

Electrofishing surveys, 2008

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2008 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 than 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 m² 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. Hope 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 m².

Table 1.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
H1A	247700	957800	30	Allt a Muillin
H2A	247400	956900	10	Breasgill below road
H2B	247500	956900	15	Breasgill burn, above road and below sheep dip.
H3A	246100	952700	10	An Garbh-allt
H4A	246300	947700	25	Trib at shed by ben Hope path.
H9A	242000	941500	120	Abhains Strath Coir an Easaidh
H9B	243600	941800	60	Abhainn Strath Coir an Easaidh
H10A	243200	941500	100	Allt a Choire Ghrainde
H12A	245200	942600	30	By passing place on road to Gober, above bridge

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
H1A	10	3.37	33.67	0.00	5.94	2.97	14.85
H2A	20	3.50	70.00	25.71	21.43	15.71	5.71
H2B	11.8	4.90	57.82	29.40	13.84	12.11	6.92
H3A	8.5	5.70	48.45	4.13	14.45	10.32	6.19
H4A	10.5	2.73	28.70	45.30	52.26	34.84	3.48
H9A	10.5	11.53	121.10	0.00	0.83	4.13	4.95
H9B	16	7.03	112.53	0.00	7.11	0.00	8.89
H10A	8	5.33	42.67	0.00	0.00	9.38	4.69
H12A	9	8.47	76.20	0.00	1.31	0.00	0.00

The maximum, minimum and mean densities are given for all sites (Table 1.3a), sites on the east shore of Loch Hope (Table 1.3b) and all other sites (Table 1.3c). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

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

	Minimum	Maximum	Mean
Salmon fry	0.00	45.30	11.62
Salmon parr	0.00	52.26	13.02
Trout fry	0.00	34.84	9.94
Trout parr	1.21	14.85	6.19

Table 1.3b A summary of the densities determined for tributaries on the east shore of Loch Hope

	Minimum	Maximum	Mean
Salmon fry	0.00	29.40	14.81
Salmon parr	5.94	21.43	13.91
Trout fry	2.97	15.71	10.28
Trout parr	5.71	14.85	8.42

Table 1.3c A summary of the densities determined for all other tributaries

	Minimum	Maximum	Mean
Salmon fry	0.00	45.03	9.06
Salmon parr	0.00	52.26	12.30
Trout fry	0.00	34.84	9.67
Trout parr	0.00	8.89	4.40

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

Eels were present in low densities at all sites with the exception of H9A. No other species were found within the survey.

Discussion

There has been considerable variability in juvenile densities over the course of this monitoring programme. While this can be seen in both species, the greatest variability is present within the salmon population, reflecting the purely migratory nature of the species. Unlike the situation in many other catchments the salmon and trout populations are well mixed throughout the catchment, with no area being more suited to one species than the other.

Despite this, the average densities of salmon fry and parr during 2008 were significantly greater than those found in previous years, with the largest difference being observed in the fry population. This is likely to reflect an increase in salmon adults entering the rivers, as demonstrated by an increase in rod catch, and therefore spawning success. The parr population appears to be greater than the fry population in contrast to the expected decline between fry and parr numbers and is probably the result of the habitat surveyed as this situation has been common in previous years.

Average trout densities are also higher than in previous years, although the difference is less marked than that observed in the salmon population. This is likely to reflect the presence of a resident

population as well as migratory one, which will serve to smooth out the annual variability in marine survival. That trout density is lower than salmon within this survey and reflects the habitat surveyed along with the fact that the east side of the loch, which is known to provide significant trout spawning, was not surveyed.

In contrast to the salmon population, trout densities declined from fry to parr. This will have been the result of natural density dependent mortality, and the greater use of the loch by trout parr when displaced from the tributaries. It is known from other areas that salmon will displace trout from optimal habitats and thus the increased movement of trout parr into the loch compared to salmon. However, it must be noted that the average juvenile salmonid densities within the Hope catchment are at or above the Sutherland average for both species.

From this survey it would appear that the juvenile salmon and trout population within the Hope catchment remains stable. Variability observed within the population does not appear to have a long term pattern, reflecting annual variations in environmental conditions affecting sampling efficiency rather than a lack of spawning. This is encouraging for the long term viability of the populations, although the low adult returns, as reflected by rod catch, compared to historic levels would suggest that conservation measures should be retained for the time being. In particular the use of catch and release or bag limits should be encouraged.

2. Polla catchment

The Polla catchment could not be sampled in the normal manner as a result of extremely low flows at the time. However spot samples were undertaken in different areas in order to collect genetic samples from the lower, middle and upper reaches. During this sampling a large number of salmon were observed in all parts of the system. This demonstrated that the juvenile salmon population appears to be healthy. Unfortunately few trout were observed. This may have been the result of site selection, but leads to some concern about the current status of this predominantly sea trout system. As such, it is proposed that a full survey be undertaken in 2009.

3. Dionard 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 m².

Table 3.1 Electrofishing site details

Code	Easting	Northing	Altitude	River	Situation
DI1	236236	947780	110	Allt an Easain Gyl	Upstream of the junction
DI2	236169	947787	110	Dionard	In meanders beyond the junction
DI3	235380	949678	105	Dionard	Just below the loch
DI4	235327	949918	95	White Burn	Below bridge
DI5	235354	950463	105	Leafy burn	Below bridge
DI6	234467	952312	95	Dugals Burn	20m below bridge, before bend
DI7	233149	954287	80	Maggies Burn	From junction with river to top of track
DI8	231711	956759	140	Gualin Burn	By road between bend and quarry
DI9	233743	957902	25	Rhigolter Burn	Near track just before junction with other tributary
DI10	233671	958506	25	Red burn	15m upstream from main stem, under tree
DI11	235449	959664	20	Colonels Burn	From river junction to narrowing of river
DI12	236052	960491	15	Allt Ach na Cailce	10m upstream of watergate, pointed rock to big boulders
DI13	236200	961600	5	Allt Dail na Cra	10m upstream of junction with main stem, gravel bar on left bank

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
DI1	12.4	3.17	39.27	43.29	20.37	12.73	2.55
DI2	8.7	5.27	45.82	50.20	6.55	6.55	2.18
DI3	4.8	19.05	91.44	10.94	6.56	0.00	4.37
DI4	9.3	4.00	37.20	0.00	0.00	0.00	0.00
DI5	11.7	1.57	18.33	0.00	32.73	0.00	5.46
DI6	7	4.50	31.50	3.17	9.52	0.00	3.17
DI7	8.7	3.60	31.32	3.19	0.00	3.19	0.00
DI8	6.3	3.43	21.63	9.25	9.25	0.00	4.62
DI9	11.7	2.60	30.42	46.02	13.15	6.57	13.15
DI10	19	3.93	74.73	12.04	2.68	1.34	8.03
DI11	11	1.17	12.83	0.00	0.00	77.92	7.79
DI12	6.1	2.23	13.62	7.34	7.34	7.34	14.68
DI13	14	3.80	53.20	5.64	15.04	3.76	3.76

The maximum, minimum and mean densities are given for all sites (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 all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	18.12	6.19
Salmon parr	0.00	40.04	12.16
Trout fry	0.00	47.27	13.22
Trout parr	1.21	16.31	8.89

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 DI2 and DI4. Greatest densities were recorded in DI3. Three - spined sticklebacks were found in low density in DI10 only, while juvenile plaice were recorded in DI13. There were no minnows recorded within the system.

