

# River Lossie Juvenile Fish Survey 2013

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This report was submitted as part of a UHI dissertation by Tim Aspden.



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## 1.0 Introduction

The 2013 survey of the Lossie River and its tributaries follows and builds on the previous 2000 and 2010 surveys. Most of the previously surveyed sites were revisited and a few additional sites were also added to the survey.

The River Lossie is situated in Morayshire, north-east Scotland and lies between the Spey to the East and the Findhorn to the west and flows for approximately 45km from Loch Trevie to Lossiemouth on the Moray Firth coast. The river supports a fishery for both salmon and sea trout with the latter viewed as the more important fish.

The Lossie supports a number of water abstraction schemes located at Loch Romach, Glenlatterach and several distilleries within the catchment. Along the middle and lower reaches the land use is dominated by arable farming while in the upper reaches, from Dallas to the source at Loch Trevie, land-use includes both arable and livestock farming, moorland and commercial and semi-natural forest. There is also a significant quarrying activities along the river near Cloddach. Additional developments include the Rothes wind farm in the upper reaches and the Berryburn wind farm also impinges on a small part of the upper Lossie. The main urban areas are Elgin and Lossiemouth and both create potential for increased pollution to enter the watercourse.

There are several distilleries within its catchment area, which in general adhere to strict guidelines regarding water uptake and discharge. Distilleries require large quantities of cold water for the distillation process. After use this cooling water is usually released back into the nearby burn and can often raise the water temperatures above normal which in turn can affect juvenile fish growth although this may not affect the returning adults (Laughton and Laburn, 2001). In addition weirs are often installed to extract the water which can restrict fish

passage which is particularly evident on the Linkwood Burn where four weirs are present.

Early juvenile fish data for the Lossie is available from a limited electro-fishing survey of fish populations at four locations in 1987 conducted by the Freshwater Fisheries Laboratory (now Marine Science Scotland, MSS) in Pitlochry. A fish survey of the Linkwood burn was conducted after an accidental spillage of pot-ale syrup in 1997 by Hynd, (1997). A more comprehensive survey of fish populations within the Lossie was completed in 2000 by McRitchie and Laughton (2000) and a further survey of two sites on the mainstem Lossie near Mayne Farm was completed in 2002 (Laughton and Burns, 2002). Further fish data is also available from surveys commissioned by the Moray Flood Alleviation scheme during the last few years (Aquaterra Ecology 2009a-d, Era 2004, Era 2006a-b).

The River Lossie Fisheries Management Plan (Laughton, 2010a) highlighted the need for better data on fish populations (FMP Action 3.1), leading to a further survey in 2010 (Laughton, 2010b). This survey repeats the majority of the survey sites examined in 2010 and aims to provide distribution and abundance data on the juvenile fish species present within the Lossie and its tributaries.

## 2.0 Materials and Methods

Electro-fishing was carried out using methodology prescribed by the Scottish Fisheries Co-ordination Centre (SFCC, 2007). Each site was approximately 100m<sup>2</sup> and marked out using ropes at either end and as far as possible each site contained a range of fish habitats. Electro-fishing commenced from the downstream end, to and fro across the stream, until the full site area was fished. Species present and fork length (tip of nose to the V of the tail) was recorded along with a small sample of scales for age determination. After analysis all fish were returned to the site. Each site was electro-fished once only to allow a greater number of sites within the catchment to be visited.

Details of the habitat available within the site including, water depth, flow type, substrate type, riparian vegetation, land-use etc., were also recorded along with a photographic record of the upstream and downstream limits and the general site surroundings. This also allowed re-orientation to sites from previous survey sites from 2000 and 2010.

## 3.0 Results

Table1: Electro-fishing site locations for the Lossie juvenile fish survey 2000 2010 and 2013.

