Electrofishing surveys, 2011

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2011 juvenile surveys

Introduction

Electrofishing surveys are designed to assess the juvenile fish populations within a system. The equipment operates by creating an electrical field within the water that at first attracts the fish and subsequently stuns them for a brief period. As the field is restricted in size, the best operating conditions are shallow water within smaller tributaries. While it is possible to sample main stream areas, and this has been done within this survey, the escape rate is higher that that found in the narrower streams. Similarly, a high escape rate is found in exceptionally shallow, stony or weedy areas, where fish can move into the substrate and thus are inaccessible to the nets.

This survey repeats many of the catchments surveyed previously. Where possible all sites were revisited, although some were not accessed due to time and flow constraints, while others were removed from the survey on the basis of the results from the previous survey. Additional sites were added in some instances.

This report summarises the data for each system. Maps giving the location of each site and the densities represented pictorially are available on request. Similarly, length-frequency data for each site are available, together with the length-frequency data for each system as a whole.

Methods

Fish densities were assessed by electrofishing using a backpack supplying pulsed D.C. power over sites marked with string. Fish attracted to the hand-held anode were netted into a bucket and retained. The sites were fished systematically upstream.

All fish were anaesthetised using 2 Phenoxyethanol, identified to species and measured (± 1 mm). Small samples of scales were removed from a proportion of each length range for age determination. The fish were then allowed to recover before returning to the electrofished section. Densities of fish were calculated as minimum estimates, such that a minimum number of fish present per 100 m^2 could be determined. Water level was not used in the density estimates, although it must be realised that stream conditions will have an impact on the density determined and efficiency of the fishing technique.

Site characteristics were recorded at each site, including bed type, flow and bankside characteristics in accordance with the SFCC protocol.

Results

1. Polla catchment

Table 1.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 1.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 1.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
P3A	239100	955300	30	By hatchery/road junction
P4A	239100	951800	20	By Strabeg House in trees
P5A	239200	951900	30	Tributary next to Strabeg House 50 m from main river
P7A	238800	952600	20	Tributary downstream of loch Bad na h Achlaise
P8A	238800	952400	20	Burn running out of loch Bad na h Achlaise downstream of Strabeg House
P9A	239100	952300	20	Tributary downstream of Strabeg House same bank
P10A	238700	954100	20	Tributary on the left bank upstream of the fishing hut by the dam

Table 1.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

Site code	Length (m)	Area (m^2)	Density (100 m^2)			
			Salmon fry	Salmon parr	Trout fry	Trout parr
P3A	6.2	14.47	0.00	0.00	0.00	13.82
P4A	5.3	28.62	34.94	10.48	10.48	0.00
P5A	17.5	93.92	4.26	23.42	11.71	4.26
P7A	20.7	28.98	0.00	3.45	0.00	0.00
P8A	18.5	30.83	0.00	6.49	6.49	3.24
P9A	16.2	66.96	0.00	0.00	0.00	2.99
P10A	8.5	19.55	25.58	20.46	0.00	0.00

The maximum, minimum and mean densities are given for all sites (Table 1.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 1.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	34.94	9.25
Salmon parr	0.00	23.42	9.19
Trout fry	0.00	11.71	4.10
Trout parr	0.00	13.82	3.47

Two year classes (0+ - 1+) are discernible within the salmon and three (0+ - 2+) within the trout populations.

Eels were not present at P3A, P7A and P10A. Greatest densities were recorded in P5A, although there was little difference across the catchment. Sticklebacks were recorded in P9A only. There were no other species recorded within the system.

Discussion

The average densities of salmon within the system are double the average for the Sutherland area. In addition, densities of both fry and parr have increased significantly since the survey carried out in 2009. While trout also show an increase in densities, these are more significant for fry, with parr showing little real change. The density of trout is about average for the area, with parr densities being below average and fry slightly above.

Previous studies, and an analysis of the catch returns, have indicated that the Polla was primarily a trout system. Catch statistics have shown this to be changing with time, and the current study would suggest that salmon are dominating the catchment. It is unclear why this change is taking place, although it is known from other areas that salmon can outcompete trout. However, in both cases the population shows a decline in density from fry to parr and would indicate a healthy salmonid population. Taken as a whole, average salmonid densities within the Polla are high for the area.

2. Rhiconich catchment

Table 2.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 2.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 2.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
R1	225900	951600	25	On bend between cairn and outcrop. Just up from large boulder on right
R2	226300	950700	45	Before loch after widening of the river
R3	227000	949400	45	Between the bends on the river between the lochs
R4	228000	947200	65	Below first falls in burn

Table 2.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

Site code	Length (m)	Area (m^2)	Density (100 m^2)			
			Salmon fry	Salmon parr	Trout fry	Trout parr
R1*			1.80	1.00	0.00	0.00
R2*			1.20	0.20	0.00	0.00
R3	11.6	40.21	32.33	19.90	2.49	0.00
R4	4.5	13.8	7.25	7.25	43.48	0.00

(*R1 and R2 were timed electrofishing, as such the densities are fish per minute)

The maximum, minimum and mean densities are given for sites R3 and R4 (Table 2.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 2.3 A summary of the densities determined for R3 and R4

	Minimum	Maximum	Mean
Salmon fry	7.25	32.33	19.79
Salmon parr	7.25	19.90	13.58
Trout fry	2.49	43.48	22.99
Trout parr	0.00	0.00	0.00

Two year classes (0+ - 1+) are discernible within the salmon and one (0+) within the trout populations.