Discussion

While efforts were made to ensure that the sites surveyed were similar to those used in 1996, based on grid references, without photographic or descriptive guidance it is probable that they were at slightly different locations. This will affect the habitat surveyed and therefore the densities of fish observed, either species or life stage. This will be relevant to the following discussion and should be borne in mind.

The average densities of salmon fry within this survey were significantly lower than those found in 1996. However an assessment of the densities recorded at individual sites suggests that this is the result of changes in DI5 (Leafy Burn) and DI11 (Colonels Burn) only. This may reflect habitat changes or a change in the site location, with some doubt existing as to whether 'Colonel's Burn' was sampled, despite a match in grid reference. The remaining sites showed a similarity, or increase, in fry density when compared to 1996.

Salmon parr, in contrast, showed an increase in average density, although the range of ages recorded in 1996 was not seen here. This would suggest that the productivity of the system has increased, leading to an increase in growth rates and decrease in age at smolting. However an invertebrate study would be required to support this. The increase in parr density observed could also reflect the different sites selected within this study and changes in condition at the time.

Trout populations in the Dionard have also shown a significant increase in density, although this is more marked in fry than parr. This, together with the changes in salmon density would indicate that the juvenile fish population within the Dionard is stable or slightly increasing. These values are reasonable although not proving that the system is currently at its carrying capacity. With the exception of salmon fry, all densities recorded were greater than the Sutherland average for 2008, this being significant in

the case of salmon parr and trout fry. While salmon parr were below the average for the area, this was not significant.

No fish were recorded in DI4 (White Burn). This was the result of an extremely low conductivity within the burn which rendered electrofishing an inefficient sampling method. Fish were observed within the site, primarily fry, although the species is unknown. Fish were captured at all other sites, although densities, species and life stage varied as a result of available habitat. Several fish were missed in DI3 as a result of instream vegetation and the nature of substrate which was predominantly boulder and enabled the fish to evade the nets.

4. Achriesgill 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 m².

Table 4.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
GL1	225700	954100	10	In main river, just above bridge
GL2	226600	953100	70	Down from water work, across from ruin
GL3	227100	953900	35	Down from double passing place, by boulder pile on bend of river

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
GL1	12.1	5.87	70.99	19.72	5.63	0.00	1.41
GL2	12.2	6.50	79.30	0.00	2.52	8.83	20.18
GL3	11.4	6.47	73.72	4.07	31.20	1.36	1.36

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	0.00	19.72	7.93
Salmon parr	2.52	31.20	13.12
Trout fry	0.00	8.83	3.39
Trout parr	1.36	20.18	7.65

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

Eels were present in low densities at all sites. No other species were recorded.

Discussion

The 2008 survey results were encouraging, with average densities of salmon being 6 – 7 times higher than in previous years. It is probable that this reflects the increased numbers of adult salmon reported within the Sutherland area over the past few years rather than a change in habitat over this time. This can be inferred from the fact that the trout densities are similar to previous years. It does, however, indicate that the removal of the dam has not had a long-term negative impact on the migratory population, and if anything may have improved the situation.

The average densities of salmon and trout parr recorded in this survey are above average for the Sutherland area, while trout fry densities are significantly below average. Parr densities for both species are greater than fry densities and this is likely to reflect the habitat sampled rather than an issue with the fish populations. This situation has been recorded on all other sampling occasions.

In 2008 a release of silt was noted from the new water treatment works. This was reported to SEPA and resulted in the rapid improvement of the situation by the construction company. While this may have

had an adverse effect on the burn through silting of the sediment, it is unlikely to be extreme given the timing of the incident and the rapid response to reduce the problem.

5. Oldshoremore 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 m².

Table 5.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
OM1	221800	958950	55	Near head of Loch Aisir Mor
OM2	222100	958700	65	Pool-riffle in gully, rise to the left bank
OM3	222800	958300	80	Before glide, at widest part of the channel

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
OM1	11.5	4.20	48.30	37.27	16.56	18.63	0.00
OM2	10.5	2.87	30.10	16.61	9.97	0.00	0.00
OM3	11	3.63	39.97	7.51	5.00	10.01	5.00

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.

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

	Minimum	Maximum	Mean
Salmon fry	7.51	37.27	20.46
Salmon parr	5.00	16.56	10.51
Trout fry	0.00	18.63	9.55
Trout parr	0.00	5.00	1.67

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

Eels were present in OM1 and OM2 only, with the greatest densities in OM1. No other species were observed.

Discussion

There are significant interannual variations in density of both salmon and trout. The densities on both species, with the exception of trout parr, are significantly higher than those observed in previous years. This would suggest that the migratory populations within the Oldshoremore catchment are variable and require careful management to ensure that over-exploitation does not occur. This is particularly important given the high returns likely to have been seen in the past few years.

That trout do not show the same pattern as salmon, particularly with regards to trout parr, reflects the situation seen in other parts of the area of increasing salmon rod catches, and therefore adult returns, coupled with a decline in sea trout returns.

With the exception of trout parr, which are significantly below average for the area, juvenile salmon and trout populations are above average for the area. In the case of trout parr this may reflect the habitat surveyed and the increasing salmon population which may have displaced the trout to other areas.

6. Loch na Thull catchment

Table 6.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 6.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 6.1 Electrofishing site details

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

Table 6.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
NT1	9.2	4.27	39.25	38.21	10.19	10.19	0.00
NT2	9.5	5.10	48.45	0.00	0.00	18.58	0.00
NT3	14	2.43	34.07	0.00	5.87	26.42	2.94
NT7	9.3	3.10	28.83	6.94	41.62	3.47	17.34

The maximum, minimum and mean densities are given for all sites (Table 6.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 6.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	38.21	11.29
Salmon parr	0.00	41.62	14.42
Trout fry	3.47	26.42	14.66
Trout parr	0.00	17.34	5.07

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

Eels were present in low numbers at all sites. There were no other species found within the survey.

Discussion

Interannual variations in juvenile salmonid densities are apparent over the monitoring period, being particularly pronounced within the salmon population. This would suggest that there is a strong resident trout population within the system that maintains the stability of the juvenile trout densities.

