



WESTER ROSS FISHERIES TRUST

Juvenile fish assessment of Little Gruinard River 2006



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1. Introduction

The Wester Ross Fisheries Trust has examined juvenile salmon and trout stocks in the Little Gruinard River system since 1997. Through electro-fishing surveys, the Trust has been able to gain an indication of the health and status of the salmon population within the river system, and gained information about other fish. Survey results have helped to highlight problems and opportunities for fisheries management. An absence of salmon fry or salmon parr at a survey site usually indicates that adult salmon have not spawned within the area in the preceding two or three years. Very low densities of juvenile fish may be indicative of a shortage of spawning fish or other problems – for example poor spawning habitat or redd washout.

The Little Gruinard is a Special Area of Conservation [SAC] for Atlantic salmon. In 2004, WRFT carried out a detailed electro-fishing survey of the distribution and densities of juvenile salmon within the Little Gruinard River as part of a contract to assess the status of all Atlantic salmon SACs in Scotland for Scottish Natural Heritage [SNH]. The final report, including sections comparing and contrasting juvenile salmon populations in the Little Gruinard with those of other rivers in Scotland, was completed in 2006; copies should shortly be available from SNH.

This report presents the results of the WRFT survey in the Little Gruinard River in late summer 2006. The survey was planned with the following aims:

1. to investigate the distribution and density of juvenile salmon within the accessible section of the river, focussing on some of the marginal areas where there was greatest uncertainty
2. to record the occurrence of other fish species within the river system
3. to consider the need for management interventions

2. Methods

Electro-fishing surveys were carried out by contract surveyors and WRFT staff trained to Scottish Fisheries Co-ordination Centre (SFCC) protocols, using 'Electracatch' back-pack electro-fishing equipment.

For most sites, semi-quantitative (timed) electro-fishing was used involves fishing for a recorded time at a steady rate through a section of likely juvenile habitat. This gives an index of abundance of juvenile fish caught per minute, or Catch Per Unit Effort (CPUE). This technique is faster to use than fully quantitative fishing and allows an insight into the relative abundance of juveniles over a large area in a relatively shorter period of time than fully quantitative fishing (as used in previous surveys). For nearly all purposes, the data obtained is as useful as fully quantitative fishing; as each site is fished only once, more sites can be fished in a day – so information describing juvenile fish occurrence can be gathered for more sites in a day than fully quantitative fishing.

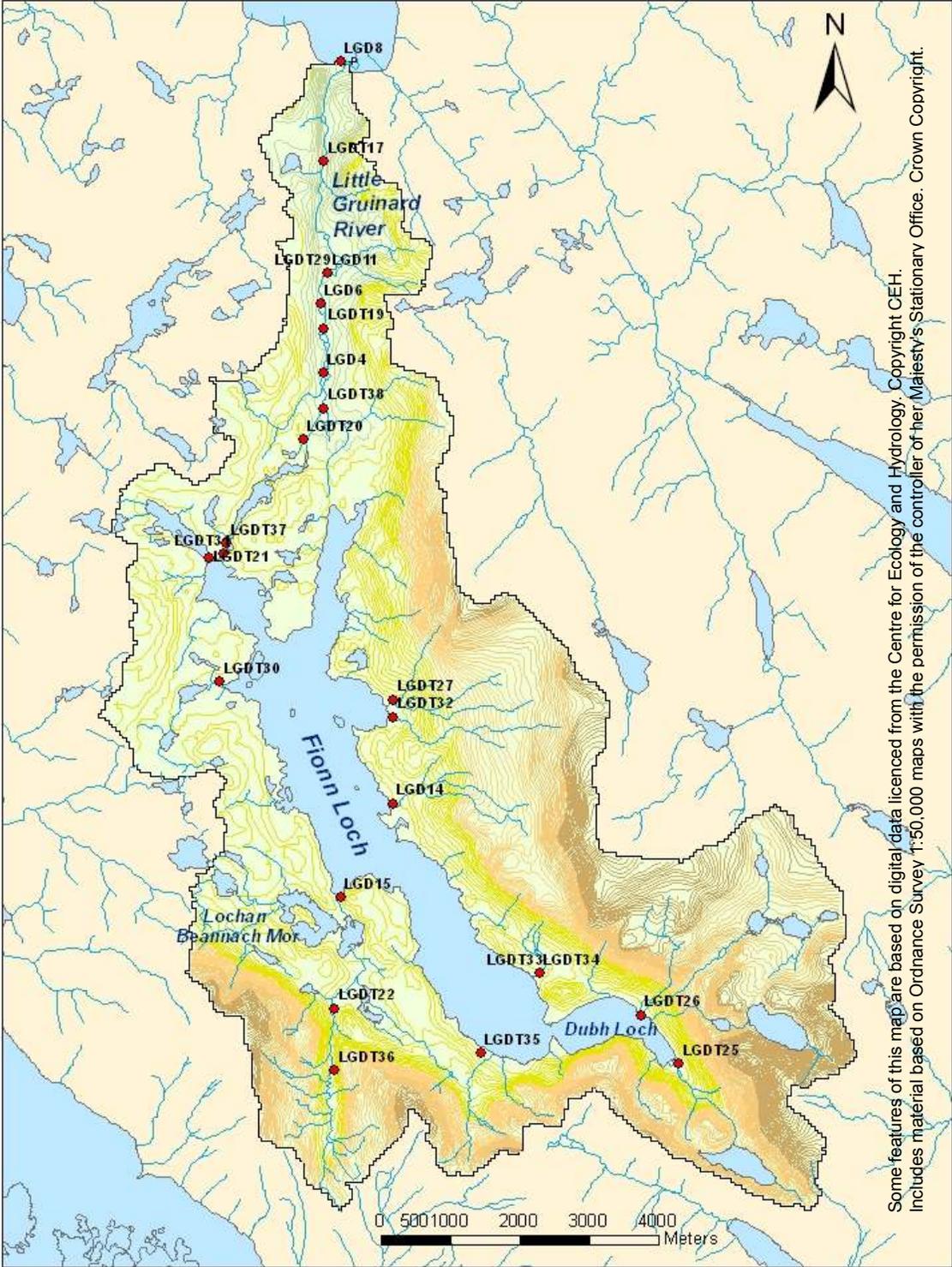
For some sites, where river conditions were particularly high (and many fish were able to escape) or the objective was simply to try to ascertain whether salmon were present or not, the electro-fisher 'cherry-picked' likely spots rather than fishing at the usual steady rate.