Eels were present at all sites surveyed. Greatest densities were recorded in R2 and R3. There were no other species recorded within the system.

Discussion

The densities of salmon found within R3 and R4 are significantly higher than the average for the Sutherland area and show a healthy salmon population within the system. The densities observed are higher than those found in the 2007 survey, with salmon also being found for the first time in R4. The main stem sites (R1 and R2) were surveyed using timed fishing. The values observed at these sites are reasonable for the area surveyed and would suggest that the population throughout the catchment is healthy.

Trout fry densities would also appear to be very healthy, being significantly higher than the Sutherland average. Densities were also greater than those found in the 2007 survey. There were no trout parr taken within the survey. It is probable that this represents the habitat surveyed rather than the trout population *per se*, with trout parr moving into the deeper water or lochs. In addition the main trout spawning burn, the Garbh Allt, could not be surveyed as a result of high water. While no trout were found within the main stem this is again likely to reflect the habitat rather than the complete absence of the species.

3. Strath Shinary catchment

Table 3.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 3.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 3.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
SL1	224600	960900	35	At mouth of river diagonally opposite track junction with river.
SL3	224000	962200	20	Allt na Fearna, by mouth of river
SL5	224100	960600	105	Upstream of bridge below Loch Mor a Chraisg
SL6	223950	962200	15	In main stem
SL7	224000	962050	15	In main stem

Table 3.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

Site code	Length (m)	Area (m^2)	Density (100 m^2)			
			Salmon fry	Salmon parr	Trout fry	Trout parr
SL1	8.8	36.08	0.00	0.00	0.00	5.54
SL3	5.3	18.02	22.20	5.55	22.20	27.75
SL5	9.4	8.77	0.00	0.00	22.81	0.00
SL6*			0.80	0.60	0.00	0.40
SL7*			1.40	1.60	0.00	0.20

(SL6 and SL7 were sampled using timed electrofishing)

The maximum, minimum and mean densities are given for SL1, SL3 and SL5 (Table 3.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 3.3 A summary of the densities determined for SL1, SL3 and SL5

	Minimum	Maximum	Mean
Salmon fry	0.00	22.20	7.40
Salmon parr	0.00	5.55	1.85
Trout fry	0.00	22.81	15.00
Trout parr	0.00	27.75	11.10

Two year classes (0+ - 1+) are discernible within the salmon and three (0+ - 2+) within the trout populations.

Eels were present at all sites with the exception of SL5. Greatest densities were recorded in SL1. There were no other species recorded within the system.

Discussion

The densities of trout found within SL1, SL3 and SL5 are significantly higher than the average for the Sutherland area and show a healthy trout population within the system. Fry densities are lower than those found in 2006, while parr densities show an increase. This may, however, reflect the habitat surveyed. The other sites (SL6 and SL7) were surveyed using timed fishing. The timed values for trout observed are low for the area, while those of salmon are reasonable, suggesting that this part of the catchment has habitat more suited to salmon. However in general the Strath Shinary catchment is more suited to trout.

Salmon fry densities would also appear to be healthy, being significantly higher than the Sutherland average. There were fewer salmon parr taken within the survey. However, the 2006 survey failed to find salmon within the catchment and these findings are therefore encouraging. It is likely however that this represents the habitat surveyed rather than the salmon population *per se*. Salmon were found only in one part of the catchment, around Allt na Fearna. The sediment in the main stem at this point is particularly mobile and as a consequence may result in the salmon population being more vulnerable to adverse events. However Allt na Fearna itself would appear to provide some refuge, although small in area.

4. Loch na Thull catchment

Table 4.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 4.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 4.1 Electrofishing site details

Code	Easting	Northing	Altitude	River	Situation
NT1	224700	951300	35	Outflow	Above the road bridge by trap location
NT2	224800	951100	45	Outflow	Below Loch Na-Cailich by large boulder
NT3	224500	951600	35	Outflow	By telegraph poles between two bends and next to small stream on right
NT7	224600	951400	30	Outflow	Below road bridge

Table 4.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

Site code	Length (m)	Area (m^2)	Density (100 m^2)			
			Salmon fry	Salmon parr	Trout fry	Trout parr
NT1	8.8	30.8	51.95	6.49	12.99	0.00
NT2	13.8	62.56	1.60	0.00	11.19	0.00
NT3	17.8	29.67	70.78	43.82	0.00	6.74
NT7	8.6	18.92	15.86	52.85	10.57	21.14

The maximum, minimum and mean densities are given for all sites (Table 4.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 4.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	1.60	70.78	35.05
Salmon parr	0.00	52.85	25.79
Trout fry	0.00	12.99	8.69
Trout parr	0.00	21.14	6.97

Three year classes (0+ - 2+) are discernible within the salmon and four (0+ - 3+) within the trout populations.

Eels were present at all sites. Greatest densities were recorded in NT3. There were no other species recorded within the system.

Discussion

The densities of salmon and trout are significantly higher than the West Sutherland average. Salmon fry in particular appear at exceptionally high densities, not just with regards to the area but also compared to previous years within the catchment, although parr densities remain similar. This would indicate a stable and healthy salmon population.