Salmon densities are lower than those seen in 2007 but are approximately in the middle of the range observed previously. As sampling efficiency is influenced by a range of factors, this would suggest that the Loch na Thull salmon population is relatively stable. Trout fry densities are also lower than those recorded in 2007, while trout parr showed an increase. However, trout populations were at the upper end of the range recorded previously and also indicate a stable population.

That the juvenile salmonid populations are healthy can be inferred from the fact that, with the exception of trout parr, all are significantly greater than the Sutherland average. While trout parr are slightly below average this is likely to reflect the habitat surveyed rather than issues with the population as a similar feature has been seen previously.

7. Laxford 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 m².

The maximum, minimum and mean densities are given for all sites (Table 7.3a), tributaries of Loch Stack (Table 3b) and sites within the River Laxford (Table 7.3c). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Three year classes (0+ - 2+) are discernible within the salmon population and two (0+ - 1+) within the trout.

Eels were present in low densities at all sites with the exception of FTS2. Minnows were present in low densities in FTS7 only. No other species were present.

Table 7.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
FTS2	229970	943573	45	In tributary, from junction to narrowing
FTS4	229759	943791	50	Between 2 riffles
FTS5	229545	944038	60	Above pool to large rock
FTS7	228815	945061	60	Between two bends, between two lochs
STS1	223719	946819	10	On left bank, in eddy, from tree to gravel bar
STS2A	224173	946962	10	In side channel on left bank
STS2B	224311	946938	10	In side channel on right bank
STS4	225032	946605	30	In main channel, on right bank, to midstream. From small rock to large rock

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
FTS2	15	1.17	17.50	11.43	5.71	11.43	0.00
FTS4	21	2.63	55.30	10.85	9.04	0.00	0.00
FTS5	15.4	2.33	35.93	11.13	19.48	8.35	0.00
FTS7	18.5	1.40	25.90	0.00	7.72	11.58	7.72
STS1	13.4	4.33	58.07	13.78	8.61	0.00	0.00
STS2A	17.4	5.50	95.70	4.18	1.04	1.04	0.00
STS2B	20.2	4.93	99.65	1.00	6.02	0.00	0.00
STS4	13.5	7.83	105.75	5.67	2.84	0.00	0.00

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

	Minimum	Maximum	Mean
Salmon fry	0.00	13.78	7.26
Salmon parr	1.04	19.48	7.56
Trout fry	0.00	11.58	4.05
Trout parr	0.00	7.72	0.97

Table 7.3b A summary of the densities determined for tributaries on Loch Stack

	Minimum	Maximum	Mean
Salmon fry	0.00	11.43	8.35
Salmon parr	5.71	19.48	10.49
Trout fry	0.00	11.58	7.84
Trout parr	0.00	7.72	1.93

Table 7.3c A summary of the densities determined within the River Laxford

	Minimum	Maximum	Mean
Salmon fry	1.00	13.78	6.16
Salmon parr	1.04	8.61	4.63
Trout fry	0.00	1.04	0.26
Trout parr	0.00	0.00	0.00

Discussion

The sites surveyed were within the traditional salmon spawning areas, as determined from previous surveys, and this is reflected within the results. In particular the lack of trout spawning within the river was well demonstrated. This sampling bias is also apparent when comparing the results to the Sutherland average, with trout densities significantly below average, while salmon densities were slightly above average. These results indicate that the salmon population within the Laxford is relatively healthy for the area.

The sites selected were not optimal, in some cases with respect to sampling design and others with habitat, where efforts were made to sample specific areas. In particular, sampling of the main stem creates difficulties with this method of electrofishing and is therefore likely to have under-estimated the size of the population. This again serves to highlight the reasonable size of the juvenile salmon population within the Laxford system.

8. Bad na Baighe 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 m².

Table 8.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
BB1	222100	946500	10	30m from boundary fence
BB2	222700	946000	20	Near loch
BB4	222400	945400	50	Above falls on way to junctions of 3 tributaries
BB5	222500	945500	30	Downstream, in riffle area
BB6	222700	945600	25	Deep pool
BB7	223000	945600	15	By loch

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
BB1	12.3	5.53	68.06	0.00	1.47	5.88	1.47
BB2	9.3	4.30	39.99	0.00	2.50	0.00	7.50
BB4	7.2	2.80	20.16	0.00	0.00	0.00	0.00
BB5	12.3	3.70	45.51	0.00	19.78	0.00	8.79
BB6	18.8	3.60	67.68	0.00	14.78	5.91	4.43
BB7	21.5	3.07	65.93	10.62	6.07	9.10	3.03

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	10.62	1.77
Salmon parr	0.00	19.78	7.43
Trout fry	0.00	9.10	3.48
Trout parr	0.00	8.79	4.20

Two year classes (0+ - 1+) are discernible within the salmon and four (0+ - 3+) within the trout populations.

Eels were present at all sites within the catchment. Greatest densities were recorded in BB1, BB2 and BB7. No other fish species were found.

Discussion

The average densities of trout fry within this survey were higher than those found in previous years, with the exception of 1999. Similar variations are evident within the parr population, with 2008 densities lying within the range observed. This would suggest that overall trout densities within the system are relatively stable. Trout densities recorded during 2008 are, however, below average for the Sutherland area.

Average salmon fry densities, by contrast, are lower than that recorded in any other year, while parr densities are within the range observed previously. While this may be the result of the extremes of weather noted during 2007 and 2008, this seems unlikely given the success of the trout population. It is likely that the small population in Bad na Baighe is such that large fluctuations may result from the loss of a small number of adults and therefore this does not indicate a large decline in the salmon

population. However this should be regularly monitored. Comparisons with the west Sutherland average indicate that salmon fry densities are significantly below average, while parr are slightly above average.

9. Claise na Fearn 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 m².

Table 9.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
Outflow 3	220600	947700	10	In the trees, close to the end, downstream of a bend
04	220600	947500	30	Upstream of the trees, downstream of bend in river
Bmain3	220000	946400	50	Just above small falls, near road bridge
Bmain5	219700	946200	55	Downstream of bend in river, opposite Council Depot
bmain6	219700	946100	60	Glide near house
Bmain8	219500	945800	60	Near Loch a Bhagh Ghaimhica

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
Outflow 3	9	2.73	24.60	12.20	0.00	12.20	8.13
04	9.2	3.00	27.60	18.12	0.00	7.25	10.87
Bmain3	15.9	2.70	42.93	0.00	0.00	0.00	16.31
Bmain5	14.7	2.43	35.77	5.59	19.57	8.39	8.39
bmain6	19.5	2.43	47.45	0.00	40.04	4.21	8.43
Bmain8	25	3.30	82.50	1.21	13.33	47.27	1.21

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	18.12	6.19
Salmon parr	0.00	40.04	12.16
Trout fry	0.00	47.27	13.22
Trout parr	1.21	16.31	8.89

Two year classes (0+ - 1+) are discernible within the salmon and four (0+ - 3+) within the trout populations.

