Ullapool River** had not been stocked in 2005 following the best rod catch in recent years in 2004. Salmon fry that were recorded at the top of the accessible area within the Rhidorroch River on 17th August were therefore all of wild origin. Further downstream, by East Rhidorroch, fry densities were high at over 2 fish per minute (see Part 4: Ullapool River FMP summary). Two sites in small tributary burns of the **River Broom** (Allt a' Bhraigh, 'Sawmill' Burn) were surveyed on 5th August. Juvenile trout and salmon parr were encountered in both burns at frequencies indicative of healthy populations despite high water (salmon parr: 0.8-1.3 fish per minute). However, salmon fry were not encountered: salmon parr appear to migrate into these burns from the mainstem River Broom nearby. Traditional quantitative sites on the mainstem River Broom (established by Ross Gardiner) were not fished in 2005 because of high water.

On the 12th August, sites within the accessible section of the **Dundonnell River** were surveyed. Overall densities of juvenile fish at the 3 quantitative sites were the highest on record (previous surveys in 1997, 1999, 2003). Estimated salmon densities for the site above the road bridge were 52.7 fry per $100m^2$ and 20.4 parr per $100m^2$; similar densities were recorded elsewhere. Trout densities in the Allt a' Bhodaich at the roadside site were the highest on record (243 fry per $100m^2$ & 19 older trout per $100m^2$) despite high levels of suspended silt in run-off from forestry in the winter 2005. In spring 2004 Dundonnell Estate planted salmon eggs of native origin into sections of the upper river around Fain as part of a trial to investigate whether wild salmon smolts could be produced in this area above impassable falls. Electro-fishing surveys in 2004 and 2005 indicated that juvenile salmon had grown well; some parr had moved into areas several hundred metres upstream from where eggs were planted. A smolt trap was set to catch smolts as they descended in spring 2006 for transfer to the lower river.

The **Gruinard River** survey was delayed until October, and then curtailed, because of high water. On the 24th October, 4 sites were fished on Allt Loch Guibhsachain. In 2003, salmon fry of native Gruinard origin were stocked by Gruinard Estate into an area above a series of bouldery falls where wild salmon were not thought to have spawned in recent years. Water levels were high on the day of survey. At the lowest site near the main river the frequency of occurrence and small size of salmon fry (median length 43mm) indicated high fry densities within the accessible area. Above the falls only large parr of between 102mm and 129mm length were encountered. These were assumed to be from the 2003 stocking, demonstrating good growth and survival. On 25th October, the e-team set off on an expedition to investigate the **Abhainn Gleann na Muice**, a principle nursery stream above Loch na Sealga. Much of the stream appeared to have been freshly scoured by movement of the stream bed; most obviously a consequence of the unusually severe spate on 13th September. The distribution of juvenile salmon was patchy, with very few fish encountered in freshly scoured areas. Salmon fry, 1+ parr and 2+ parr were encountered, but combined densities were low at scoured sites (less than 1 juvenile salmon / min). Densities of fry and parr were higher over 'green' areas where the streambed had remained stable. It is very likely that higher densities would have been recorded earlier in the year, before the spate. The quality of juvenile salmon habitat in this tributary relates closely to the health of riparian alder trees, the roots of which help to stabilize the streambed. At present there is little regeneration of alder; fish habitat is deteriorating.

Heading home after a wonderful day's electro-fishing in the upper Gruinard.

A number of small 'marginal' rivers were visited in the Gairloch – Laide area in July 2005 primarily to investigate whether juvenile salmon were present. Salmon fry, but not parr, were found in both the **Sand (Gairloch) River** and the **Aultbea River** (including a site at the top of the restored fish ladder) indicating spawning of wild salmon in 2004 but not in 2003. Salmon fry and parr were distributed through much of the **Tournaig** system (see Part 2.4). However, only trout and eels were found in the **Sand (Laide) Burn, Loch Sguod River**, **Flowerdale Burn** and **Port Henderson Burn**. Later in the year (31/8) the lower **Cuaig River** was surveyed; trout but no juvenile salmon were found.

Table 2.1: Summary of information relating to juvenile salmon populations within the WRFT area from WRFT electro-fishing surveys in 2004 and 2005. See text (and WRFT Review May 2005) for further details.

River System	Stocked?	Dates surveyed	[2]Distri-bution	Juveniles present	[3]Density	Comments
Kanaird	upper river 2004, 2005	Aug 05	100%	fry & parr	locally high	wild fry in upper Kanaird in 2005
Ullapool	[1]upper river 2004	Aug 04 & Aug 05	100%	fry & parr	variable	wild fry throughout river
Broom	no	Jul 04 & Aug 05	100%	fry & parr	high	only side streams fished in 2005
Lael	no	Oct 04	?50%+	parr	low	historic distribution may have extended above falls
Dundonnell	[1]side streams 2004, 2005	Aug 05	100%	fry & parr	high	wild fry and parr present
Gruinard	[1]top tributary 2004	Oct 05	?80%+	fry & parr	locally high	incomplete survey in 2005 due to highwater
Little Gruinard	no	Aug-Sep 04	100%	fry & parr	high	detailed survey for SAC monitoring funded by SNH
Allt beith	no	Jul 05	?90%	fry	high	parr absent; fry above restored fish ladder
Tournaig	no	Aug 04 & Aug 05	90%+	fry & parr in '05	high	see report for further fdetails
Ewe	[1]Coulin & B'chaig 04 & 05	various 04 & 05	80%+	fry & parr	locally high	wild salmon still absent from Bruachaig
Sguod	no	Jul 05	0	0	0	juvenile salmon last recorded in ?early 1990s
Sand	no	Jul 05	?100%	fry	variable	parr absent
Flowerdale	no	Jul 05	0	0	0	only anecdotal records of grilse 20+ years ago
Kerry	[?1](2003)	Jul - Sep 04	100%	fry & parr	locally high	fry absent from upper reches
Badachro	no	Jul 04	90%+	fry & parr	locally high	hybrid salmon x trout found in upper reaches
Torridon	no	Aug 05	90%+	fry & parr	locally high	fry absent from some sites in lower mainstem
Balgy	no	Aug 05	~80%	fry & parr	uncertain	salmon fry absent burns above Loch an Loin
Cuaig	no	Aug 05	0	0	0	anecdotal reports of salmon ~10 years ago
Ling	[1]midle river 2004, 2005	Oct 05	?100%	fry & parr	locally high	healthy wild population towards top of accessible area
Elchaig	?	Oct 04	~80%	fry & parr	variable	origin of salmon fry above loch uncertain
Croe	no	Sep 04	100%	fry & parr	locally high	
Shiel	no	Sep 05	~90%	fry & parr	locally high	salmon absent from upper section
Glenmore (G'elg)	no	Oct 04 & Jul 05	~80%	fry & parr	variable	salmon absent from upper section
Glenbeag	no	Aug 04	~80%	fry & parr	low	salmon absent from upper section
Arnisdale	[1]2004, 2005	Sep 04	100%	fry & parr	locally high	wild adults throughout accessible area in 2005
Barrisdale	no	Sep 04	0	0	0	grilse seen in pool

Notes:

[1] Progeny of native (to river) fish used for stocking

[2] % of area thought to be accessible to salmon in which juveniles were present

[3] density: 'high': > 20 fry or 10 parr per 100m^2 ; or > 1.0 fry or 0.5 parr per minute of fishing at majority of sites

River Ewe catchment

Within the **River Ewe system**, sites in headwater streams above Loch Bharranch and Loch Coulin, in the Bruachaig River, Docherty Burn, Loch Maree Burns, Kernsary River, and Tollie Burn were surveyed. On 30th June, 1+ salmon parr were found in the **Bruachaig** and A' Gleann na Muice near the Heights of Kinlochewe where fry had been stocked in 2004. No juvenile salmon of wild origin have been found above the main falls (between Incheril and the Heights') since 1999.

On 22nd August, wild salmon fry and parr were found above the road in both the burns that flow into **Loch Bharranch** from Beinn Eighe (low densities), and above **Loch Coulin** in the Allt na Feithe Buidhe where trout densities, following stocking, were high (1.6 fish per minute). In the Allt Doire Bheithe above the stone bridge at the top of the Coulin River; salmon fry were absent, though parr were recorded at 0.3 fish per minute. On 23rd August, wild salmon fry were encountered in the **Docherty Burn** near the confluence with the Bruachaig at (2 fish per minute); trout fry were also abundant. Salmon fry and parr were recorded less frequently at sites as far upstream as the old 'Craft Shop' by the old road bridge. Two salmon parr were found at a higher site where road construction work for the new bridge began later in the year. The results of electro-fishing surveys around shallow margins of Loch Maree are presented in Part 5.

Near **Kernsary** on 7th September, one 2+ salmon parr (but no salmon fry) was found above the falls (old fish ladder) on the Allt Innis a Bhaid; in contrast, in the same burn below the falls and in the Kernsary River nearby below the road culvert, densities of salmon fry and parr were high, (Kernsary: 3 salmon fry per minute; 1.5 parr minute). Finally, 40 trout of sizes between 45 and 160mm (3+ age classes) were caught in 16 minutes fishing in the Tollie Burn on 12th July, but no salmon were recorded.

Southern rivers

Sixteen sites were surveyed in the **Torridon River** system (2nd -3rd August 2005), including a site on the Abhainn Thrail just above the confluence. Fry were absent from 3 sites in the lower Torridon River and 4 sites in a small tributary stream nearby. However, salmon parr were more widely distributed and were present at all but two sites. Salmon fry densities were highest at sites near Loch an Iasgair; salmon parr densities were highest in the main stem near Glen Cottage (up to 2.2 fish per minute) and in the Allt a Gharaidh Dhuibh (2.4 fish per minute). Trout fry were recorded at all sites except at the Abhainn Thrail site; larger trout were found at highest densities in the smaller tributary streams.

Eight sites were surveyed on the **River Balgy** above Loch Damph on 18th and 31st August. Water levels on both days were too high for useful quantitative assessment. Both salmon fry and parr were found in the Abhainn Dearg and Allt an Eisg. However, salmon fry were absent from the streams of high conductivity (draining limestone) that flow into Loch an Loin. In this part of the Balgy catchment area, salmon parr were found only at the lowest site in the Allt a' Ghiubhais; and near the mouth of the Allt na Criche (where they were outnumbered 79:1 by minnows [see section 5.1 for more about minnows]). Trout fry were recorded at densities of up to 3.2 fish per minute in the Allt a' Ghiubhais.

The **River Ling** was surveyed on 28th October. Water levels were fairly high. Fry and parr were found at all seven sites, including three unstocked sites around the confluence with the Blackwater near the top of the known accessible areas where fry and parr were each caught at rates of about 1 fish per minute, indicative of a healthy juvenile population. Sites were fished on the **River Shiel** on 25th and 26th August. Water levels were high, preventing quantitative assessment of stocks. Salmon fry and parr were present at all sites except the top site below the falls, where according to local residents, salmon were present in the past. Lampreys (*Lampetra* sp.) were also recorded for the first time within the river (see cover photo). The Shiel is the 4th river within the WRFT area where lampreys have been recorded. The upper **Glenmore River** was surveyed on the 11th July. Only trout and eels were recorded above Bealachasen; salmon fry and parr were found beneath the vehicle bridge a few hundred metres further downstream.

Salmon fry and parr were recorded here in the Glenmore River below Bealachasen on 11th July 2005
(*photo by Dr Gonzalo Zelaya*)

2.3 Rod catches of adult salmon and sea trout

Rod catches of salmon and sea trout for established fisheries help to provide an indication of the health of respective fish populations.

Salmon

From a limited amount of catch data submitted, it is possible to say, tentatively, that 2005 was another better one for salmon angling relative to the period 1990-2003. Rod catches of salmon for some rivers were as high as or higher than the 2004 totals; other rivers were not far short.

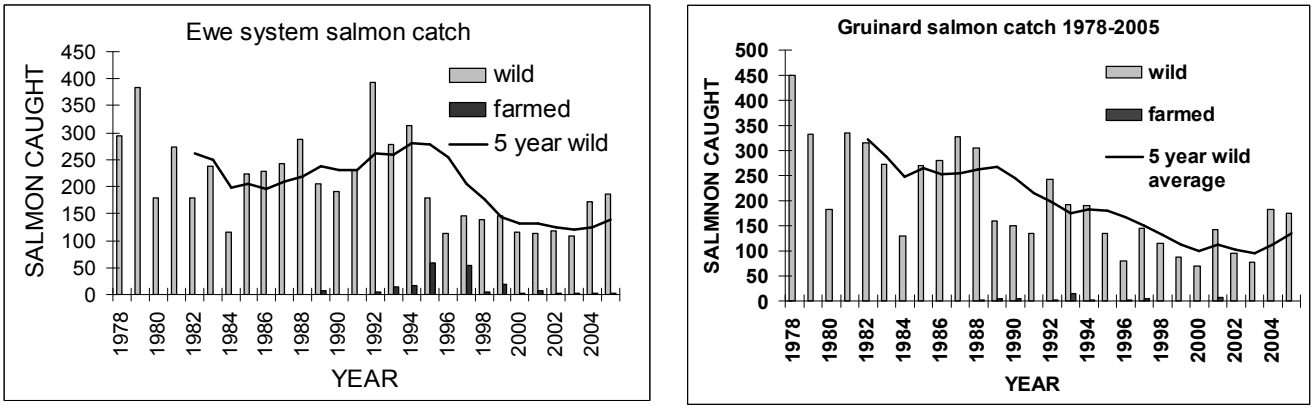


Figure 2.2 River Ewe system and Gruinard River salmon catches

The catch of salmon for the River Ewe system (left) was the highest since 1994 and marginally higher than for 2004. The Gruinard catch was slightly lower than that of 2004.

In 2005, the River Carron also recorded the highest catch of salmon for many years (see part 6) with over 100 salmon taken by a single rod!

Catches of salmon from the two rivers with a reputation for producing early running salmon, the Ullapool and the Ling *(shown below*), were both slightly lower than in 2004, but well above 5 year averages.

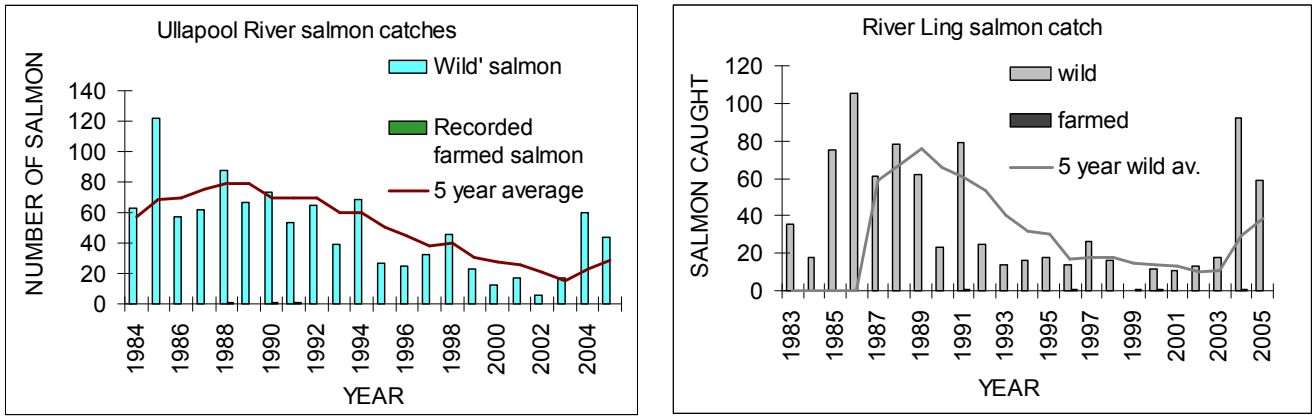


Figure 2.3 Ullapool River and River Ling salmon catches

Sea trout

Sea trout catches appear to have been mixed; mainly down from those of 2004. Recorded catches of sea trout (mainly taken by salmon fishermen) in the Gruinard River and in the River Carron were well down on those of 2004. There were no reports of serious sea lice epizootics in either area, so other explanations need to be found.