Trout fry densities are low compared to previous years while parr densities have increased slightly. However, they still remain slightly above the Sutherland average. While this survey was located only in the outflow, missing the tributaries into Loch na Thull where trout are known to spawn, it is unlikely that this will have had a significant impact on the results. Instead the low fry densities observed are probably a reflection on the increasing salmon population within the system and the habitat at the different sites.

5. Laxford catchment

Table 5.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 5.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

The maximum, minimum and mean densities are given for all sites (Table 5.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Two year classes (0+ - 1+) are discernible within the salmon population, while four (0+ - 3+) can be seen in the trout population.

Eels were present at all sites with the exception of L18D and L19. Greatest densities were recorded in L26B. Minnows were recorded in high numbers in L12, L19, L20 and L59A. There were no other species recorded within the system.

Table 5.1 Electrofishing site details

Code	Easting	Northing	Altitude	River	Situation
L12	227600	943700	40	Tributary of Loch Stack	From first bend to tree
L18A	230900	942200	40	Lone burn	Downstream of Bridge at Lone
L18B	231100	942300	50	Lone burn	Upstream, in gorge section
L18C	231200	942400	55	Allt Horn	Moorland below the woodland
L18D	231300	942600	55	Allt Horn	within conifer corridor (scots pine/rowan)
L19	230700	941700	40	Tributary	Near quarry on way to Lone, below track.
L20	230700	941600	50	Allt a Chuillin	50m upstream of the trees, from riffle to drop off - deep scour
L26A	229500	939700	50	Allt Achfaraidh	Below Ian's house in the gorse bushes.
L26B	227000	940700	70	Allt Achfaraidh	upstream site located in the coniferous plantation.
L36	230900	938200	50	Tributary of Loch More	Maternity Burn, below road
L59A	234800	934800	50	Allt Ceann Loch	Below houses
L59B	234800	934300	60	Allt Ceann Loch	50m above the bridge

Table 5.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
L12	19.2	49.92	18.03	0.00	12.02	2.00
L18A	9.7	129.01	21.70	3.88	0.00	0.00
L18B	7.3	69.35	10.09	27.40	0.00	0.00
L18C	10.7	28.53	42.06	28.04	10.52	0.00
L18D	8.5	43.35	0.00	9.23	2.31	0.00
L19	31.3	44.86	2.23	0.00	62.42	0.00
L20	15.2	26.85	70.76	26.07	0.00	0.00
L26A	9.4	60.16	28.26	3.32	4.99	0.00
L26B	18.1	44.65	2.24	8.96	0.00	22.40
L36	7.5	13	0.00	7.69	0.00	53.85
L59A	11.6	40.21	17.41	57.20	4.97	2.49
L59B	8.6	47.87	10.44	12.53	16.71	16.71

Table 5.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	70.76	18.60
Salmon parr	0.00	57.20	15.36
Trout fry	0.00	62.42	9.49
Trout parr	0.00	53.85	8.12

Discussion

Salmon densities within this survey are significantly higher than those found in the 2009 survey. Trout densities in contrast are much lower. Total salmonid parr densities are, however, similar, while fry densities have declined slightly. This would suggest that at least some of the observed changes in trout population are a result of ecosystem dynamics. A similar pattern has been observed previously within the Laxford catchment.

The average densities of both salmon and trout within this survey are exceptionally high for the west Sutherland area, with maximum densities being in line with those found in other parts of Scotland. This demonstrates a healthy and successful salmonid population throughout the catchment. Differences in fry and parr densities observed at the different sites reflect the habitat at each site, with most habitat types covered within the survey.

As expected, fry densities are greater than parr for both species, demonstrating a balanced and healthy migratory population, where density dependent mortality is in operation. This, together with the changes in the juvenile populations over the past 14 years would suggest that the salmonid population

is stable. From this, and previous surveys, the Laxford system would appear to be a mix of salmon and trout, with different parts of the system supporting different species.

6. Bad na Baighe catchment

During the collection of genetic material a healthy number of fish were observed, of all species and stages, indicating a thriving fish population. In particular the number of trout and salmon were good for the area, with a mature sea trout also observed at this time. Eels were also present in good densities within the lower system, at a range of sizes. No minnows were observed.

Discussion

Densities of salmon and trout were not calculated during this survey, with no qualitative sampling undertaken. However, while collecting the fish for genetic sampling it was observed that the outflow burn was particularly productive. A healthy, balanced population was observed for all species, with good numbers of all stages seen.

Attempts to trap smolts in the burn failed as a result of the high flows experienced this summer, but it was noted that there were large numbers of salmon smolts present, based on the short period of trapping undertaken. Sea trout have also been recorded in numbers within the system, and indeed finnock captured in the electrofishing survey would suggest that densities are high. As such it would appear that the salmonid population within the catchment is good for the west Sutherland area.

