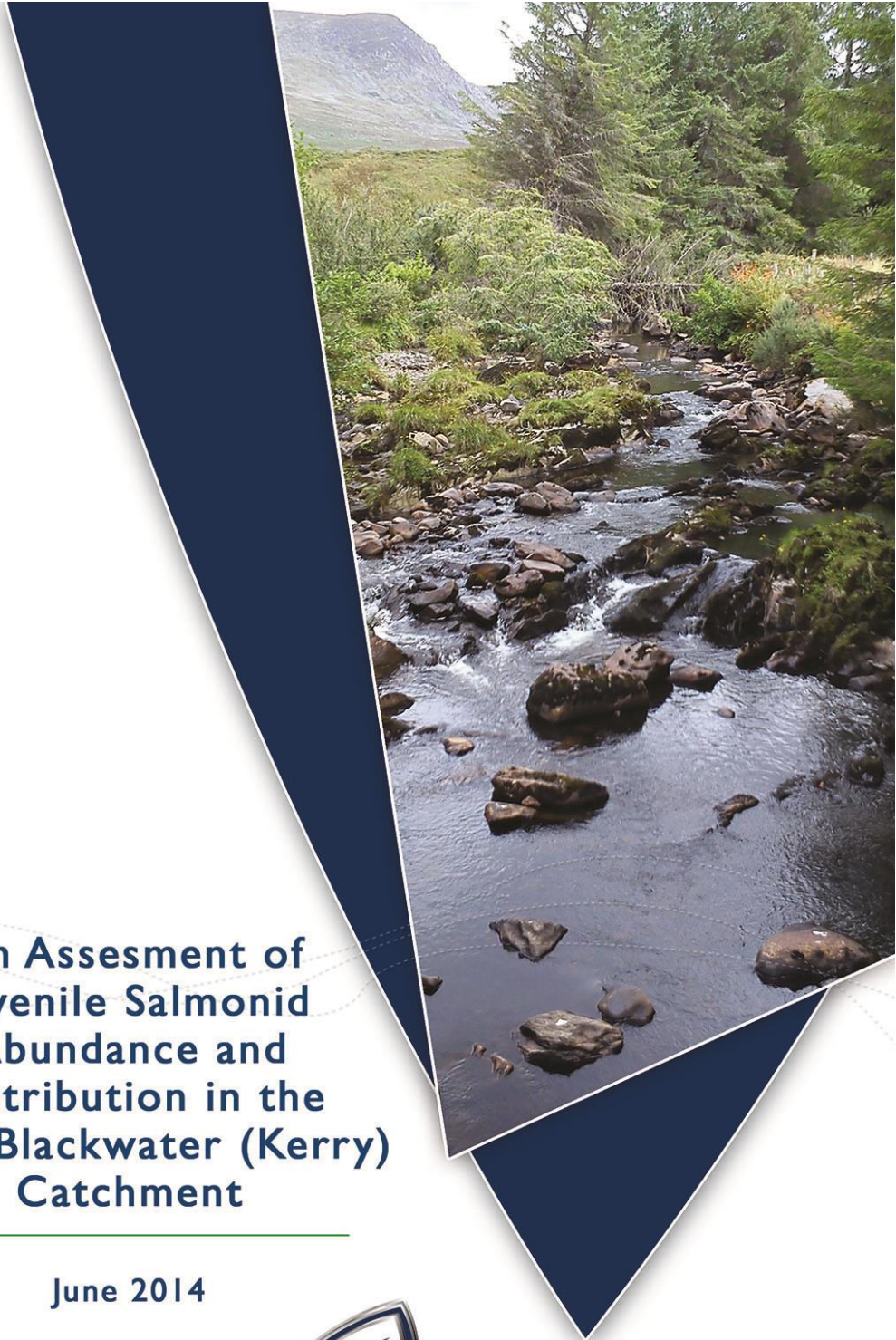# An Assesment of Juvenile Salmonid Abundance and Distribution in the River Blackwater (Kerry) Catchment

June 2014

IASCACH INTÍRE ÉIREANN
INLAND FISHERIES IRELAND

An Assessment of Juvenile Salmonid Abundance and Distribution in the River Blackwater (Kerry) Catchment 2014 & Comparison with Previous Surveys.

Inland Fisheries Ireland.

June 2014.

Project Personnel

Executive Summary

- A depletion electro-fishing survey was undertaken in the Kerry Blackwater catchment in summer 2014 following concerns regarding numbers of salmon passing the counter on the lower reaches of the Blackwater.

- A Previous depletion electro-fishing survey had been undertaken on the Kerry Blackwater catchment in 1995. The current survey will allow comparison of juvenile salmon and trout stocks with that of previous surveys.

- Two distinct electro-fishing survey methods for juvenile salmonids were employed, depletion fishing (Quantitative) and catchment wide electro-fishing (Qualitative).

- Depletion fishing recorded salmon at 8 of the 9 sites fished. A high mean salmon fry density of 0.42 fish per m^2 was recorded, significantly higher than 1995 survey. A high mean salmon parr density of 0.20 fish per m^2 was also recorded- not significantly different from the 1995 survey.

- The main Blackwater and the Kealduff tributary below Lough Brin are most important areas for salmonid production. Fry densities in the Derreendarragh were lower.

- Depletion fishing recorded trout at all 9 sites surveyed. A mean trout fry density of 0.08 fish per m^2 was recorded, and a mean trout parr density of 0.05 fish per m^2, each not significantly different from the 1995 survey.

- Catchment wide Electrofishing (CWEF) was undertaken at 43 sites throughout the Kerry Blackwater catchment. Salmon were present at 29 sites surveyed and absent from only 14 of sites, these latter sites being on streams in upper reaches of the catchment. The mean

salmon fry density in 2014 was 17.82 salmon fry/5min. This figure is in the mid 50% of all results from the CWEF programme 2007 to 2014.

- CWEF found trout abundance was highest in the upper reaches of the catchment.

- Q values assess the freshwater quality of the catchment based on the presence of invertebrates. Results from the catchment indicate water quality was good with all three of sites surveyed in 2012 with a Q value of 4-5.

- 5 minute qualitative electrofishing gave a more comprehensive coverage of the Blackwater catchment and demonstrates the importance of lower order steams to trout, in terms of spawning and nursery areas. However neither survey was conducted on any 1st order streams, likely to be important for trout production. Further surveys may be able to quantify the importance of the lower order streams for trout production, and assess the vulnerabilities and risks to such habitats from changes in land use.

- Much of this river flows through areas of blanket peat which have been planted with coniferous forestry. Research has shown that coniferous forestry on peat is associated with putting the streams at risk of eutrophication, acidification, changes in macroinvertebrate and salmonid populations and sediment loading.

Contents

1. Introduction.

An electro-fishing survey of the Kerry Blackwater catchment was conducted during2014. The catchment had previously been surveyed in 1995. The 1995 survey (Roche, 1996) was initiated following poor salmon catches in the Kenmare bay area in 1995. The current 2014 survey was initiated at the request of IFI Macroom and allows comparison of juvenile salmon and trout density at sites previously electro-fished during earlier surveys.

Over the 2008 to 2012 period there was been a declining trend in the numbers of salmon counted on the Blackwater counter; 2013 and 2014 have seen a slight increase in counter numbers. The fall in salmon counts has been reflected in the predicted salmon surplus calculated by the Standing Scientific Committee on Salmon (SSCS) (figure 1.1). This survey will examine the juvenile salmonid stock at sites previously surveyed using depletion electrofishing techniques to determine how the stock densities have changed since the previous survey. It will also compare salmonid densities in this catchment with that in other catchments.

The survey will determine the relative importance of major tributaries and the main channel and of channels of different order in terms of salmon and of trout productivity.

A second electro-fishing technique, catchment wide electro-fishing (CWEF) described in Gargan, P., Roche, W., Keane, S. & Stafford, T. (2008), was also undertaken on the Kerry Blackwater catchment. The method allows a wider coverage of sites to be fished than the standard depletion fishing survey and allows the results to be compared against previous equivalent surveys on the Blackwater and with a wide range of rivers nationally.
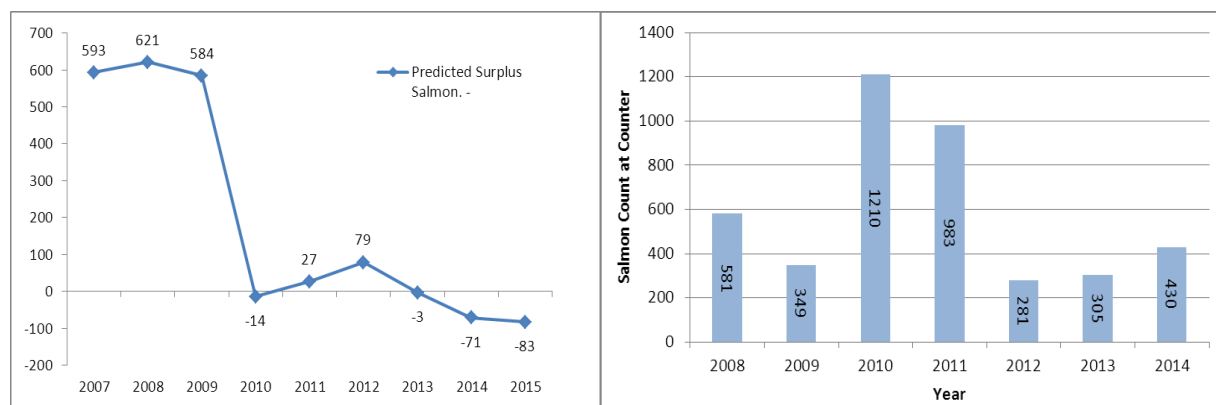
Figure 1.1: SSCS predicted surplus salmon for the Blackwater 2007 to 2015 (left) and number of salmon recorded passing the fish counter on the Kerry Blackwater each year 2008 to 2014 (right).

1.1. Study Area

The Kerry Blackwater is designated as Salmonid status under the EU directive 78/659/EEC (i.e. Quality of water needing protection or improvement to support fish life). More recently the Blackwater has been designated as an SAC for Salmon under the EU habitats directive (Council directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna); salmon are listed as an Annex 2 species; that is animals and plants species whose conservation requires the designation of an SAC. Margaritifera are also present in the Blackwater.

The entire catchment drains an area of approximately 88 km^2. Its main tributaries are the Blackwater the Kealduff and the Derreendarragh. There are three lakes of over 5 hectares: Loughs Brin (24.6ha), Fadda (15.2HA) and Beg (6.1Ha). The river basin is entirely on Red Sandstone. Conductivity is low. Land use is predominantly peat bogs, pasture and coniferous (primarily Sitka spruce) forestry.
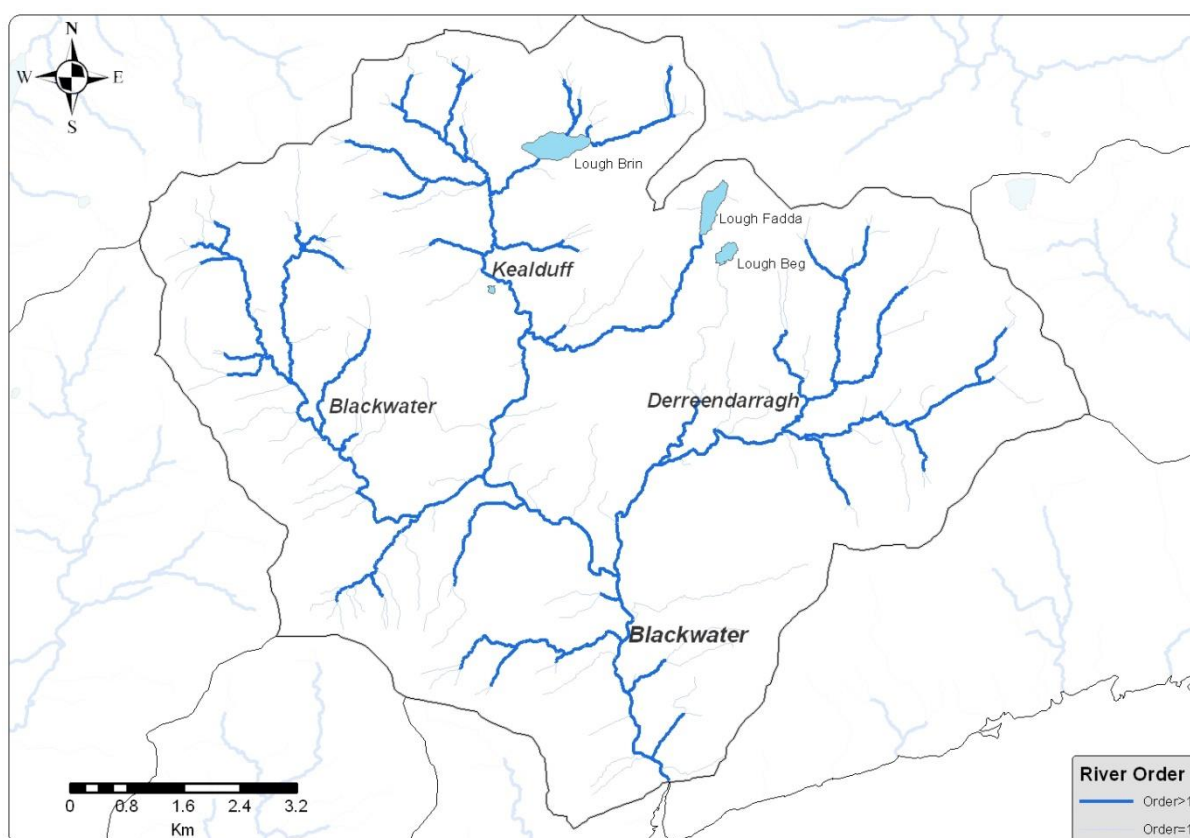
Map 1.1. Showing the main tributaries and lakes in the Kerry Blackwater.