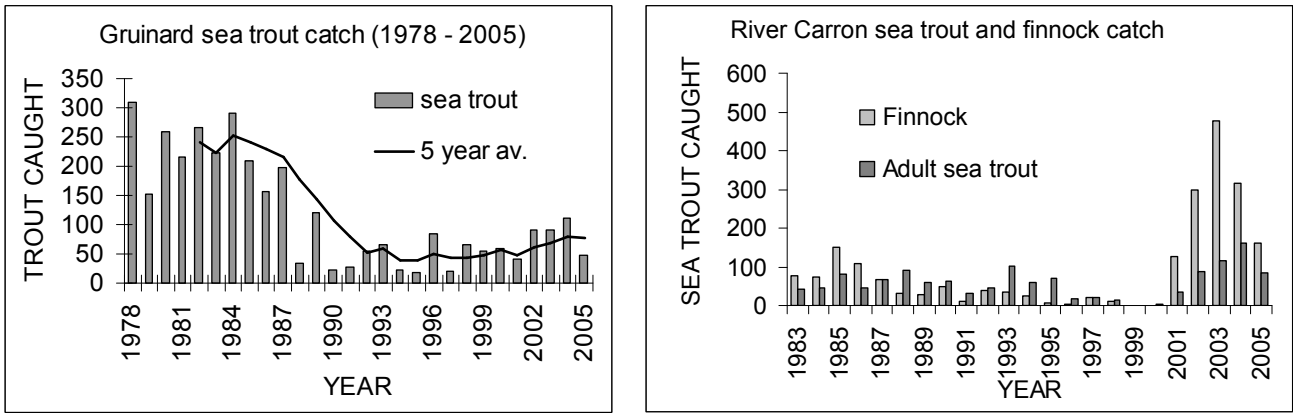


Figure 2.4 Sea trout catches for the River Gruinard and River Carron

There are reports of a few sea trout to over 3lb from the River Broom and Dundonnell rivers suggesting improved survival of sea trout in that area (see also Part 3). Sea trout were also taken by anglers from the shore around Ullapool.

Loch Maree was lightly fished: 61 sea trout and 65 finnock were recorded. The catch was similar to that of 2004. The largest fish taken were just over 2lb.

*If records submitted to Fisheries Research Services could, in future, be copied to the Trust, then we would be in a better position to reflect upon catches. For those who submitted catch data for 2005, many thanks.

Spring salmon taken by Bob Kindness from the River Carron on 14th March 2006

Box 2.1 Salmon remains by Runie Falls. . . .

Some of the rivers in Wester Ross have waterfalls over which salmon must ascend to reach spawning areas. On the 8th June, Peter Cunningham and John Webb (Atlantic Salmon Trust Biologist) visited the Runie Falls (River Kanaird system). Salmon remains were found around the falls as follows: scales (*below left*) and a backbone (*cover photo*) of an adult 'spring' salmon by the lower falls. Many scales were found on rocks nearby. Our initial interpretation was that a 'pod' of salmon had become trapped in the pool below the upper falls and had been taken one by one by a predator. We assumed that otters had been responsible for taking fish; one otter spraint was found. However, otter predation of early running salmon on the scale suggested by our observations is unusual.

The falls were revisited on 4th September 2005 following a morning of e-fishing on the upper Kanaird as water levels were rising. Salmon were observed clearing the lower fall and jumping at the upstream (main) fall under the footbridge (*below right*). Several grilse and a larger salmon were seen attempting to progress upstream. However, all failed; several times they reached the base of the second step (indicated by the dark arrow) – but all were swept back downstream. Several fish jumped and hit the overhanging rock hard enough for the impact to be heard above the noise of the water (indicated by the light arrow).

A retrospective explanation for earlier observations is that a run of 'spring' salmon were unable to progress over the main fall because of insufficient flow (or temperature). Rather than returning downstream, some of them may have continued jumping at the upper falls, ultimately to their injury - providing scavenging animals with a relatively easy meal. However, not all fish were unable to clear the falls. In November 2005, salmon were observed in spawning areas in the Runie above the falls. Thanks to Andy Aitken and Keanchulish Estate for help and information.

Anecdotal reports suggest that the Runie Falls may have been modified during the early 1990s. Does anyone have recollections of the falls (and ascending fish) prior to this date?

(left) John Webb pointing to salmon scales strewn on rocks below the upper falls pool on 8th June 2005. (right) Salmon observed attempting to jump the falls on 4th September reached only as far as the ledge (black arrow) or hit over hanging rocks (light arrow).

2.4 Tournaig trap update

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The Tournaig River is the smallest river system in Wester Ross known to have supported wild salmon. The Tournaig Trap project was set up in 1999 to monitor the salmon and sea trout populations. Fish are recorded as they descend on their way to sea, and as they return to freshwater. The project is currently demonstrating how a small river system that has lost its salmon population can be recolonised by wild salmon without stocking.

Salmon failed to spawn in the Tournaig system in 2000, 2001 and 2002. In 2003 and 2004, no salmon smolts left the Tournaig River system. However, contrary to expectations, catches of salmon in the upstream trap in 2004 and 2005 were the highest on record (Figure 2.5). Grilse entering the system in 2004 and 2005 were all stray fish from other river systems (probably, the River Ewe). Salmon spawned within the system in 2003 for the first time since 1999, and again in 2004. In 2004, the electro-fishing survey demonstrated that juvenile salmon were widely distributed within the accessible area. In 2005, salmon fry and parr were found throughout the accessible area. Fry were smaller than in 2004, suggesting that densities were near carrying capacity in the main juvenile rearing area (Allt na Coille). 11 S1 salmon smolts descended in 2005. By mid May 2006, over 230 salmon smolts had descended.

In 2004, 118 sea trout smolts descended and the number of finnock and sea trout entering the system (16 and 4 respectively) was higher than in any previous year or in 2005. In 2004 the rate of return (marine survival) for finnock was at most 13% (assuming that all finnock were trapped and were of Tournaig origin). However, in 2005, when 183 sea trout smolts descended only 6 finnock returned the rate of return was only 2.7% unless other finnock ascended the usually impassable fall during the exceptional spate on 13th September. Several finnock in July 2004 carried high (30+) numbers of sea lice. Over-wintered finnock and sea trout tended to descend in March and early April, about 1 month earlier than sea trout smolts. Five descending over-wintered finnock were trapped early in 2006.

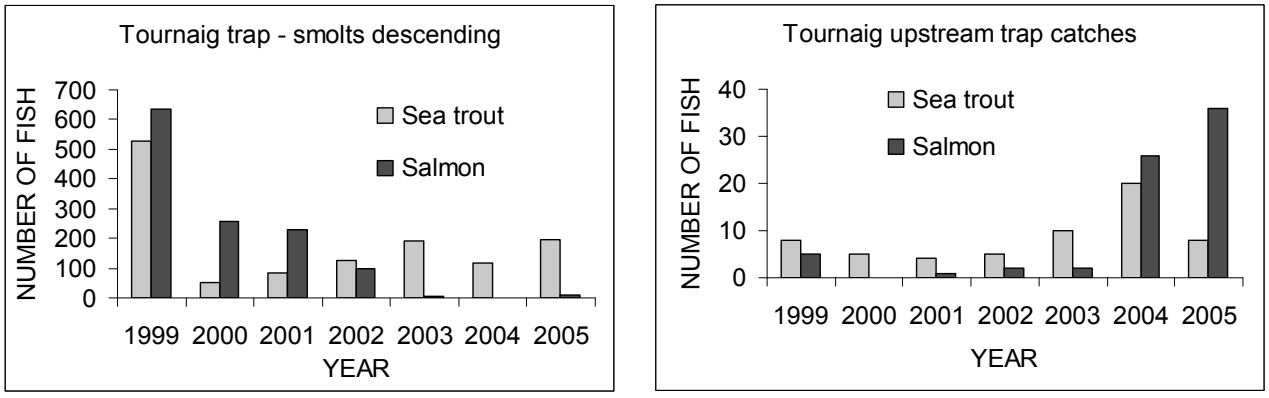


Figure 2.5 Numbers of smolts (left) and adult salmon and sea trout (right) passing through traps at Tournaig on their way out and in to the river system.

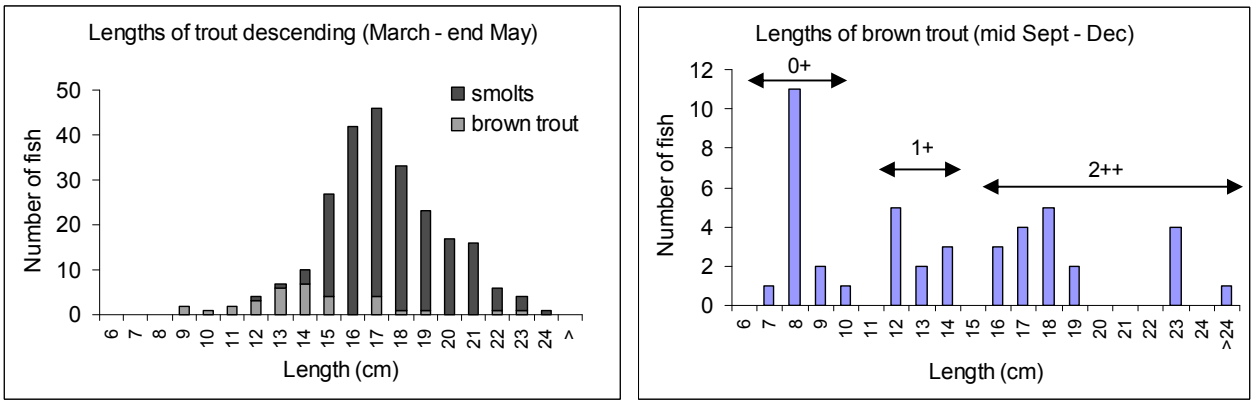


Figure 2.6 Lengths of 'trout taken in the downstream trap during the spring and autumn

In addition to fully-silvered sea trout smolts, small numbers of 'brown' trout also pass through the downstream trap in the spring. Some of these may be salt-water tolerant. They tend to pass through the trap a few weeks earlier than the main sea trout smolt run and to be a little smaller (Figure 2.6). A few trout are also taken in the autumn: these include both mature fish and a few adult trout which may be returning downstream following upstream spawning excursions earlier in the autumn. A few 'resident' brown trout live in the pools of the fish ladder between the trap and the sea. Similar observations have been made at the FRS trap at Shieldaig (Jim Raffell, *pers. com*.).

More salmon entered the Tournaig system in September than in other months in 2005, with steady numbers of fish in the days following the big spate on 13th September. It is possible that some of these stray fish became confused by the unusually high discharge of water from the river. Most of these fish were grilse of between 55 and 65cm.

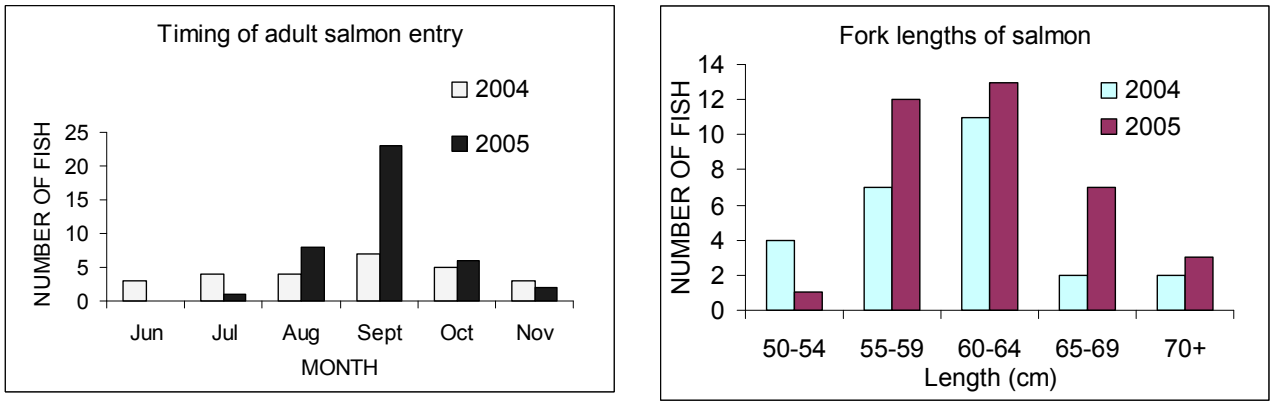


Figure 2.7 (left) Month of entry and Figure 2.8 (right) fork lengths of salmon caught in the upstream trap at Tournaig in 2004 and 2005.

Electro-fishing survey

The electrofishing survey at Tournaig was carried out on 1st August 2005. Salmon fry and parr were found through most of the accessible area (Figure 2.9).

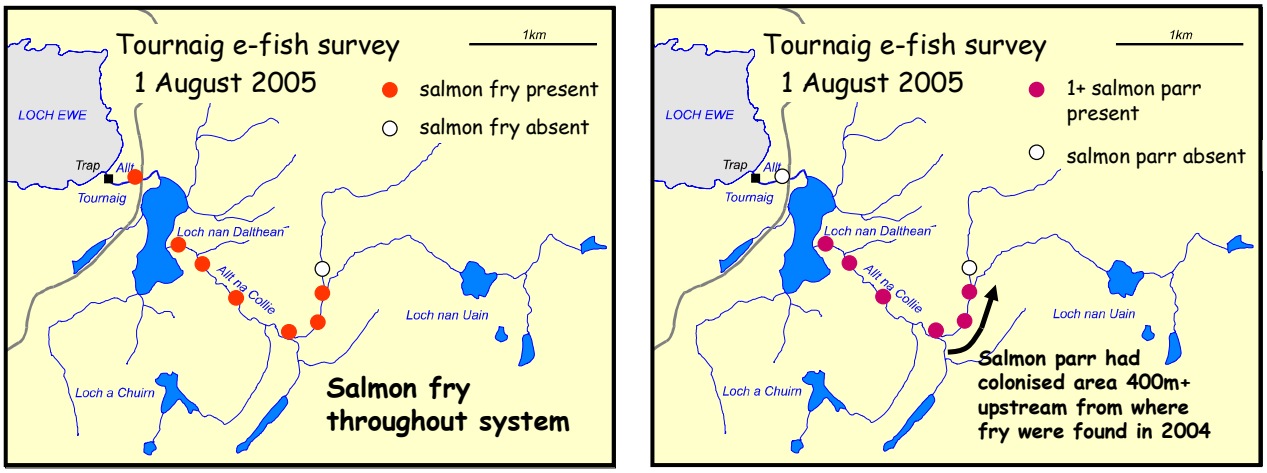


Figure 2.9 Distribution of salmon fry in the Tournaig River in 2005 (right) distribution of salmon par in 2005.

Salmon fry were smaller in 2005 than in 2004, perhaps because of competition with salmon parr which were not present within the system in 2004 (Figure 2.10).