Eels were present in low density at all sites with the exception of Bmain3. Minnows were only present in Bmain3.

Discussion

The average densities of trout found during this survey were lower than those found in previous years, both for fry and parr. Salmon fry densities were also lower than those seen in 2002 and 2006, although parr densities were higher. Salmon fry densities, however, have shown an increase from none in 1998 to the highs seen in 2006 before this slight reduction, while parr densities continue to increase.

Densities of total salmonids within the system have shown a similar increase with time. Although fry densities in 2008 were lower than in previous years, parr densities continued to increase. This may reflect either a change in the habitat within the survey sites from fry to parr, or a problem with spawning in 2007/08. This is the more likely explanation with a wet winter, followed by a particularly dry spring, having the potential to impact on the juveniles through either redd washout or the desiccation of the alevin.

The increasing densities of salmon within the system are encouraging, although the decline in trout is less acceptable. However it is known that salmon juveniles will outcompete trout for optimal habitat and as the overall density of salmonids within the system has also increased it would suggest that trout are being displaced to other areas. This trend follows that of the catch records for the area which indicate a massive increase in the rod catch of salmon over the last 3 to 4 years while trout catches have remained relatively static.

Despite the decrease in densities with the Claise na Fearn system witnessed in 2008, the observed densities were still above average for the area in all species and stages with the exception of salmon fry, which were found to be about average for the area.

10. Loch nam Brac 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 m².

Table 10.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
NB1	218300	947200	70	by lochside
NB2	218400	947150	70	upstream of road culvert
NBA1	218100	948700	70	between two riffles just below loch
NBA2	217400	948800	70	downstream of small waterfall
NBA3	218400	949300	50	below road culvert

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
NB1	18.8	1.57	29.45	0.00	0.00	37.35	27.16
NB2	20	1.30	26.00	0.00	0.00	7.69	19.23
NBA1	10.2	2.53	25.84	0.00	0.00	7.74	0.00
NBA2	12	3.23	38.80	0.00	0.00	30.93	12.89
NBA3	30	2.93	88.00	0.00	0.00	36.36	7.95

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	0.00	0.00
Salmon parr	0.00	0.00	0.00
Trout fry	7.69	37.35	24.01
Trout parr	0.00	27.16	13.45

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

Eels were present at NBA2 and NBA3 only, with the greatest density in NBA3. Minnows were present at NB1, NBA1 and NBA2, the lowest densities being found at NBA2.

Discussion

Surveyed annually since 2000, the Loch nam Brac trout population shows interannual variations, with no pattern apparent. The average densities of both fry and parr remain significantly higher than the Sutherland average. Fry densities are, however, lower than those recorded at any point since 2000.

Parr densities, in contrast, are greater than those recorded in 2007 and are at the top end of the range of values noted since 2000. Despite this, fry continue to dominate the samples, reflecting the habitat at the survey sites and the presence of the loch and deep glides in the outflow. Parr migration into these areas would account for the declining density between fry and parr despite the lack of a migratory population.

Despite this reduction in fry, the population appears to comprise a good mix of age classes and remain healthy. This would suggest that any impacts resulting from the algal bloom have now passed and it is proposed that the catchment revert to a two yearly sampling programme, in line with other catchments within the area.

11. Loch a Bhadaidh Daraich 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 m².

Table 11.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
BD1	216000	944700	20	Below loch
BD2	215600	944800	10	Below house, by reeds and wall
BD3	216500	944300	25	By the big boulder
BD4	216300	944200	35	Between small rocks and higher barrier (with heather in middle of barrier)
BD5	216300	944100	45	Just below loch

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 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
BD1	16.5	2.93	48.40	0.00	0.00	24.79	20.66
BD2	24	2.20	52.80	0.00	0.00	9.47	18.94
BD3	15.6	1.55	24.18	0.00	0.00	41.36	45.49
BD4	11.4	2.20	25.08	0.00	0.00	7.97	3.99
BD5	22	2.86	62.98	0.00	0.00	20.64	3.18

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	0.00	0.00
Salmon parr	0.00	0.00	0.00
Trout fry	7.97	41.36	20.85
Trout parr	3.18	45.49	18.45

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

Eels were present at all sites with the exception of BD5. Greatest densities were recorded in BD2 where large numbers of elvers were found together with eels of other sizes. Minnows were present in BD3, BD4 and BD5, with the greatest density in BD5.

Discussion

The average densities of trout fry within this survey are generally lower than those found in previous years, although interannual variations are apparent and the differences are not large. It is possible that extreme low water levels at the time of hatching may have had an effect on fry densities. Trout parr densities, however, are greater than those encountered in all previous years with the exception of 2005. This would suggest that there has been a habitat shift within the system in favour of parr at the sampling sites as there does not appear to be any concern about the population itself, with high densities of fry still being recorded. Trout densities within the system are significantly above average for the Sutherland area.

The recorded conductivities remain exceptionally high for the area, with a high silt content in BD5. This is similar to the previous findings for the system, something that was previously attributed to the Council Yard. It is likely that this is still the cause of these findings, despite the closure of the yard

several years ago, as there will be a high salt content remaining within the sediments. In addition, the physical nature of BD5 is such that silt deposition rather than removal will be encouraged.

No sea trout were encountered in sampling or observed within the burns. However, it is still hoped that sea trout can be encouraged to re-enter the system. It is recommended that remedial works within the main tributary are completed as a matter of urgency and the stocking of the system with sea trout ova has been approved for 2009. The current survey will be extended at this time to cover the stocked areas and monitor the health of the fry. In addition, it is recommended that the smolt trap be installed in the outflow to monitor the presence of any smolt run.

12. Duart catchment

Table 12.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 12.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 12.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
D1	219800	937400	30	Just above loch, below hatchery
D2	220100	937400	40	Above hatchery, just before bend into waterfall pool. From the first trees to the riffle
D3	218300	937200	50	In riffle, just before bend down to falls
D4	219000	937400	25	Right braid of river between the two lochs
D5	221400	936400	60	Near mouth of river, just after boulder bar before sharp bend
D6	221400	936200	60	Approx. 100m from loch, just before small fall at bend. Near stock fence on right.
D7	221200	936100	60	At base of burn, starting at loch. By pinnacle of hill
D8	221000	936200	60	Left braid of riffle below Loch Allt nan Ramh
D9	220600	936400	50	In riffle area above Loch Yucal, by corner of deer fence