Fluvial Resource and Gradient Classification.

River gradient has been identified as a key indicator of habitat quality (Amiro, 1993), as it acts as a good indicator of river morphology, indicating the possible presence of riffle, falls, pools etc. within the river channel. These habitat features in turn are good indicators of where salmon and trout would be expected. To simplify matters river gradients have been classified low gradient (<1.5%), medium gradient (>1.5 ≤3%) and high gradient (>3%). Amiro (1993) found that medium gradient habitat has the best potential for the production of juvenile salmon.

The wetted area report and subsequent studies (McGinnity et al, 2003 & 2012) examined all the salmon rivers in Ireland and has quantified that resource in terms of gradient and wetted area. The 2012 wetted area revision assessed that there was 29 Ha of fluvial (river) habitat available to salmon within Blackwater catchment, making it the 60th largest catchment in the country in terms of accessible fluvial habitat**.** This estimate of accessible area does not include any channels of stream order 1; it is acknowledged however that these small streams are capable of supporting salmonids (Aprahamian et al. 2003). Around 20% of the total wetted area within the Kerry Blackwater catchment is on channels of stream order 1. Due to the mountainous terrain in this catchment many of the first and indeed a proportion of the second order streams are high gradient. While much of this water may be inaccessible to both salmon and trout, at least some of this habitat will be important in terms of trout production.
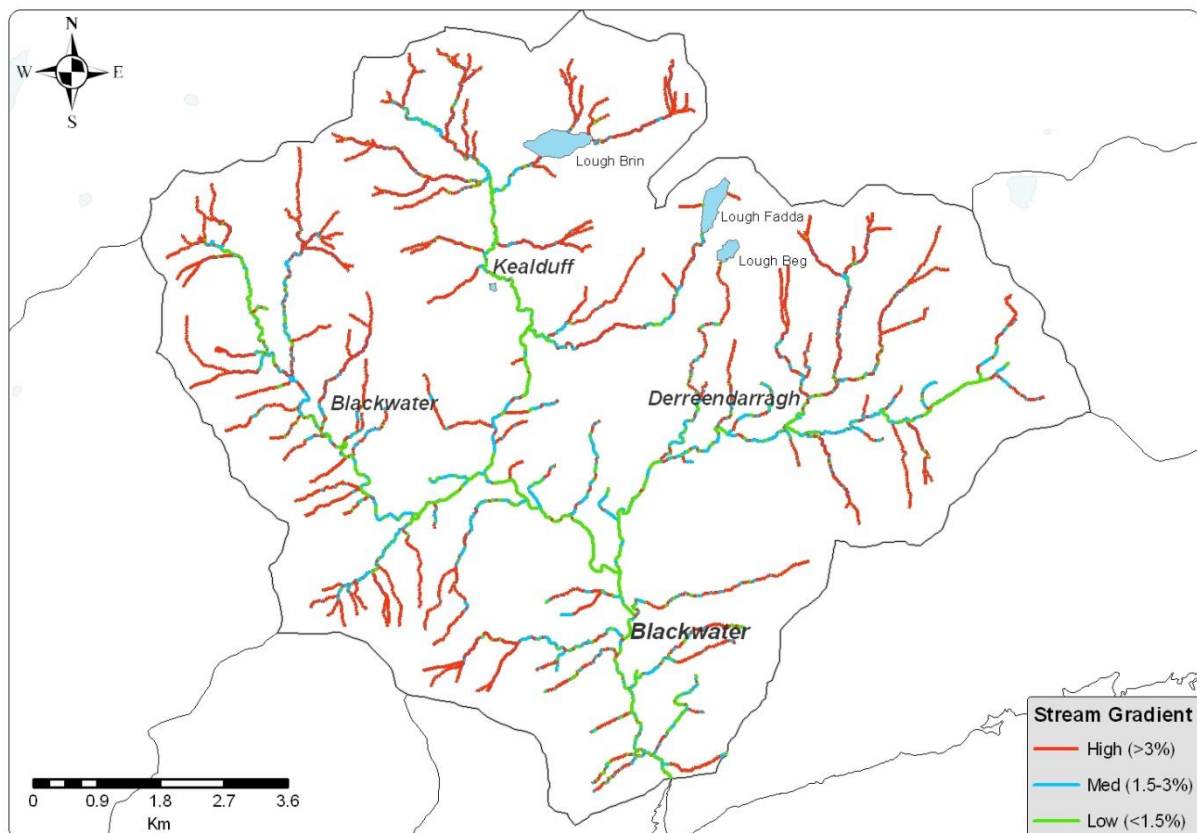
Map 1.2 Main river channels on the Blackwater Catchment classified by gradient: low gradient (≤1.5%), medium gradient (>1.5 ≤3%) and high gradient (>3%).

Water Quality – Q Values

The EPA undertakes biological water quality assessments of catchments on a national basis. Kick samples are taken from specific stations. The invertebrate species collected are then identified. According to the proportions of species and taxa of macroinvertebrates present a quality score (Q Score) from 1 (grossly polluted) to 5 (pristine) is given.

The last extensive survey of the catchment occurred in 2012 (EPA, 2015). It found that the water quality was Excellent; all 3 sites were found to have Q value of 4-5.

Quality Classes	Class A		Class B	Class C	Class D	
Q Ratings	Q5	Q4	Q3-4	Q3	Q2	Q1
Pollution Status	Pristine, Unpolluted	Unpolluted	Slight pollution	Moderate pollution	Heavy pollution	Gross pollution
Fishery Potential	Game fisheries	Good game fisheries	Game fish at risk	Coarse fisheries	Fish usually absent	Fish absent

Table 1.1: Pollution status and fishery potential of water characterised by Q status (after Clabby et al. in Champ, 2007)

Q Value	1997	2000	2003	2006	2009	2012
2-3						
3						
3-4						
4			1	1	1	
4-5	4	3	1	2	1	3
5		1	2	1	1	
Grand Total	4	4	4	4	3	3

Table 1.2. Q Values from EPA Surveys of Kerry Blackwater. .(EPA 2015)
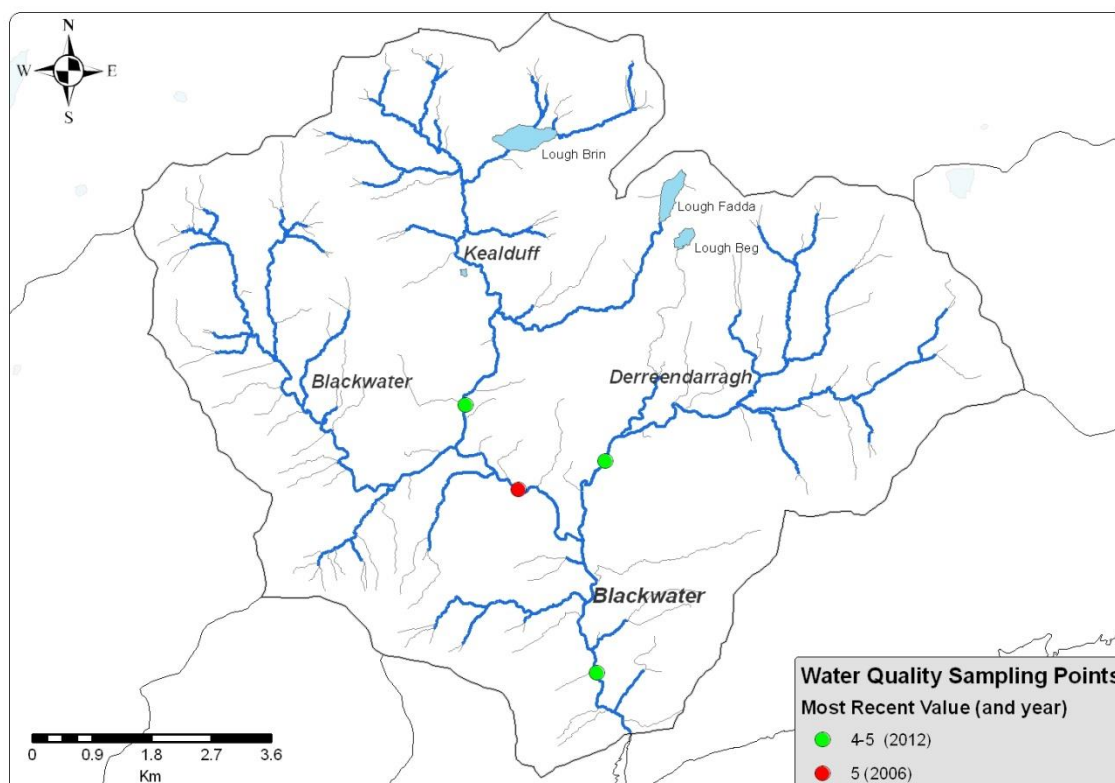
Map1.3: Location and most recent Q value of water at EPA monitoring sites.

Previous Electro-fishing Depletion Survey.