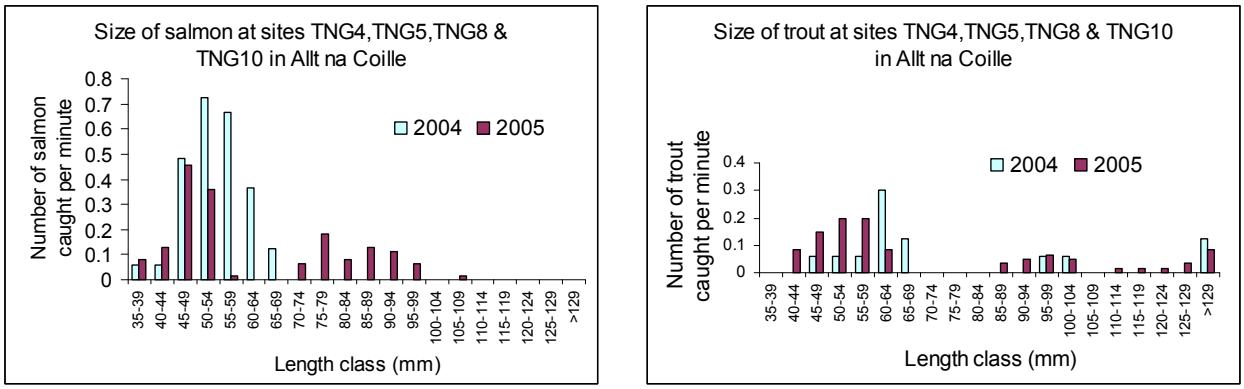


Figure 2.10: Size - frequency distributions of juvenile salmon (left) and trout (right) caught in the Allt na Coille during the electro-fishing surveys on 2nd August 2004 and 1st August 2005.

Silver eel migration

The European eel is widely distributed in Wester Ross and is frequently encountered during electro-fishing surveys, especially at sites nearest the sea. Three years after hatching in the Sargasso Sea in the Western Atlantic, juvenile eels, known as 'elvers', reach coastal waters around Wester Ross and enter rivers. It may take a further 12 years or more for them to grow from about 60mm to maturity in freshwater. Eels are known to grow to large sizes in the Tournaig system, an eel of over 80 cm was captured in a trap in Loch nan Dailthean in 2001. As they begin to mature, the adult eels turn silver, stop feeding, and return to sea.

There is much concern for the future of the European eel as the number of elvers reaching our shores each has fallen to about 2% of historic levels on record.

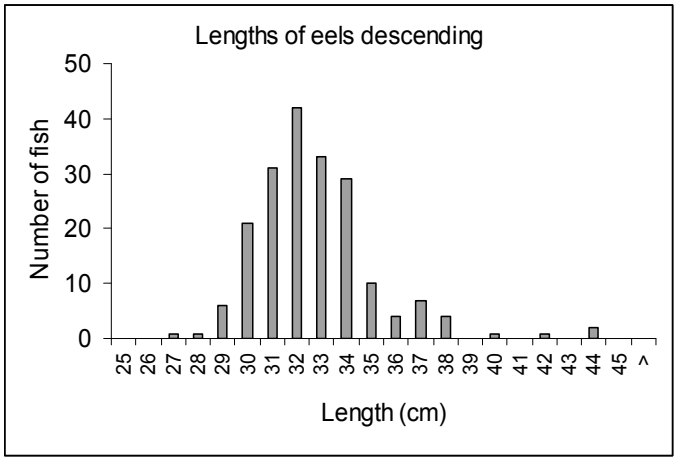


Figure 2.11: Lengths of silver eels descending through the trap at Tournaig in 2005

In 2005, 200 silver eels were caught descending to sea in the autumn, with the majority descending from 27th to 29th September. The trap was kept in operation almost throughout the autumn. However, water levels over topped the screen on the 13th of September and during November, so other eels may have been missed. This is the largest number of silver eels so far recorded leaving the Tournaig system. As in previous years, most eels were between 30 and 34 cm in length; the largest was 44 cm (Figure 2.11)

Spate (off the scale) on 13th September 2005: Estimated discharge into Loch Tournaig of ~5+ m^3sec^{-1}.

2.5 Summary

- Stocks of wild salmon in Wester Ross have not yet fully recovered to former levels. Healthy populations of wild juvenile salmon were recorded in parts of the Kanaird, Ullapool, Dundonnell, Gruinard, Tournaig, parts of Ewe and Ling rivers in 2005. However, in some accessible parts of rivers including the Kanaird, Ewe, Torridon, Balgy and Glenmore Rivers, wild juvenile salmon were either absent or present at sub-optimal densities.

- Rod catches of salmon have again exceeded the preceding five year averages for most (if not all) rivers, following a series of poor years at the turn of the millennium. It was a particularly good year for the River Ewe and the River Carron [see Part 6].

- Rod catches of sea trout were higher than 5 year average in some rivers. However, catches were generally less than in 2004. Fish of over 1kg (2.2 lb) were still scarce except in the Loch Broom – Little Loch Broom area.

- Another 'record' year at Tournaig. Eleven S1 salmon smolts descended. 37 stray salmon entered the upstream trap, but only 6 finnock were recorded after a sea trout smolt run of 183 earlier in the year (a few other finnock may have ascended during an exceptional spate flow on 13th September without entering the trap). Juvenile salmon (both fry and parr) were distributed at healthy densities throughout the river system. A record 200 silver eels passed through the downstream trap on their way to sea in the autumn.

Ben with the largest Tournaig fish of the year: a 13lb salmon taken in September.
(photo by Ken Williamson)

Part 3 **Marine Environment**

3.1 Area Management Agreements and the Northwest Mainland Regional Project

Supported by:

Highlands & Islands ENTERPRISE

In 2000, the Tripartite Working Group was convened by the Scottish Executive to bring together wild fisheries interests and fish farmers as a first step towards resolving problems in coastal areas. Since then, Area Management Groups [AMGs] have been set up in Lochcarron – Kishorn area (2001), Loch Torridon (2001), Loch Ewe (2005) and Loch Alsh-Duich (2005), and meetings have taken place periodically in the Two Brooms area (Loch Broom and Little Loch Broom) to review fish health issues, including sea lice data and to discuss issues relating to the management of fisheries and fish farms in local areas.

The Northwest Mainland Regional Project was set up to provide financial support from Highlands and Islands Enterprise for AMGs, for the monitoring of sea lice on wild sea trout and for other project work that could help to inform AMGs. There has also been a substantial input of time and commitment from both fish farm representatives and wild fisheries interests as in-kind contributions in support of this work. This section of the report provides a summary of some of the results of this work.

Over the three years of the project, sea lice abundance on wild sea trout declined in all areas (see Part 3.3). Collaborative research to learn more about the occurrence and behaviour of seals in Kyle Rhea (see Part 3.4). and to learn more about the availability of food items for sea trout (see Part 3.5) was undertaken. Much of this work may continue as part of a new funding package provided by the Scottish Executive.

Hugh Richards & Colin Milne (Wester Ross Salmon), Ben Rushbrooke (Tournaig trap operator), and Ray Dingwall (River Ewe ghillie) visiting WRS cages in Loch Kanaird.

3.2 Reports from Area Management Groups

These reports, submitted by respective Area Management Groups [AMGs], summarise progress over the past year. Thanks to all who contributed.

Lochs Carron/Kishorn AMA

"This AMA is now in its sixth year and has fully demonstrated the value of co-operation between farmed and wild salmon interests - total control of the sea lice problem, synchronisation of farm production, and the remarkable restoration of wild salmon and sea trout to the River Carron. For several years the AMG has included representatives from the Lochcarron Community and Highland Councils, and recently welcomed Ferguson Transport as a signatory to the AMA. Encouraging developments have been the meticulous consultation on the proposed Aquaculture & Fisheries Bill for which the AMG made a submission and the Executive's commitment to funding the AMA process for a further two years."

Loch Torridon AMA

"This was the first AMA in Wester Ross, signed in February 2001. There have been changes in personnel here too, caused by the sales of Highland Fish Farmers to Pan Fish and KLD to Scottish Sea Farms. This AMA is unusual in that Fisheries Research Services have a research station based in it, at Shieldaig.

The joint efforts of all the AMG members, particularly the excellent co-operation between the fish farmers and FRS researchers, and between the fish farmers themselves, have led to considerable improvements in the understanding of the dynamics of sea lice transport in a relatively enclosed system such as Loch Torridon. This in turn has fed into the decision-making processes regarding when and how to treat the farmed salmon, and sea lice levels both on the farms and on wild sea trout have greatly improved. FRS has published several scientific papers based on the results of research in Loch Torridon, and there's more to come. These would probably not have been possible if the AMA had not been established."

Loch Ewe AMA

"This AMA was signed in May 2005. Two constructive meetings have taken place so far, and the signs are positive for the future. Marine Harvest and representatives of the Ewe catchment proprietors make up the group. This AMA took a considerable amount of time to establish, but now that it is underway, the group is confident that improvements can be made in the health of both the wild and the farmed salmon of Loch Ewe."

Lochalsh AMA

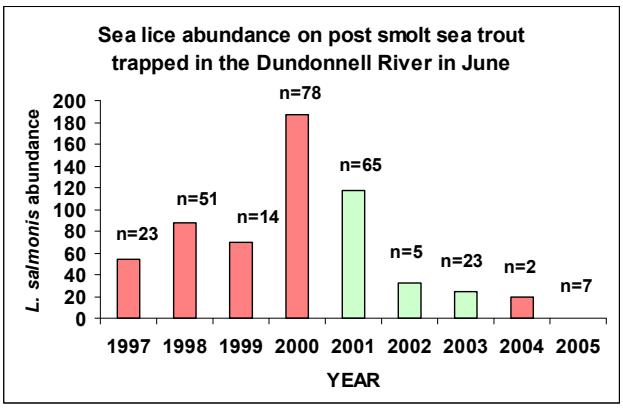
''The inaugural meeting of the LAMG took place on September 14th 2005. The Area covers from Loch Carron south to the end of Loch Hourn embracing some eight rivers and three fish farms. It was agreed that the Chairmanship of the group would rotate annually between Fish farming and Wild fishery interests. Arrangements were made to exchange information on diseases in rivers and fish farms, escape reports, illegal fishing and pertinent changes in legislation. Various other subjects including sea lice monitoring, stocking programmes, movement of fish, wild fish returns and cooperation in matters relating to the health and welfare of both rivers and fish farms were also covered. The next meeting of the Area Group was scheduled to take place on June 8th 2006.''

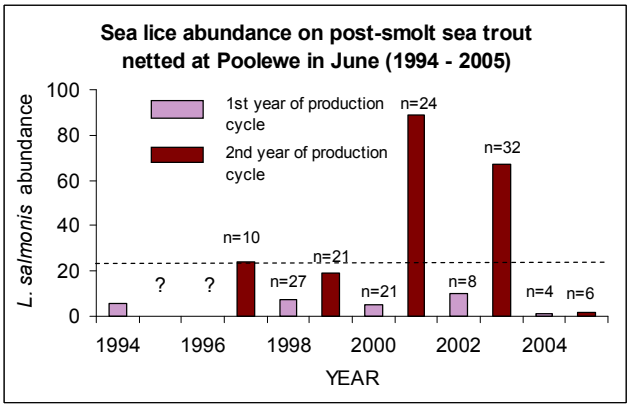
3.3 Sea lice monitoring

As part of a funding programme awarded by Highlands and Islands Enterprise to support the implementation of Area Management Agreements [AMAs] and inform AMGs, sea lice monitoring continued in 2004 and 2005. In addition to the annual June monitoring programme for post-smolt sea trout in the estuaries of the Dundonnell River, River Ewe and Glenmore River, local anglers, including estate staff, were trained to record sea lice abundance on rod caught fish, thereby extending a network of 'sea lice surveillance' of wild sea trout to other areas of Wester Ross.

In 2005, live sea trout were caught using traps, nets, and rod and line. After capture, all fish were anaesthetised in a solution of 1:~2000 Eugenol (clove oil), measured and examined. Numbers of lice in each of 3 categories (*chalimus* [attached stages]; preadults and adult males [mobile stages]; ovigerous females [with trailing egg sacs]) were counted. Scale samples were taken for future reference; adipose fin clips were taken for subsequent DNA analyses and to enable recognition of fish if they were recaptured. After a period of recovery, fish were released. All sea trout of less than 25cm caught in June or early July were categorised as 'post-smolts'.

Figure 3.1 sea lice abundance on post-smolt sea trout taken at (left) Dundonnell and (right) Poolewe in June.





Results

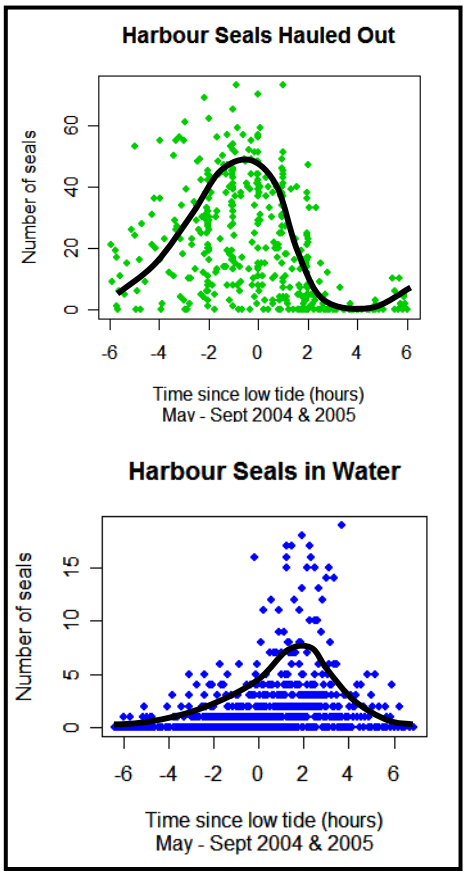
Numbers of early-returned post smolts and numbers of sea lice were low at all sites. No serious sea lice epizootics affecting wild sea trout were recorded in WRFT area in 2004 or in 2005 despite fairly widespread surveillance within the WRFT area. However, some finnock and sea trout with moderate abundance of sea lice (30++ lice per fish; mostly pre-adult and adult lice) were caught at Tournaig (particularly in 2004) and Poolewe. Some of these fish may have become infected with sea lice beyond the local area. The Tournaig sample may indicate a more local problem within Loch Ewe in early July 2004.

Few early returned post-smolt sea trout were taken at Dundonnell or at Poolewe in 2005 despite correlation with the 2nd year of fish farm production cycles at nearby fish farms (Figure 3.1). There is no evidence that the 7 fold increase in farm salmon biomass within Little Loch Broom since 2000 had an adverse impact upon wild sea trout within the loch. The generally improved situation for wild sea trout compared to years prior to 2004 appears to correlate with use of the in-feed sea lice treatment SLICE (*emamectin benzoate*) at nearby salmon farms.

Stocks of sea trout in Loch Broom and in Little Loch Broom show signs of recovery, with fish of up to 56cm recorded. In Loch Ewe (Loch Maree area), catches of finnock and sea trout were a little higher in 2005 than for years previously, and several fish of between 40 and 45cm were taken at Tournaig in both years.

Thanks to Hugh Richards and Gilpin Bradley of Wester Ross Salmon for hosting a pre-season discussion meeting at WRS Ardmair in April 2005. Many thanks again to Willie Hardy for use of a row boat Poolewe and to Andy Aitken, Ian MacFadyen, Donald MacLeod, Alastair MacDonald, Peter Hann, Graeme Wilson, Ray Dingwall, Ken Williamson, Murry Stark, Dr Gonzalo Zelaya, Bill Page, David Huntingdon and all others for helping with monitoring / submitting records.