3. Locations

In 2006, 24 sites were fished at locations throughout the accessible area of the Little Gruinard catchment, including streams above the Fionn Loch. 16 of the sites had been fished in previous years, including a series of 'core sites' that have been visited each year of survey. Of the 8 new sites, 4 were located above the Fionn Loch, 2 located between the Fionn Loch and Eileach Mhic-ille Riabhaich (more usually referred to as the 'boat pool') and two sites in the main river (including one in the back channel at Eilean Dubh of the Lower flat. Conditions were very good only on 1 of the 4 days of survey (8 Sep); water levels were a little high on the 23rd and 29th of August and the 1st September for some sites. Overall, good progress was made.

As in previous years, most sites were in relatively shallow areas of riffle – run type habitat, which are more suitable for salmon fry than salmon parr or trout. Juvenile trout and salmon parr are therefore likely to be under recorded.

Figure 1: Locations of sites surveyed within the Little Guinard River Catchment Area in 2006.



4. Results

Distributions and relative abundance of fish

A summary of results is presented in Appendix 1.

Salmon

Salmon fry and parr were recorded at all timed sites within the main Little Gruinard River below the lochs (see Figure 2 and 3). Fry were recorded at high abundance at nearly all sites reflecting good spawning in 2005. Parr were less abundant, though may have been under-recorded at some sites where relatively high water allowed them to escape more easily than fry. The survey at the new top site at the stepping stones below the Fionn Loch (LDGT37) was not timed because fishing conditions were difficult: densities of fry appeared to be lower there. Above the Fionn Loch, salmon fry were found at all the sites that were fished in 2004, with high densities in the stream entering the head of the Dubh Loch (LGDT25). Notably, two large salmon fry were found at the outflow of Loch na Moine Buige (LDGT21) above the dry stone wall (which has acquired a small hole through which adult salmon may be able to pass since the survey in 2004!). Salmon fry (but not parr) were also found at a new site in the lower Allt na Moine [Sandy Bay south burn] but juvenile salmon were not present at new sites in the Carnmore jetty burn (LGDT33 & 34), the Allt Poll Fraochain below Bealach Mheinnidh (LGDT21), the Loch an Eilean Burn (LGDT30) and the Abhainn an t-Srathain Mhoir [Beannach burn] above the bridge (LGDT36).

Trout

Trout were recorded at all sites above the Fionn Loch except T25 (at the head of the Dubh Loch). The highest CPUEs for trout fry were at LGDT34 (new site at burn mouth below Bealach Mheinnidh), LGDT21 (burn below Loch na Moine Buige) and LGDT33 & 34 (Carnmore jetty burn). Sites with high a CPUE of salmon fry generally had a relatively low CPUE of trout fry.

Larger trout were relatively scarce at all sites except at LGDT36 (Beannach burn above footbridge falls), LGDT34 (new site at burn mouth below Bealach Mheinnidh) and LGDT33 & 34 (Carnmore jetty burn).

Eels

Eels were recorded at 7 sites; the highest number being 6 at the lowest site (LGD8). Above the main river, eels were recorded at the outflow of the Loch Beannach burn (LGD15) and Loch an Eilean Burn (LGDT30)



*Gold-ribbed dragonfly,
photographed near the Lower
Flats on 28th August 2006.*

Figure 2: Distribution and relative abundance of salmon fry recorded in the Little Gruinard River, 23rd Aug – 8th Sep 2006. Note that each circle is proportional to the relative abundance except where the circle has a grey fill indicating 'presence' only.