A depletion survey was undertaken in 1995 on the Blackwater, the survey consisted of 30 sites (map 1.2). Salmon fry were present at 11 (37%) sites; maximum density was 0.38 fish/m^2 at site 9 on the main channel. Salmon 1+ were present at 19 (63%) of sites, maximum density was 0.41 fish/m^{2}on the Kealduff. Trout were present at 29 (97%) of sites, trout 1+ at 27 (90%) of sites. None of the surveys included sites on channels of stream order 1. The survey concluded that the distribution of salmon 0+ was limited and that densities were low, and that while limited in distribution parr densities were generally satisfactory.
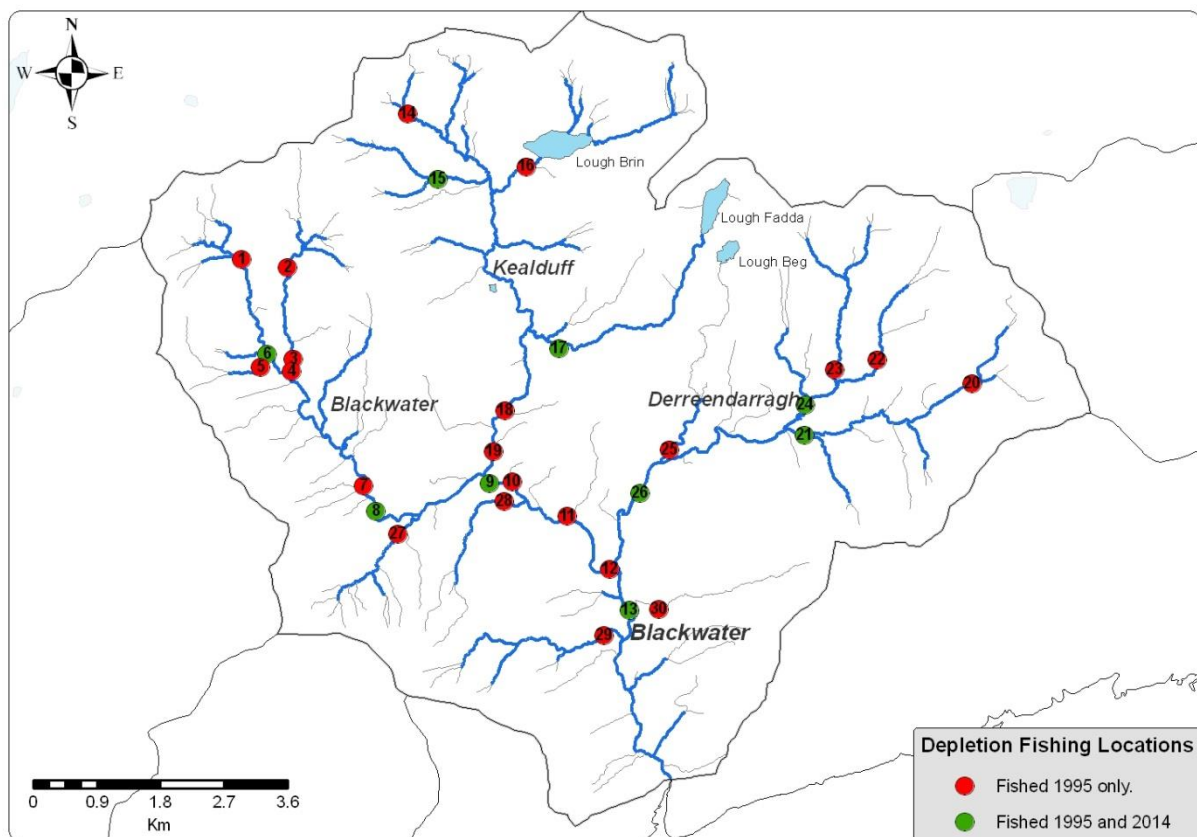
Map 1.4: Showing Location of depletion fishing survey locations 1995, some of which were resurveyed in 2014.
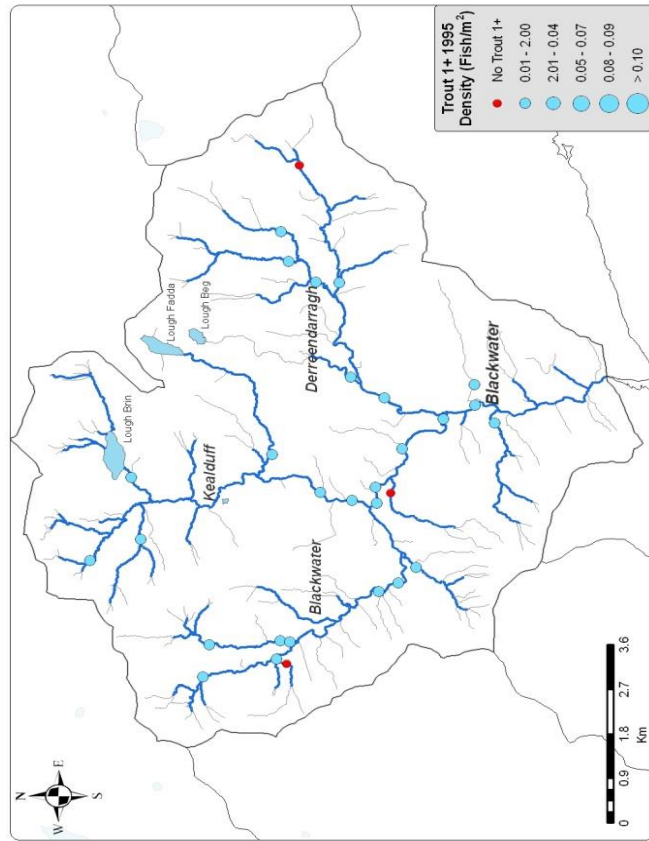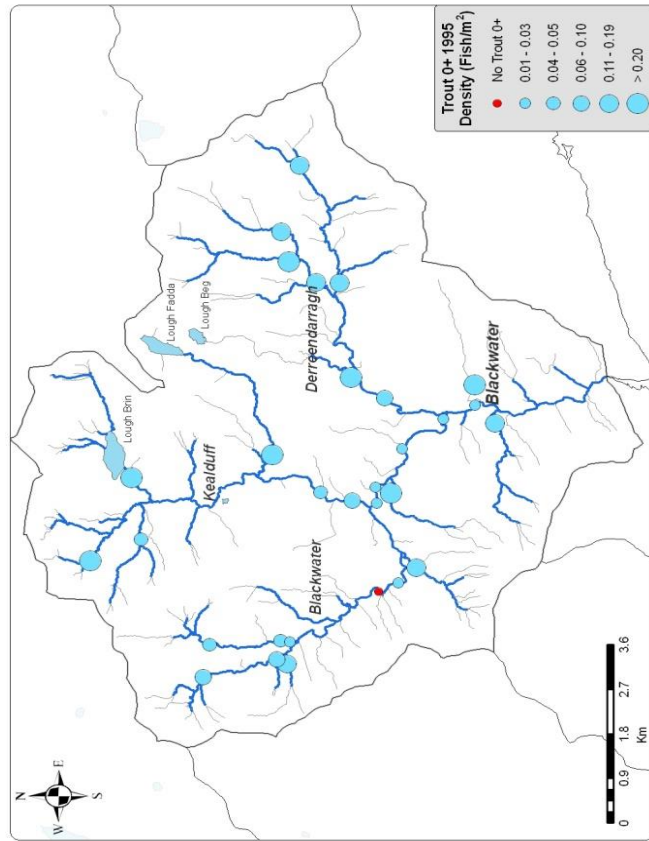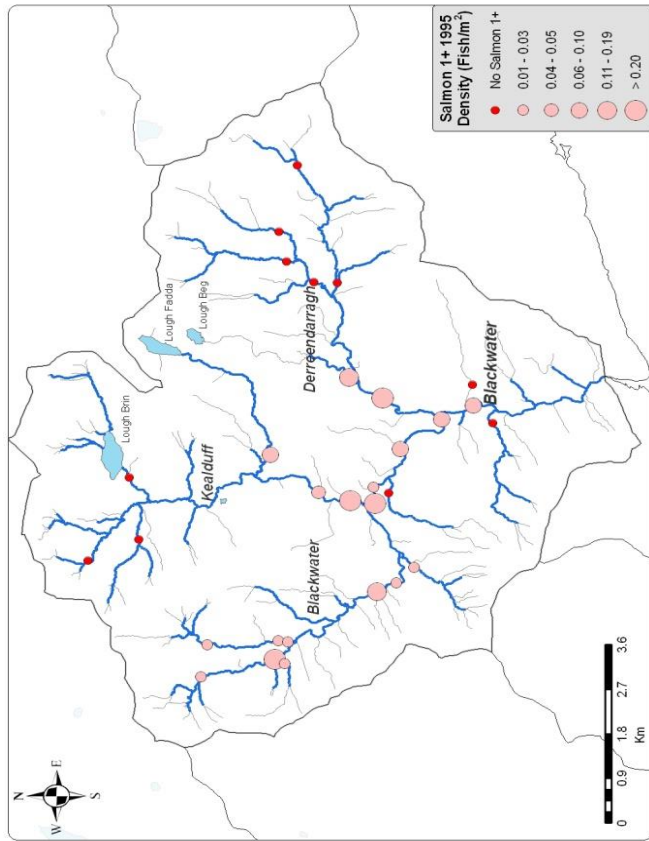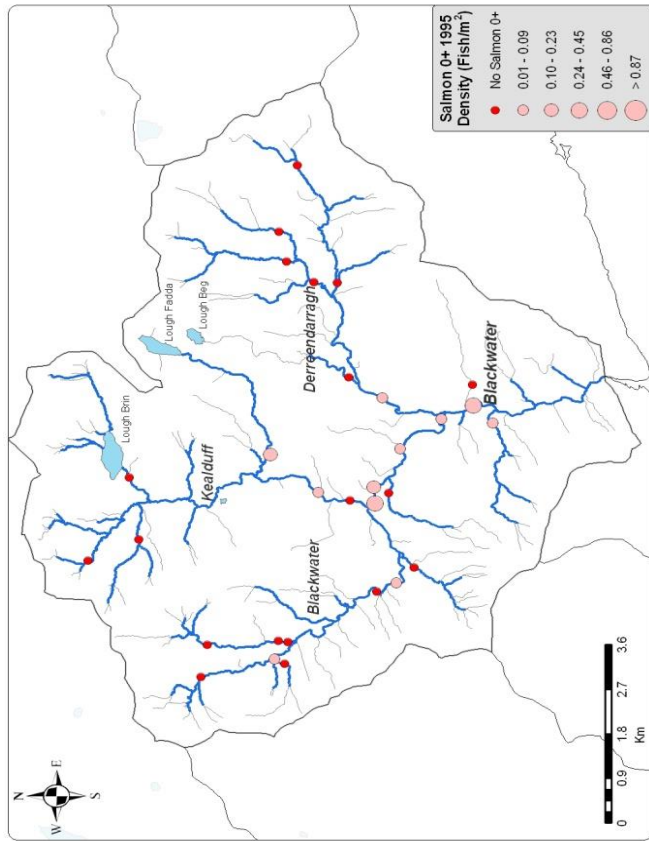
Maps 1.5 to 1.8 (top Left to bottom right): Showing the densities of salmonids found by depletion fishing in 1995 on the Kerry Blackwater.

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2. Methods

Two independent surveys were carried out in 2014, each employing different electrofishing techniques. Depletion electrofishing was carried out at a selection of the sites identified and surveyed during the 1995 survey.

A more rapid and extensive five minute electrofishing technique was employed at new sites identified in the Blackwater catchment throughout the course of this survey. The surveys were conducted in August and September 2014 during a warm dry summer with very few interruptions due to rain.

2.1. Depletion Fishing.

Fish were removed using bank based electrofishing equipment consisting of a portable generator (220/240V) with an appropriate control (D.C. converter) unit attached. The sampling area at each site was isolated by using stopnets to ensure no escapement of fish upstream or downstream during the electrofishing operation. A number of fishings were carried out in the contained area in an upstream direction from the bottom net. Fish from each pass were held in bins of water, sorted and processed separately. All fish were measured for fork length within 1cm length groupings. All fish were held in a large bin of water after processing until they were fully recovered at which time they were returned to the water.

Population estimates were calculated using the two fishing depletion of Seber and Le Cren (1967) or the three fishing method of Zippin (1958). Where catchability was low (<0.3) or where single fishing was carried out minimum densities were calculated.

2.2. Five Minute Fishing.

This is a rapid technique to qualitatively assess the number of salmonid fry (0+ salmon and trout) present at riffle sites throughout a catchment. The sites chosen consist of an area of riffle sizable enough to provide for 5 minutes of electrofishing. The survey was carried out only on sites in second order and higher streams. A single uninterrupted fishing in an upstream direction lasting five minutes was undertaken at each site. Fish were removed by a single operator using a backpack electrofishing unit (Safari Research 550-e) and collected into a bucket of water carried by an assistant. The number of salmonid fry missed was recorded. Any other fish observed were noted, but not captured or measured. At the end of the fishing period the fish were identified to species and measured for fork length within 1cm groups. When the fish were fully recovered they were returned to the water. The ratio of salmon to trout fry captured was used to assign the missed fish to one or the other species. If catch efficiency was below 60% then the site survey was not used. Full methodology is set out in Gargan, P., Roche, W., Keane, S. & Stafford, T. (2008).

3. Results.

3.1. Depletion Fishing

Depletion fishing was undertaken by a team of IFI staff at 9 sites on dates from the 15th to the 17th of September 2014. The sites were a selection of those that had been surveyed in the 1995 survey.

Salmon were present at eight of the nine sites. Trout fry were present at all nine sites, trout 1+ were present at all but one site. Other species present were Minnow (50 fish, 4 sites) and Eel (1 fish, 1 site).