Date Fished	Site Code	Easting	Northing	Altitude (M)	River/Burn	Location
<b>Mainstem</b>						
23/09/2013	L1	325400	863850	5	Lossie	200m downstream from Calcots Bridge
20/09/2013	L2	320200	858450	45	Lossie	100 Above Cloddach Bridge
17/09/2013	L3	312650	852600	155	Lossie	Downstream of Bridge at Torcastle
17/09/2013	L4	312650	852600	210	Lossie	Downstream of Bridge at Ballacraggan
02/19/2013	L5	312400	847050	260	Lossie	Below bridge above Torwhinnie Falls
Not Fished	L6	353950	853150	145	Lossie	Upstream of Blackhill Bridge
02/10/2013	L8	316606	853755	130	Lossie	200m downstream of Kellas Ford
<b>Tributaries</b>						
24/09/2013	LW1	323500	861450	17	Linkwood Burn	Below Linkwood Distillery
24/09/2013	LW2	322600	860950	22	Linkwood Burn	Upstream from Linkwood Distillery Weir
24/09/2013	LW3	322400	859600	35	Linkwood Burn	Below Blossom Bank House Bridge
Not Fished	TY	322800	862550	15	Tyock Burn	Downstream from Ashgrove Council Dept
Not Fished	AL1	317000	861950	20	Aldroughty Burn	Downstream from road bridge
16/09/2013	LB1	318200	860100	30	Black Burn	Upstream of Miltonduff Distillery
18/09/2013	LB2	313150	857100	70	Black Burn	Downstream from Road Bridge
18/09/2013	LB3	309400	854250	90	Black Burn	Above Bridge at Bruiach
18/09/2013	LB4	308950	853900	110	Black Burn	Below Bridge
30/09/2013	LB5	309342	854205	25	Black Burn	Below Valeries House
Not Fished	LCB	314050	849650	200	Corrhathnich	Downstream of Bridge at Aultahurn
Not Fished	LA1	314050	849050	205	Aultahurn Burn	Downstream from Road Bridge
Not Fished	LC1	312100	846750	275	Clashgour Burn	Below Drainage Pipe
20/09/2013	LMFU	320546	860514	25	Lossie	Mayne Farm Upper Site
17/09/2013	LAU01	311900	849750	175	Auchness Burn	Below Double Culvert
29/09/2013	LH4	327300	860300	40	Lhanbryde	Scotsburn Farm