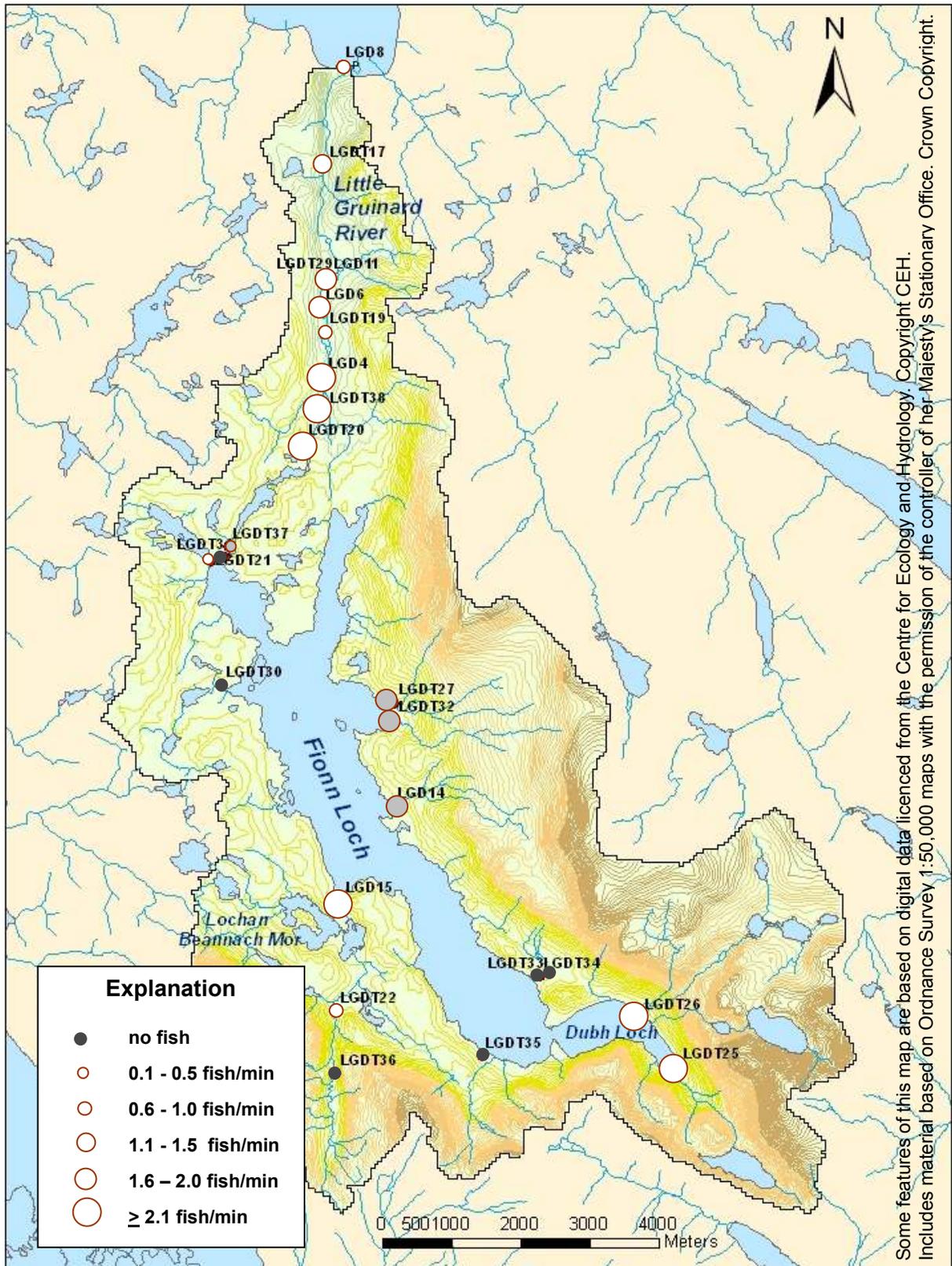
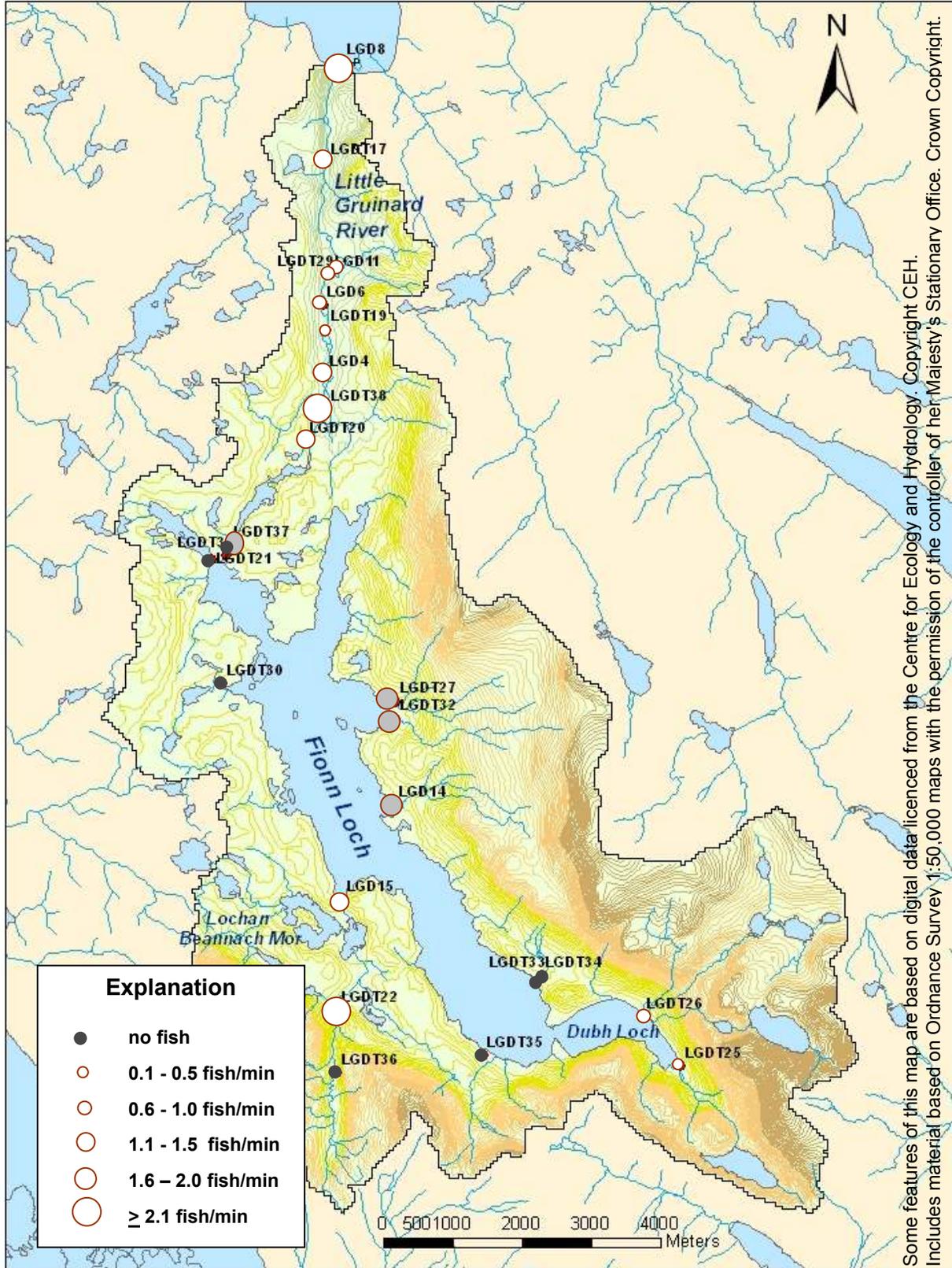


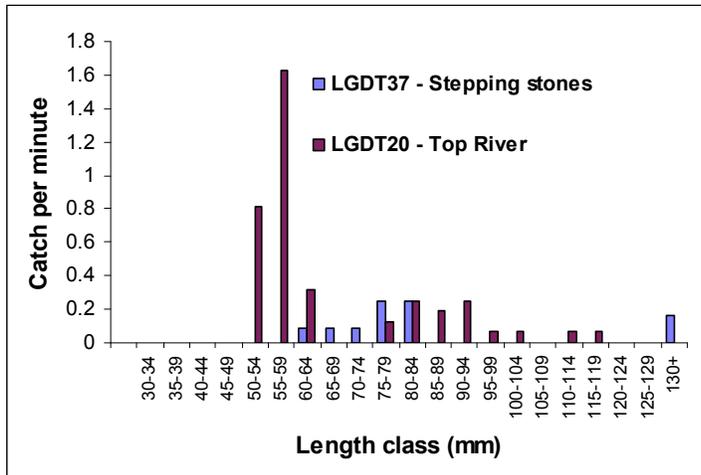
Figure 3: Distribution and relative abundance of salmon parr recorded in the Little Gruinard River, 23rd Aug – 8th Sep 2006. Note that each circle is proportional to the relative abundance except where the circle has a grey fill indicating 'presence' only.