A summary of the calculated densities of salmon and trout is presented (table 3.1). Salmon 0+ had the highest overall mean abundance of about 0.416 fish per m^2, salmon 1+ were at 0.208 fish per m^2, trout 0+ at 0.085 fish per m^2, and trout 1+ were the least abundant at 0.047 fish per m^2.

Species / Site Number	Sal 0+	Sal 1+	Trout 0+	Trout 1+	Eel
6	0.873 (±0.099)	0.078 (±0.1)	0.210 (±0.061)	0.053 (±0.027)	0.000
8	0.713 (±0.094)	0.468 (±0.028)	0.059 (±0.004)	0.124 (±0.071)	0.000
9	0.450 (±0.138)	0.057 *	0.061 *	0.000	0.000
13	0.744 (±0.05)	0.200 (±0.03)	0.053 (±0.026)	0.013 (±0.003)	0.000
15	0.000	0.000	0.035 *	0.135 (±0.102)	0.000
17	0.499 (±0.319)	0.351 (±0.026)	0.144 (±0.021)	0.054 (±0.004)	0.011 *
21	0.299 (±0.029)	0.264 (±0.151)	0.033 (±0.004)	0.025 *	0.000
24	0.011 *	0.100 *	0.045 *	0.011 *	0.000
26	0.155 (±0.099)	0.351 (±0.129)	0.126 (±0.045)	0.010 *	0.000
Mean Density	0.416	0.208	0.085	0.047	0.001

Table 3.1; Summary of Fish densities (with 95% Confidence Intervals) Fish/m^2 calculated from site surveys in 2014. Where catchability was low (<0.3) minimum (*) densities were calculated.

The highest individual site densities of Salmon 0+ juveniles were all found in the upper sections of the Blackwater channel or in the Kealduff. The lower densities of salmon were found on the Derreendarragh, salmon were entirely absent from site 15 - a stepped narrow mountain stream. Salmon 1+ densities were highest at sites on the main channel and the Derreendarragh. Salmon 0+ densities were general much lower than 1+ densities.

Trout fry were widely distributed throughout the catchment. Densities were much lower than salmon 0+.

Trout 1+ were distributed similarly to the Trout 0+, but the densities were considerably lower, the highest density being 0.135 fish per m^2 at site 15 – the only site from which salmon were entirely absent.
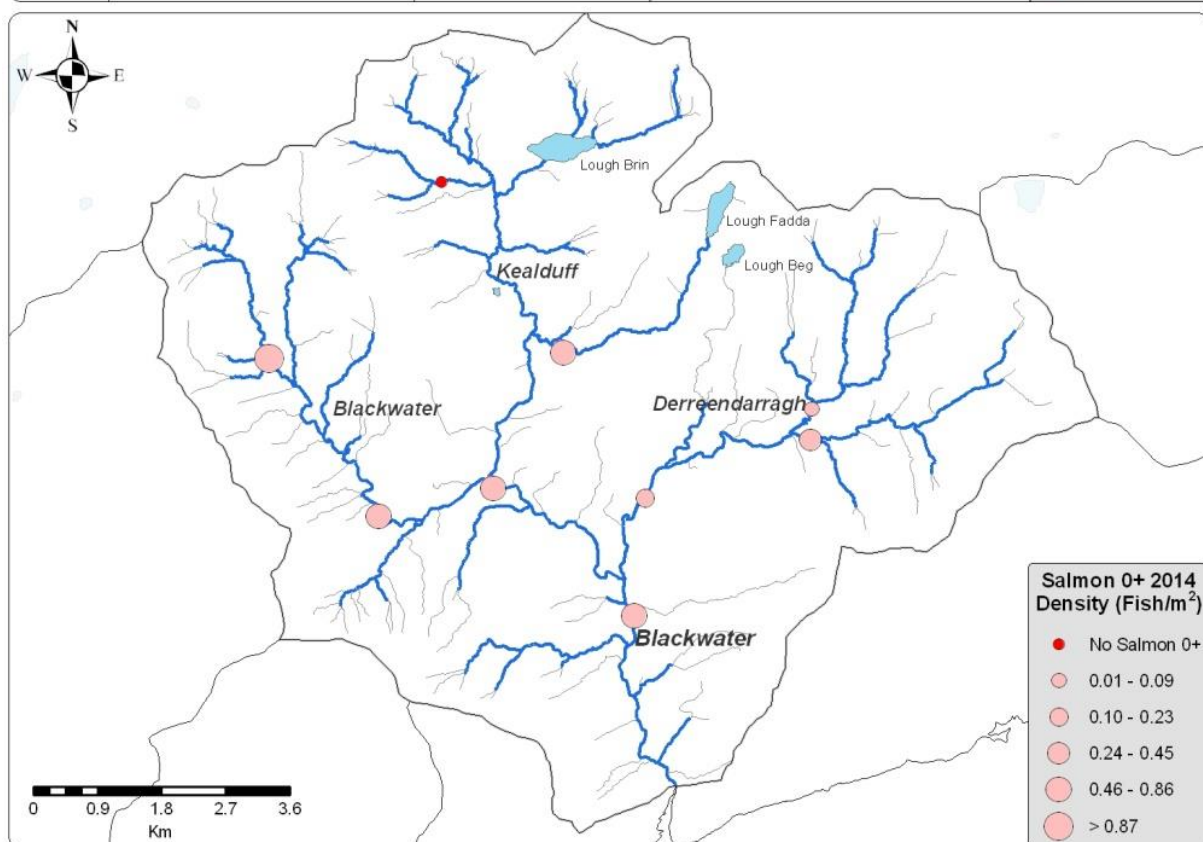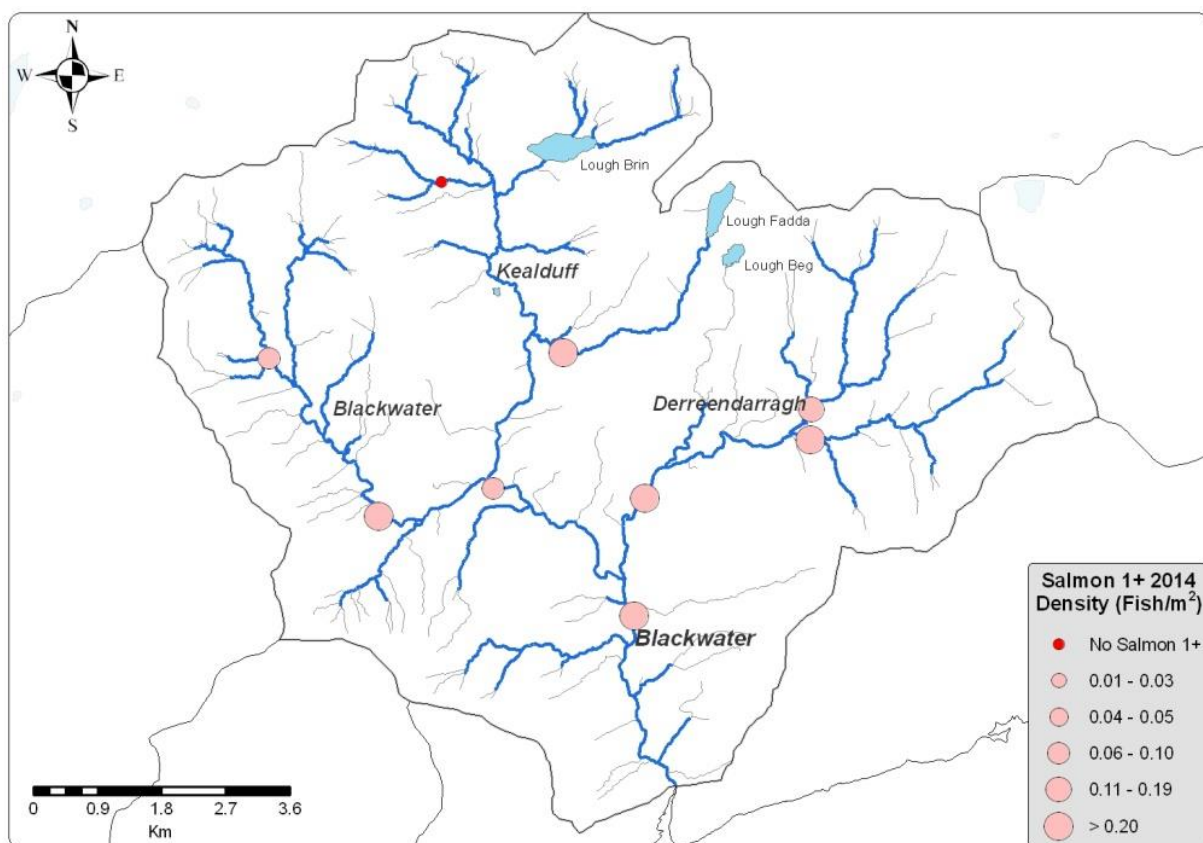
Maps 3.1 to 3.2: Showing the densities of Salmon found by depletion fishing in 2014 on the Kerry Blackwater.
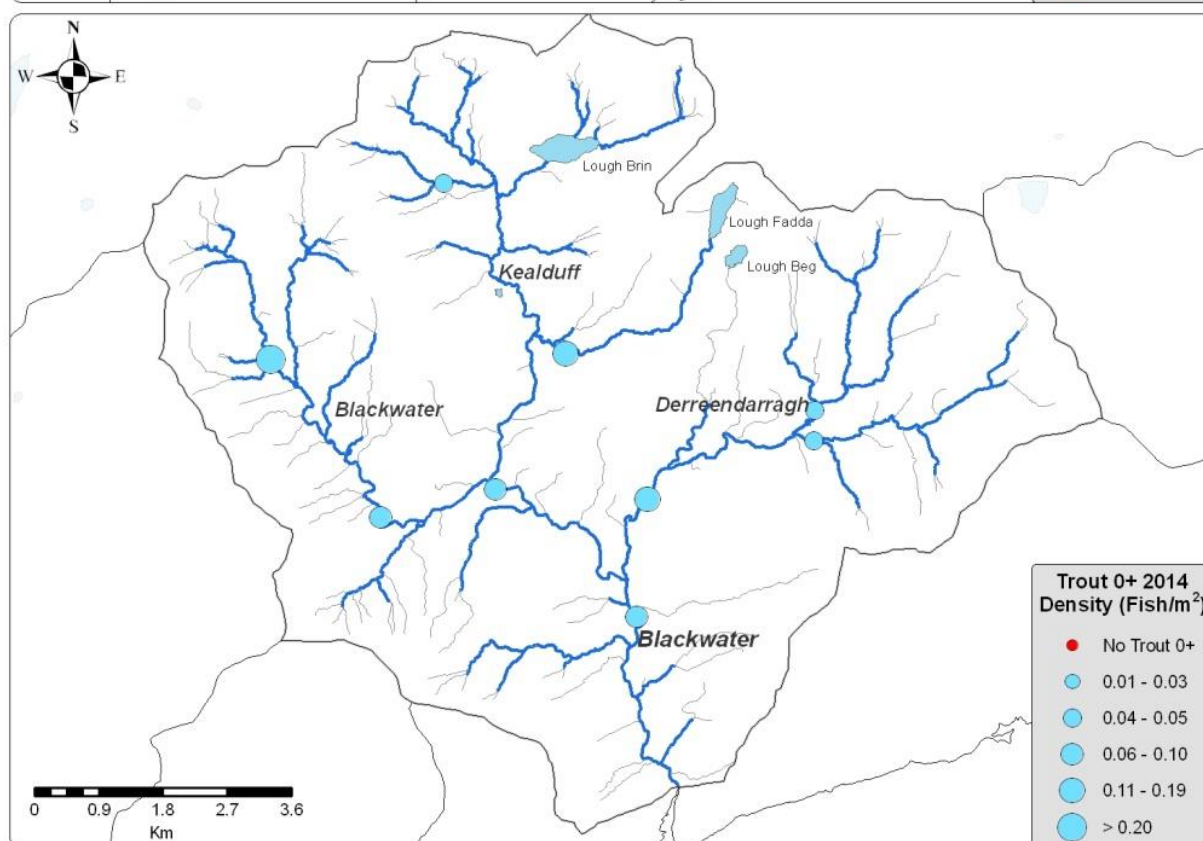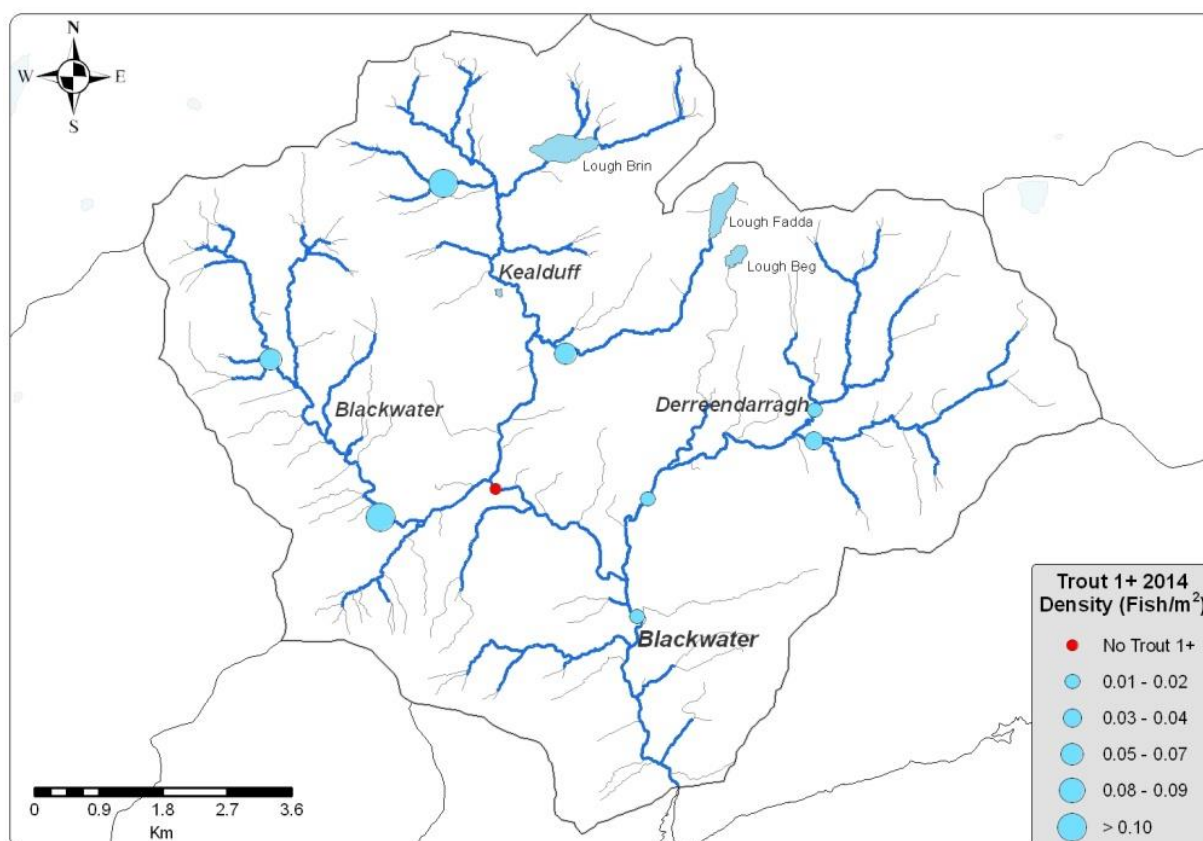
Maps 3.3 to 3.4: Showing the densities of Trout found by depletion fishing in 2014 on the Kerry Blackwater.