Table 12.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
D1	10.2	13.87	141.44	0.00	0.00	5.66	0.00
D2	17.2	4.33	74.53	0.00	0.00	1.34	2.68
D3	9.3	31.05	288.77	4.16	0.35	10.74	0.35
D4	12.2	4.52	55.18	1.81	0.00	0.00	0.00
D5	13.8	6.18	85.33	9.38	3.52	17.58	11.72
D6	13.5	3.66	49.46	0.00	8.09	4.04	2.02
D7	13.1	0.70	9.17	0.00	10.91	21.81	0.00
D8	12	12.00	144.00	0.00	0.69	1.39	0.69
D9	13.1	6.35	83.19	0.00	3.61	1.20	0.00

The maximum, minimum and mean densities are given for all sites (Table 12.3a), sites below and around Duartmore hatchery (Table 12.3b) and sites around Loch Allt nam Ramh (Table 12.3c). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 12.3a A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	9.38	1.70
Salmon parr	0.00	10.91	3.02
Trout fry	0.00	21.81	7.08
Trout parr	0.00	11.72	1.94

Table 12.3b A summary of the densities determined for sites below and around Duartmore hatchery

	Minimum	Maximum	Mean
Salmon fry	0.00	4.16	1.49
Salmon parr	0.00	0.35	0.09
Trout fry	0.00	10.74	4.43
Trout parr	0.00	2.68	0.76

Table 12.3c A summary of the densities determined for sites around Loch Allt nan Ramh

	Minimum	Maximum	Mean
Salmon fry	0.00	9.38	1.88
Salmon parr	0.69	10.91	5.36
Trout fry	1.20	21.81	9.20
Trout parr	0.00	11.72	2.89

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

Eels were present at D1, D2, D3, D4 and D8, and in greatest density at D1 and D4. The eels at D1 were a mix of sizes, some very large, possibly due to higher nutrient levels, reflected in the excess weed growth and therefore greater food availability. Minnows were only present at D1, D2 and D3, with the greatest density at D3.

Discussion

The average densities of salmon and trout recorded within the Duart system have shown extreme variability since 1998. However, with the exception of trout fry, values recorded in this survey are at the lower end of the range. This is particularly true for sites below the hatchery, although this may reflect the high weed growth in D1 reducing the sampling efficiency at this site. On previous occasions this site has shown high densities of juveniles.

Trout densities above the hatchery are within the range of observed values, while salmon are again at the lower end of the range. This would indicate that there has been a low return of salmon to the system in the last 2 years, contrary to the situation in other Sutherland systems. However the variability in juvenile populations observed over the past 10 years would suggest that access to the system may be an issue. This is likely to be linked to weather conditions, where fish are only able to access the system under certain circumstances rather than habitat changes.

The average densities observed within the Duart system are significantly below the Sutherland average for all species and stages, with the exception of trout fry. While still below average, the variability is less marked.

It should also be noted that a set line was also found below the bridge at the hatchery, this is an illegal method of fishing and was reported.

13. Glendhu catchment

This report covers the catchments of Abhainn a' Ghlinne Dhuibh and Abhainn an Loch Bhig.

Table 13.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 13.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 13.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
GD1	229100	933400	25	Glendhu. From top of gabion basket (LB) to just before large rock on right and pile of 3 rocks on left
GD2	229392	933264	25	Glendhu. In riffle below large pool
BW1	227800	928500	15	Loch Bigh. Large boulder on right, below escarpment, to riffle. 20m
BW2	228100	927900	35	Loch Bigh. By rock on left, in view of waterfall. Between shoulders of both hills

Table 13.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
GD1	29.5	9.80	289.10	0.00	0.00	0.00	7.26
GD2	8.4	11.73	98.56	0.00	0.00	0.00	2.03
BW1	13.4	7.03	94.25	0.00	0.00	1.06	8.49
BW2	12	8.23	98.80	0.00	0.00	0.00	5.06

The maximum, minimum and mean densities are given for all sites (Table 13.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 13.3 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	1.06	0.27
Trout parr	2.03	8.49	5.71

Three year classes (0+ - 2+) are discernible within the juvenile trout population, with one finnock also caught.

Eels were present in low densities at all sites with the exception of BW2.

Discussion

There were no salmon recorded within the survey. This repeats previous findings, although it is known that the system is accessible to migratory salmonids through the presence of finnock in the catch. Adults were also seen at the falls at Glendhu at the time of survey, although definitive ID was difficult. In addition, large numbers of salmon were historically taken from the systems, particularly Glendhu. The lack of salmon is therefore something that could be addressed in the future. It is likely that the primarily cause of the extinction was a change in habitat, particularly the loss of adult holding pools and insufficient spawning habitat.

The average density of both trout fry and parr are below the Sutherland average. Densities are however, similar to those found in previous years indicating that the population is stable. Parr densities are higher than fry density at all sites. This reflects the habitat surveyed, particularly in Glendhu, rather than the population structure within the system. All sites were within the main stem, while high numbers of fry were observed in the tributaries while walking the system.

14. Gleann Leireag catchment

Table 14.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 14.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

The maximum, minimum and mean densities are given for all sites (Table 3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

One year class (1+) is discernible within the salmon and three (0+ - 2+) within the trout populations.

Table 14.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
TS1	214969	931336	20	Behind fish farm, below falls
2.4	215373	930999	30	In trees and gorge
TS3B	215849	930816	75	Just before braid, from riffle to barrier in main stem, by bottom of braid
TS4	216051	930674	75	Below braid, from riffle to split at bottom of braid

Table 14.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
TS1	10.5	6.63	69.65	0.00	1.44	1.44	2.87
2.4	17.9	2.73	48.93	0.00	0.00	2.04	8.18
TS3B	10.5	4.17	43.75	0.00	0.00	4.57	18.29
TS4	12.5	6.20	77.50	0.00	0.00	2.58	6.45

Table 14.3 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	1.44	0.36
Trout fry	1.44	4.57	2.66
Trout parr	2.87	18.29	8.95

Eels were present at all sites, with the greatest density recorded in TS1. No other species were recorded in the survey.

Discussion

Salmon were only present in TS1, the site below the falls. This would suggest that the falls are a barrier to migration within the system. In contrast, trout were found throughout the system, with the highest densities found in TS3B. Parr density was consistently higher than that of fry and is likely to reflect the absence of a migratory population as well as the habitat sampled.

Trout fry densities were below the Sutherland average, while those of parr were above average for the area. This further indicates that the habitat surveyed was a factor in determining the population dynamics observed within this system.

15. Manse catchment

Table 15.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 15.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 15.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
ML1	208200	924700	15	By road, from overhanging beech on right to next tree up and rowan on left
ML2	208400	924900	30	Above bridge, where path opens out before irises
ML3	208800	924950	35	By sluice

Table 15.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
ML1	9.3	6.90	64.17	28.05	4.68	1.56	1.56
ML2	12.8	5.77	73.81	21.68	20.32	12.19	4.06
ML3	13.5	7.13	96.30	0.00	0.00	0.00	3.12

The maximum, minimum and mean densities are given for all sites (Table 15.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 15.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	28.05	16.58
Salmon parr	0.00	20.32	8.33
Trout fry	0.00	12.19	4.58
Trout parr	1.56	4.06	2.91

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

Eels were present in reasonable densities at all sites. Minnows were present in reasonable density in ML2 only.