Sizes of juvenile salmon

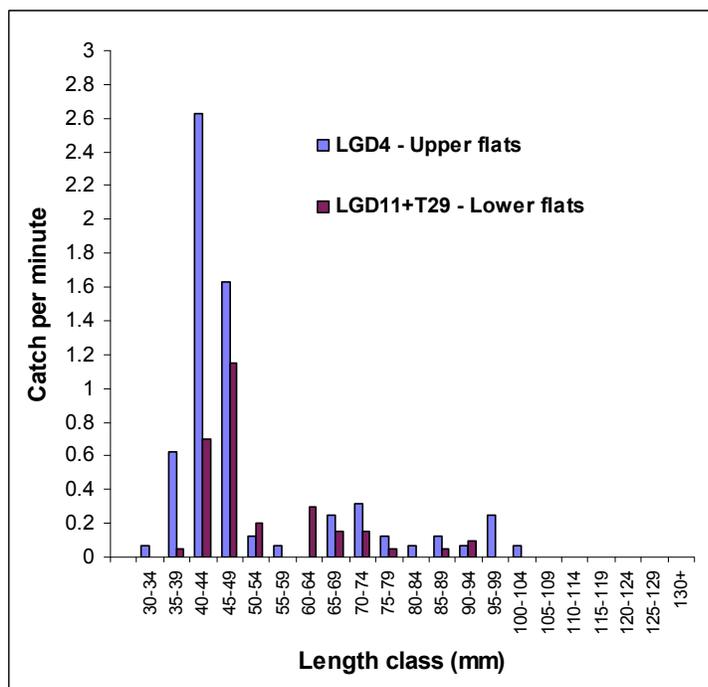
The size of salmon fry varied considerably from site to site. Within the main river, salmon fry were typically 1-1.5+ cm longer at the top sites below the lochs than at sites near the flats with similar differences in parr sizes (Figures 4a and 4b). At the stepping stones above the Boat Pool (LGDT37), 0+ salmon fry ranged from 63 – 81mm in length, with large 1+ parr of 134 mm and 135 mm. Further downstream at LGDT20 (250m downstream from Garbh Eilean cascade) fry ranged in size from 50mm to 62 mm; 1+ parr from 76 mm – 116 mm, and at least one 2+ parr of 103 mm.

Figure 4a: Lengths of juvenile salmon caught at sites in the upper part of the Little Gruinard. (The fishing time for LGDT37 was estimated at 12 minutes; water levels were high at the time of survey so the recorded relative abundance is less useful than for other sites. See 'Discussion' section).



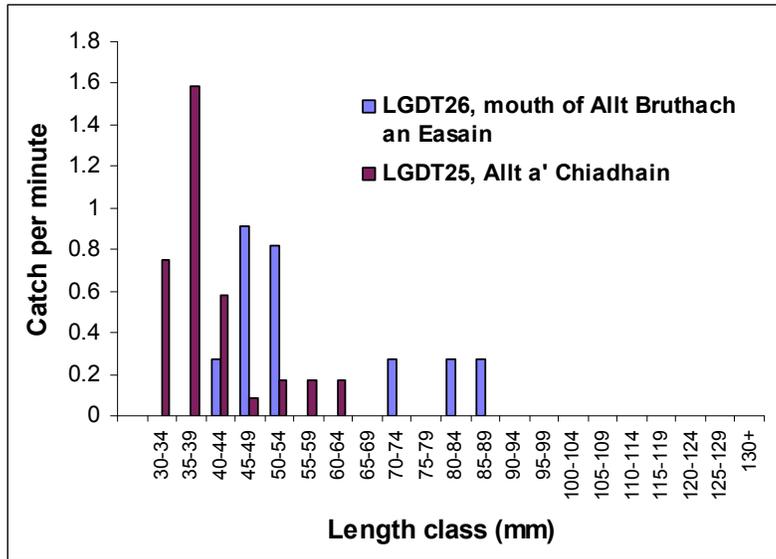
In contrast, in the side channel by the Upper flats (LGD4), although 0+ fry were relatively more abundant, they were small, ranging in size from 33 to 55mm. At the same site, 1+ parr ranged in size from 68 - 75 mm (smaller than 0+ fry at the stepping stones!), and 2+ parr were 82mm – 102mm. By the Lower flats (LGD11 and LGDT29) juvenile salmon were of a similar range in size.

Figure 4b: Lengths of juvenile salmon caught at sites in the middle part of the Little Gruinard near areas of ancestral salmon spawning areas at the Upper and Lower flats.



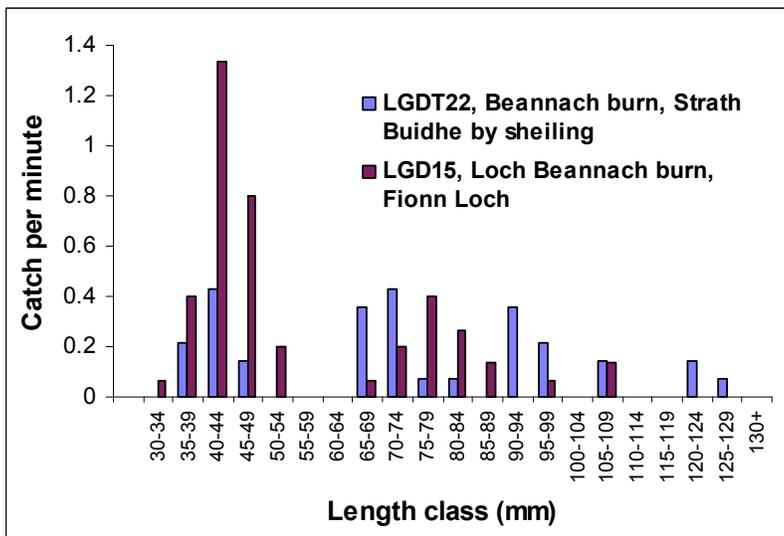
There was also variation in the size of juvenile salmon at sites above the Fionn Loch (Figure 5a and 5b). The smallest juvenile salmon in the whole system were in the Allt a' Chiadhain at the head of the Dubh Loch (LGDT25) where the median size class was 38mm, and 1+ parr ranged in size from 50mm to 63mm. No larger juvenile salmon were caught here. Juvenile salmon were slightly larger in the Allt Bruthach an Easain ranging from 41 to 53 mm in length, and 1+ parr of 70mm to 89mm.