Results of in 2014 survey compare favourably with those of the 1995 survey (figure 3.1).

The results indicate that:

- For Salmon fry (0+)   2014 densities were significantly higher than 1995.
- For Salmon parr (1+),   2014 densities not significantly different from 1995.
- For Trout fry (0+)   2014 densities not significantly different from 1995.
- For Trout parr (1+)   2014 densities not significantly different from 1995.
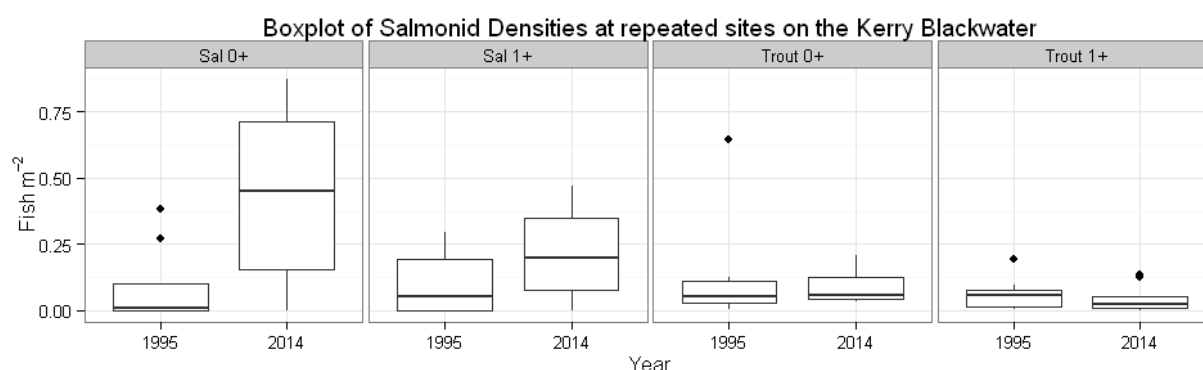
Figure 3.1; Boxplots of Densities of fish found at sites sampled by both the 1995 and the 2014 surveys

Figure 3.2: Salmon 0+ Blackwater Repeated Sites, 8 increased, none decreased, 1 unchanged at zero. Wilcoxon Matched Pairs non-parametric test showed a significant difference between years (p=0.02).

Figure 3.3: Salmon 1+ Blackwater Repeated Sites, 6 increased, 2 decreased, 1 unchanged at zero .Wilcoxon Matched Pairs non-parametric test showed no significant difference between years (p=0.14).

Figure 3.4: Trout 0+ Blackwater Repeated Sites, 6 increased, 3 decreased, 0 unchanged. Wilcoxon Matched Pairs non-parametric test showed no significant difference between years (p=0.61).

Figure 3.5: Trout 1+ Blackwater Repeated Sites, 2 increased, 7 decreased, 0 unchanged. Wilcoxon Matched Pairs non-parametric test showed no significant difference between years (p=0.54).

Comparison of Salmonid Density with Previous Surveys.

Surveys are conducted by IFI each year to fulfil its responsibilities for delivering fish population status reports for the Water Framework Directive. One element of these surveys is to monitor fish populations at river sites on systems of various habitat characteristics around the country by undertaking depletion surveys at these sites, results are published (Kelly et al., 2009a, 2001, 2011, 2012 and 2013) and are publicly available through the IFI website.

Salmon 0+	Salmon 1+	Trout 0+	Trout 1+
Density	Density	Density	Density
1.12	0.47	0.64	0.44
0.87	0.43	0.43	0.4
0.8	0.35	0.422	0.3
0.75	0.35	0.22	0.283
0.74	0.34	0.21	0.22
0.71	0.32	0.18	0.17
0.56	0.307	0.14	0.14
0.50	0.306	0.14	0.12
0.47	0.27	0.13	0.05
0.45	0.26	0.06	0.05
0.443	0.246	0.06	0.02
0.35	0.23	0.05	0.01
0.30	0.20	0.04	0.01
0.15	0.10	0.04	0.01
0.083	0.08	0.03	0.00
0.01	0.06		
0.00	0.00		

When individual site results obtained in 2014 on the Blackwater are compared with the best sites from WFD surveys, it can be seen that salmon 0+ and 1+ WFD results lie within the range of maximum results from the Blackwater and that trout results in the Blackwater would generally be lower than the best from the WFD surveys. The surveys sites on the Blackwater would be amongst the best 'salmon' sites, but would not be amongst the best 'trout' sites.

☐ - WFD Sites

☐ - Blackwater 2014 sites

Table 3.2: Comparison of individual site results from the Blackwater with the best results from WFD surveys 2009-2012.

For rivers in England and Wales the National Rivers Authority analysed the densities of juvenile salmon from a database of over 600 survey sites. A classification scale was developed (table 3.4) point A on the scale representing the best sites. (Mainstone et al., 1994 and Hendry, 2003) Comparison of the Blackwater survey sites in 2014 with this index would put 55% of sites into groups A and or group B for salmon 0+, and 66% of sites into groups A or group B for salmon 1+.

Species Group	A	B	C	D	E
0+ Fish Density	>0.86	0.86-0.45	0.45-0.23	0.23-0.09	0.09-0
0+ Trout	0	0	0	3	6
0+ Salmon	1	4	1	1	2
0+ Fish Density	>0.19	0.19-0.1	0.1-0.05	0.05-0.03	0.03-0
1+ Trout	0	2	2	0	5
1+ Salmon	5	1	2	0	1

Table 3.3: Atlantic salmon abundance (fish per m^2) associated with classifications modified from Hendy, 2003 along with the number of sites within those groups found in the 2014 survey on the Blackwater.

Depletion surveys on the Kerry Blackwater were compared with similar surveys of other catchments throughout Ireland (Gargan, 2006). This indicated that salmon 0+ and 1+ and Trout 0+ and 1+ average densities were in the mid-range of densities found.

Catchment	Year	# Sites	Salmon Fry	Salmon Parr	Total
R. Feale	2001	20	0.98	0.25	1.23
R. Feale	2013	16	0.89	0.4	1.29
Currane	2014	16	0.77	0.21	0.98
R. Deel		6	0.66	0.1	0.76
Upper Blackwater		9	0.61	0.22	0.83
Kerry Blackwater	2014	9	0.42	0.21	0.63
R. Feale	1992	19	0.36	0.21	0.57
Currane	1994	34	0.34	0.08	0.42
R Erriff		10	0.31	0.17	0.48
R. Feale	2005	14	0.25	0.12	0.37
L. Currane		8	0.24	0.07	0.31
R. Inney		16	0.23	0.07	0.3
R. Feale	1988	37	0.29*	0.14	0.43

Table 3.4: Mean densities (fish/m^2) of salmon from a selection on Irish channels.
(NB: *Refers to Tributaries only, no Data available for main channel)

| Catchment	Year	# Sites	Trout Fry	Trout Parr	Total
Currane	1994	34	1.19	0.04	1.23
Currane	2014	16	0.77	0.04	0.81
Upper Blackwater		9	0.69	0.26	0.95
R. Inney		16	0.59	0.04	0.63
L. Currane		8	0.33	0.13	0.46
R. Feale	2013	16	0.25	0.03	0.28
R. Deel		6	0.19	0.15	0.34
R. Feale	2001	20	0.14	0.15	0.29
R. Feale	1992	19	0.08	0.03	0.11
Kerry Blackwater	2014	9	0.08	0.05	0.13
R Erriff		10	0.06	0.02	0.08
R. Feale	2005	14	0.03	0.07	0.1
R. Feale	1988	37	0.2*	0.12	0.32