7. Claise na Fearna catchment

Table 7.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 7.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 7.1 Electrofishing site details

Code	Easting	Northing	Altitude	River	Situation
Bmain3	220000	946400	50	Allt na Clais Fearna	Just above small falls near road bridge
Bmain5	219700	946200	55	Allt na Clais Fearna	Downstream of bend in river opposite Council Depot
Bmain8	219500	945800	60	Allt na Clais Fearna	Near Loch a Bhagh Ghaimmhica

Table 7.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
Bmain3	14.3	38.61	0.00	2.59	0.00	2.59
Bmain5	17	45.9	0.00	4.36	4.36	6.54
Bmain8	23	91.23	12.06	3.29	17.54	2.19

The maximum, minimum and mean densities are given for all sites (Table 7.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 7.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	12.06	4.02
Salmon parr	2.59	4.36	3.41
Trout fry	0.00	17.54	7.30
Trout parr	2.19	6.54	3.77

Two year classes (0+ - 1+) are discernible within both the salmon trout populations.

Eels were present in Bmain8 only. There were no other species recorded within the system.

Discussion

The average densities of both trout and salmon found during this survey were lower than those found in previous years, both for fry and parr. This follows the trend observed in 2008 and indicates a need to

monitor the situation. Densities at all sites have declined to varying degrees from those found in 2008, with the exception of trout parr in Bmain8. Salmon were, however taken in Bmain3, where previously they were absent.

Salmon densities are slightly below average for the West Sutherland area, as are trout parr. Trout fry densities, in comparison, are more than double the average for the area. However it must be noted that the outflow, where the greatest densities are historically found, could not be surveyed due to weather and this will have had an impact on the average densities. In both cases there is a decline in density from fry to parr, indicating a healthy migratory population.

8. Gleann Leireag catchment

Table 8.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 8.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 8.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
GLL1	215900	930700	80	Abhainn Gleann Leireag, just up from braid - tree on the left in middle of site
GLL2	217100	930600	125	Small tributary into first loch, just below path
GLL3	217800	929700	125	Tributary into upper loch, below falls after bend

Table 8.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
GLL1	9.8	50.96	0.00	0.00	0.00	3.92
GLL2	7.6	6.84	0.00	0.00	58.48	0.00
GLL3	16.5	66	0.00	0.00	4.55	0.00

The maximum, minimum and mean densities are given for all sites (Table 8.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 8.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	0.00	0.00
Salmon parr	0.00	0.00	0.00
Trout fry	0.00	58.48	21.01
Trout parr	0.00	3.92	1.31

Two year classes (0+ - 1+) are discernible within the trout population.

Eels were present at GLL1 only. There were no other species recorded within the system.

Discussion

Salmon are absent from the Gleann Leireag catchment as a result of the waterfall at the lower end of the catchment. They are present in the river below these falls but this area was not covered in the 2011 survey. Some stocking of salmon was undertaken previously in the upper reaches of the catchment, with salmon taken in previous surveys, but no further evidence of these fish exist.

The high densities of trout fry within the catchment are the result of the habitat surveyed. In particular GLL2 is a prolific area of fry development, although unsuitable for parr. GLL1, in contrast, is primarily parr habitat, and this is reflected in the absence of fry from this area. A number of fish were missed during the survey, with the highest number being from GLL3. Here parr were observed but not caught. This was the result of operator error associated with a higher flow rate.

Fry densities are exceptionally high for the west Sutherland area, while parr densities are below average. This reflects the habitat surveyed rather than the fish population *per se*, with trout parr moving into the deeper water or lochs out with the scope of an electrofishing survey. The fry densities alone are encouraging, indicating a thriving trout population.

9. Inver catchment

Table 9.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 9.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 9.1 Electrofishing site details

Code	Easting	Northing	Altitude	River	Situation
I4A	212300	923700	50	Allt na h'Airbhe	Moorland at the mouth of the tributary near Brackloch.
I4B	212700	923600	50	Allt na h'Airbhe	Between the gorse on the right and the bedrock on the left
I11A	215100	924600	60	Allt an Tiaghaich	Upstream of deer fence
I11B	215200	924600	70	Allt an Tiaghaich	Upstream in the boulder section by path
I13B	215901	924580	70	tributary	Upstream of deer fence
I23	220700	925800	80	tributary	Between bridge on new road and old road
I30A	223500	924400	60	Allt Sgiathaig	At road junction
I30B	223400	924700	80	Allt Sgiathaig	In the gorge near the parking space.
I32B	224100	923800	70	tributary	By Ardvreck Castle, left tributary at mouth of loch
I33A	224300	923500	70	Caldha burn	Downstream of road bridge
I35A	225000	921700	70	River Traligill	Downstream of road bridge. Downstream of tree on left bank for 18 m
I35B	225800	921900	95	River Traligill	Just below the foot bridge upstream of the road

Table 9.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
I4A	25.4	108.37	6.46	47.98	5.54	7.38
I4B	12.4	39.68	0.00	37.80	5.04	27.72
I11A	5	39	28.21	15.38	0.00	5.13
I11B	14.3	79.13	10.11	42.97	1.26	3.79
I13B	12.2	27.25	14.68	22.02	7.34	22.02
I23	15	29.5	0.00	33.90	3.39	23.73
I30A	4.8	20.8	4.81	43.27	9.62	4.81
I30B	3.9	17.42	11.48	0.00	11.48	5.74
I32B	5.8	23.78	4.21	12.62	96.72	0.00
I33A	5.9	25.57	35.20	11.73	0.00	0.00
I35A	7.2	72.72	20.63	23.38	0.00	1.38
I35B	11.8	58.61	0.00	3.41	0.00	13.65

The maximum, minimum and mean densities are given for all sites (Table 9.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 9.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	35.20	11.31
Salmon parr	0.00	47.98	24.54
Trout fry	0.00	96.72	11.70
Trout parr	0.00	27.72	9.61

Three year classes (0+ - 2+) are discernible within both the salmon and trout populations.