3.4 Kyle Rhea seal monitoring



The aim of this collaborative project was to record the numbers and behaviour of seals in Kyle Rhea, the narrow channel between the Isle of Skye and mainland of Scotland. The project was developed and managed by Dr Louise Cunningham of the Sea Mammal Research Unit, and Murray Morrison from Glenelg assisted with seal counts. See WRFT Review May 2005 for further details.

Patterns of seal occurrence were similar to those of 2004, with numbers peaking in early summer. The number of seals on haul out sites increased to a peak just before low tide; the number of seals seen in the water nearby peaked about two hours after low tide when fishing opportunities for seals in the Kyle may be at their best. During the period around high tide, few seals were seen either at the haul out site or in the water nearby suggesting that they had travelled some distance away from the area to feed.

Seals were recorded eating adult salmon on less than 5 occasions. Previous work suggests that seals in the Inner Hebrides have a varied diet dominated by gadids (Pierce & Santos, 2003; Hammond *et al.,* 1994) and further work is required to find out what seals in Kyle Rhea feed upon. One suggestion that may be considered by the local AMG is to locate underwater cameras in the Kyle in places frequented by feeding seals to observe fish and seal behaviour.

(left) Counts of seals at haul out sites and in the water in Kyle Rhea, in relation to the tidal cycle.

(left) 5 seals fishing off the mouth of the Tournaig river in July, 2005 (photo by Ben Rushbrooke). Seals pursue salmon, but their diet also includes many gadoids including pollack (right)

3.5 Baitfish survey

Summer comes to the seas around the coastline of Wester Ross, the sun shines, and marine life proliferates. Blooms of phytoplankton are followed by blooms of zooplankton (mainly tiny crustaceans), jellyfish and many kinds of small 'fin' fishes. Sea trout smolts enter the sea from freshwater in late spring as the abundance of potential food items increases and by mid–summer they may have more than doubled their body weight. However, little is known about their diet and how food availability varies (see back cover).

During the summer of 2005, many small gadoids (mainly Pollack) and sandeels (both ?Greater and Lesser) were seen during snorkel surveys over kelp beds around Loch Gairloch, indicating an apparently plentiful supply of food for sea trout feeding close to the shore. However, the breeding success of sea birds was generally poor, perhaps with the exception of Greater black-backed gulls and Great skua (which breed on Longa) which were seen taking starving guillemots and puffins. In 2004, up to 12 Minke whales were seen at a time in the Minch nearby (feeding on sprats / small herrings); rarely were more than 2 seen at a time in 2005. In 2005, mackerel were taken by anglers from within Loch Gairloch from May (unusually early) to October; many of the mackerel were small.

These *ad hoc* observations may relate to adverse climatic conditions or to exploitation of 'bait fish' by commercial fishing boats. More detailed records were submitted by Wester Ross Salmon documenting observations from fish farms in Loch Broom and Little Loch Broom. Sandeels, Clupeids, (sprat & herring) were seen in the Ullapool area between June and August; mackerel were most often seen in August and September. Pipefish were seen regularly in late August and September. Of other fish-eating animals: Porpoise and both Grey and Common seals were seen occasionally between May and October; Fulmar, terms and Gannet were seen occasionally throughout the same period; Bottle nosed dolphin visited the loch in June. Most frequently seen of all were Common jellyfish (*Aurelia aurita*) and their main predator, Lion's mane jellyfish (*Cyanea sp*,. red and blue forms) with the highest abundance in early July. How does the abundance of jellyfish relate to the abundance of small fishes?

In 2006 the baitfish survey will focus on the week of 1st – 8th July, a period when finnock and sea trout should be growing fastest.

Thanks to Hugh Richards and other staff of Wester Ross Salmon for submitting records of observations.

Minke whale west of Gairloch, August 2005. Minke whale and sea trout both feed upon sandeels, sprats & herrings, and small gadoids (Peter Cunningham).

Part 4 **Ullapool River Fisheries Management Plan**

Supported by:

The Ullapool River Fisheries Management Plan 2006 – 2010, published in April 2006, presents work carried out by WRFT in 1997 - 2006 to assess salmon and trout stocks and identify factors determining their abundance. The management plan outlines a series of proposed actions aimed at restoring and developing the wild fisheries of the river. The following is a summary of the plan.

Ullapool River catchment: The Ullapool River has a catchment area of 168km^2 and drains glaciated, hilly terrain, with peaks of up to 928m (Seana Bhraigh). The River Douchary gathers headwaters streams and plunges over a series of waterfalls, to become the Rhidorroch River, which flows for a further 8km to Loch Achall. From Loch Achall (125 ha area), the Ullapool River flows through glacial moraines before dropping through a rocky gorge. From the Ness Falls (Eas Dubh), located 1 km below the loch, the river flows swiftly through a wooded valley for a further 3km to the tidal limit. Most of Ullapool catchment area lies to the east of the Moine Thrust Zone. The rocks underlying the catchment comprise a complex assortment of hard, generally base poor metamorphic rocks, predominately granulate, schists and gneisses of the Moine Series. Heather moor is the dominant vegetation, with mosaics of upland grasslands, meadows and bare rock above about 500m. The catchment is noted for extensive areas of native woodlands, dominated by Scots Pine. In March 2005 the Rhidorroch Woods were designated as a Special Area of Conservation (SAC) for Caledonian forest and Northern Atlantic wet heaths with *Erica tetralix* (Cross-leaved heath). There are also areas of alder woodland on the floodplain between East Rhidorroch and Loch Achall.

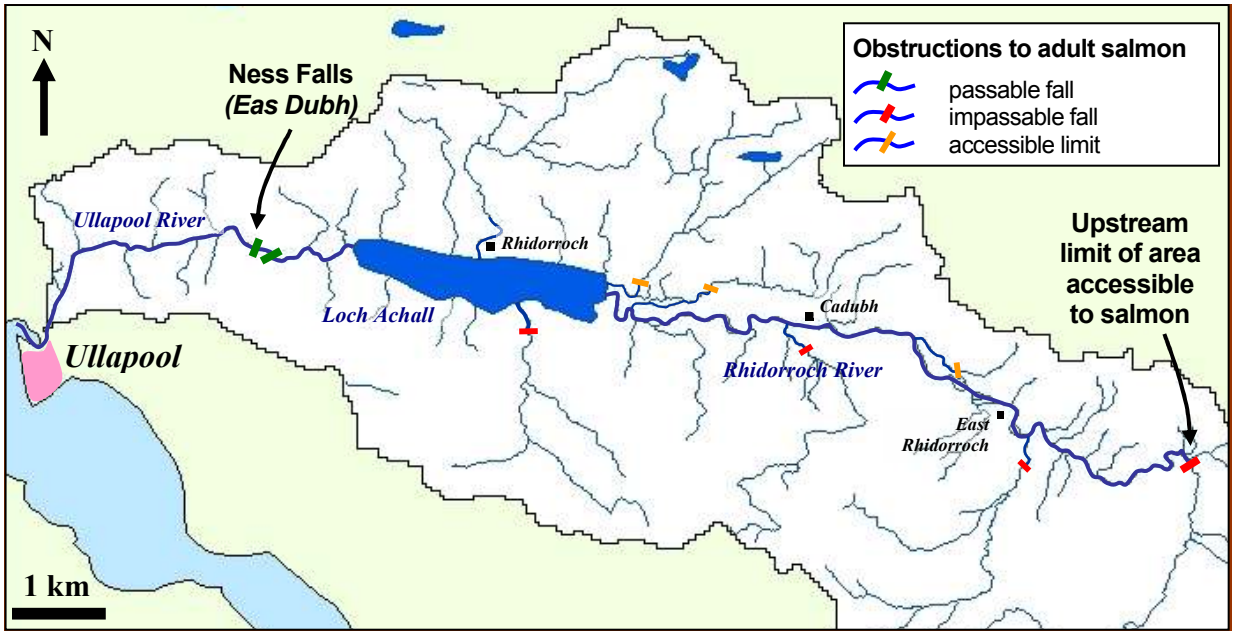


Figure 4.1 Parts of the Ullapool River that are accessible to adult Atlantic salmon.

Important species and habitats: At least 14 habitats and species listed under the EU Habitats Directive occur within the Ullapool catchment including the Atlantic salmon. Five of these, Freshwater pearl mussel, Otter, Red-throated diver, Black-throated diver and alder woodland, would also benefit directly from action to conserve the catchment's fish stocks and riverine habitats.

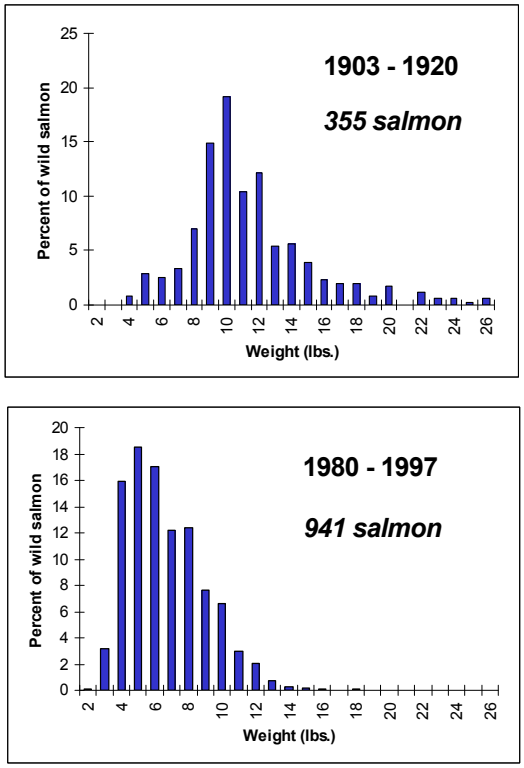


Figure 4.2 The weight distribution of salmon caught by rods in the Ullapool catchment during the period 1903 -1920, and 1980 – 1997

Salmon fishery: The Ullapool River is remarkable for having supported a fishery for 'spring' salmon for over 100 years. This unusual population may have evolved in response to the Ness Falls situated downstream from the main spawning areas. During the first half of the 20th Century rod catches of salmon from the Ullapool River comprised almost entirely of 2SW spring salmon taken before the end of June.

From the mid 1950s, catches of summer salmon and grilse increased. By the 1960s catches of 'summer fish' exceeded those of 'spring fish'. This change may be associated with stocking non-native salmon into the river from 1947.Catches fell to their lowest levels during the 1990s, but subsequently recovered. The Ullapool River retains a 'spring run'. Of 44 salmon caught in 2005, 8 were caught during spring months.

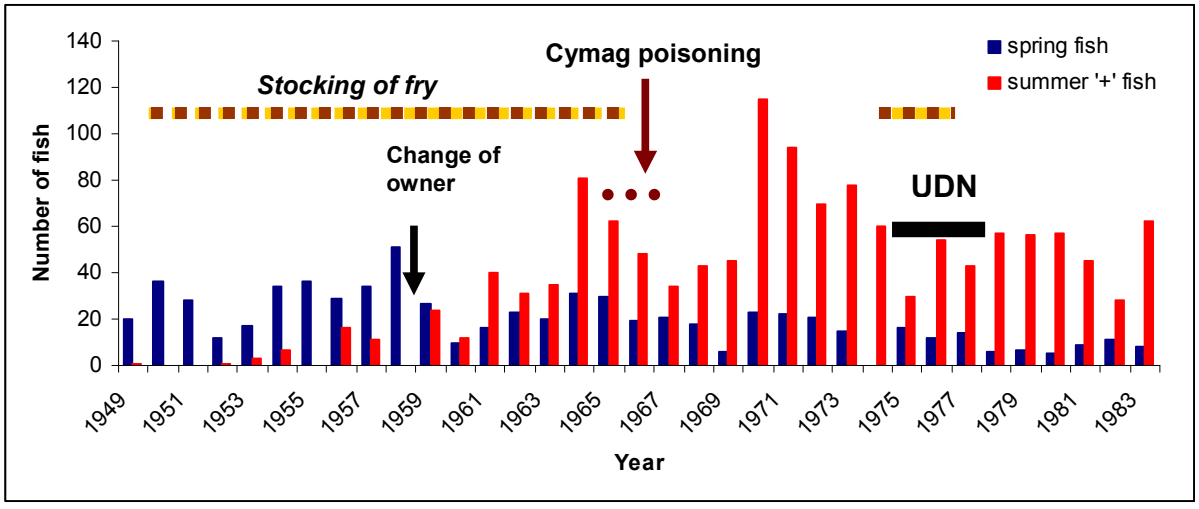


Figure 4.3 Recorded numbers of spring fish (taken before June) and summer fish (salmon and grilse) taken from the Ullapool River during the period 1949 - 1984

Trout fishery: Loch Achall supports a wild brown trout population which consistently yielded 500 -1000 trout, of average weight 5 to 6 oz (145-175g), per year to anglers. There is no evidence that the average weight of trout in Loch Achall changed as a result of the stocking of trout fry, freshwater shrimp (which were stocked in the 1940s), or in response to heavy fishing pressure. Small numbers of sea trout were taken below the Ness Falls, but seldom were sea trout caught in Loch Achall above the Falls.

Production of juvenile salmon and trout: Electro-fishing surveys were carried out in 1997, 1999, 2002, 2004 and 2005 to investigate the occurrence of juvenile trout and salmon within the Ullapool River system. Juvenile salmon and trout were recorded throughout the accessible area. However, their occurrence and overall densities varied between years. Salmon parr densities were consistently low at sites fished in the lower part of the Rhidorroch River. The possibility that larger salmon parr in the Rhidorroch River inhabited pools and deeper glides was investigated by snorkel survey in 2004 and 2005. Although visibility was good, few parr were observed and they were outnumbered by trout. Further investigations are required to assess the extent to which juvenile salmon utilise Loch Achall.