Discussion

Interannual variations in density within the Manse outflow are exceptionally high for all species and life stages. This would indicate the population is migratory and strongly influenced by environmental factors affecting access to the system. Thus the populations are more transitory than others within the area and will require careful management to ensure the over exploitation does not occur.

The 2008 results show that the salmon densities were at the higher end of the range observed previously and that, in line with other catchments within the area, salmon have had good returns to the system over the past few years. In contrast, trout densities were at the lower end of the range and demonstrate that trout returns have been poorer. This also agrees with findings from other catchments.

Salmon densities within the Manse catchment are above average for the Sutherland area, significantly so in the case of salmon fry, while trout densities are below average.

16. Inver catchment

Table 16.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 16.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 16.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
I4A	212300	923700	50	Allt na-h-Airbhe, at the mouth of the tributary near Brackloch.
I4B	212700	923600	50	Allt na-h-Airbhe, 400 m upstream from the river
I11C	215150	924600	65	Allt an Tiaghaich, just above deer fence to mossy rock on right
I23	220700	925800	80	Allt na Doire, between bridge on new road and old road
I30A	223500	924400	60	Skiag, at road junction
I32A	224120	923800	70	By Ardvreck Castle, right tributary at mouth of loch
I32B	224100	923800	70	By Ardvreck Castle, left tributary at mouth of loch
LB1	214050	925300	65	River out of Loch Beannach, by large rock in stream
LB2	214100	925500	65	In left hand braid, below Loch Uidh na Geadaig
LB3	213600	925500	65	Just below Loch Bad nan Aighean
LB4	213400	926000	70	Just below Loch Beannach

Table 16.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
I4A	24.6	4.70	115.62	6.05	16.43	1.73	6.05
I4B	12	3.63	43.60	4.59	20.64	6.88	9.17
I11C	17	7.90	134.30	5.21	8.94	0.74	0.00
I23	14	2.50	35.00	0.00	0.00	14.29	17.14
I30A	11.2	4.70	52.64	22.80	22.80	1.90	3.80
I32A	8.7	3.00	26.10	0.00	0.00	0.00	0.00
I32B	11	5.30	58.30	1.72	0.00	0.00	0.00
LB1	11.6	6.93	80.43	3.73	1.24	6.22	1.24
LB2	8	1.73	13.87	0.00	0.00	0.00	0.00
LB3	15	4.87	73.00	0.00	1.37	0.00	4.11
LB4	8.6	3.57	30.67	6.52	16.30	0.00	0.00

The maximum, minimum and mean densities are given for all sites (Table 16.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 16.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	22.80	4.60
Salmon parr	0.00	22.80	7.97
Trout fry	0.00	14.29	2.89
Trout parr	0.00	17.14	3.77

Within this graph, one year class (0+) is discernible within the salmon and three (0+ - 2+) within the trout populations.

Minnows were found at 3 sites, LB1, LB2 and LB3, with highest densities being at LB3. No other species were recorded within the survey.

Discussion

Interannual variations are high throughout the monitoring period within the Inver. However, the average densities of juvenile salmonids recorded in 2008 are, with the exception of trout parr, are very low compared to previous years. In addition, all, with the exception of salmon parr, are below the average for the area. Trout parr, while low, remain within the range seen previously. The greatest decline appears to be in the salmon fry density, although it is likely that this is partly as a result of the tributaries I33 and I35 not being sampled in 2008. In previous years these tributaries have shown exceptionally high densities of salmon, which will have increased the overall average.

Unfortunately, the 2008 densities of both species are significantly depressed compared to other years and as such reflect a depression in spawning success and/or juvenile survival over the past 2 years. No obvious habitat issues were noted during the survey, although environmental factors cannot be ruled out by this. The artificial spate in 2004, followed by a drying of the river to allow repairs, could potentially have severely damaged that particular component of the stock. While only directly affecting the main river, there will have been impacts on other areas of the catchment, in addition to the fact that the majority of sampling on this occasion occurred within the river tributaries.

17. Culag catchment

Table 17.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 17.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 17.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
CG1	210600	921700	45	Below bridge on Glen Loch, near inlet on right bank
CG2	210000	921700	25	Riffle adjacent to side braid on left bank, approximately 70 m upstream of School Loch
CG3	210000	921800	25	Just above loch, below bend in muddy area

Table 17.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
CG1	11.7	14.60	170.82	2.93	1.76	5.27	0.00
CG2	8.8	15.27	134.35	11.17	0.74	0.74	0.00
CG3	18.3	3.47	63.44	4.73	0.00	0.00	0.00

The maximum, minimum and mean densities are given for all sites (Table 17.3). 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 and one (0+) within the trout populations.

Eels were present in low density in CG1 and CG2. Minnows were present in CG2 and CG3, with densities of juveniles exceptionally high in CG3.

Table 17.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	2.93	11.17	6.27
Salmon parr	0.00	1.76	0.83
Trout fry	0.00	5.27	2.00
Trout parr	0.00	0.00	0.00

Discussion

The average densities of salmon and trout observed within this survey were lower than those recorded previously, with the exception of trout fry which showed a slightly higher density. From the results obtained in this and previous surveys it can be seen that the sites sampled are primarily suitable habitat for fry rather than parr, with salmon dominating. This is likely to be a reflection of the survey sites alone rather than the population structure of the system.

The selected sites are difficult to fish, with weed growth in CG1 having increased since 2000. This will have resulted in a significant number of fish being missed within the survey and thus a potential underestimation of the numbers of fish within the site. Fish were also missed in CG2 as a result of higher than optimal flow rate. CG3 has poor habitat and a large number of juvenile minnows, which can outcompete salmonids when present in high numbers.

The average densities of fish recorded within the Culag system were below average for the Sutherland area. The exception to this was salmon fry, where densities were similar to the average. This again highlights the habitat as being more suitable to salmon fry than other species or life stages.

18. Badnaban catchment

Table 18.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 18.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 18.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
TS1	207757	921009	20	Behind houses, in trees
TS2	208017	920720	40	In canal type area, between gorse and overhanging tree
TS3	208435	920376	50	In sheep field, near the dip. Between tree and riffle
TS4	208834	920057	130	Below loch, in riffle area

Table 18.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
TS1	13	2.03	26.43	0.00	0.00	3.78	3.78
TS2	13	1.67	21.67	0.00	0.00	0.00	23.08
TS3	24.5	1.97	48.18	0.00	0.00	29.06	10.38
TS4	21	1.63	34.30	0.00	0.00	64.14	5.83

The maximum, minimum and mean densities are given for all sites (Table 18.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Three year classes (0+ - 2+) were discernible within the trout population.