Eels were present at I4A only. Minnows were only recorded in I4A and I35A. There were no other species recorded within the system but a large number of salmonids were missed during this survey.

Discussion

The 2008 survey of the Inver catchment showed a depressed salmonid population compared to previous years. This is reversed in 2011, with the salmonid population once again showing a healthy density, with the average densities of both salmon and trout within this survey being above average for the Sutherland area. This difference was significant for all stages and species, indicating a healthy and successful salmonid population within the catchment. The high number of salmon parr compared to fry is of some concern, potentially reflecting a poor spawning success in 2010, although fry numbers themselves are not of any concern.

Trout densities are more indicative of a 'normal' population, with densities of fry higher than parr. However the figures are close, potentially reflecting the presence of a non-migratory component. This pattern does not, however, support the conclusion that a poor spawning year within the salmon population was the result of adverse weather conditions. It is therefore possible that the observed differences in salmon densities are the result of habitat selection within the sites.

10. Polly catchment

Table 10.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 10.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 10.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
Polly TS5	207820	912749	25	Braid 50 m upstream of Stac Burn
Polly 3.1	207315	913660	25	In braid towards house behind the fields
Stac 3.1	208176	912169	30	50 m downstream of two trees and the fence
Stac TS5	208750	912400	60	Just before the gorge 50 m upstream of fence

Table 10.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
Polly TS5	8.6	62.06	3.22	9.67	0.00	0.00
Polly 3.1	9.2	30.05	13.31	3.33	16.64	3.33
Stac 3.1	6.5	17.77	0.00	28.14	0.00	16.88
Stac TS5	6.7	27.69	0.00	21.67	3.61	0.00

The maximum, minimum and mean densities are given for all sites (Table 10.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 10.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	13.31	4.13
Salmon parr	3.33	28.14	15.70
Trout fry	0.00	16.64	5.06
Trout parr	0.00	16.88	5.05

Two year classes (0+ - 1+) are discernible within the salmon and three (0+ - 2+) within the trout populations.

Eels were present at all sites. Greatest densities were recorded in Stac 3.1. Minnows and 3-spined stickleback were recorded in Polly 3.1 only. There were no other species recorded within the system.

Discussion

The average densities of salmon parr within this survey were significantly higher than the Sutherland average. Fry densities, in contrast were slightly below average. This is likely to reflect the habitat surveyed, with the Stac Burn sites being excellent parr rather than fry habitat. Trout densities were, however, about average for the area, being slightly above average for fry and below average for parr.

Again this reflects the habitat surveyed. These sites were sampled for the first time in 2011 and therefore there is no long term trends to be assessed.

Less than 2 months after this survey Polly 3.1 was revisited at the request of the owner. The gravels were found to be covered in white fungus, possibly sewage fungus, as was the rest of the burn in this area. In addition there was substantial weed growth observed, such that the spawning potential of the gravel was likely to be compromised. It is believed that this has emanated from bad practice within the fish farm and SEPA were informed.

11. Garvie catchment

Table 11.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 11.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m^2.

Table 11.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
G2A	213300	906500	70	Moorland at foot of hill
G3A	213800	906600	50	Downstream of ford over tributary

Table 11.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2

			Density (100 m^2)			
Site code	Length (m)	Area (m^2)	Salmon fry	Salmon parr	Trout fry	Trout parr
G2A*	11.9	39.27	2.55	0.00	10.19	5.09
G3A	6.4	16.43	0.00	0.00	12.18	12.17

*Approximately 50% of the fish were missed.

The maximum, minimum and mean densities are given for all sites (Table 11.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 11.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	2.55	1.28
Salmon parr	0.00	0.00	0.00
Trout fry	10.19	12.18	11.19
Trout parr	5.09	12.17	8.63

One year class (0+) is discernible within the salmon and two (0+ - 1+) within the trout populations.

Minnows were recorded in G3A only. There were no other species recorded within the system.

Discussion

Trout densities at both the sites are higher than those found in the 2008 survey and therefore greater than those found in previous years. This would suggest a healthy and potentially increasing trout population. While the latter statement has some reservations, with this survey only monitoring the upper catchment, it is likely that the pattern will be repeated throughout. The densities observed are above average for the west Sutherland area.

Salmon densities are also similar to those found previously at these sites. They are extremely low compared to the other catchments in the west Sutherland area. However this is not an issue of concern at the present moment as the main salmon spawning area for the Garvie catchment has in the past proved to be the River Osgaig. High flows meant that the lower catchment, including the River Osgaig, were not sampled during 2010 and as such the salmon population has not been adequately sampled. However, the similarity with previous surveys at these sites would suggest that the salmon population is stable.

12. Average for the West Sutherland Fisheries Trust area

The average densities of fish within each catchment are summarised (Table 12.1). This allows a comparison between the catchments, although it should be noted that the temporal changes in density, occasioned by sampling at different times of the year, and habitat differences between catchments are not considered in this table. The timing of sampling is important, with fish moving within the tributaries as a result of water height and temperature, food availability and size. Thus, sampling after a spate may give a low density as a result of washout, while drought may decrease density as fish move into deeper water to avoid predation or desiccation, or may increase density as a result of concentration in severe cases. Similarly, densities will be greater shortly after hatching, reducing with time as the fish grow and require a larger territory for survival.