Table 3.5: Mean densities (fish/m^2) of trout from a selection on Irish channels.
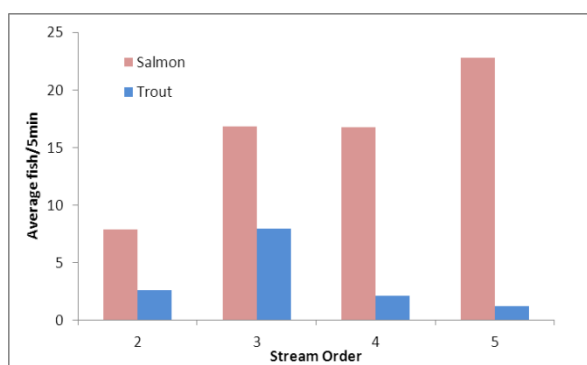**(NB: *Refers to Tributaries only, no Data available for main channel)**
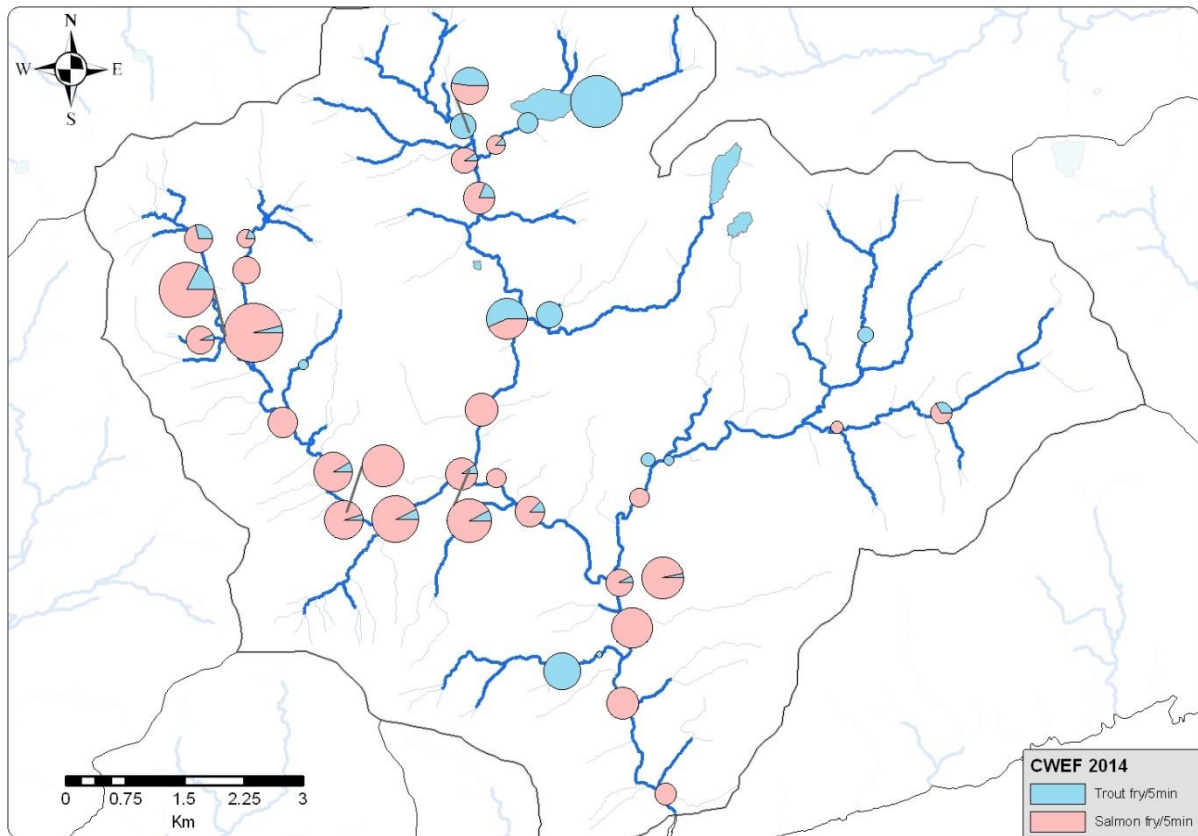
Map 3.5: Showing relative proportion of Salmon and Trout fry at 5minute electrofishing survey locations throughout the Kerry Blackwater system.

3.2. Catchment Wide Electro-Fishing (Five Minute Fishing)

Surveys were undertaken between 19th August and the 3rd of September 2014 by a team of two or three staff. The survey comprised 43 sites, 35 of which were included for the calculation of the CWEF index. Salmon fry were present at 29 sites. The maximum salmon fry catch was 51 salmon at site 4 on the upper Blackwater. The mean catch of included sites was 17.82 salmon fry/5min.

Average Salmon fry abundance was greatest at sites with lower riffle grades and in the mid-section

Figure 3.6: Avg. 0+fish per 5 min from CWEF surveys on the Blackwater 2014 Salmon fry per 5 min.by stream order (no sites on stream order 1 fished).
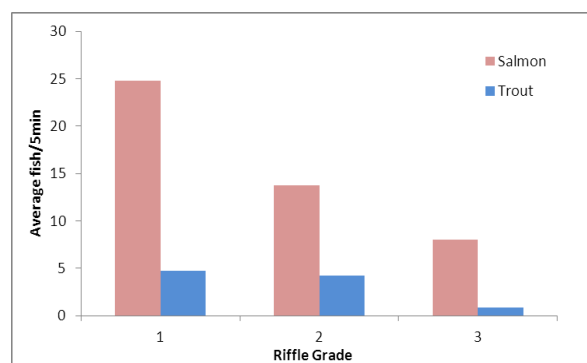
Figure 3.7. Avg.0+ fish per 5 min from CWEF surveys on the Blackwater 2014 Salmon fry per 5min by riffle grade (1- highest quality to 3- poorest quality riffle.)

of the catchment (maps 3.5 to 3.7). The most consistently good stretches were the main Blackwater channel sites, and the Kealduff River; no salmon were located upstream or immediatley downstream of L. Brin, a long section of cascades leading up to the lake probably hinders adults' progress in most water condtions. Salmon fry were absent or present in only small numbers on the Dereendarragh- the most easterly mian tributary of the catchment, this river appears to be spatey, the substrate is domiated by bedrock and large cobble/small boulders for large parts of it's length.

Trout fry were present at 29 of the 43 sites (61%). The highest number 57 trout fry per 5 min was at site 13, the site just upstream of lough Brin – salmon were absent from this site and probably unable to reach this position due to physical barriers below the lough. Trout fry were more abundant in streams with a lower stream order, and were absent from a number of sites on the main channel (map 3.2). The ratio of trout to salmon increased as stream order decreased.

Spawning Year	Fry Year	1SW CL	Predicted Surplus	Status	SalFry/5min	Survey Sites Included
2006	2007	-	-	Open	30.54	5
2007	2008	539	593	Open	15.52	10
2008	2009	539	621	Open	13.35	15
2009	2010	539	584	Open		
2010	2011	539	-14	Open		
2011	2012	539	27	Open		
2012	2013	539	79	Brown Tag		
2013	2014	435	-3	Brown Tag	17.82	35

Table 3.6: Conservation limits and provisional returns on the Kerry Blackwater catchment along with the 2014 CWEF fishing result.
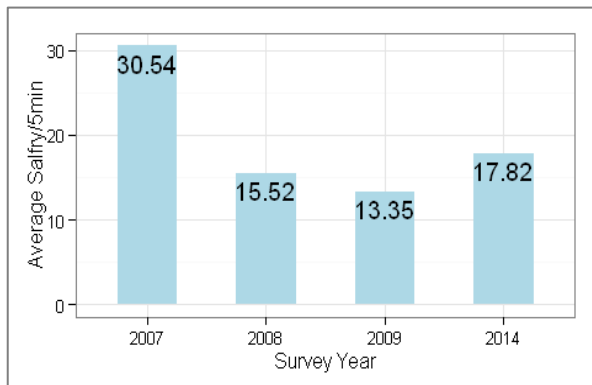
Figure 3.8: Comparison of Mean Salfry/5 min for all surveys on the Kerry Blackwater catchment to 2014.
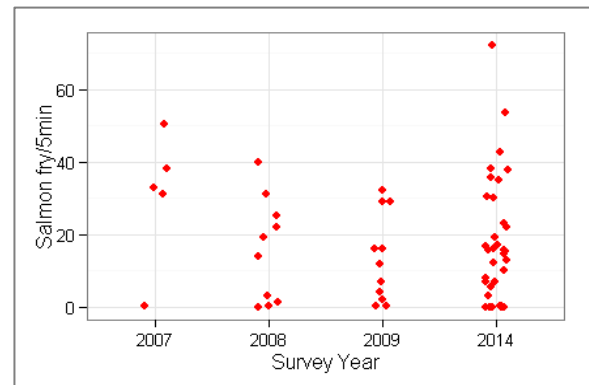
Figure 3.9: Comparison of Salfry/5 min from each site each year on the Kerry Blackwater catchment to 2014.

The mean salmon fry per 5min obtained in 2014 is high and compares well with that obtained in 2008 and 2009. It is much lower than that obtained in 2007, however that survey consisted of only 5 sites, and would not be considered comprehensive. Comparison of the range of results from individual surveys in 2014, with the range of individual results obtained in previous years shows that on the whole the range is broadly similar but that the highest value from any site was obtained in 2014. It is also apparent that the 2014 is the most comprehensive survey of the catchment undertaken in this programme.
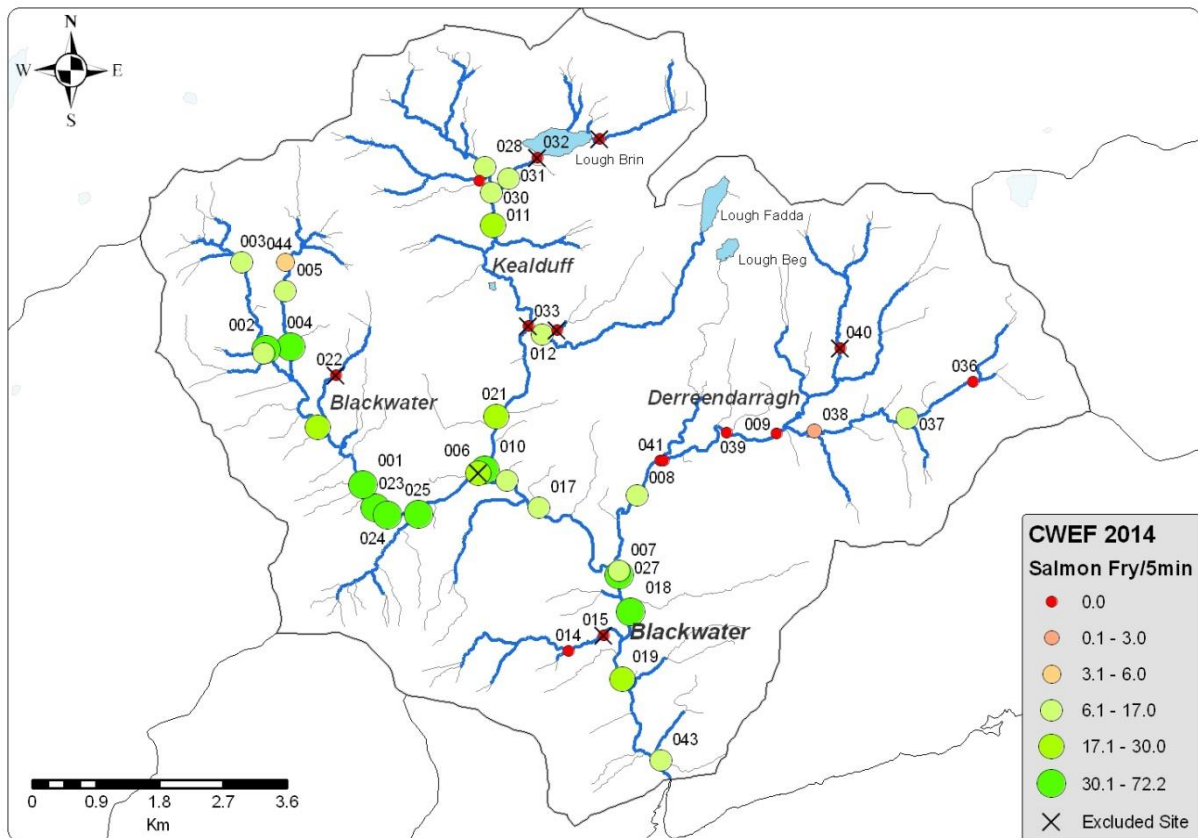
Map 3.6: Showing the distribution of Salmon fry at 5minute electrofishing survey locations throughout the Kerry Blackwater system.
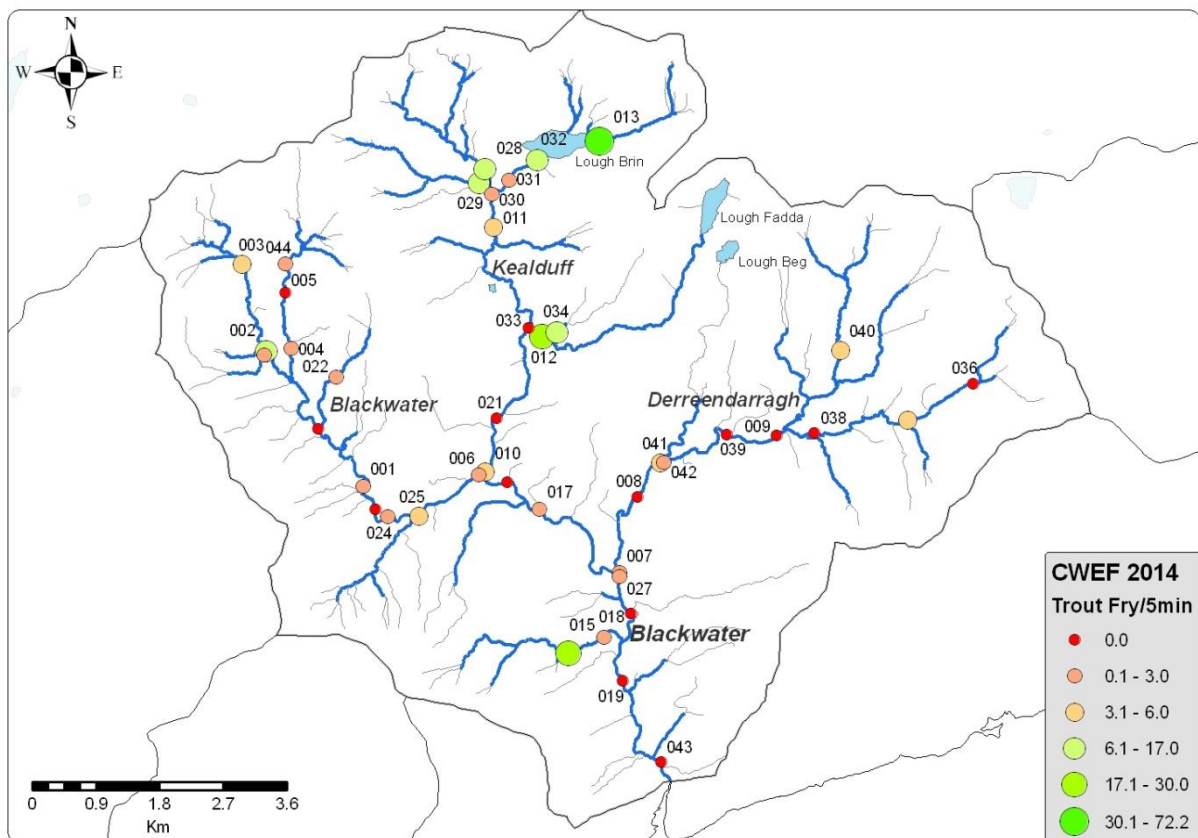
Map 3.7: Showing the distribution of Trout fry at 5minute electrofishing survey locations throughout the Kerry Blackwater system.