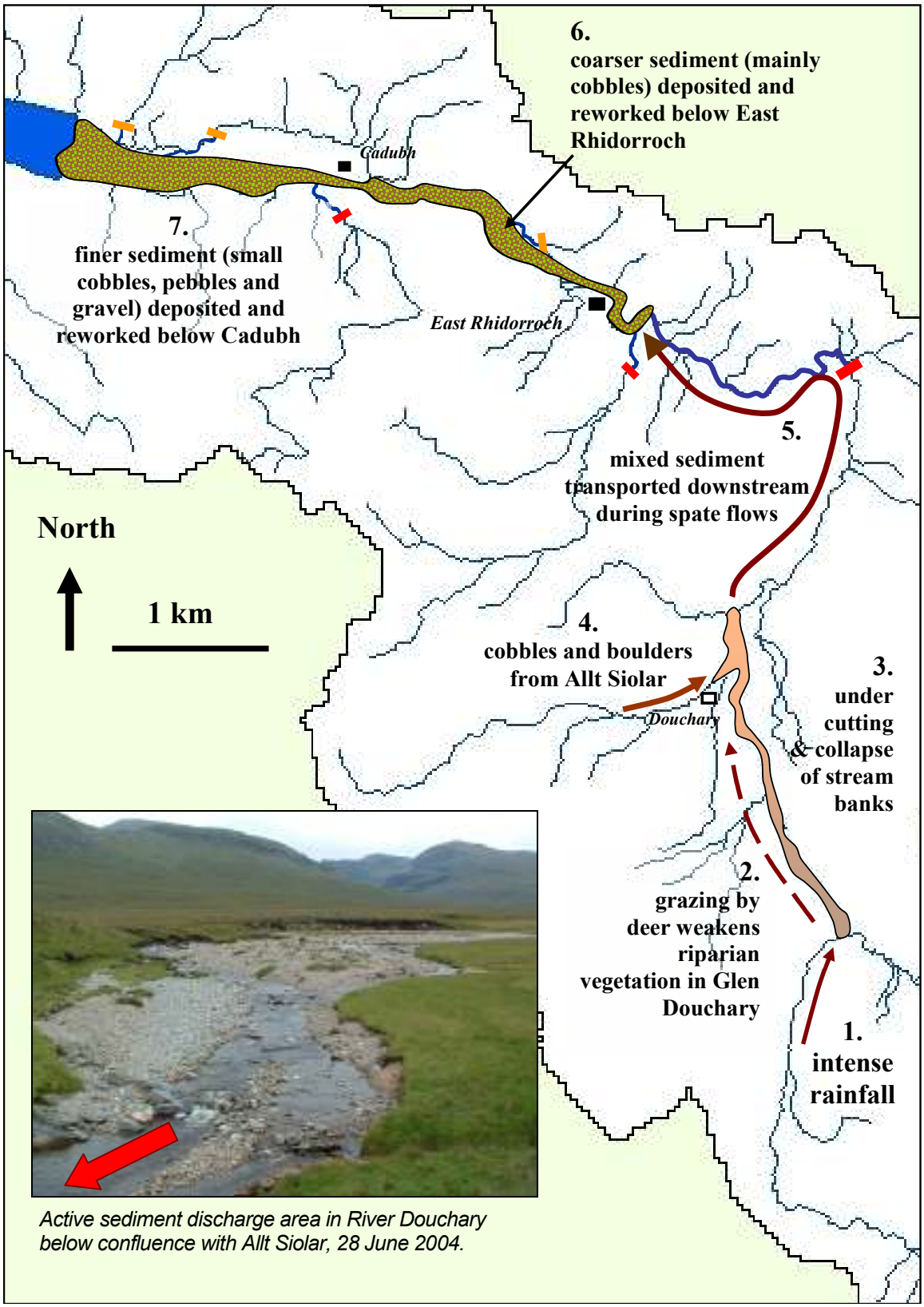
Freshwater habitat: In total, the accessible area for salmon comprises about 1,250,000m^2 of loch habitat (87% of total) and 192,157m^2 of riverine habitat (13%). Of the riverine habitat, 60% is within the Rhidorroch River, 35% in the Ullapool River below the loch, and only 5% in other minor tributaries flowing into Loch Achall or the Rhidorroch River. The most important minor tributaries in terms of accessible area are the Allt Coire Cronaidh, the Allt Dail a' Bhraid and the Allt Beallach na h-Imrich. Access for salmon above the Ness Falls (Eas Dubh) is dependent upon spate flows and probably also water temperature. Above Loch Achall, there are no major obstructions within the accessible section of the Rhidorroch River below the impassable falls at the top. The Rhidorroch River provides the largest area of salmon spawning habitat but is unstable throughout its length with highly mobile substrate, braided channels (below East Rhidorroch), erosion and bank collapse, associated with frequent scouring events due to 'bed-load transportation' of sediment from Glen Douchary. Habitat instability is likely to be a major factor limiting both recruitment of fry and the growth and survival of salmon parr.

Management Recommendations: Provisional recommendations are being finalised following peer review by SNH and the AST Biologist. These will focus upon restoration and support for the salmon fishery, and specifically, the need to maintain adequate smolt production to prevent the salmon population from 'downward spiralling' during periods when rates of marine survival of salmon smolts are low, by:

1. Protecting wild salmon to ensure that deposition of salmon eggs is adequate to maintain adequate levels of smolt production. Catch and release of all salmon unless there are clearly surplus fish e.g. a large late-summer grilse run. Possibly delaying the start of the salmon fishing season to minimise risk of trauma to the earliest entering salmon until they have ascended the Ness Falls.
2. Restoring and developing stronger, more natural, riparian vegetation to reduce the frequency and severity of bed-scouring events in the Rhidorroch River and to provide additional nutritious material for more varied and productive life within the river (including juvenile salmon).
3. Strengthening the wild salmon population for future years by promoting the 'survival of the fittest'. Stocking should therefore only be considered when egg deposition by wild fish or severe redd washout is likely to result in inadequate recruitment of juvenile salmon to maintain adequate levels of smolt production. Only native Ullapool River salmon should be used as brood fish, and FRS guidance should be followed.
4. Record keeping. Rhidorroch Estate has set an example of record keeping that other fisheries managers could do well to follow.

Further research of particular relevance to Ullapool River fisheries management: topics for consideration include: *'cultural oligotrophication'* of the catchment and the need for restoring fertility; the utilization of Loch Achall by juvenile salmon; interactions between resident brown trout and juvenile salmon; genetic characteristics of the salmon population compared to those of other nearby river: does the Ullapool River salmon population merit 'special' conservation status?

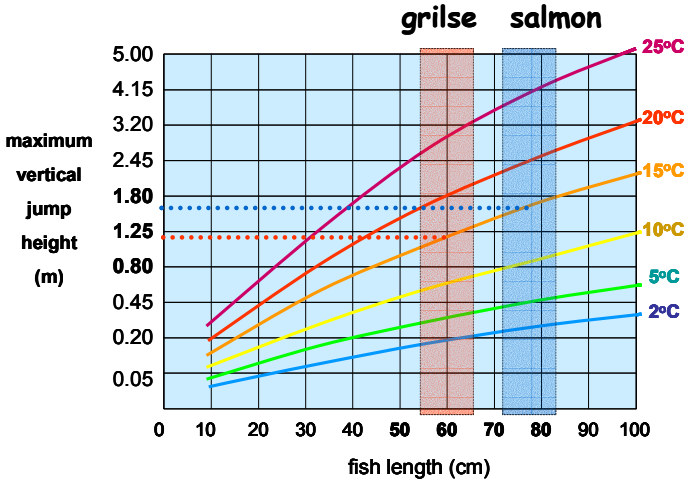
Figure 4.4 The quality of juvenile salmon habit within the Rhidorroch River is governed by erosion and sediment discharge from Glen Douchary. If rates of erosion and sediment discharge go up, stream stability and fish habitat quality goes down.



Active sediment discharge area in River Douchary below confluence with Allt Siolar, 28 June 2004.

Box 4.1 **Spring salmon and waterfalls**

Until the 1950s, The Ullapool River appears to have had a distinctive population of early running 2SW salmon with few later running (1SW) grilse. Over many generations, the salmon population of the Ullapool River may have evolved to produce a high proportion of 2SW salmon that entered the river early in the year, in response to the need to be able to surmount the falls to reach the main spawning habitat within the river system. Together, the Ness Falls (*below left*) and the narrow gorge immediately above the falls through which the flow is accelerated after heavy rain (*below right*) may have acted as the selective pressure determining whether or not salmon were able to reach upstream spawning areas. Sea trout, although regularly taken below the falls, were very rarely recorded above the falls.



Maximum vertical jumping height for trout and salmon based on values for maximum swim speeds presented in Beech, 1984.

Note how a typical salmon would be able to jump higher than a grilse at any given water temperature (dotted lines contrast a 60 cm grilse with a 75cm salmon). Also note that smaller fish (e.g. a sea trout of 40cm) would have difficulty surmounting waterfalls that salmon and grilse would be able to ascend.

Genetic studies need to be undertaken to clarify *how* different Ullapool River salmon are now from salmon returning to neighbouring rivers. The salmon population of the Little Gruinard SAC is dominated by grilse (90% of catches in 1995 - 2000), as is the Gruinard River nearby. Neither of these systems have major obstructions such as the Ness falls. The only other comparable system within the WRFT area with a consistent run of spring salmon is the River Ling near Dornie (although records for the Ling are not as detailed as those for the Ullapool River). The River Ling also has challenging water falls over which salmon must ascend to reach spawning areas. The River Bruachaig (River Ewe system) also has several formidable waterfalls and also supported a salmon population which may have been characterised by early running fish. Wild salmon have not been recorded above the Bruachaig falls since 1999.

Box 4.2 **Population structuring: spring salmon versus summer grilse**

Until the 1950s, The Ullapool River appears to have had a distinctive population of early running 2SW salmon with few later running (1SW) grilse. Subsequently, numbers of spring salmon recorded in catches declined and numbers of smaller, summer grilse, more typical of Wester Ross river systems, increased. Records indicate that this change may have been partly as a result of stocking. Some of these later fish have shown that they are more than capable of surmounting the falls (Eas Dubh) and reaching headwater streams to spawn. Can the spring salmon 'population' of the Ullapool River be restored?

Over the past 20 years, geneticists have greatly extended our knowledge of salmon populations and how fish in different parts of their range are related to each other. Some studies have found genetic variation that appears to be associated with phenotypic characteristics and / or environmental variables. These studies support the hypothesis that different salmon populations have become adapted to their local environments. For example, genetic protein variation at one of the loci [*MEP-2**] has been shown in a series of studies to be correlated with latitude, January and July temperature and local river gradient, and with phenotypic traits such as mean size at age, specific growth rate and sea age, and also with growth variation within families. Another study found associations of *MEP-2** genotype with survival and growth in the early life-history stages among planted-out fish as well as an association with smolt age and male parr maturation. Please refer to the review paper by Verspoor, *et al.,* 2005 for more detailed discussion and the full list of studies cited.

The model presented here considers how competition between first-feeding fry may influence population structuring.

Consider a spawning stream (e.g. upper Rhidorroch River) where 20,000 fry are needed to 'saturate' the available habitat.

Scenario A: In year 1, only 10,000 fry emerge from spawning areas and of these 50% are progeny of summer grilse and 50% progeny of 2SW spring salmon. The burn is cold, oligotrophic and food is limited. Although progeny of grilse are initially a little smaller and swim up later than those of 2SW spring salmon, growth is not limited by competition between fry and rates of fry survival for both groups are relatively high. Subsequently, smolt runs comprise 50% progeny of grilse and 50% progeny of 2SW Spring salmon.

Rates of smolt to spawning adult female survival remain low. However, the survival of summer grilse (that spend 1 winter at sea) is higher than that of spring salmon (2 winters at sea). In subsequent years, egg deposition remains below 'saturation' levels. Because of the higher rates of survival and higher egg deposition of grilse, the proportion of grilse in subsequent years increases relative to 2SW spring salmon.

Scenario B: In year 1, 50,000 fry emerge from spawning areas and of these 50% are progeny of summer grilse and 50% progeny of 2SW spring salmon. The burn is cold and oligotrophic: food is limited. Progeny of 2SW spring salmon emerge from the gravel earlier than those of grilse. They are already larger and occupy available habitat. Food becomes even more limited as there are many mouths cropping drifting items. Progeny of 2SW out-compete those of grilse and through 'self thinning' dominate. Subsequently, smolt runs comprise 95% progeny of 2SW Spring salmon and only 5% progeny of grilse.

Although rates of survival of spring salmon progeny remain lower than those of grilse, numbers of adult female 2SW spring salmon in excess of those required to saturate available habitat with fry return in subsequent years. In other words, the egg deposition by 2SW female fish remains higher than required; and because their progeny are better adapted to the environmental conditions of the spawning burn, the progeny of any female summer grilse which return to spawn perform poorly. In subsequent years, the population becomes increasingly dominated by 2SW spring salmon.

The aim of this model is to demonstrate why **spawning targets** (or conservation limits) for adult fish may need to be set at levels high enough to ensure that there is a high degree of competition for food and habitat as fry emerge from gravels if populations dominated by 2SW spring salmon (such as that of the Ullapool River) are to be retained. For the Ullapool River, with a relatively small area of spawning and nursery habitat, it is possible that selection can work quite rapidly (within a few generations) to favour 'spring salmon' if sufficient numbers of female spring salmon spawn. But conversely, if densities of spawning fish remain lower than those required to ensure high levels of competition between fry, the population will tend to become increasingly dominated by fish capable of producing the most eggs that are viable the fastest (i.e. late-running, later-spawning, grilse).

Reference: Verspoor, E. *et al* (2005): Population structure in the Atlantic salmon: insights from 40 years of research into genetic protein variation. *Journal of Fish Biology* (2005) **67** (Supplement A), 3 - 54

Part 5 **Other Research and Project Work**

5.1 Loch Maree Fish Survey 2005

Supported by:

Bill Woodrow (Artist & sculptor)

Highland Biodiversity – The Variety of Life

The Highland Council – Comhairle na Gaidhealtachd

Scottish Natural Heritage

Atlantic Salmon Trust

Loch Maree formerly supported the most important fishery for sea trout in the north west of Scotland. The fishery collapsed at the end of the 1980s early 1990s. With fewer female sea trout returning to spawn around the loch, concerns were raised regarding production of juvenile trout within the system following reports from anglers that fewer small trout were being seen and taken than in the past. Small fish are also an important food for Black-throated divers (see www.rspb) for which the loch is a designated Special Protection Area (SPA). The Loch Maree Fishes Survey and Awareness Raising Project Report 2005 [henceforth referred to as the Loch Maree Project 2005] was set up to explore methods of assessing the distribution of small fishes within shallow areas of the loch. For the purposes of this study, 'shallow' means water of about 50cm depth or less. One reason for initially exploring shallow margins of the loch was because of the possibility that such areas might provide some indication of juvenile salmon and trout abundance in relation to pre-existing and contemporary information from electro-fishing surveys of spawning streams around the loch.

Initial aims were as follows:

- to develop an understanding of the distribution and production of small fishes, including juvenile trout and salmon, initially in and around the shallow margins of Loch Maree and to consider this with the contemporary occurrence of small fishes within nearby inflowing streams.

- to compare the effectiveness and efficiency of different methods of surveying fishes within the shallow margins of the loch.

- to foster greater public awareness and understanding of fishes and fish biodiversity within Loch Maree and of the links between healthy fish populations, associated wildlife, and productive fisheries.

Peter and Lorna electro-fishing flooded margins of Loch Maree by Talladale (Norman Thomas)

Methods

Surveys were undertaken using both back-pack (battery powered) and bankside (generator powered) electro-fishing equipment, with and without use of nets to enclose areas to be fished. Sites were fished in shallow parts of the loch and in in-flowing streams nearby. Snorkelling was used to set nets and for visual surveys. A set fyke net was fished to intercept fishes moving westwards around the Slattadale – Talladale shore area in October. In November, sites were fished in Loch Clair and Loch Coulin for comparative purposes.

Results

Progress was hampered by unusually high water levels in September, especially following streambed scouring spate on the 13th September 2005.

Minnow, stickleback, eel and juvenile trout were recorded from the margins of lochs using pack-pack electro-fishing equipment especially where there was cover (large stones or weed beds). Use of stop nets can limited escapement of trout and minnows ahead of the electro-fisher, but because of the disturbance of setting them – the additional effort required provided minimal advantage.

Use of bank-side generator powered electro-fishing equipment made little difference to fish catches in this study – possibly because of the relatively low voltage produced.

Minnow was the dominant fish species recorded at all shore electro-fishing sites around Loch Maree. At nearby sites in streams, trout and juvenile salmon were more abundant than minnows. Minnow were not found in Loch Clair and Coulin where only trout were found. Most of the minnows caught at loch sites were smaller than those caught at stream sites. Many of the larger minnows caught in the loch were infected with a parasitic tapeworm, causing distended belly. Further work is needed to assess how the size distribution of minnows relates to parasite infection.