Table 12.1 The average densities of salmon and trout per 100 m^2 within each catchment surveyed (Graphically displayed in Fig. 12.1)

	Density (100 m^2)			
Catchment	Salmon fry	Salmon parr	Trout fry	Trout parr
Polla	9.25	9.19	4.10	3.47
Rhiconich	19.79	13.58	22.99	0.00
Strath Shinary	7.40	1.85	15.00	11.10
Loch na Thull	35.05	25.79	8.69	6.97
Laxford	18.60	15.36	9.49	8.12
Claise na Fearna	4.02	3.41	7.30	3.77
Gleann Leireag	0.00	0.00	20.01	1.31
Inver	11.31	24.54	11.70	9.61
Polly	4.13	15.70	5.06	5.05
Garvie	1.28	0.00	11.19	8.63

From Fig 12.2 it can be seen that the length distribution for trout and salmon is similar throughout the area. As expected, there was a greater spread in the length of trout caught compared to salmon, reflecting the presence of resident trout. The largest trout were taken in the Strath Shinary.

The West Sutherland area shows a good mix of salmonid species, with trout and salmon present in all catchments (Fig 12.3) with the exception of Gleann Leireag. Eels are also common throughout the area, occurring in all of the systems examined with the exception of the Garvie. Minnows are present within the larger rivers in the area, occurring in the Laxford, Inver, Polly and Garvie, while 3-spined sticklebacks were found only in the Polla and the Polly.

Discussion

The results from this survey indicate that salmon and trout populations are dispersed throughout the area. Missing year classes were observed in the Rhiconich, with trout parr absent from the sampling, and the Garvie, where salmon parr were absent. In the case of the Garvie this is likely to be a function of the habitat present. With these exceptions the salmonid populations throughout the area appear to be healthy, if small.

When compared to the previous surveys within these systems, the fish densities did not show any discernible pattern, increasing in some systems while decreasing in others. However, they remained within the range found in previous surveys, therefore indicating that there are no current problems within these catchments. Stocking does not form a major part in the management of systems monitored in 2011, with the exception of the Laxford and the Garvie. In the Laxford the system stocking is undertaken with salmon in the Lone tributary. However this will not have affected these sites. Similarly, the Garvie stocking will not impact on this survey as the trout are stocked into the River Osgaig and tributaries of Lochs Osgaig and Badagyle. Other factors that may affect the results, compared to previous years, include water flow and temperature.

DISCLAIMER NOTICE

Whilst this report has been prepared by the WSFT biologist on the basis of information that she believes is accurate, any party seeking to implement or otherwise act upon any part or parts of this report are recommended to obtain specialist advice. The WSFT and its biologist do not accept responsibility under any circumstances for the actions or omissions of other parties occasioned by their reading of this report.