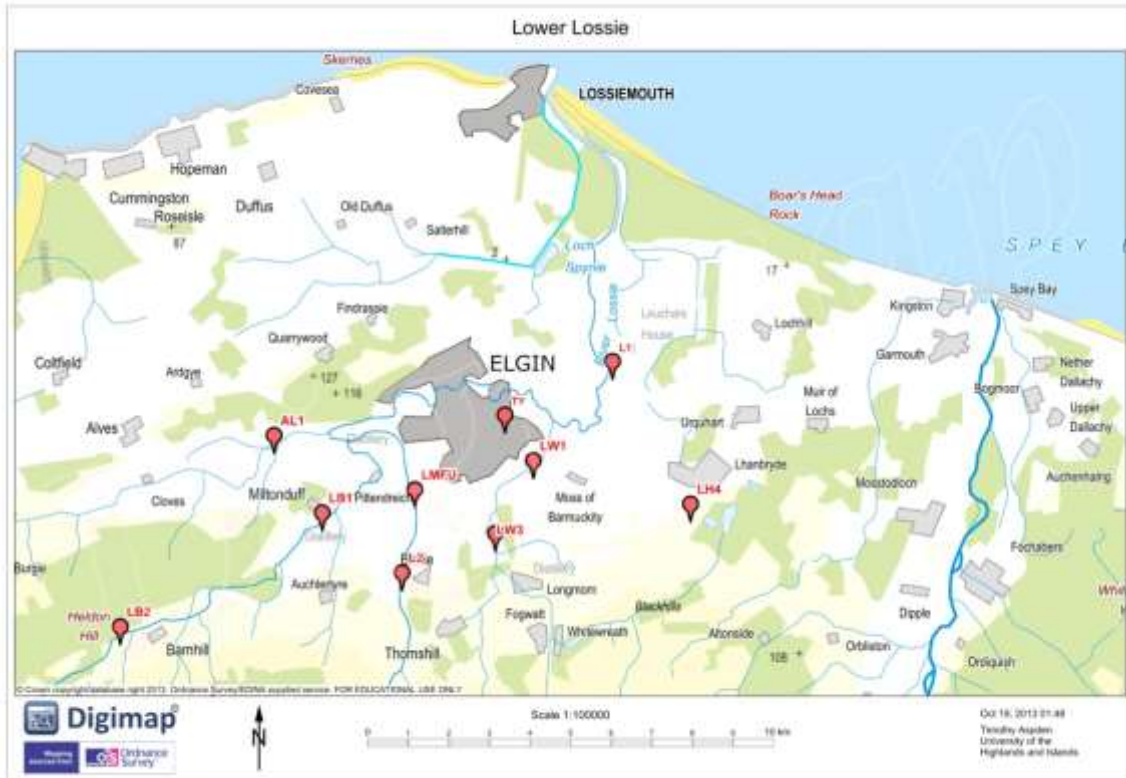


Figure 1: Electrofishing sites on the lower River Lossie 2013.

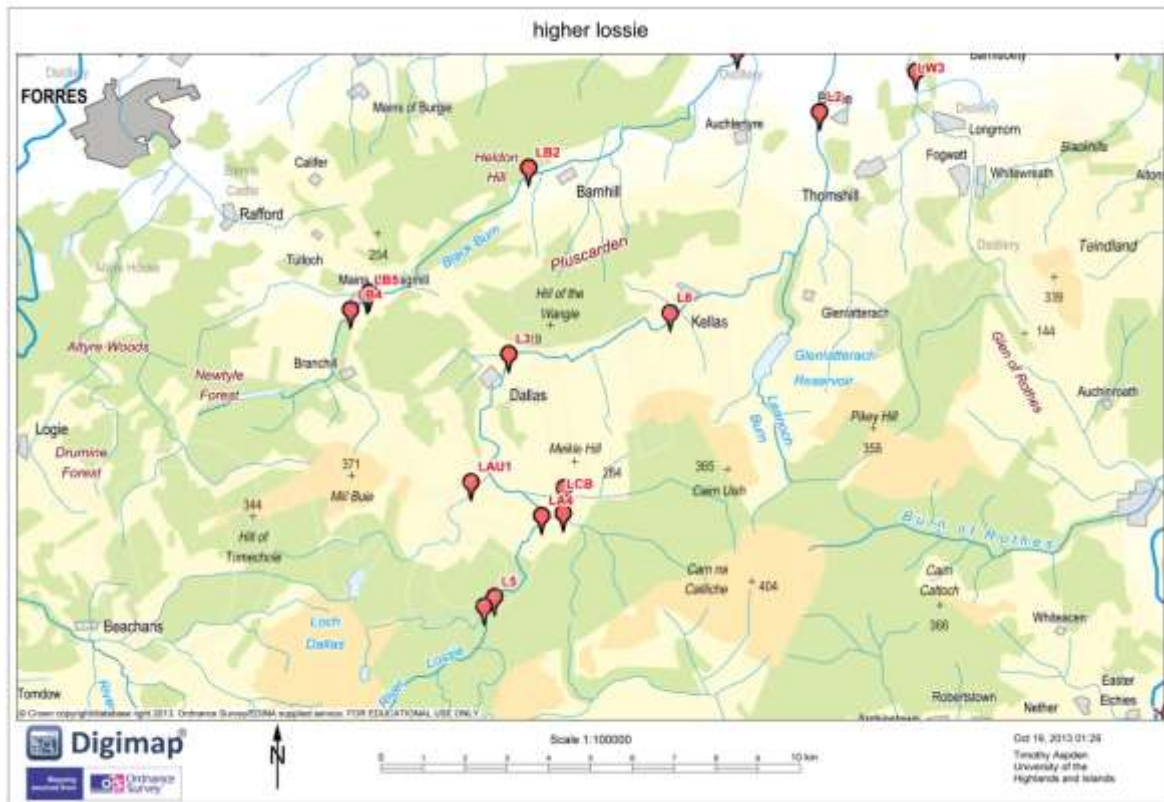


Figure 2: Electrofishing sites on the upper River Lossie 2013.