Figure 5a: Sizes of juvenile salmon caught in the two principle spawning burns around the Dubh Loch at the head of the Little Gruinard system.



Juvenile salmon in the Beannach burn (LGDT22) were also small for their age (Figure 5b); three year classes of parr were present, with 3+ year old parr ranging in size from 103 – 127mm.

Figure 5b: Sizes of juvenile salmon caught above (LGDT22) and below (LGD15) Loch Beannach Mor.



5. Discussion

Overall, the survey demonstrated that juvenile salmon were distributed throughout accessible areas of the Little Gruinard. Trout and eels were scarce except at relatively few sites though this may be partly a consequence of sampling bias. Within the main river, the inferred densities of salmon fry (proportional to CPUE) were generally high or very high. Unfortunately, high water on the day of survey at some sites limited the fish catching ability of the electro-fishing equipment, allowing some of the larger parr in particular to evade capture. Salmon parr may therefore be under-represented overall. Nevertheless, the general picture is of a river system which supports a healthy population of juvenile salmon, particularly fry. But is it as productive as it should be?

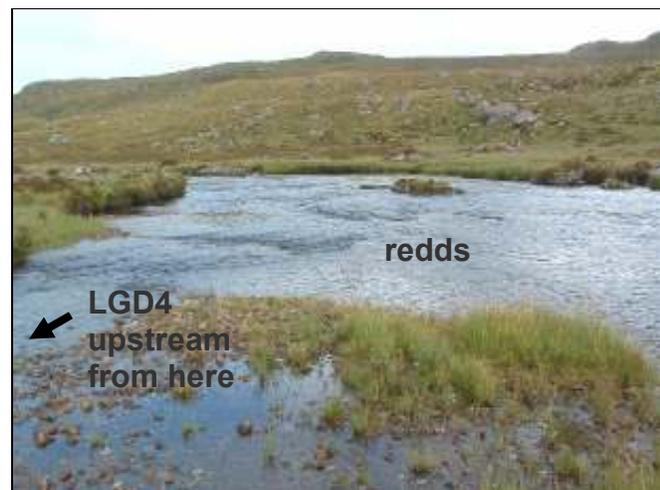
5.1 Why is there so much variation in the sizes of juvenile salmon of respective year classes between sites within the Little Gruinard system?

The variation in the relative size of juvenile salmon within the mainstem Little Gruinard from the lochs downstream reflects a high degree of variation in growth rates of juvenile salmon in different areas. As growth rates affect smolt production, for fisheries management purposes it would be useful to understand why juvenile salmon in some parts of the system are able to grow much faster than in other parts of the system.

Although the survey produced only semi-quantitative data, there is a suggestion that where the relative abundance of salmon fry is particularly high, the size of fry is particularly small. For example, site LGD4 by the upper flats, near an area where salmon clearly spawn in considerable numbers, had the highest CPUE of salmon fry (at over 5 per minute – see Appendix 1) and average fry length 44mm. Likewise, at site LGDT25 in the burn at the head of the Dubh Loch the CPUE for salmon fry was 2.83 fry per minute (second highest) but fry were very small at only 38mm average length (the smallest recorded anywhere).



Colder water draining high ground may be part of the explanation for the small size of fry at LGDT25 at the head of the Dubh Loch (left); but water temperature can not explain why fry in the mainstem river at LGD4 (below) were smaller than at sites further upstream towards the Fionn Loch. (Note the 'ancestral' spawning redds!)



In contrast, the largest fry of 74 mm average length were recorded at the stepping stones below the pool below the outlet of the Fionn Loch but at CPUE of less than 1 per minute (partly due to difficult fishing conditions). At the two other sites above the Upper Flats (T20 and T38) fry were also large: 58mm and 56 mm average lengths respectively at CPUEs of 2.75 and 2.07 fry per minute.



Electro-fishing site LGDT37, the stepping stones below the lochan just below the Fionn Loch, on 1st September 2006. The largest salmon 0+ fry (63 – 81mm length) and largest 1+ salmon parr (134 & 135 mm) of the survey were caught here.



Electro-fishing site LGDT38, at the Allt Riabhach confluence, on 1st September 2006. The 2nd largest salmon 0+ fry (50 – 62mm length) and 2nd highest CPUE of salmon parr of the survey were recorded here. The tent is an insect trap: what information does it provide about insect abundance?

Fry at the top three sites in the Little Guinard River below the Fionn Loch were larger than at other downstream sites, demonstrating very favourable growth. It is unlikely that **water temperature** could explain the large size of fry immediately below the lochs. One possibility is that **food availability** for salmon fry is highest at sites immediately below the lochs and thereafter at sites further down the river, becomes more limited because of the many more mouths.

In some ways, this situation is perhaps comparable to trout lochs in Wester Ross. Some lochs have large numbers of small trout; other lochs have fewer trout which grow more rapidly. Food limits growth. Where spawning habitat is unrestricted, annual recruitment is high and large numbers of small trout have to compete for meagre rations.

However, variation in **substrate** may provide an alternative explanation for the observed range in sizes of juvenile salmon. Juvenile salmon need cover. As they grow, each fish needs a larger hiding hole to evade predators. Salmon fry are able to hide in streambeds composed mainly of pebbles. However, substrate composed primarily of large cobbles is required to provide hiding holes for 80 – 100mm parr. Is the size range of juvenile salmon recorded at different sites simply a reflection of substrate composition? Consider the following:



LGDT26: Allt a' Chiadhain, head of Dubh Loch
20% sand, 20% gravel, 50% pebble, 10% cobble
 Juvenile salmon at this site ranged in size from 31mm to 63mm. Of the 40 juvenile salmon caught, only 6 (15%) were 50mm or more in length. Larger juvenile salmon may have been unable to find suitable cover.



