Update on electric fishing survey analysis (Nov, 2013)

So far, it has only been possible to examine the data for fry (ie. fish that hatched in 2013) because the scale-readings that will enable detailed examination of the parr (hatched in 2012, 2011 or 2010) are not yet available.

Table 6 from the draft report lists the sites surveyed and gives salmon fry and parr densities (ie. number of fish per square metre): the parr data are meantime for all ages combined.

The numbers are generally very good when judged against values expected from surveys carried out elsewhere in Scotland.

Table 6. Density of salmon.

River	Site name	Estimated true density ($n.m^{-2}$)	
		Fry	Parr
Forss	Cnoc-glas	0.39	0.15
	Shurrery	1.60	0.46
	Lythmore	1.79	0.45
Thurso	Rumsdale	1.13	0.20
	Dalganachan	2.45	0.26
	Dalnagletin	0.94	0.03
	Smerrary	1.45	0.31
	Dalemore	4.01	0.44
	Hoy	1.72	0.18
Wester/Lyth	Barrock Mill	+	+
Wick	The Clow	0.18	0.43
	Sheriff's	1.87	0.31
	Bilbster	0.67	0.26
Dunbeath	Achnaclyth	0.33	0.38
	Culvid	1.39	0.31
Berriedale	Gobernuisgach	0.25	0.16
	Corrichoich	0.24	0.21
	Braemore	1.22	0.43
	Strathcoull	0.19	0.47
Langwell	Wag	0.74	0.18
	Aultibea	0.96	0.28
	Coille Braigh	0.08	0.24

+ present but numbers insufficient for analysis.

The numbers observed can be compared with the "standard" developed by Godfrey (2005) to help with site condition monitoring of SAC rivers. Table 2, below, shows the standard criteria.

		Critical percentile values for density and colour codings					
		< 20th	20th- 40th	40th - 60th	60th - 80th	80th -100th	> 100th
Salmon	Fry	0.05	0.13	0.28	0.33	0.67	
	Parr	0.04	0.07	0.13	0.19	0.28	
Trout	Fry	0.01	0.02	0.03	0.04	0.06	
	Parr	0.01	0.01	0.01	0.02	0.04	

I have adopted a colour coding system, as above, in order to make things easier to pick out. The colour code runs through red (poor), orange (low), yellow (average), green (good), light blue (very good) and dark blue (exceptionally good).

The colour-coded classification system has been applied to the 2013 data, as per Table 3, below.

Table 3. Semi-quantitative evaluation of survey sites based on comparison with data presented by Godfrey (2006).

River	Site name	Salmon		Trout	
		fry	parr	fry	parr
Forss	Cnoc-glas	yellow	yellow	dark blue	dark blue
	Shurrery	dark blue	dark blue		
	Lythmore	dark blue	dark blue		
Thurso	Rumsdale	dark blue	green		
	Dalganachan	dark blue	green		
	Dalnagletin	light blue	red		
	Smerrary	dark blue	light blue		
	Dalemore	dark blue	light blue		
	Hoy	dark blue	orange		
Wester/Lyth	Barrock Mill	red	red		
Wick	The Clow	orange	dark blue		
	Sheriff's	dark blue	light blue		
	Bilbster	light blue	light blue		
Dunbeath	Achnaclyth	yellow	light blue		
	Culvid	dark blue	light blue		
Berriedale	Gobernuisgach	yellow	green	green	dark blue
	Corrichoich	yellow	green		
	Braemore	dark blue	dark blue		
	Strathcoull	orange	dark blue		
Langwell	Wag	light blue	green		
	Aultibea	light blue	light blue		
	Coille Braigh	orange	green		

As can be seen, most sites are in very good order although there are a few notable exceptions that need further consideration.

In general, low fry densities are coupled with good parr densities. This indicates that either habitat quality at sites like these is poor for fry but not for parr or that the supply of fry to the site is not sufficient because the spawning areas are too far away.

Barrock Mill is the only site where fry and parr densities are both poor.

Table 3 uses the standard approach. However, it is defective because it attempts to compare data obtained in different years by different operators often for slightly different sites. What is needed is a way of making comparisons among the sites surveyed in 2013.
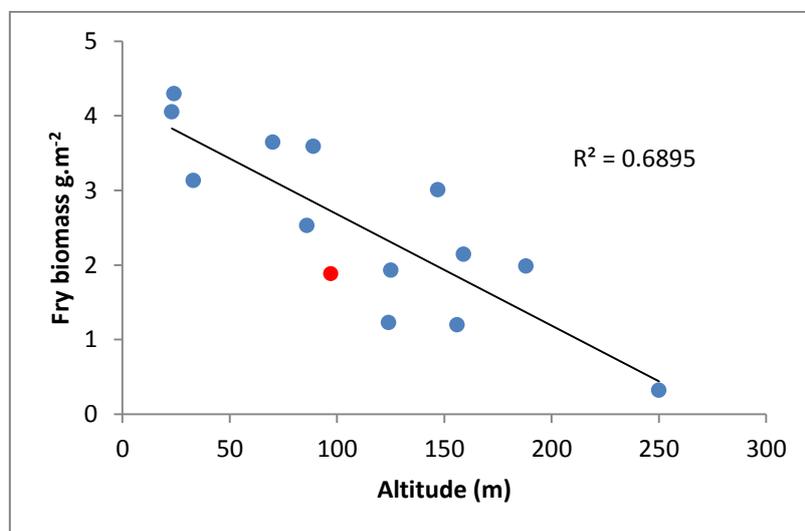

Figure 11. The relationship between observed biomass density of salmon fry and altitude, for sites classed as "favourable" for fry and excluding the anomalous sites at Bilbster and The Clow.