Many of the larger minnows especially those from loch sites had grossly distended bellies (see also cover photo). Sub-samples dissected at Tollie Bay, Slattadale and Taagan Bay showed them to be infected by tapeworm.

If this parasitic tapeworm is Ligula intestinalis (to be confirmed), its lifecycle includes a bird (Black throated diver?) and copepod zooplankton as intermediate hosts. Parasitic tapeworms were not found in small trout.

Few juvenile trout were recorded at shore sites around Loch Maree. This may have been partly due to sampling error (though subsequent fishing at Loch Clair and Coulin suggested this is not the full explanation), to displacement of trout from shallow water habitat by minnows, and / or to very low densities of juvenile trout within Loch Maree relative to Lochs Clair and Coulin. Further work is required to clarify this and whether this relates to prey availability for Black-throated divers.

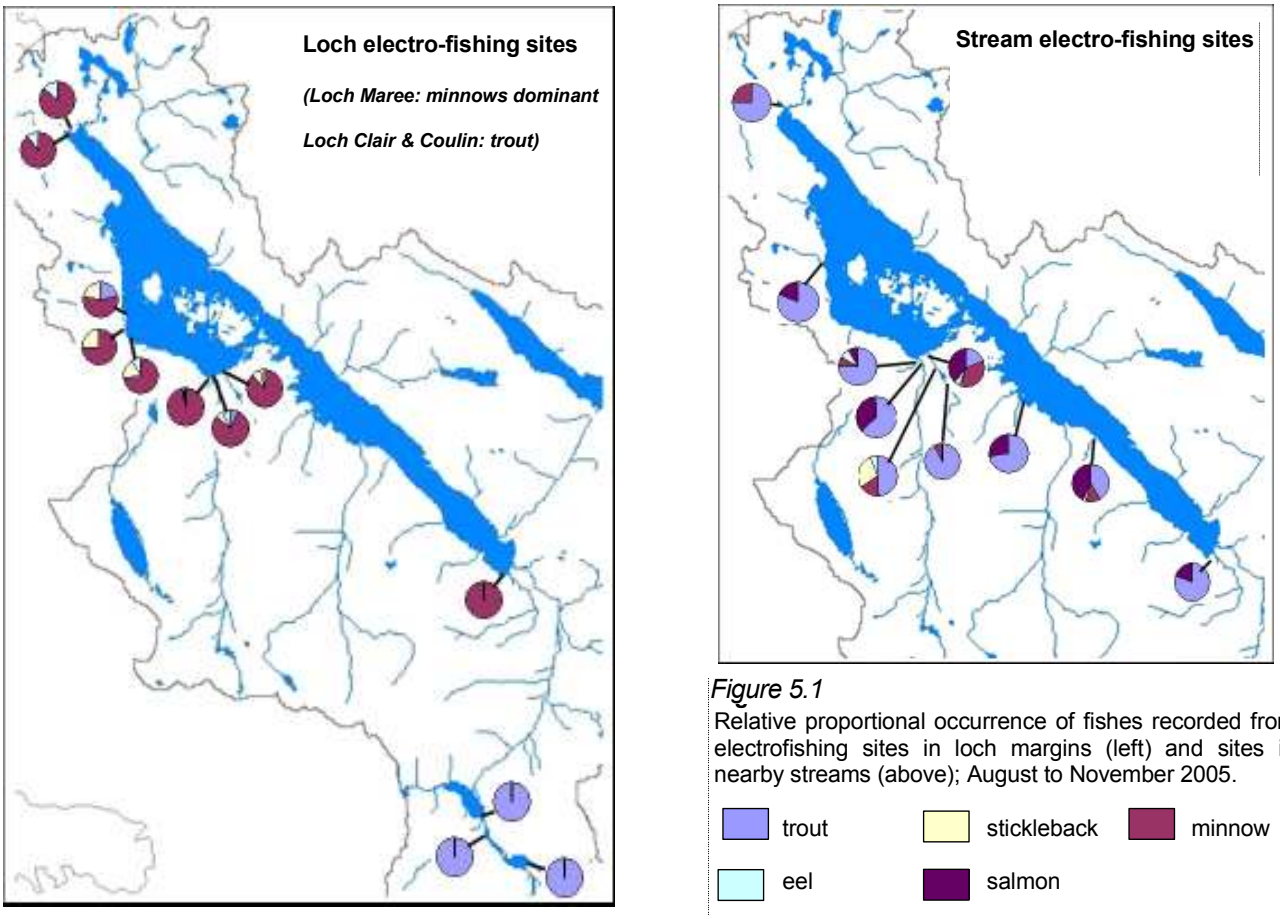


Figure 5.1
Relative proportional occurrence of fishes recorded from electrofishing sites in loch margins (left) and sites in nearby streams (above); August to November 2005.

The school field excursion to Slattadale and the Open Day at Loch Maree Hotel provided opportunities primarily for school students, children and their parents to learn about different fishes living in Loch Maree and of ways of catching them and studying them.

The Open Day was supported by personnel from a range of government agencies and by the local angling club and was judged by all to have been a success. There are plans to hold a similar day in October 2006, building on the success of this event.

5.2 Wild Trout Project

Supported by

The Wester Ross Wild Trout Project [WTWTP] was set up in 2003 to learn more about the biodiversity, ecology and productivity of many of the lochs and lochans in Wester Ross. The project provides opportunities for anglers and wildlife enthusiasts to assist with sample collection and research. By adopting a collaborative approach, the project aims to generate interest and create greater awareness, especially within the local community, of the value of local waters and the potential to manage them to enhance their value as fisheries and for wildlife conservation.

(left) Jim Rudderham, Wild Trout Trust auction lot winner, assisted by Ala MacKenzie (Gairloch Angling Club) landing a trout from Loch Airghe a' Phuill near Gairloch in May 2005; (right) two trout from Loch a' Mhuilinn nearby.

In 2005, samples of trout were collected from hill lochs between Gairloch and Loch Maree, a series of children's 'trout fishing expeditions' were organized for the school holidays, a study to investigate the genetic relationships of trout in both hill lochs and the accessible part of the River Ewe catchment was initiated, and an outline draft of a booklet 'A Wee Wildlife Guide to the Gairloch Hill Lochs' based on Caroline Bowes's hill loch studies was prepared.

Table 5.1 trout sizes and CPUE for selected lochs sampled in May – June 2005

Loch	NGR	Date sampled	Number of trout caught	Fishing effort (rod hours)	CPUE	Average length (mm)	Longest trout (mm)
Loch Clair	1829 8765	02-Jun-05	12	5	2.40	191	230
Loch an t-Sabhail-Mhoine	1820 8763	02-Jun-05	9	5	1.80	224	255
Loch a' Mhuilinn	1825 8759	02-Jun-05	2	4	0.50	277	295
Loch Druim nan Uamh	1823 8769	17-May-05	8	6	1.33	211	250
Loch Airighe a' Phuill	1840 8757	17-May-05	6	6	1.00	198	214
Lochan Dubh nam Biast	1862 8732	04-Jun-05	5	6	0.83	207	245
Lochan Creag Ruadh	1876 8736	04-Jun-05	9	3	3.00	226	260
Loch Doire na h-Airighe (west bay)	1871 8740	04-Jun-05	11	5	2.20	196	263
Loch Doire na h-Airighe (east bay)	1874 8740	04-Jun-05	12	5	2.40	167	202

Samples of trout were taken from 8 hill lochs at altitudes of between 200 and 300m listed in Table 5.1 using rod and line. Trout were anaesthetized, measured and scale samples were taken. Adipose fin clips of trout from lochs draining into the River Ewe catchment were collected (see 'Loch Maree Wild Trout Project') were collected. The average length of trout caught in 4 of these lochs was less than 8 inches. However, all lochs produced larger trout. Most of the trout were aged from 3 to 5 years old (Figure 5.2). Most scales indicated particularly rapid growth during the second year, with progressively smaller annual increments thereafter. The largest trout of 295mm from loch a' Mhuilinn was aged as a 4+ year old fish. In contrast, two trout of 250 and 260mm were tentatively aged as 6+ from Lochan Creag Ruadh.

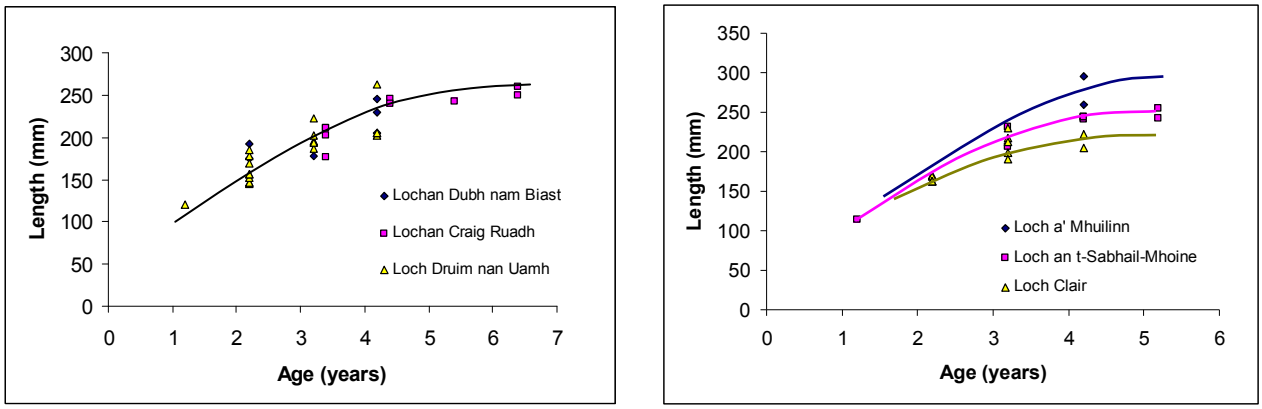


Figure 5.2 Growth curves from trout caught in lochs in the Gairloch Hills in June 2005 by Jim and Deidre Rudderham and David and Dugald Foreman, winners of Wild Trout Trust Auction lots.

Loch Maree Wild Trout Project

Dugald Foreman returning trout to a lochan in the Gairloch Hills.

Wild trout enthusiasts are increasingly concerned for the maintenance of the natural genetic diversity of brown trout and sea trout. Over the years, many lochs in Wester Ross were subjected to stocking of non-native trout (including 'Loch Leven' trout, and sea trout from east coast rivers) by fisheries managers and angling clubs, sometimes in the belief that 'new blood' would improve the 'quality' (size) of fish for angling.

This project aims to identify genetic origins and relationships between the wide variety of forms of trout ranging from Loch Maree sea trout & *'ferox'* to little mountain stream brownies above insurmountable waterfalls. The project may be able to demonstrate whether or not there are still distinctive ancestral 'Wester Ross' trout populations living within the River Ewe – Loch Maree catchment, and whether any of the stocked fish established viable populations.

The project is a collaborative venture between Middlesex University (Dr Steve Kett and Calum Button), University of Highlands and Islands Seafield College (Bob Kindness), FRS Freshwater Laboratory (Dr Eric Verspoor) and WRFT. A series of 'expeditions' in search of trout are scheduled for the summer of 2006. Please contact WRFT for further information.

Children's Wild Trout Expeditions

Children's trout loch days were once again held in the Gairloch area and at the Ullapool Angling Club's children's fishing competition (during the Ullapool Fish Week). A series of 'Wild Trout Expeditions' were aimed at introducing local children to some of the wonderful hill lochs in the Gairloch area and providing opportunities for finding out about the life and habitats of wild trout, and other wildlife living in and around lochs. WRFT is grateful for the support of Ala Mackenzie (Gairloch Angling Club), Highland Council Countryside Ranger, Meryl Carr, Norman Thomas, and several mums and dads! In addition to trout, children found a number of other animals including frogs, newts, dragonflies and a lizard. Although earth worms were in rather short supply, several boys and girls persevered with flies and caught their first ever trout.

(left) Group photo of young anglers and helpers by Loch Airighe a' Phuill in August 2005. Similar days are scheduled for summer 2006.Please contact the WRFT Biologist for further information

(left) The Flowerdale Burn supports a healthy population of trout!

(right) All set to go electro-fishing at the Loch Maree Open Day on 19th October, with Meryl Carr (Highland Council Countryside Ranger) and enthusiastic helpers. (Julia Coates)

5.3 Arctic charr in Wester Ross

Arctic charr (*Salvelinus alpinus*) are rather wonderful, somewhat mysterious and at times brightly coloured members of the family Salmonidae. Populations of Arctic charr are known to exist in a number of lochs within the WRFT area. However, little is known about them. Charr tend to inhabit deeper water. Even where present, they are rarely taken or even seen by anglers. Scottish charr populations are descended from anadromous (sea–going) ancestors. As water temperatures rose at the end of the last ice age, Scottish charr populations became confined to freshwater. Subsequently, over thousands of years, isolated charr populations have diverged in their morphology, behaviour and genetic make up. Taxonomists continue to debate whether or not some populations should be given 'sub-species status'.

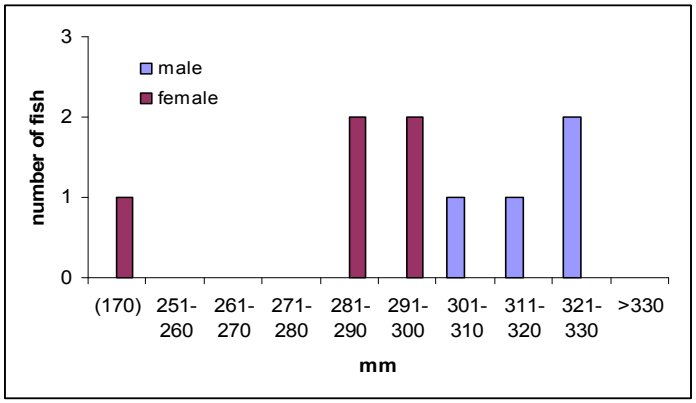
Wester Ross is possibly one of the most important areas for Arctic charr in the British Isles. At least 14 lochs are known to support populations of charr. Genetic studies in the early 1990s (Alexander *et al*) identified two separate charr populations in Loch Maree, which is thus one of only a handful of lochs in Scotland where more than one kind of charr is known.

Stream spawning Arctic charr

Most Scottish charr populations spawn over pebble – cobble substrate in the sides of lochs. Stream spawning populations of charr are therefore unusual. The best known stream spawning charr population in the British Isles inhabits Lake Windermere in the Lake District. Stream spawning charr are also known from Loch Inch (River Spey), and were formerly present in St Mary's Loch in the Borders.

On 25th October 2005 we visited a charr spawning burn near a large loch in Wester Ross. The stream is about 2 – 2.5m wide. The streambed is composed mainly of pebbles with patches of sandy gravel disturbed in places where charr had been spawning. Banks are mainly of heather which overhangs the water along ~50% of the spawning area. Charr were observed in the sides of pools and moving between pools (sometimes through shallow water with their backs out of water) along a length of about 400m.

Within the burn (and river nearby) there may have been 200-300 charr; not many more than that (it may be possible to more accurately record the size of the population in future years). Nine charr were captured using electro-fishing gear from the lower end of the spawning burn carefully avoiding areas where charr eggs may have been present. After anaesthetizing fish, measurements were taken and adipose fin clips were taken for DNA analyses. Most of the fish were of a very similar size (between 280 and 330mm) as were others seen in the burn; only one smaller charr of 170mm. Although a scale sample was taken, their age could not subsequently be determined because of even growth.