LGD4: by Upper Flats, Little Guinard River
10% gravel, 40% pebble, 50% cobble
 Juvenile salmon at this site ranged in size from 33mm to 102mm. Of the 102 salmon caught, only 22 (21%) were 50mm or more in length. Large parr may have been unable to find suitable cover here.



LGDT20: Allt a' Chiadhain, head of Dubh Loch
10% pebble, 40% cobble, 60% boulder
 Juvenile salmon at this site ranged in size from 50mm to 116mm. Of the 62 juvenile salmon caught, all (100%, including 44 fry) were 50mm or more in length. 2 eels were seen. Perfect habitat for salmon parr.



LGD8: below Garden Pool, Little Guinard River
10% gravel, 15% pebble, 30% cobble, 40% boulder
 (fished at medium high water). Juvenile salmon at this site ranged in size from 34mm to 100mm. Of the 39 salmon caught, 33 (85%) were 50mm or more in length. 6 eels were also caught (which also live in the streambed).



LDGT29: Right channel by Lower flats; mostly pebbles. Of 24 fish caught, only 7 (29%) were 50mm or more in length. More hiding places for fry than larger salmon parr (sample from catch at site).

LGDT4, LGDT26 and LGDT29 may simply provide inadequate cover for many larger salmon parr. Salmon parr may be more abundant in the faster, deeper water nearby which can not be surveyed using the electro-fishing pack. Overall, substrate composition (which determines the number of places where fish of different sizes can find places to hide) appears to relate quite closely to the numbers of juvenile salmon of different sizes present. This suggests that densities of juvenile salmon (fry at least) were close to the **carrying capacity** of many sites in terms of the numbers of small fish of different sizes that the habitat can support.

In conclusion: the variation in the size of juvenile salmon between many of the sites appears to be partly a consequence of the variation in the carrying capacity. The carrying capacity determines the numbers of fish of different sizes that the area can support. The small size at age of juvenile salmon at many sites suggests that the food supply is very limited.

Exceptions are as follows: at site LGDT37, the very large growth rates appear to be a reflection of fewer fish relative to the available habitat and much greater food availability per fish so faster growth. This probably reflects a lack of spawning in nearby areas by the outflow of the Fionn Loch so local juvenile salmon densities far below the carrying capacity for juvenile salmon in this area.

From site LGDT4 (possibly from LGDT20) downstream, juvenile salmon densities appear to be close to (or, by late summer in excess of) the carrying capacity. This means that inevitably, there will be 'self-thinning' of the salmon population (density dependent displacement of the weaker fish) for some fish are to grow larger. If the river has cover for twice as many small fry as larger parr, then 50% of the fry will have nowhere to go once they reach a certain size. Some of these fish may be eaten by larger parr; others may provide food for trout, eels, birds and other predators. Alternatively, winter spates may wash them out of the system.

5.2 Are some sites over-stocked with small juvenile salmon?

If a juvenile salmon is to become a smolt, it needs to reach a critical size by the end of the preceding 'growing season'. Large smolts have higher rates of survival at sea than small smolts: they can swim faster and can probably reach distant feeding grounds more quickly than smaller smolts. At Tournai, emigrating salmon smolts varied in size from 110mm to 190mm in 1999. Smolts larger than 150mm had spent a year or more growing in the loch prior to smolting.

Most of the Little Gruinard River may be close to carrying capacity in terms of numbers of juvenile salmon. However, only a small proportion of the juvenile salmon recorded in the Little Gruinard survey were large enough (greater than about 90mm by September 2006) to smolt in 2007.

Too many small fish may be almost as detrimental to achieving maximum smolt output as too few. Juvenile salmon are territorial. Juvenile salmon defend feeding territories to ensure that they have access to enough food. However, if food supply is very limited, the energy required to defend feeding territories may be too much relative to the amount of food that can be obtained. Within the Little Gruinard the overall limited food resource is shared between large numbers of fish some of which are barely able to maintain themselves. If large numbers of these fish are starved, they may simply be washed out of the system during periods of high flow in winter months. If this happens, much of the observed juvenile salmon production in the river may come to nothing.

To maximise smolt output, the faster the juvenile fish grow the better. It's possible that some of the areas with lower densities of juvenile salmon actually produce larger numbers of better-sized smolts! There are complex issues to explore here: to what extent are terrestrial insects of importance as a food for juvenile salmon in late summer?; to what extent are surplus salmon eggs and carcasses required in the late autumn to 'feed' the juvenile salmon population and give them nourishment to survive the winter?; to what extent does a certain level of predation (e.g. by eels) actually support smolt output by removing weaker fish, thereby providing more food for stronger fish? To what extent can smolt production be elevated by restoration of trophic pathways?



(left) 1+ & a 2+ salmon parr from LGDT29 (23 Aug 2006). Contrast these wee fish with (below) 1+ salmon parr stocked as fry at low densities into the Bruachaig near Heights of Kinlochewe in 2004 (photo taken on 28 June 2005)



5.3 Fisheries production in and around the Fionn Loch and Dubh Loch

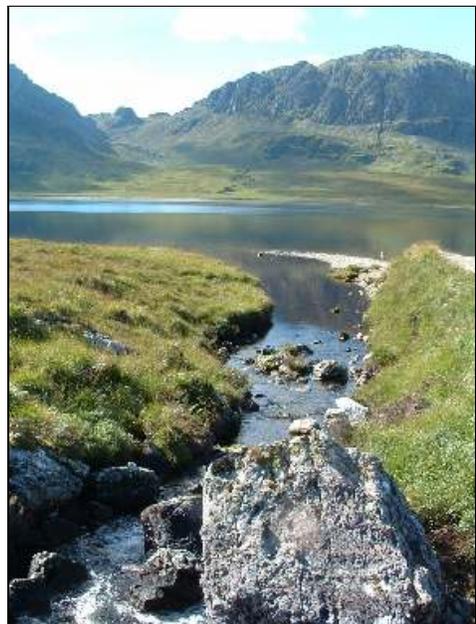
The Fionn Loch is perhaps the most famous brown trout loch in Wester Ross. As surveys in 2004 and 2006 have demonstrated, the streams flowing into it are also populated by salmon. Five streams entering the loch in addition to those sampled in 2004 were sampled in 2006.