Comparison with Previous Annual CWEF Surveys Nationally.

The average CWEF result of 17.82 salmon fry/5min obtained from the Blackwater on 2014 can be compared with results of other similar surveys undertaken as part of the CWEF programme 1997 to 2014. The result in the Blackwater in 2014 is within the mid 50% of all results and larger than 73% of the other results.
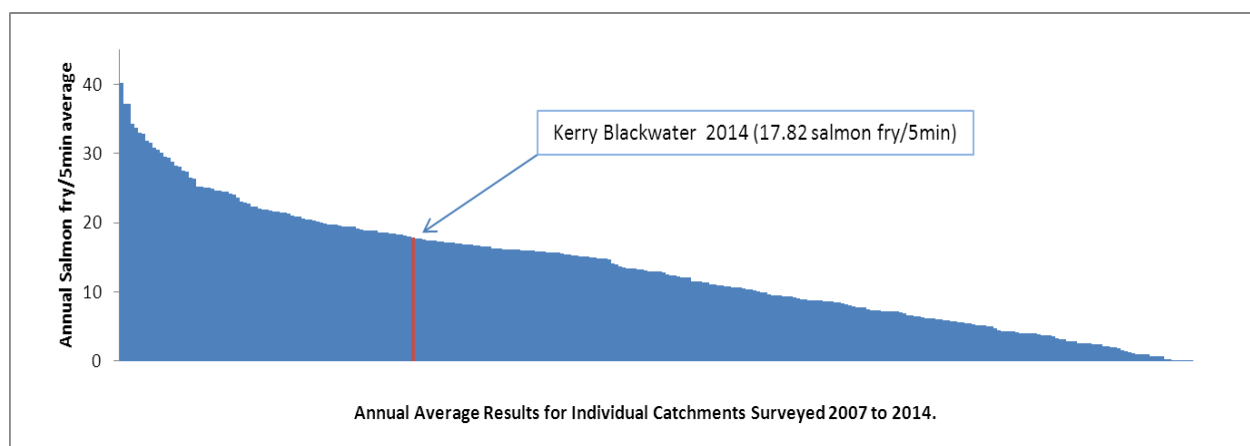
Figure 3.8: Bar plot of annual average salmon fry per 5min obtained in annual Catchment surveys 1997 to 2014. (Min: 0; 25th percentile: 5.7; median: 12.2; 75th percentile: 18.2; maximum: 40.1)

3.3. Length Frequency Distribution of Salmon and Trout and age verification by Scale Reading.

Length frequency distribution of captured salmonids captured by depletion fishing and CWEF was compared (figure 4.3). For salmon 0+ the modal lengths were the same for both methods (5.5 cm), Salmon 0+ would be expected to be from 3 to 7cm in length and fish greater than 7cm to be 1+. Scale reading of a small number of fry verified these assumptions.

The modal length class for trout was 5.5 from CWEF and 4.5cm from depletion fishing. The 0+ would be expected to be from 4 to 10cm in length, the 1+ fry being those above 10cm.

Length frequency distributions for both species were similar from each of the fishing techniques.
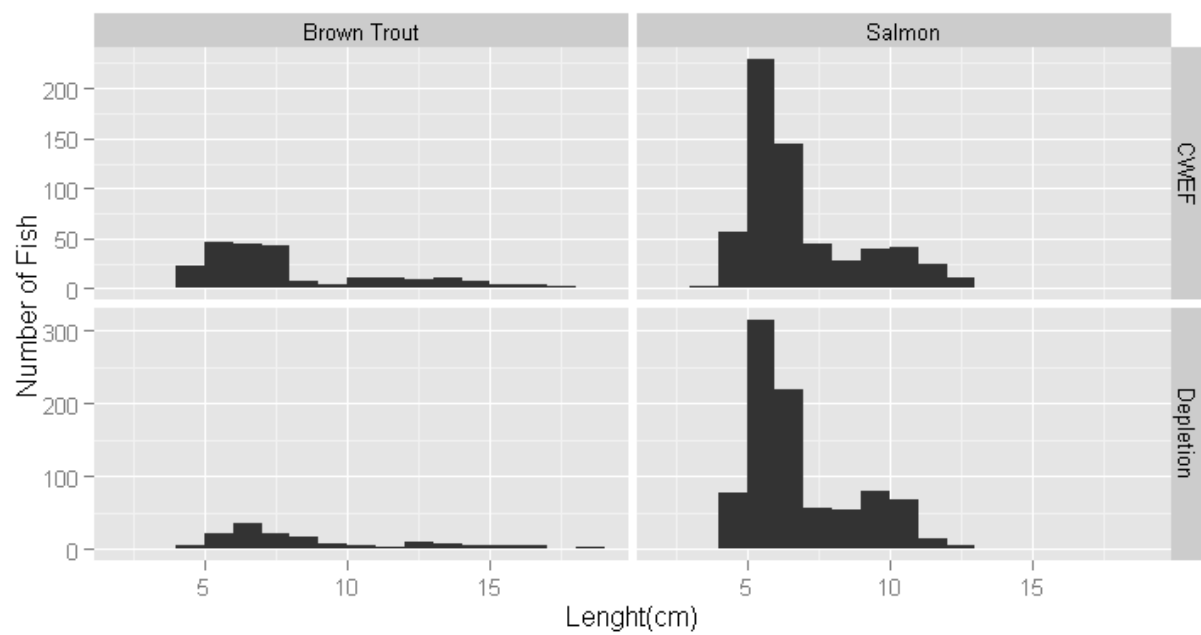
Figure 3.9: Comparison of Length distribution of Salmon and Trout captured using two fishing methods. (Sal CWEF N=623, Trout CWEF N=229; Sal Depletion N=889, Trout Depletion N=156)

4. Discussion

Depletion fishing results for the 2014 Kerry Blackwater survey were good in relation to the previous survey undertaken in 1995 and compared to surveys undertaken elsewhere. The densities of salmon 0+ fry recorded in 2014 were significantly better than that found in 1995.

CWEF electrofishing was slightly up on the surveys undertaken in 2008 and 2009. And while it was considerably lower than the result in 2007, that survey was based on only 5 sites and would not be considered to be comprehensive. The 2014 result is in the mid-range of similar surveys undertaken on catchments elsewhere within Ireland 2007 to 2014. The Kerry Blackwater had a mean catch of 17.82 salfry/5min in 2014 resulting in a cumulative average of 19.31 salmon fry/5min over four surveys since 2008. The majority of salmon rivers known to be meeting and exceeding salmon conservation limits have a modal salmon fry index of 17 or higher. The average salmon fry index for the Blackwater is above this threshold of 17 salmon fry set by the SSCS as indicative of good spawning and likely reflects the improved run of salmon seen since 2012.

CWEF found 0+ fry widely distributed throughout the system with excellent numbers present at a number of sites on both the Blackwater and the Kealduff. Fry numbers on the Derreendarragh were much poorer than elsewhere and fry were absent from a number of sites on this channel; habitat on this channel was generally poorer with large substrate more dominant, spawning does occur at sites along this channel but is likely much more restricted than elsewhere in the catchment.

Trout 0+were widely distributed, but present in lower densities than salmon. The densities of Salmon 1+ and trout 0+ and 1+ were not significantly different than those found in 1995.

Average densities of Salmon were highest in 5th order streams; trout densities were highest in 3rd order streams.

Q values assess the freshwater quality of the catchment based on the presence on invertebrates. Results from the catchment indicate water quality was generally good with all of sites surveyed (2012) with a Q value of 4-5.

Many of the streams in the catchment are found on areas of blanket peat which a have been planted with coniferous forestry areas. Research has shown that coniferous forestry on peat is associated with putting the streams at risk of eutrophication, acidification, changes in macroinvertebrate and salmonid populations and sediment loading in the streams (Hutton et al., 2008a; Hutton et al., 2008b;Kelly-Quinn et al., 2008; Rogers et al., 2008; O'Driscol et al., 2013).

The most recent SSCS figures for 2015 advice, based on the most recent five years counter data, indicate that the Blackwater is only meeting 81% of its' CL. However, counter numbers have increased modestly each year since 2012, but are still below their long term mean numbers. The reasons for the decline in salmon counts on the Blackwater in recent years are likely to be complex and may not be entirely restricted to the freshwater phase of the salmon lifecycle. However, careful management of the freshwater habitat is vital in order to maintain and enhance the production of salmon and trout fry from the catchment.