Figure 11 shows how this may be done. Omitting the details, there is a relationship within the 2013 set of sites between the biomass density of fry (ie. the weight of fry per square metre) at any site and the altitude of the site. The points show the individual site values and the line shows the average relationship. The average relationship can be used as a standard to rank and compare the 2013 sites according to how much they exceed or fall short of the line depicted. This has been done in Table 9, below.

The central column in Table 9 shows the appropriate value (headed Obs-exp) by which each site exceeds or falls short of the standard line. The colour-coding on the right is a repeat from Table 3, above, and it is shown for comparison.

Table 9. Difference between observed and predicted fry biomass.

Site	Obs – exp biomass (g.m^{-2})	Rating cf. Godfrey (2006)
Dalganachan	1.03	
Shurrery	0.75	
Wag	0.62	
Dalemore	0.52	
Lythmore	0.48	
Rumsdale	0.34	
Hoy	0.22	
Gobernuisgach	-0.13	
Smerrary	-0.36	
Aultibea	-0.38	
Sheriff's	-0.55	
Braemore	-0.65	
Culvid	-0.84	
Corrichoich	-0.87	
Dalnagletin	-1.09	
Cnoc-glas	-1.50	
Achnaclyth	-1.67	
Bilbster	-2.58	
Coille Braigh	-2.62	
The Clow	-3.26	
Strathcoull	-3.33	
Barrock Mill	-3.93	

The first point to note is that the two methods of comparison often give the same result – high values for Obs-exp biomass density tend to be colour-coded blue and low biomass values mostly orange or red.

However, for various reasons, the biomass comparisons are likely to be more appropriate and they show that the colour-coded system over-rates Bilbster and Dalnagletin and under-rates Wag and Gobernuisgach.

Again omitting the detail, the take home messages are that -

1. Most sites were highly, or very highly, rated for fry in 2013.

2. Some low ranked sites, like Strathcoull and Coille Braigh, are not particularly suitable habitat for fry and their low rankings are therefore to be expected.

3. Some low ranked sites, like The Clow and Bilbster, are classed as suitable for fry. Since they contain good densities of parr, the low fry values probably mean that the sites are distant from a source of emerging fry.

4. The only problem that can be identified at this stage of the project is at Barrock Mill where both fry and parr are few in number despite the habitat being suitable for both.

It is possible to compare the survey results for all-Caithness in 2013 with those of a separate survey carried out in 2004 for Thurso and Berriedale/ Langwell only. We know that the densities of fry seen in 2013 were greater than those of 2004 (data not shown here) but we cannot compare them directly because many of the sites were different. However, we can compare them using the relationship between biomass density and altitude, as per Figure 13.
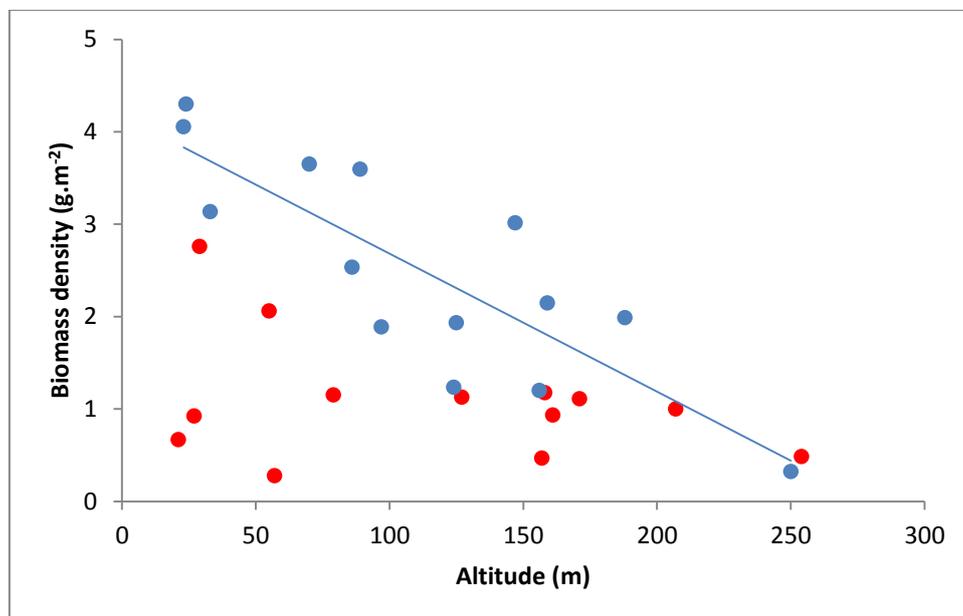

Figure 13. Relationships between altitude and biomass for the edited set of Caithness sites examined in 2013 (blue) and the set of sites for the Thurso and Berriedale/ Langwell SACs surveyed in 2004 (red).

Inspection of Figure 13 shows that in 2004 (points shown in red), for any particular altitude, values were only around 50% of the 2013 values (shown in blue). This may reflect an upwards trend or it may just reflect variation between years.