Juvenile salmon were found in the larger burns, but not the smaller ones. Clockwise around a map of the loch, 2 salmon fry were found in the outflow of Loch na Moine Buige above the wall (LGDT21); salmon fry and parr were found in both the Glac Chaol burn (Allt na Glaic Caoile, LGDT27) and Allt na Moine (LGDT32) which enter Sandy Bay (both burns were too high for semi-quantitative survey); salmon fry and parr were found in the mouth of the Garbh Allt (LGD14); salmon were not found in the Carmnore Jetty burn (LGDT33 and T34) nor in the Allt a' Chairn Mhoir (sites not established); salmon fry and parr were found in the Allt Bruthach an Easain (LGDT26); salmon fry and a few small parr were found in the Allt a Chladhain in the flats at the far end of the Dubh Loch; salmon were not recorded in the Allt Poll Fraochain (LGDT35); salmon were found at the two lower sites in the Beannach system (LGD15 and LGDT22) but not a new site above the footbridge (LGDT36); salmon were not found in the Loch an Eilean burn (LGDT30, by the boat moorings). In 2004, juvenile salmon were also found in the two burns entering the west end of Lochan Beannach Mor.



Salmon fry and parr were found at the mouth of the Allt Bruthach an Easgain, LGDT26 (left). . .

but not at the mouth of Carmnore Jetty burn (LGDT33) where only juvenile trout were recorded (right).



The distribution of juvenile salmon around the Fionn Loch is therefore fairly well established. However, it is much more difficult to estimate the number of smolts that are produced from the upper part of the system. In 2006, salmon parr were recorded by survey gill netting in loch habitat in Loch Maree. At Tourniag, around 50% of salmon smolts leaving the system had loch growth [having spent 1 or more years in Loch nan Dailthean]. To what extent are smolts produced from within and around the the Fionn Loch?

The Fionn Loch and the Dubh Loch have a reputation for occasionally producing large trout. However, they are seldom caught by fly fishermen. In 2004, of over 300 trout taken by fly (most of which were released) by Gairloch Angling Club members, only one was over 40cm in length (it had been feeding on fry at the mouth of the Allt na Glaic Caoilein, Sandy Bay). Scale analyses indicated little change in growth rate since the 1920s. There are also Arctic charr in the Fionn Loch the spawning locations of which are unknown.

The full extent to which juvenile salmon are present in the loch and the extent to which they contribute to the diet of trout within the loch are difficult to gauge. Fionn Loch trout are known to eat salmon parr: Walker (1991) records a 547mm trout which disgorged a 140mm salmon parr. He also records a 598mm trout which disgorged a 250mm trout, 42% of its own length. Elsewhere, salmon fry have been found in trout of less than 20cm length. Migrating smolts can be taken by trout not much more than 30cm in length. So fewer very large trout (>550mm) may not necessarily lead to less predation of juvenile salmon!

Further work is required to find out more about the fish and fisheries of the Fionn Loch.

The mouth of the Loch Beannach Beag burn, electro-fishing site LGD15. CPUE of salmon fry and parr was high at this site; no juvenile trout were recorded. To what extent do juvenile salmon survive and grow-on within the Fionn Loch nearby?



6. Some Conclusions

- 'Core sections' of the Little Gruinard River below the Fionn Loch continue to support large numbers of juvenile salmon. Juvenile salmon were also found in 7 streams flowing into the Fionn Loch or Dubh Loch. At most sites, the CPUE and range of sizes of juvenile salmon indicated that densities of juvenile salmon were close to (or above) carrying capacity.
- Juvenile trout were seldom encountered in the mainstem Little Gruinard River, but were recorded in streams flowing into the Fionn Loch. Eels were scarce. Only the lowest site (LGD8) produced more than 2 eels.
- At many sites, juvenile salmon were small for their age, with few parr recorded of a size large enough to become smolts the following year. Reasons for this are discussed, including fishing bias (associated with high water); site habitat characteristic (esp. substrate); and food availability. It's possible that more smolts would be produced from some areas if there were fewer juvenile salmon (lower densities)!
- Further studies are required to understand the importance of the Fionn Loch, Dubh Loch and Beannach lochs for producing juvenile salmon, and how trout and charr interact with salmon.



(left) Two large salmon fry were found at LGDT21 by the mouth of Loch na Moine Buige. However (right) only trout were found at LGDT36 in Abhainn an t-Srathain Mhoir above the falls by the footbridge at the top of the Beannach system.



Boatman's catch (29 Aug 06):

(left) Trout taken from the top of the Boat Pool. How many of the smolts that leave the Fionn Loch are taken by trout as they pass through pools in the upper part of the river?

(right) Grilse of 50cm taken on trout fry in Sandy Bay (released after scale sample taken). It was aged at 3.1+ having gone to sea as a small smolt. There was no clear indication of more rapid freshwater 'loch growth'.