Eels were present at all sites with greatest densities in TS4. No other species were recorded during the survey.

Table 18.3 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	64.14	24.24
Trout parr	3.78	23.08	10.77

Discussion

There were no salmon present within the system. However trout were found in high densities throughout, with the exception of TS1. This was a result of available habitat within TS1, which was exceptionally poor. Habitat also dictated the lack of fry in TS2, where the site was located within a glide and the fish found were mature adults.

The decline in density from fry to parr in TS3 and TS4 is as expected given density dependency factors within the fish populations. The patterns in density observed, together with the values involved, indicate that a healthy and dynamic trout population exists within the Badnaban catchment. The densities observed are significantly above average for the Sutherland area.

19. Gleann an Strathain catchment

Table 19.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 19.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 19.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
TS1	207714	917009	20	In gorge, by cliff face
TS3	208634	916319	25	In glide, by bend
TS4	208852	916135	30	In glide, upstream of bridge
TS5	209410	916516	40	Within trees, next to road

Table 19.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
TS1	20	3.57	71.33	0.00	1.40	5.61	16.82
TS3	27.2	1.63	44.43	6.75	9.00	4.50	33.76
TS4	7	5.53	38.73	10.33	5.16	7.75	0.00
TS5	12.5	2.30	28.75	17.39	17.39	13.91	24.35

The maximum, minimum and mean densities are given for all sites (Table 19.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 19.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	17.39	8.62
Salmon parr	1.40	17.39	8.24
Trout fry	4.50	13.91	7.94
Trout parr	0.00	33.76	18.73

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

Eels were present in low densities at all sites. No other species were recorded.

Discussion

While trout parr densities were higher than fry, salmon densities were similar for both fry and parr. The greater range of ages observed within the trout population may account for some of this difference, but

is unlikely to explain it all. It is therefore possible that the trout population in this catchment did not spawn as successfully in 2007 as the salmon, indicating issues with the number of returning adults.

Despite this, densities of both species and life stages were above average for the Sutherland area, indicating reasonably healthy populations.

20. Garvie catchment

Table 20.1 gives the grid reference, altitude and location of each site fished. The length, mean width and area fished are presented in Table 20.2, together with minimum estimates of density for salmon and trout fry (0+ years) and parr (>1 year) per 100 m².

Table 20.1 Electrofishing site details

Code	Easting	Northing	Altitude	Situation
G2B	213400	906400	70	Allt Claonaidh, in moorland
G3A	213800	906600	50	Downstream of ford over tributary
OB1	205200	911700	35	In the braids, by Keith's willow bundles in the first braid reached
OB2	205200	911650	35	Second braid, unimproved
OB3	205250	911650	40	Above large boulder in 1st main braid (OB2)
OB4	205250	911700	40	Centre braid, adjacent to Keiths boulders

Table 20.2 A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m²

Site code	Length (m)	Average Width (m)	Area (m ²)	Density (100 m ²)			
				Salmon fry	Salmon parr	Trout fry	Trout parr
G2B	12	6.10	73.20	0.00	5.46	2.73	4.10
G3A	6.5	2.73	17.77	0.00	0.00	0.00	0.00
OB1	9.3	2.00	18.60	5.38	0.00	0.00	0.00
OB2	7.3	2.37	17.28	0.00	0.00	17.36	5.79
OB3	8.8	5.27	46.35	6.47	8.63	0.00	6.47
OB4	8.5	4.63	39.38	10.16	5.08	5.08	2.54

The maximum, minimum and mean densities are given for all sites (Table 20.3). This summarises the data and allows comparisons within the system and with other systems within the west Sutherland area.

Table 20.3 A summary of the densities determined for all sites surveyed

	Minimum	Maximum	Mean
Salmon fry	0.00	10.16	3.67
Salmon parr	0.00	8.63	3.20
Trout fry	0.00	17.36	4.20
Trout parr	0.00	6.47	3.15

Two year classes (0+ - 1+) are discernible within the salmon population, while 3 (0+ - 2+) can be seen in the trout population.

Eels were present at low densities throughout the River Osgaig. Minnows were only present at G3A and OB2, with the greatest density at G3A.

Discussion

Poor weather at the time of undertaking this survey meant that several of the sites could not be visited on this occasion and G2B was marginal for effectiveness. This will have some effect on comparisons with other years, particularly as the sites sampled were primarily salmon rather than trout rivers.

Salmon fry and parr densities recorded in 2008 were similar to those found in previous years, although interannual variations were observed. This would suggest that the salmon population is stable within the catchment and that the tributaries surveyed covered that range of tributaries supporting salmon spawning. The latter is supported by the habitat surveys, which indicated that Allt Claonaidh and the River Osgaig form the main areas for salmon spawning within the catchment.

Trout densities, in contrast, are lower than previously observed. This is likely to be the result of G4 and G7 not being surveyed in 2008. Missed as a result of high water restricting access, these tributaries are the primary location of trout juveniles in previous years. An assessment of the individual sites indicates that trout densities are similar to those observed in previous years. This would indicate that the trout population is also stable.

Both salmon and trout densities within the Garvie catchment are below average for the Sutherland area.

21. Average for the West Sutherland Fisheries Trust area

The average densities of fish within each catchment are summarised (Table 21.1). 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 21.1 The average densities of salmon and trout per 100 m² within each catchment surveyed

Catchment	Density (100 m ²)			
	Salmon fry	Salmon parr	Trout fry	Trout parr
Hope	11.62	13.02	9.94	6.19
Dionard	6.19	12.16	13.22	8.89
Achriesgill	7.93	13.12	3.39	7.65
Oldshoremore	20.46	10.51	9.55	1.67
Loch na Thull	11.29	14.42	14.66	5.07
Laxford	7.26	7.56	4.05	0.97
Bad na Baighe	1.77	7.43	3.48	4.20
Claise na Fearn	6.19	12.16	13.22	8.89
Loch nam Brac	0.00	0.00	24.01	13.45
Bhadaidh Daraich	0.00	0.00	20.85	18.45
Duart	1.70	3.02	7.08	1.94
Gleann Dhub	0.00	0.00	0.27	5.71
Gleann Leireag	0.00	0.36	2.66	8.95
Manse	16.58	8.33	4.58	2.91
Inver	4.60	7.97	2.89	3.77
Culag	6.27	0.83	0.00	0.00
Badnaban	0.00	0.00	24.24	10.77
Gleann an Strathan	8.62	8.24	7.94	18.73
Garvie	3.67	3.20	4.20	3.15

From Fig 21.1 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 West Sutherland area shows a good mix of salmonid species, with trout present in all catchments with the exception of the Culag and salmon in most (Fig 22.2). The absence of trout from the Culag is likely to be a function of the habitat surveyed, as trout have been previously sampled in the Glen Loch. Eels are also common throughout the area, occurring in all of the systems examined, with the exception of the Inver. Minnow, in contrast, occurred with varying distributions in 9 out of the 20 systems, while 3-spined stickleback and plaice were found only in the Dionard.