(left) Fork lengths of Arctic charr taken from a spawning burn near Loch na Sealga on 25th October 2005.

Most fish were of a very similar size: between 280 and 325 mm.

Males were almost black headed, with an orange–red belly and had a slightly protruding lower jaw *(above left)*. Most of the females were of similar size and colouration to the males *(below left)*. However, the smaller fish was of lighter colouration *(above right*); its spawning status was not investigated further. In addition to charr, juvenile salmon and trout were also taken whilst electro-fishing. The largest trout of 145mm *(below right)* had eaten 51 charr eggs.

Arctic charr (all except bottom right) from a spawning burn near a large loch in Wester Ross. See text for details.(Photos by Peter Cunningham and Ben Rushbrooke)

In early November, charr were observed spawning in a larger stream near another loch. These fish were of similar colouration, though smaller than the charr seen at the first location. Their behaviour was observed in clear water with sunlight shining on the fish and included redd cutting and combat between males (below). [A large male is about to 'broadside' a smaller, lighter coloured male; a small female can also be seen slightly to lower right of centre]

There are reports of stream spawning charr at one other location in Wester Ross and anecdotes of Arctic charr inhabiting a number of lochs within the WRFT area which are not listed. Further surveys, in collaboration with some of Scotland's Arctic charr specialists, are scheduled for October and early November 2006. Please contact the WRFT biologist if you would like to take part.

Part 6 **River Carron – Building on Success**

by Bob Kindness, University of Highlands and Islands Seafield College

It is now more than 10 years since the first efforts were made to try to reverse the decline in salmon and sea trout stocks in the River Carron. Once one of the finest salmon and sea trout fisheries in the West Highlands, rod catches had dropped dramatically to almost zero. Juvenile stocks were at a very low level while the habitat within the river system was generally good and certainly capable of supporting a much healthier stock of young fish. The logical answer was to increase the young stock through stocking to a level that would generate a much improved smolt run and hopefully result in an increase in adult returns to the river.

Due to the dearth of adult salmon and sea trout in the Carron through the late nineties, early stocking efforts involved low numbers and made little noticeable difference to the number of returning adults. However, with the establishment of captive broodstocks for both salmon and sea trout, we were able to increase the level of stocking considerably. Since 1997 more than 1.5 million young sea trout and since 2001 over 1.0 million salmon have been stocked into the Carron. All freshwater life stages are used in the stocking programme. The good news is that the river has made a remarkable recovery:

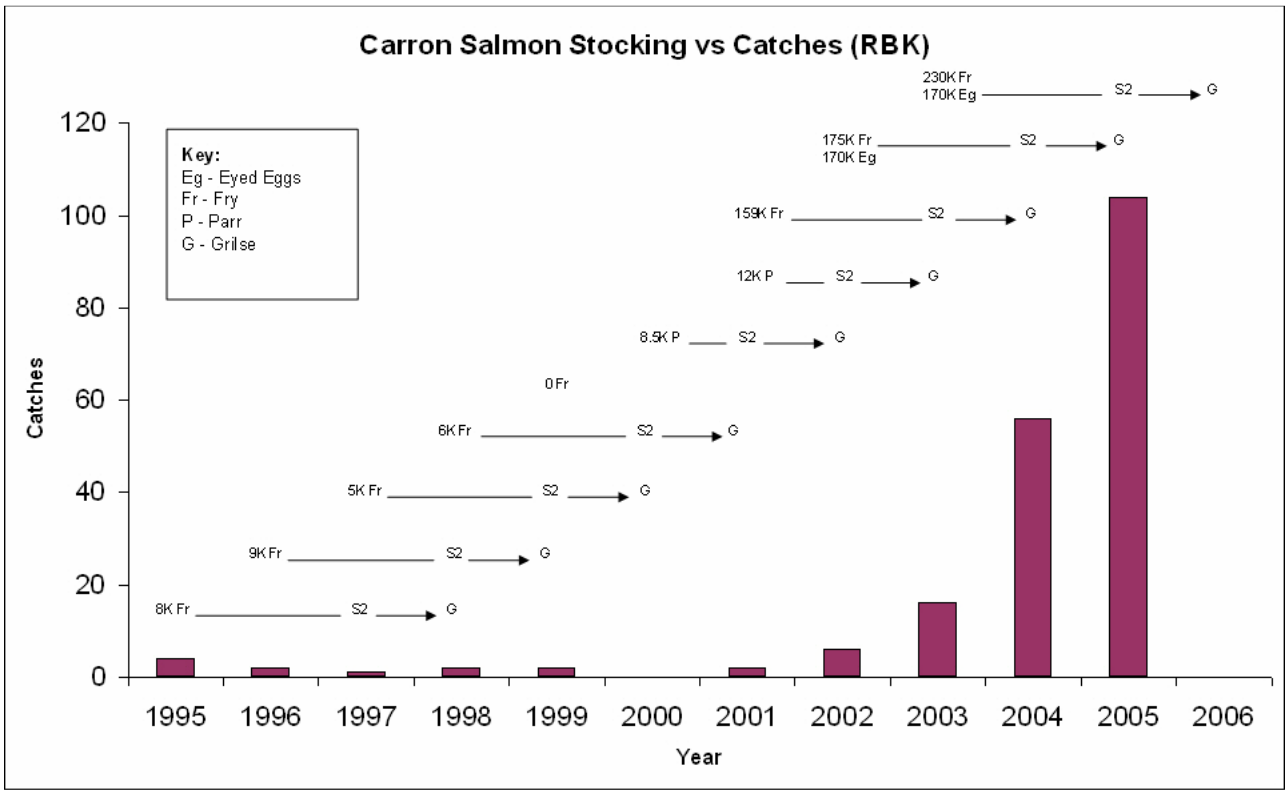
- **1999** - total catch of 5 salmon, 1 sea trout and 1 finnock
- 5 year average for salmon to 2001 was 6.2
- 5 year average for sea trout to 2000 was 11.2

- **2005** – total catch of 166 salmon, 83 sea trout and 162 finnock
- 5 year average for salmon to 2005 was 74.4
- 5 year average for sea trout to 2005 was 97.2

While the recovery of the salmon stocks is clear-cut with year-on-year increases, the situation for sea trout is less clear. Finnock catches rose sharply to a high level in 2003 but has since dropped back, while sea trout rose to 162 in 2004 but fell back in 2005.Although it is too early to determine whether the poorer catches in 2005 represent a real set-back or simply a single poor year, it does appear that sea trout are suffering poor survival during their marine phase. This is reinforced by results from the majority of sea trout rivers around Scotland. It is interesting to note that in respect of sea trout, sea lice does not appear to have been a problem in recent years with no early returning post-smolts caught in the Carron in the last 4 years and yet the sea trout numbers are not increasing in a manner as might have been expected. Since sea lice levels are now generally low throughout Wester Ross, it would now appear that any problems that have been associated with this destructive parasite are overwhelmed by other factors that are depressing sea trout numbers. Unfortunately, it looks very likely that sorting out the sea lice problem will not in itself bring sea trout flooding back to our rivers.

Although the recovery of the Carron is a proven fact, there is still scepticism from certain quarters that it may be simply a natural recovery and have little to do with the stocking programme. Some point to the fact that other rivers had improved catches in 2004 and 2005, but the reality is that none of these had hit rock-bottom like the Carron and then shown such a dramatic increase. All rivers, including the Carron, benefited from improved marine survival during the last two years but to reap the benefits, a reasonable smolt output would have been required. For many rivers in the Highlands, although catches have been poorer in relation to the past, there would still have been enough spawning fish to generate a sufficient number of smolts to take advantage of the improved conditions. In the case of the Carron, the evidence points to the fact that the vastly improved catches are primarily due to the stocking programme that has produced a good smolt run to take advantage of the better marine survival. We can consider the following for salmon:

In the 2 years, 2004 and 2005, a total of 307 salmon were caught. 31 of these fish were known to be from the smolt release programme, leaving a balance of 276 fish which, assuming a 15% catch rate, would equate to a total of 1,840 salmon returning to the river. If most of the adult salmon are grilse, then the runs in 2004 and 2005 would have been generated from S2 and S3 smolts produced by fish spawning in 1999, 2000 and 2001. During these 3 years a total of only 16 salmon were caught and, if we assume a 5% catch rate, due to low fishing effort, 320 adults would have returned to the river. If half of these were hens and each produced 4,000 eggs then the total smolts produced between 2002 and 2005 would have been approximately 6,400 (1% smolts from eggs). At 5% marine survival, these smolts would result in 320 returning adults. This figure represents 17.4% of the estimated number of salmon returning in 2004 and 2005. The question is where did the other 82.6% come from?



If we look at the chart showing salmon stocking effort in relation to my own catches, the question would appear to be answered. From 1995 to 2001, I struggled to catch any fish although I was trying hard to catch fish for broodstock. During this period only small numbers of fry from wild broodstock were stocked out. However, with yearlings being stocked out in 2000 and 2001, this coincided with a rise to 6 and 16 salmon caught in 2002 and 2003 respectively. The captive broodstock came on stream in 2001, resulting in a considerable increase in eyed ova and fry stocking from that year onwards. The effect on my catches was spectacular rising to 56 in 2004 and 104 in 2005. This contrasted with only 2 in 2001.The correlation between stocking and rod catches is so strong that there appears little doubt that the 82.6% of the returning adults were from stocked fish.

Smolt Release Programme

As part of the overall stocking strategy, a programme has been put in place since 2002 to release both salmon smolts and sea trout smolts. The purpose was two-fold, firstly to determine whether or not releasing smolts is a viable method of stocking and secondly, to establish whether protecting smolts against sea lice results in a better return of adults.

The method employed was to rear both salmon and sea trout through to the S1 smolt stage in tanks before releasing them into the river. The release was done through a simple release pond, fed from a small burn on the New Kelso beat approximately two miles from the sea. All the smolts were tagged using CWT tags injected into the nose and adipose fin-clipped to allow identification before being transferred to the release pond. Half of each batch of smolts was treated with the anti-sea lice medicine 'Slice' which was incorporated into the feed. This would give the fish protection for up to 10 weeks. 6,000 salmon smolts were released in both 2002 and 2003 while 8,000 were released in 2004. 4,000 sea trout smolts were released in 2002 and 2,000 in each of 2003 and 2004. In 2002 the smolts had to be released after only one week of imprinting due to the water level of the small feeder burn dropping very low and temperatures rising. However, in 2003 and 2004, it was possible to leave the smolts in the pond for 3 weeks before release giving them a longer time to imprint.

No fin-clipped salmon were caught in 2003, which may have been due to the short imprinting period, but 21 were caught in 2004 and 10 in 2005 with an additional 2 being caught as kelts in the spring of 2006. In considering the 2004 catch, it was possible to read the tags from 18 fish, all of which proved to be grilse including a cock of approximately 12 lbs in weight. 10 of these fish were from the Slice treated batch and 8 from the un-treated. An additional tag was recovered from the 2003 smolt output. This was also a grilse of 7.5 lbs that was caught in a drift net off Greencastle in Northern Ireland in July. This fish was from the Slice treated batch.

The 2005 return was rather different. Of the 9 tags that could be read, 6 of the fish were cock grilse while the other 3 were 2 SW hen salmon. For the grilse, the split was 3 treated and 3 un-treated while 2 of the salmon were treated and one un-treated. When combining the results for the 2 years, we get 13 treated (including the Irish fish) and 9 un-treated from the 2003 smolt output but equal numbers for the 2004 output. Until we recover fin-clipped fish in 2006 it is not yet possible to say whether or not the Slice treatment made a significant difference to the returns and therefore whether lice was a problem to migrating smolts. However, considering the fact that for the 6 tags recovered from fin-clipped finnock that were caught 3 were treated and 3 were un-treated it looks highly likely that lice were not a problem during the duration of this trial. There is further evidence to support this in that no early returning post-smolts were caught during this period.

While it is clearly evident that the release of a modest number of smolts has resulted in a significant addition to the rod catches, the smolt releases have contributed in two other ways. Firstly, each of the fish that was caught was not killed immediately for tag removal but instead was kept to be used as broodfish first. In 2004, 6 small grilse hens were stripped producing a total of 25,000 eyed ova at a fecundity level of approximately 1,000 eggs per pound of fish weight. The survival of the eggs was almost as good as wild fish resulting in a significant number of young fish (including 2,500 smolts) being stocked back into the river. The results in 2005 were even more impressive. Two 2 SW hens were stripped producing 16,950 eyed ova at the same level of fecundity as for the grilse. The survival to the eyed stage was as high as any wild fish at 99.6% and the hatching rate was 99.9%. This indicates eggs of the highest quality and, from my experience, will produce fish of exceptional quality.

The second contribution made by the returning tagged fish is that any fish that is not caught will go on and spawn in the wild thus contributing to the overall population of juveniles in the system. Since 2 hen kelts (estimated spawning weights of 5 and 14 lbs in weight) were caught in March 2006, this provides evidence that the fish went through the spawning process with undoubtedly the same level of success of wild fish.

With the egg quality established from those kept as broodfish, these fish are a very welcome addition to the spawning stock in the river.

Catch Frequency Project

The River Carron has a 100% catch and release policy for all fish other than those kept for broodstock. With a system such as this in place there is obviously the possibility of fish being caught more than once during the angling season. Although this would enable each fish to make more than one angler happy, it makes it difficult to use catch statistics as a method of estimating the number of adult salmon returning to the river.

A 3 year project commenced in 2005 to try to get an indication of whether or not fish are caught more than once by marking salmon caught by anglers with blue spots using a panjet applicator. Ten numbered locations on the ventral surface of the fish were used. By applying a blue spot to 3 of these locations on each fish, a total of 120 different combinations can be used. This enables 120 salmon to be marked with each fish recognised individually. During August and September, 34 salmon were marked and released. Of these, 2 fish were caught for a second time and a 3rd fish was caught 3 times. One fish was caught at the lower end of the Kelso beat and then caught 2 weeks later at the top of the beat. The second fish was caught at the top of the Kelso beat and then caught in exactly the same spot 3 weeks later. This fish fought well on both occasions and was caught by the same angler. The 3rd fish deserves special mention.

One of the cock salmon marked with blue 'panjet dye' between its pectoral fins. (Bob Kindness)

Fish number 1,2,5 was caught by the late Ronnie Holmes on the 19th of August below the Strathcarron road bridge and was put in a keep net to await marking. I duly marked the fish and released it. On the last day of the season, 31st October, I caught this same fish, a hen grilse of about 5 lbs, in the Black Pool on the Glencarron beat near the top of the system. The fish was taken back to a tank to be used as a brood fish and was later stripped on the 29th November before being returned to the river as a kelt the same day below the bridge at Strathcarron. While fishing the Seat pool (200 metres below the road bridge) I caught this fish again on the 15th March, 2006. By this time the fish was a well-mended kelt, fully silvered and ready to return to the sea. This fish clearly demonstrated a very strong ability to survive and sends a clear message to those who claim that once a fish has been hooked and played it is not likely to recover. This fish had much more handling than most and yet was still going strong. I am sure this story would have delighted Ronnie.

As a footnote, the Carron has made an early start this season with a springer of 7lbs (see photograph in Part 2) and one of 15lbs being caught on the 14th March and the 6th April respectively. Let us hope this is a good omen for the rest of the season.