7. Recommendations

- There is no need for any stocking of juvenile salmon within the river system.
- River habitats are in good physical condition with relatively stable substrate, plenty of cover and no major erosion problems.
- However, production of salmon smolts from the river is likely to be limited by food availability. Riparian enclosure schemes in addition to those already established (e.g. lower river valley; Beannach area) may contribute to higher production if the supply of terrestrial insects or leaf litter to streams is increased. Invertebrate diversity and production should be investigated.
- Is the river 'starving'? If so gentle restoration of the natural fertility of the catchment area with controlled application of phosphorus fertiliser may be required. The aim should be to rebuild 'natural fertility' not to create areas of artificial enrichment. Particularly because of the perceived risks to freshwater pearl mussel populations (. . . there are also potential benefits. . .), this issue of nutrient restoration requires a collaborative approach also involving SEPA, SNH, FRS.
- Fisheries managers should not accept the premise that because local rivers in Wester Ross are naturally oligotrophic (and are classed as such), the lower the nutrient levels and lower the fertility of water, the better! This may mean challenging SNH and SEPA. Data will be required. .
- Contrary to popular assumption, higher levels of predation by eels, trout and some birds of weaker fish might lead to faster growth of healthier juvenile salmon and higher overall levels of smolt production from the river. This possibility requires further investigation and consideration.
- The fisheries ecology of the Fionn Loch is still poorly known and should be investigated further. With greater knowledge, management requirements for productive salmon, trout and perhaps even charr fisheries could be better understood.
- Every effort should be made to prevent minnows from being introduced to the loch. The current access arrangements for allowing known, responsible, local anglers to fish the loch are therefore about right. However, to gain more information about larger trout within the loch, some relaxation of the 'fly only rule' at certain times of year (e.g. April and May) may be helpful. Details of catches should be recorded and reported.
- Additional DNA samples of salmon, trout and charr from different parts of the catchment are required to learn more about genetic stock structuring.
- Snorkel surveys particularly *at night* may help to provide more information about the occurrence of larger parr in areas too deep to electro-fish.

A few juvenile and adult salmon, and Freshwater pearl mussels were seen by snorkelling on 1st Sep 06, but water clarity was less than optimal.



8. Acknowledgements

Thank you to Graeme Wilson and to Derek Darville of Letterewe Estate for permission to carry out electro-fishing surveys, and for support. Many thanks again to Ala Mackenzie for transport, acting as a boatman, and obtaining samples of fish! Thanks to Jenny Mullaney for helping as a volunteer with the Fionn Loch.



9. References

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Appendix 1: Summary of electro-fishing results in 2006

Little Gruinard timed electrofishing results 2006

Date	Code	Location	OS Grid reference		Time	Fish caught				Catch per unit effort				Salmon ages	Notes
			Easting	Northing		Salmon		Trout		Salmon		Trout			
						0+	1++	0+	1++	0+	1++	0+	1++		
08/09/2006	LGDT33	Carnmore burn below fall	197350	876800	6	0	0	10	5	0.00	0.00	1.67	0.83		
08/09/2006	LGDT34	Carnmore burn above burn	197350	876800	10	0	0	11	9	0.00	0.00	1.10	0.90		
08/09/2006	LGDT26	Mouth of Allt Bruthach an Easain	198800	176200	11	23	9	4	0	2.09	0.82	0.36	0.00	0+, 1+	
08/09/2006	LGDT25	Allt a' Chiadhain	199350	875500	12	34	6	0	1	2.83	0.50	0.00	0.08	0+, 1+	
08/09/2006	LGDT35	Fionn Loch burn below Bealach Mheinnidh	196500	875650	5	0	0	19	5	0.00	0.00	3.80	1.00		
08/09/2006	LGDT22	Beanach burn, Strath Buidhe by sheiling	194400	876300	14	11	34	2	3	0.79	2.43	0.14	0.21	0+, 1+, 2+, 3+	
23/08/2006	LGDT8	Little Gruinard River, between weirs	194500	889950	12	12	27	0	1	1.00	2.25	0.00	0.08	0+, 1+, 2+, 3+	River high, 6 eels seen
23/08/2006	LGDT19	Back channel at second flats	194250	886100	10	16	2	0	0	1.60	0.20	0.00	0.00	0+, 2+	River high - parr escaped
23/08/2006	LGDT6	Back channel between mid and lower flats	194200	886450	15	30	10	0	1	2.00	0.67	0.00	0.07	0+, 1+, 2+, 3+	
23/08/2006	LGDT29	Little Gruinard, top of first flats	194300	886900	8	19	5	0	0	2.38	0.63	0.00	0.00	0+, 1+, 2+	
23/08/2006	LGDT11	Little Gruinard, back channel	194300	886900	12	23	12	0	0	1.92	1.00	0.00	0.00	0+, 1+, 2+	River high
23/08/2006	LGDT17	Little Gruinard River, below shelter	194250	888500	15	30	17	0	0	2.00	1.13	0.00	0.00	0+, 1+, 2+	eels seen
29/08/2006	LGDT21	Loch na Moine Buige, by wall	192750	882800	12	2	0	26	0	0.17	0.00	2.17	0.00	0+	Possible hybrids
29/08/2006	LGDT15	Loch Beannach burn, Fionn Loch	194500	877900	15	43	19	0	0	2.87	1.27	0.00	0.00	0+, 1+, 2+	1 eel seen
01/09/2006	LGDT20	Top site on main river	193950	884500	16	44	18	1	0	2.75	1.13	0.06	0.00	0+, 1+, 2+	2 eels seen
01/09/2006	LGDT38	Little Gruinard, flats at burn mouth above fence	194250	884950	14	29	32	1	0	2.07	2.29	0.07	0.00	0+, 1+, 2+	
01/09/2006	LGDT4	Little Gruinard, side channel on upper flats	194250	885450	16	82	20	1	0	5.13	1.25	0.06	0.00	0+, 1+, 2+	1 eel seen

Little Gruinard presence/absence electrofishing results 2006

Date	Code	Location	OS Grid reference		Fish caught				Salmon ages	Notes
			Easting	Northing	Salmon		Trout			
					0+	1++	0+	1++		
08/09/2006	LGDT36	Beanach burn	194400	875400	0	0	2	6		May be inaccessible
29/08/2006	LGDT30	Loch an Eilein burn	192750	881000	0	0	4	2		1 eel
29/08/2006	LGDT31	Below lochan below Fionn loch	192800	882850	0	0	1	2		
29/08/2006	LGDT27	Allt Glac Chaoi	195250	880750	2	4	7	0	0+, 1+,	
29/08/2006	LGDT32	Burn in same bay as Allt Glac Chaoi	195250	880500	1	5	1	0	0+, 1+, 2+	
29/08/2006	LGDT14	Garbh Allt, Fionn Loch from 50ms loch	195250	879250	7	6	5	0	0+, 1+, 2+	
01/09/2006	LGDT37	Little Gruinard, stepping stones above boat pool	192850	883000	9	2	3	1	0+, 1+	1 eel seen