Discussion

The results from this survey indicate that salmon and trout populations are dispersed throughout the area. With the exception of Glendhu, only rivers with restricted access to the sea did not support a salmon population, however small. These systems supported healthy trout populations. With regards to Glendhu, the poor habitat is likely to have affected this system and it is planned to remedy this in the coming year. Only in Gleann Leireag were missing year classes observed, with salmon fry absent from the sampling. This probably reflects the habitat at the survey sites, with salmon only located at one site

below the falls with habitat more suited to parr. All other systems had a range of age classes, with populations appearing 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. Stocking does not form a major part in the management of systems monitored in 2007, with the exception of the Laxford and Garvie. In the Laxford the system is stocked with salmon in the Lone tributary. However this will not have affected the sites sampled during 2008. The Garvie, in contrast, is stocked with trout eggs around Loch Osgaig. Results from this stocking would be expected in the OB sites, although there was little evidence of this activity within this survey with the possible exception of OB2. Other factors that may affect the results, compared to previous years, include water flow and temperature, with a wet summer affecting sampling efficiency and the ability to reach and survey many of the original sites.

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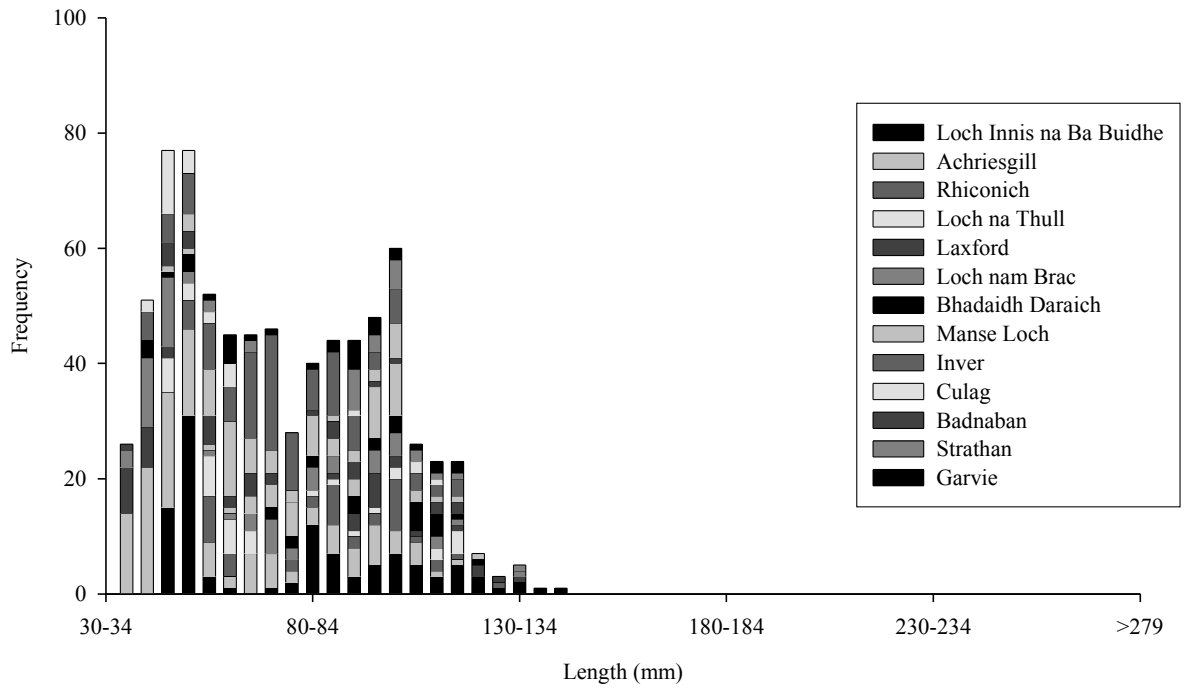


Fig. 21.1a The length - frequency distribution of salmon within the West Sutherland area

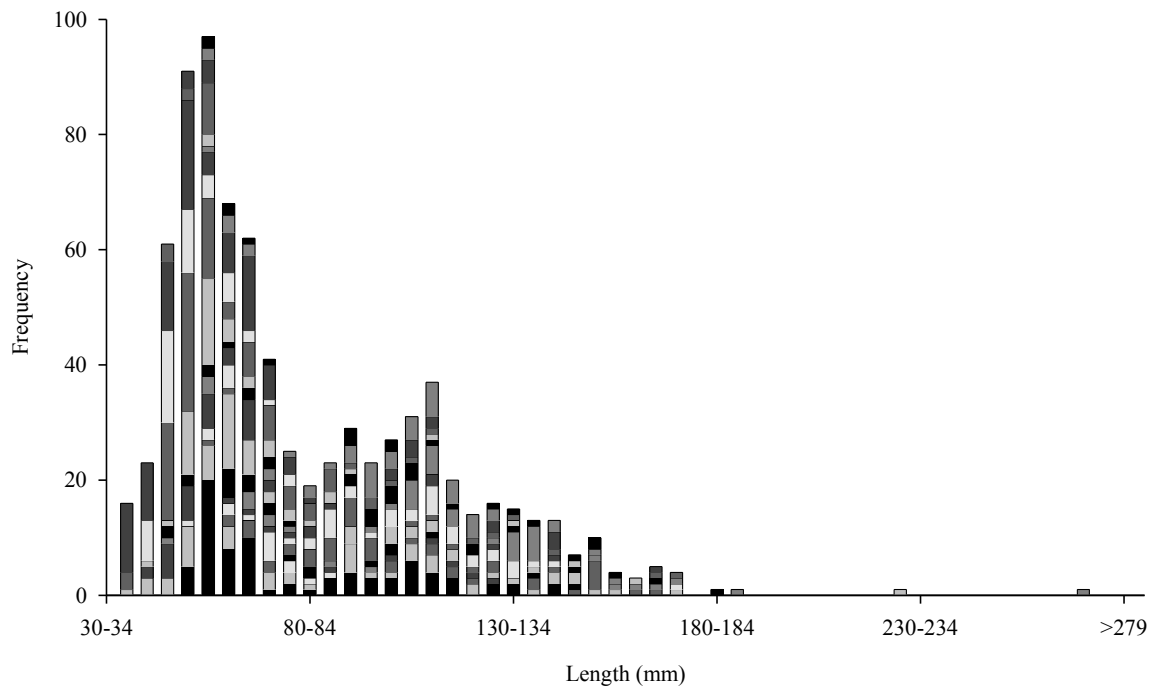


Fig. 21.1b The length - frequency distribution of trout within the West Sutherland area