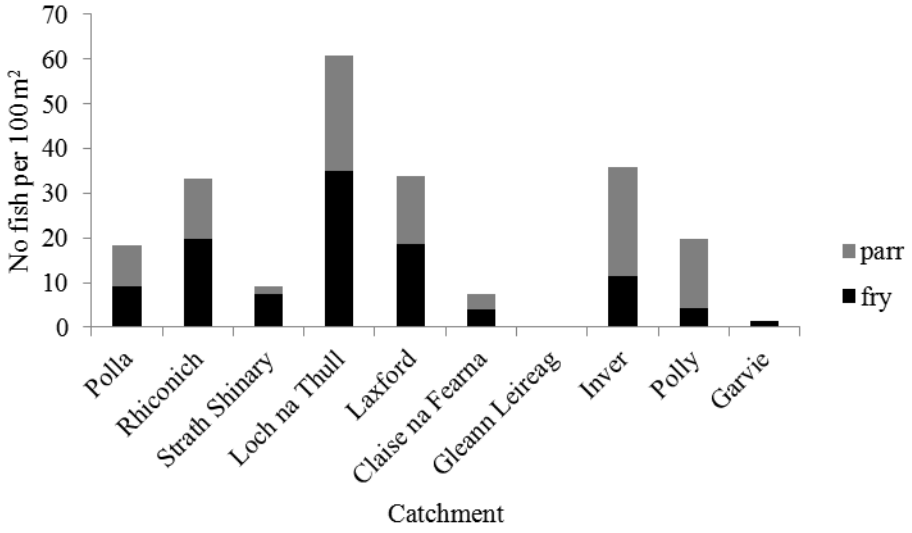

Fig. 12.1a Showing the densities of salmon fry and parr for each catchment

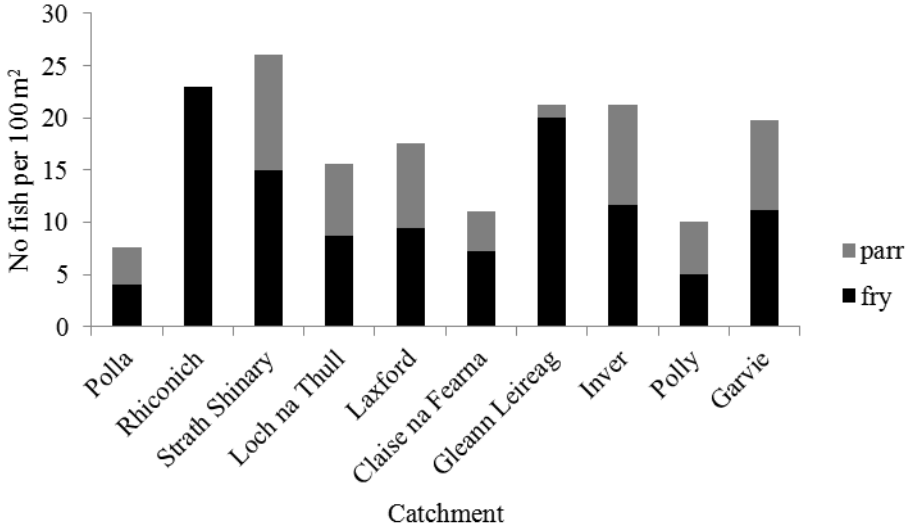

Fig. 12.1b Showing the densities of trout fry and parr for each catchment

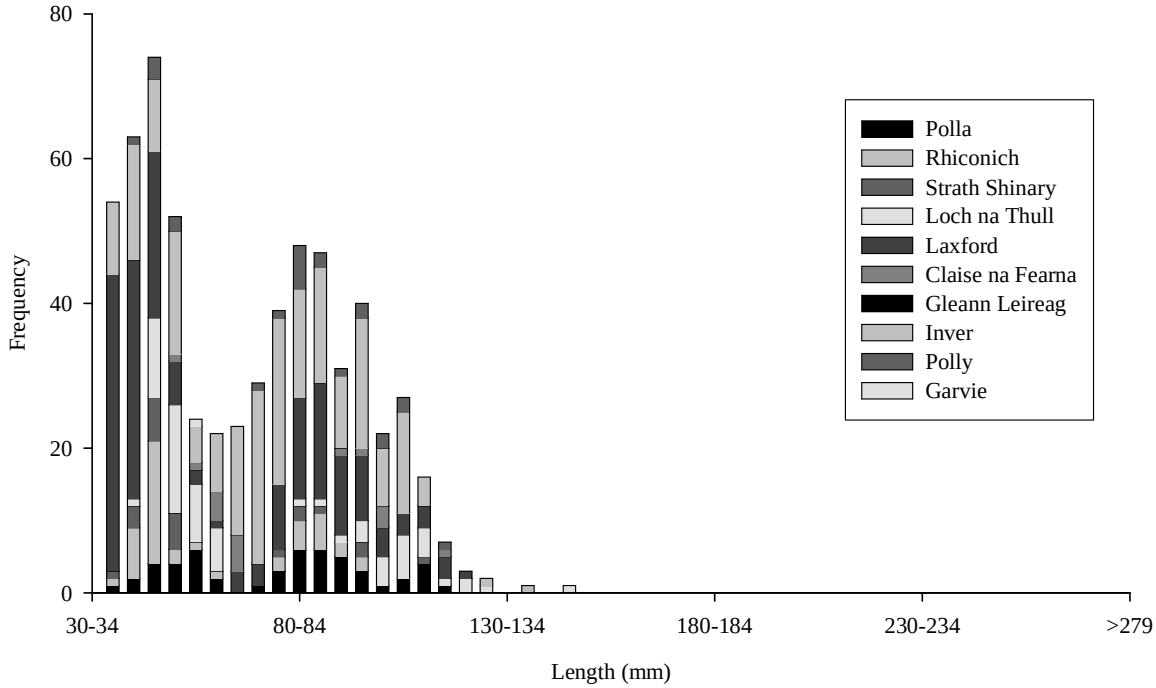

Fig. 12.2a The length - frequency distribution of salmon within the West Sutherland area