Part 7 **Salmon and trout in the Classroom**

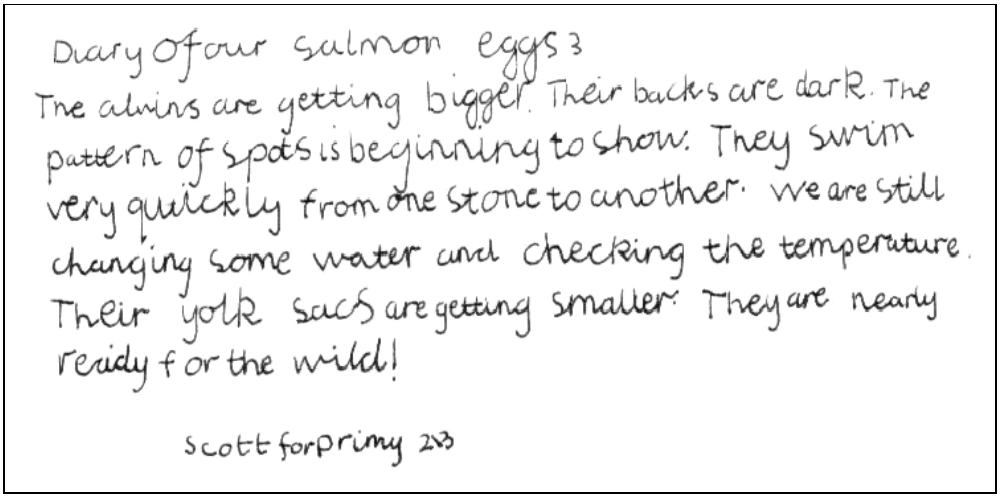
by Dr Lorna Brown

Supported by:

February 2006 saw five more primary schools joining the Salmon and Trout in the Classroom project; Ullapool in the north, Applecross, Lochcarron, Shieldaig and Torridon in the centre of the WRFT area. The aim of this project is to introduce school pupils to the complex and fascinating lifecycles of salmon and trout. It also helps to generate interest in the rich natural environment we have in Wester Ross. Each school is provided with a mini-hatchery and 200 salmon or trout eggs, which are cared for until they hatch and reach the 'first-feed' stage. These are placed out into a local burn, which is visited in autumn and electro-fished to examine the development of the released fry. This project has now been running in Wester Ross for three years and a total of fifteen schools have taken part.

WRFT always attempts to provide schools with eggs from as local stock as possible and this year we are indebted to Donald Rice and Alasdair MacDonald of Dundonnell Estate for providing salmon eggs for Ullapool Primary. Philip Smith and Neil Morrison of Coulin Estate kindly provided sea trout eggs for Torridon Primary. The Lochcarron Proprietors and the Applecross Trust were generous in providing eggs for Lochcarron, Shieldaig and Applecross. As ever Bob Kindness and Seafield Centre provided not only eggs but advice and information.

In previous years the upper primaries have tended to be involved in this project and it was with some apprehension that I set out to introduce the project, and the eggs, to the Ullapool Primary Two and Three class. I had in advance discussed with the teacher that this introduction normally lasted an hour and a half. I started talking with small Ullapool pupils before lunch and was still deep in discussion with the pupils as the afternoon wore on. My worries that this project was too complicated for them were soon dispelled, and anyone who reads the Ullapool News will have seen the wonderful detailed weekly project diaries the pupils submitted.



Diary Of our salmon eggs 3

The alvins are getting bigger. Their backs are dark. The pattern of spots is beginning to show. They swim very quickly from one stone to another. We are still changing some water and checking the temperature. Their yolk sacs are getting smaller. They are nearly ready for the wild!

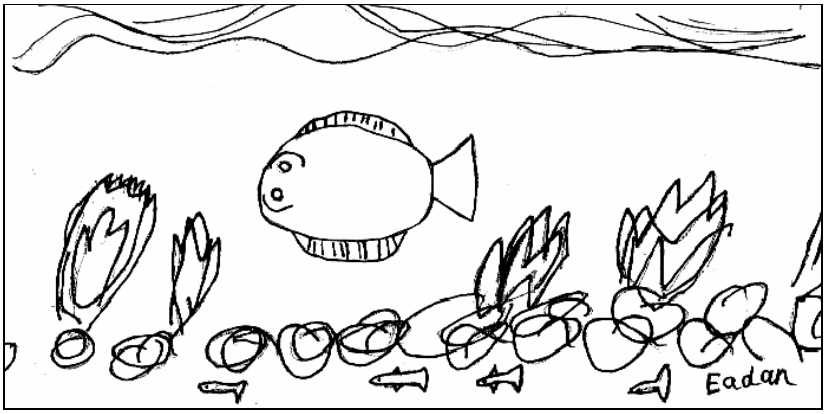
Scott for primy 2x3

The field trips to release the young elevens are an opportunity not only to revisit the schools and reinforce the learning which has already taken place, but a chance to get out and explore the local environment. It is always encouraging to hear how much the pupils have remembered from the previous discussion and to see them starting to think for themselves, about the potential of the local habitat for the young salmon for example.

Plockton Primary School ready to release their alevins into the Duirinish Burn in March 2005. (Niall MacKinnon)

At Applecross, we were fortunate in that our field trip coincided with the Seafield Centre smolt release near the Applecross River. This was a fantastic opportunity for the pupils to see an example of the size their small fish could reach in one year. Murray Stark gave the Shieldaig primary and nursery children a tour round the Seafield hatchery, where they saw salmon at all stages. At Coulin Estate, the Torridon pupils saw the hatchery and had a chance to estimate how many eggs it held in comparison to the 200 they had reared. Neil Morrison, head stalker, also joined us when the alevins were released, reinforcing the importance of the project to the pupils.

With each school we collected a sample of freshwater invertebrates which we took back to the classrooms to identify. Before this we usually have a discussion about what my “big net” might be for. Of course the pupils always answer “to catch fish” which leads to an explanation of kick sampling for invertebrates, that fish are too fast to be caught in the net and thus the use of electro-fishing. So imagine my surprise and the pupils’ delight when a flounder appeared in the net in my first kick sample at Ullapool!



Part 8 **Financial Statement**

For the year ended 31 March 2005

	Unrestricted funds	Restricted funds	2005 Total	2004 Total
	£	£	£	£
Incoming resources				
Donations and subscriptions	17,335	7,977	25,312	16,256
Activities in furtherance of the charities objectives:				
Fish farmers' contributions	4,170	-	4,170	2,500
River contributions	21,566	-	21,566	8,330
Project funding	-	34,286	34,286	30,348
Other income	141	-	141	606
…..Survey work	4,999	-	4,999	-
Plankton trawling	-	-	-	1,250
Provision of information to SEPA	-	-	-	2,514
Investment income	412	-	412	411
Total Incoming resources	***48,623***	***42,263***	***90,886***	***62,215***
Resources expended				
Costs of activities in furtherance of the charity's objectives:				
Accommodation expense	28	-	28	61
Wages and contract labour	17,646	15,450	33,096	42,100
Insurance	1,780	-	1,780	1,786
Motor, travel and subsistence expenses	1,081	374	1,455	1,766
Vehicle leasing	3,177	-	3,177	3,658
Telephone	895	-	895	880
Heat and light	443	-	443	509
Research equipment expenses	168	4,534	4,702	1,679
Electro-fishing and other fishing expenses	7,776	352	8,128	6,805
Surveys and plans	-	-	-	330
Publishing expenses	3,599	3,222	6,821	7,575
Conference expenses	207	486	693	-
Subscriptions	1,969	-	1,969	1,495
Depreciation	670	3,328	3,998	1,749
Training expenses	(630)	705	75	1,256
Managing and administration				
Management and book-keeping	4,785	-	4,785	4,942
Auditors' remuneration	2,732	-	2,732	1,821
Professional fees	-	-	-	-
Sundry expenses	1,579	152	1,731	1,801
Bank charges	120	-	120	133
Total resources expended	***48,025***	***28,603***	***76,628***	***80,346***
Net outgoing resources before transfers	598	13,660	14,258	(18,131)
Transfers between funds	12,826	(12,826)	**-**	**-**
Net movement in funds	**13,424**	**834**	**14,258**	**(18,131)**
Total funds brought forward	(2,073)	27,151	25,078	43,209
Total funds at 31 March 2005	***11,351***	***27,985***	***39,336***	***25,078***

Audited by Chiene & Tait Chartered Accountants

For the year end 31 March 2006				
	Unrestricted	Restricted	2006	2005
Incoming Resources	**Funds**	**Funds**	**Total**	**Total**
Donations & Subscriptions to include Charities	43953		43953	25312
Activities in furtherance of the charities objectives				
Fish Farm Cont	4000		4000	4170
River Cont	6440		6440	21566
Proj Funding		21229	21229	34286
Other Income	1400		1400	141
Survey Work				4999
Plankton Trawling				
Provision of info to SEPA				
Investment income	454		454	412
Total Incoming resources	**56247**	**21229**	**77476**	**90886**
Resources expended				
Costs of activities in furtherance of the charity's objectives				
Accommodation expenses		100	100	28
Wages and contract labour	12551	32957	45508	33096
Insurance	1253		1253	1780
Motor,travel and subsistence expenses	1778	418	2196	1455
Vehicle leasing	2973		2973	3177
Telephone	1180		1180	895
Heat and light	559		559	443
Fishing & Research exps		1113	1113	4702
Electro-fishing and other fishing expenses	302		302	8128
Surveys and plans			0	
Publishing expenses	1539	600	2139	6821
Conference expenses	494	465	959	693
Subcriptions	1219		1219	1969
Depreciation	?	?	0	3998
Training expenses	389		389	75
Management and administration			0	
Management and book-keeping	4349		4349	4785
Auditors remuneration	4406		4406	2732
Professional fees	1494		1494	
Sundry expenses	2602		2602	1731
Bank charges	46		46	120
Total resources expended	**37134**	**35653**	**72787**	**76628**
Net outgoing resources before transfers	**19113**	**-14424**	**4689**	**14258**
Important notice: These figures are for information only and have not been checked or audited				

Acknowledgements

Wester Ross Fisheries Trust has received a great deal of help and advice over the past year.

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Dick Shelton
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Eoghain Maclean
Ewen and Jenny Scobie
Fiona Timmins
Frank Buckley
George Hamilton
Gilpin Bradley
Gonzalo Zelaya
Hugh Richards
James Butler
Jim Brown
Jim and Deidre Rudderham
Jim Raffell
John Corbyn
John Ogle
John Webb
Karen Starr
Ken Williamson
Kenny Nelson
Lady Horlick
Les Buchan
Lloyd Gudgeon
Louise Cunningham
Maj Gen Seymour Monro
Mark Williams and family
Mary Gibson
Meryl Carr
Murray Morrison
Murray Stark
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Ray Dingwall
Roger Macdonald
Sarah Bailey
Sue Scott
Willie Hardy

…and all the other anglers, keepers and ghillies, fish farmers, school teachers, schoolchildren and parents, and everybody else who has helped us with our work.

Supporting wild fisheries and the Trust's Work

The current work programme for 2006 – 2007 includes excursions to sample trout lochs and streams, electro-fishing surveys of many of the rivers between Ullapool and Knoydart, sea life surveys, and an arctic charr discovery week, 'Open days' at Loch Maree and much else which may be of interest. There are many opportunities for becoming actively involved with the work of the Trust or for simply coming along for a day in the field to find out what we do. Please contact the WRFT Biologist for further details:

Wester Ross Fisheries Trust,
Harbour Centre,
Gairloch,
IV21 2BQ

Tel: 01445 712 899
Email: info@wrft.org.uk

Limited Edition Print by Bill Woodrow

A unique opportunity to acquire a limited edition print by the internationally renowned sculptor, Bill Woodrow RA, and to support the Wester Ross Fisheries Trust and the restoration of wild sea trout fisheries in Loch Maree.

Bill Woodrow's large bronze sculpture *Regardless of history* occupied the Fourth Plinth in Trafalgar Square during 2000 and 2001. His sculptures are represented in many important collections around the world, including Tate and the Museum of Modern Art, New York, His prints have been widely exhibited From Picasso to Woodrow at the Tate gallery in 1995.

The print depicts two rods dapping for sea trout on the spectacular North Shore beat of the Loch Maree Hotel fishery. It is printed on white Zerkall 270gsm paper, size 49 x 38 cm and the actual image size is 41 x 31 cm. It is published in an edition of 200 and printed by Peter Kosowicz Printmaker. One of the prints now hangs in the meeting room of Fisheries Research Services Freshwater Laboratory at Faskally, Pitlochry and donations received in 2005 helped support the Loch Maree Fishes Survey (see page 30).

The cost of each print is £100, unframed only, packing and UK postage included.

All profits will go to Wester Ross Fisheries Trust

Available from:
Bill Woodrow
14 Cormont Road
London
SE5 9RA

Cheques payable to:
Bill Woodrow.

Tel: 020 7733 2435
Email: bill@billwoodrow.com

Wester Ross Fisheries Trust

Harbour Centre, Gairloch, Ross-shire, IV21 2BQ

Tel: ***01445 712 899***
Email: ***info@wrft.org.uk***

WRFT Registered Charity No: SCO24787

1. Member details

Please complete details

Title: Ms Miss Mrs Mr

First name: _____

Surname: _____

Postal address: _____

_____

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City: _____ Post code: _____

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2. Renew my membership

		Please Tick
One year	**£20**	
Single Life (1 card)	**£150**	
Joint Life (2 cards)	**£200**	

Rates are valid from 01/01/2005 to 31/12/2006

3. Payment details

Membership Fees (from section 2)	**£**
Donation	**£**
TOTAL DUE	**£**

4. Method of payment

a. ☐ I enclose a cheque payable to Wester Ross Fisheries Trust for **£**

b. ☐ I would like to pay by Standing Order (please fill in the Standing Order form below – UK bank account holders only)

5. Gift Aid

Use gift aid and you can make your donation worth more. For every pound you give to us, we get an extra 28 pence from the Inland Revenue and it costs you nothing.

I want all donations I've made since 6 April 2000, and all donations I make in the future, to be Gift Aid until I notify you otherwise.

To qualify for Gift Aid, what you pay in income tax or capital gains tax must equal the amount we will claim in the tax year.

Just tick here: ☐

Signature Date / /

Please return this completed form to: **Wester Ross Fisheries Trust, Harbour Centre, Gairloch, IV21 2BQ**

Data Protection: The information you provide will be held for processing your membership and for mailing with information about Wester Ross Fisheries Trust. Your details will only be used by Wester Ross Fisheries Trust and will not be made available to any other organisation.

Instruction to your Bank or Building Society to pay Standing Order to:

Bank Name & Address: Royal Bank of Scotland – Perth Chief Office

Account Name: Wester Ross Fisheries Trust **Sort Code:** 83-47-00 **Account No:** 00633069

PLEASE PAY THE FOLLOWING

Amount £ In Words

Commencing:

Thereafter: Due Date: Annually On / /

TO BE DEBITED FROM MY ACCOUNT

Bank Name: _____

Bank Address _____

_____ Postcode _____

Name(s) of account holder(s)

Branch sort code ☐☐-☐☐-☐☐ Bank/ Building Society Account Number ☐☐☐☐☐☐☐☐

WRFT Ref. No: (office use only)

Instruction to your Bank or Building Society: Please pay Wester Ross Fisheries Trust Standing Order Mandate from the account detailed in this instruction. I understand that this Instruction may remain with the WRFT and, if so, details will be passed electronically to my Bank/Building Society. A photo copy may also be kept on file with the SGA.

Please cancel all previous standing order and/or direct debit mandates under Wester Ross Fisheries Trust.

Signature(s) Date / /