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Appendix

Depletion Results Details
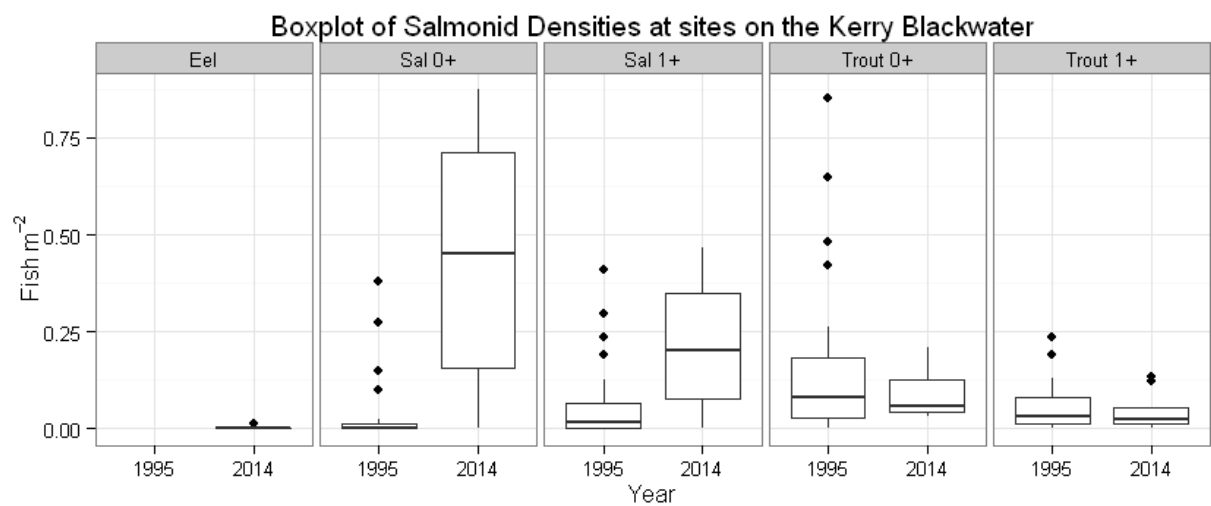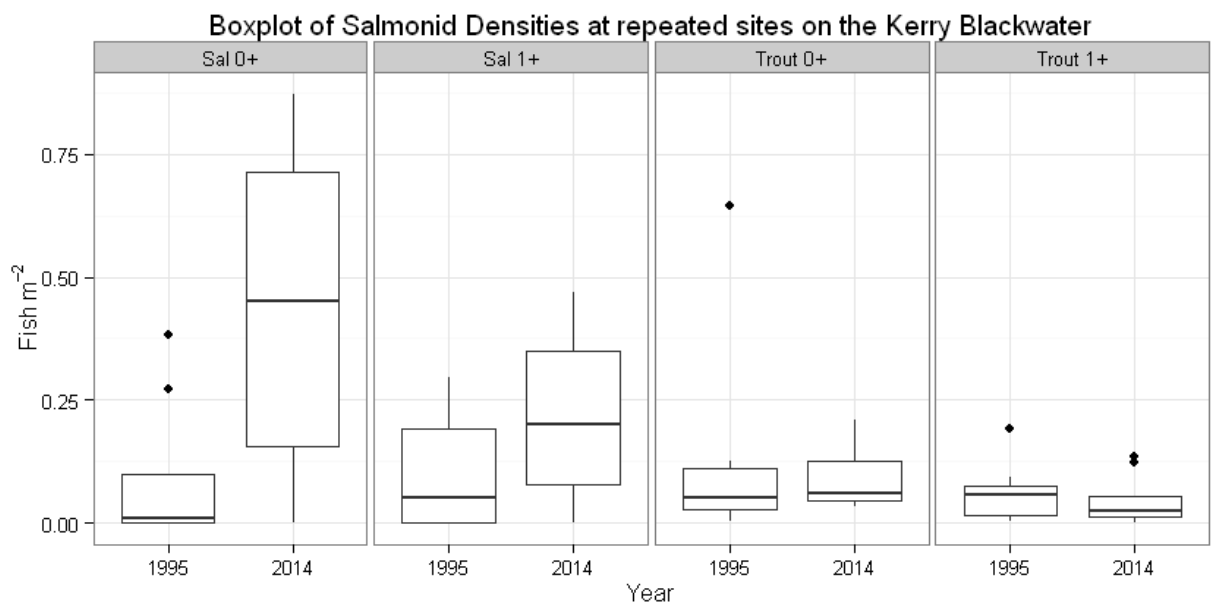
Boxplot of Salmonid Densities at repeated sites on the Kerry Blackwater

Boxplot of Salmonid Densities at sites on the Kerry Blackwater

X	Y	Site Number	Sal 0+ 1995	Sal 0+ 2014	Sal 1+ 1995	Sal 1+ 2014	Trout 0+ 1995	Trout 0+ 2014	Trout 1+ 1995	Trout 1+ 2014	Eel 2014
Blackwater											
73869	75829	1	0.000		0.008 *		0.054 *		0.039		
74513	75716	2	0.000		0.021 *		0.032 (0.072)		0.090 (0.044)		
74597	74420	3	0.000		0.019 *		0.032 *		0.023 *		
74571	74243	4	0.000		0.006 *		0.017 (0.038)		0.017 *		
74134	74304	5	0.000		0.013 *		0.135 (0.036)		0.000		
74227	74489	6	0.010 *	0.873 (0.099)	0.192 (0.066)	0.078 (0.1)	0.052 (0.056)	0.210 (0.061)	0.076 (0.177)	0.053 (0.027)	0.000
75589	72629	7	0.000		0.120 (0.007)		0.000		0.020 *		
75760	72265	8	0.005 *	0.713 (0.094)	0.012 *	0.468 (0.028)	0.002 *	0.059 (0.004)	0.005 *	0.124 (0.071)	0.000
77372	72668	9	0.381 (0.175)	0.450 (0.138)	0.296 (0.041)	0.057 *	0.010 *	0.061 *	0.020 (0.015)	0.000	0.000
77696	72688	10	0.149 (0.053)		0.018 *		0.010 *		0.011 *		
78465	72201	11	0.024 *		0.089 *		0.009 (0.002)		0.012 (0.015)		
79066	71446	12	0.016 *		0.060 *		0.006 *		0.003 *		
79345	70867	13	0.272 (0.037)	0.744 (0.05)	0.065 (0.045)	0.200 (0.03)	0.027 (0.007)	0.053 (0.026)	0.015 *	0.013 (0.003)	0.000
Keadluff River											
76212	77884	14	0.000		0.000		0.258 (0.12)		0.083 *		
76643	76965	15	0.000	0.000	0.000	0	0.032 (0.023)	0.035 *	0.192 (0.079)	0.135 (0.102)	0.000
77894	77142	16	0.000		0.000		0.263 (0.045)		0.237 (0.062)		
78359	74570	17	0.099 (0.05)	0.499 (0.319)	0.053 (0.026)	0.350664 (0.026)	0.646 (0.308)	0.144 (0.021)	0.094 (0.01)	0.054 (0.004)	0.011 *
77587	73696	18	0.007 (0.015)		0.045 (0.019)		0.039 (0.006)		0.068 (0.017)		
77429	73112	19	0.000		0.409 (0.043)		0.099 (0.014)		0.052 *		
Dereendarragh River											
84189	74074	20	0.000		0.000		0.164 (0.08)		0.000		
81821	73344	21	0.000	0.299 (0.029)	0.000	0.264 (0.151)	0.110 (0.045)	0.033 (0.004)	0.059 (0.006)	0.025 *	0.000
82852	74409	22	0.000		0.000		0.170 (0.037)		0.130 *		
82253	74270	23	0.000		0.000		0.218 (0.203)		0.123 *		
81834	73777	24	0.000	0.011 *	0.000	0.100 *	0.125 (0.027)	0.045 *	0.058 *	0.011 *	0.000
79916	73141	25	0.000		0.128 *		0.851 (0.112)		0.094 (0.007)		
79493	72528	26	0.022 *	0.155 (0.099)	0.236 (0.025)	0.351 (0.129)	0.065 (0.081)	0.126 (0.045)	0.008 (0.019)	0.010 *	0.000
Minor Tributaries											
76073	71942	27	0.000		0.020 *		0.184 *		0.061 *		
77584	72411	28	0.000		0.000		0.420 (0.037)		0.000		
78993	70514	29	0.017 *		0.000		0.179 *		0.026 *		
79766	70881	30	0.000		0.000		0.481 (0.02)		0.019 *		
		N	30	9	30	9	30	9	30	9	9
		Mean Density	0.033409	0.415896	0.060277	0.207707	0.156337	0.085203	0.054537	0.04727	0.001185

Summary of all results fish densities (fish m^{-2}) along with 95%CI (± in brackets) from depletion fishing surveys 1996 and 2014 on the Kerry Blackwater System. Where catchability was below 0.3 minimum density is presented (*).Most sires from 1995 comprised 2 fishings, most 2013 comprised 3 fishings.

CWEF Site details and results.

Site Number	X Site	Y Site	Stream Order	Width (m)	Riffle Grade	Salmon fry captured	Trout fry captured	Fry missed	Salmon fry/5min	Trout fry/5min	Include in CWEF index?
001	75589	72630	4	2.5	1	21	2	10	30.13	2.87	Include
002	74227	74531	3	3	1	37	8	20	53.44	11.56	Include
003	73884	75763	3	4.2	1	10	4	3	12.14	4.86	Include
004	74575	74575	3	2.8	1	51	2	22	72.17	2.83	Include
005	74491	75362	3	0	3	12	0	4	16.00	0.00	Include
006	77216	72789	4	8	2	9	1	12	19.80	2.20	Efficiency <60%
007	79209	71412	4	3.8	1	11	1	4	14.67	1.33	Include
008	79462	72484	4	6.8	2	6	0	2	8.00	0.00	Include
009	81430	73350	4	5	3	0	0	1	0.00	0.00	Include
010	77311	72837	5	8	2	24	2	15	37.85	3.15	Include
011	77432	76287	5	4.2	2	13	3	5	17.06	3.94	Include
012	78122	74748	3	4	1	13	17	6	15.60	20.40	Include
013	78926	77496	3	2.5	1	0	42	15	0.00	57.00	Above Cascades
014	78491	70288	3	2	2	0	21	8	0.00	29.00	Include
015	78986	70506	3	4	3	0	1	0	0.00	1.00	Unsuitable Site
016	77627	72685	5	9	1	6	0	2	8.00	0.00	Include
017	78079	72310	5	6.4	1	14	2	3	16.63	2.38	Include
018	79372	70841	5	10.5	1	27	0	8	35.00	0.00	Include
019	79257	69884	5	17	2	15	0	7	22.00	0.00	Include
020	74194	74477	2	2	1	13	1	3	15.79	1.21	Include
021	77472	73594	5	4	1	14	0	9	23.00	0.00	Include
022	75214	74169	2	1.5	1	0	2	0	0.00	2.00	Poor Site
023	75764	72309	4	7	3	28	0	10	38.00	0.00	Include
024	75936	72202	4	8	2	21	1	10	30.55	1.45	Include
025	76377	72214	4	8.4	1	27	2	17	42.83	3.17	Include
026	74952	73437	4	5.77	1	16	0	3	19.00	0.00	Include
027	79210	71356	5	15	1	27	1	9	35.68	1.32	Include
028	77314	77107	4	1.5	1	10	9	10	15.26	13.74	Include
029	77233	76902	3	1	1	0	9	5	0.00	14.00	Include
030	77406	76749	4	7	1	10	1	3	12.73	1.27	Include
031	77648	76947	4	1.5	3	7	1	0	7.00	1.00	Include
032	78053	77230	4	0	3	0	9	0	0.00	9.00	Above Cascades
033	77921	74855	5	0	3	0	0	0	0.00	0.00	Unsuitable Site
034	78327	74800	2	2	2	0	14	0	0.00	14.00	Unsuitable Site
036	84199	74076	3	9	3	0	0	0	0.00	0.00	Include
037	83283	73560	3	2.5	2	6	3	1	6.67	3.33	Include
038	81965	73377	3	5.5	3	2	0	1	3.00	0.00	Include
039	80723	73355	4	8.9	2	0	0	2	0.00	0.00	Include
040	82325	74548	3	5	3	0	1	4	0.00	5.00	inaccessible to salmon?

Site Number	X Site	Y Site	Stream Order	Width (m)	Riffle Grade	Salmon fry captured	Trout fry captured	Fry missed	Salmon fry/5min	Trout fry/5min	Include in CWEF index?
041	79792	72968	2	4	3	0	4	0	0.00	4.00	Include
042	79835	72960	4	3.9	3	0	1	1	0.00	2.00	Include
043	79798	68740	5	30	2	7	0	3	10.00	0.00	Include
044	74488	75759	3	4	2	4	1	2	5.60	1.40	Include

Salmon fry/5min from surveys included in CWEF calculations.

Site number	Survey Year			
	2007	2008	2009	2014
1	33.0	25.0	29.0	30.1
2	50.5	31.0	16.1	53.4
3	0.0	1.2		12.1
4	38.0	22.0	0.0	72.2
5	31.2			16.0
6		14.0		
7		19.0	32.0	14.7
8			4.0	8.0
9		0.0		0.0
10		40.0		37.8
11		3.0		17.1
12				15.6
13		0.0		
14			11.8	0.0
15			0.0	
16			7.0	8.0
17			2.0	16.6
18			29.0	35.0
19				22.0
20			16.0	15.8
21				23.0
23				38.0
24				30.5
25				42.8
26				19.0
27				35.7
28				15.3
29				0.0
30				12.7
31				7.0
36				0.0
37				6.7
38				3.0
39				0.0
41				0.0
42				0.0
43				10.0
44				5.6