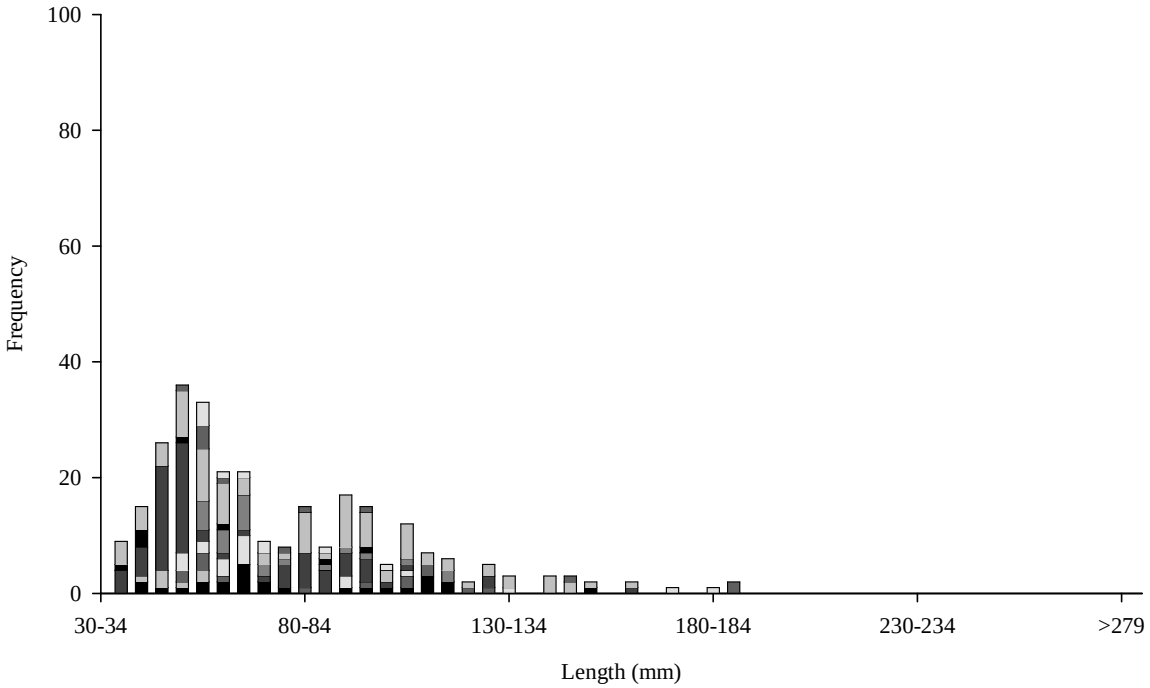

Fig 12.2b The length – frequency distribution of trout within the West Sutherland area

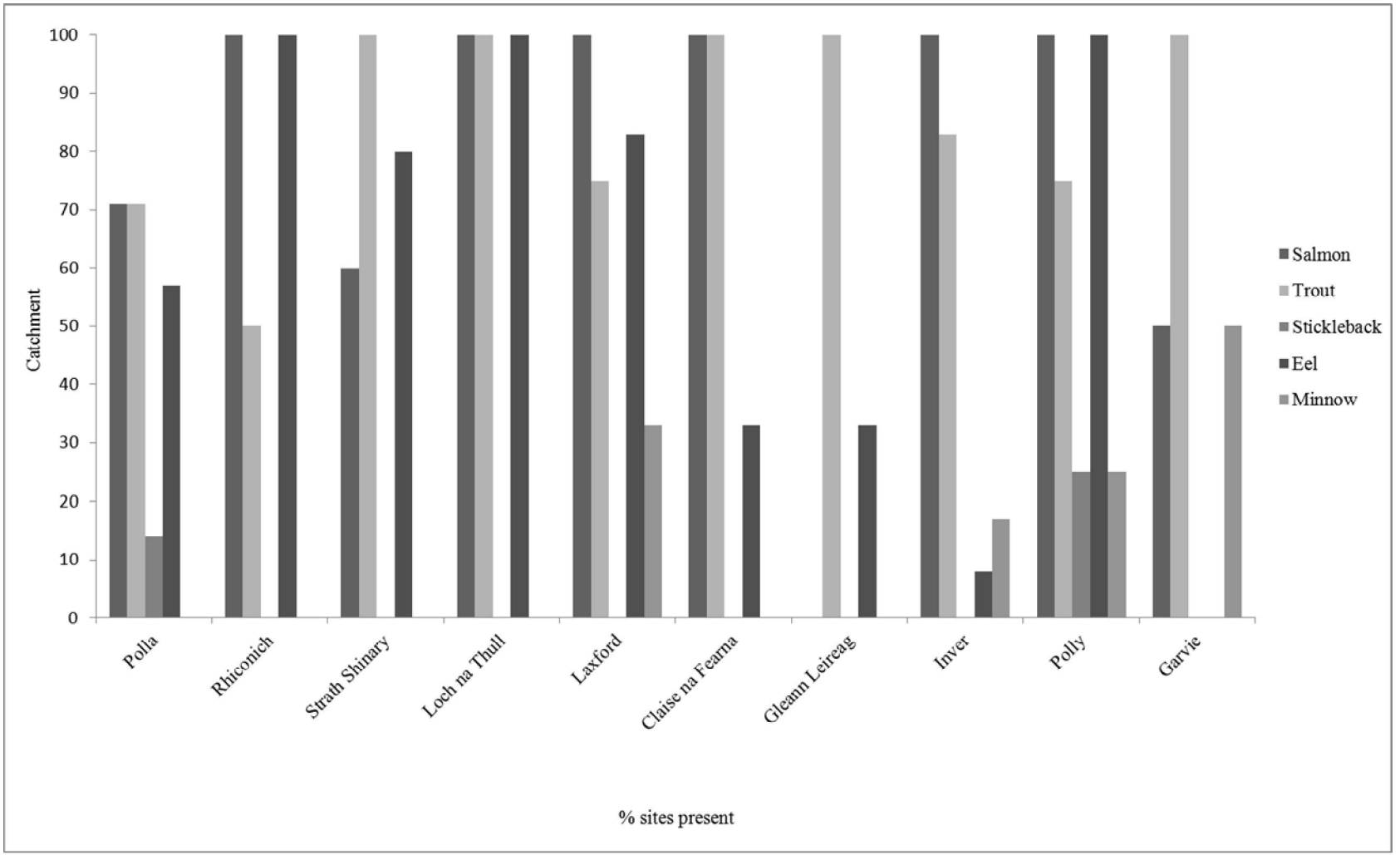

Fig. 12.3 Showing the proportion of sites in which the different species are present within the catchments