### 3.1 River Lossie Mainstem Sites

**Table 2a: Densities of trout and salmon by age class and the numbers of other fish species captured at main stem Lossie electro-fishing sites during 2000 (from McRitchie and Laughton, 2000).**

2000 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
L1	0.03	0.00	0.00	0.00	0.00	0.00	0.00	E=1 F=1 L=1
L2	0.02	0.01	0.00	0.07	0.00	0.00	0.00	E=1 L=1
L3	0.66	0.00	0.00	0.08	0.03	0.00	0.00	
L4	0.15	0.02	0.00	0.21	0.02	0.00	0.00	E=1
L5	0.00	0.00	0.00	0.19	0.09	0.04	0.01	
L6	0.28	0.26	0.00	0.16	0.01	0.01	0.00	

E=Eel F=Flounder L=Lamprey

**Table 2b: Densities of trout and salmon by age class and the numbers of other fish species captured at main stem Lossie electro-fishing sites during 2010 (Laughton 2011).**

2010 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
L2	0.01	0.01	0.00	0.01	0.00	0.00	0.00	
L3	0.38	0.02	0.00	0.10	0.09	0.00	0.00	
L4	0.12	0.02	0.01	0.09	0.04	0.01	0.00	E=2
L5	0.00	0.00	0.00	0.41	0.04	0.00	0.00	

E=Eel

**Table 2c: Densities of trout and salmon by age class and the numbers of other fish species captured at main stem Lossie electro-fishing sites during 2013.**

2013 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
L1	0.51	0.02	0.00	0.00	0.00	0.00	0.00	E=14 F=19 L=1 M=2
L2	0.36	0.06	0.00	0.06	0.00	0.00	0.00	L=2
L3	0.37	0.00	0.00	0.25	0.02	0.00	0.00	
L4	0.04	0.02	0.00	0.19	0.08	0.01	0.00	
L5	0.00	0.00	0.00	0.17	0.04	0.04	0.00	
L8	0.99	0.14	0.00	0.33	0.00	0.00	0.00	

E=Eel F=Flounder L=Lamprey M=Minnow

#### Salmon

Table 2a - 2c provide density data for salmon and trout at the mainstem survey sites along the Lossie during 2000, 2010 and 2013. With the exception of L5, salmon 0+ are present throughout the Lossie mainstem with the highest density (0.99m<sup>-2</sup>) at the newly established L8 site. With the exception of L3 and L5, salmon 1++ are also present, with the highest 2013 density (0.14 m<sup>-2</sup>) also at the highest L8 site (See table 2c).

In the Lossie tributaries (See table 3c) 0+ are present at five of the seven sites fished with 1++ present only at three of those five sites.

## Trout

Trout are sparse in the Lossie mainstem but are found at five of the six sites fished in 2013 (L1 being the exception). Like salmon the highest mainstem density was found at L8 (0.33 – m). No 1++ trout were found at L2 or L8 (See table 2c).

In the tributaries (See table 3c) trout were found at all the sites fished in 2013 with good densities found at with 0+ ranging from 0 m<sup>-2</sup> at LMFU and LB5 to 0.61m<sup>-2</sup> at LB1 and 0.73m<sup>-2</sup> at LW3. 1++ trout were found at all tributary sites in 2013 with the highest density (0.6m<sup>-2</sup>) at the highest Black Burn (LB5) site. Although 0+ trout were absent from this site!

## Other Fish

Mainstream site (See table 2c) L1 yielded pleasing numbers of eels (14) and flounder (19) with Lamprey (1) and minnow (2) also present. At L2 two lampreys were caught. Tributary sites (See table 3c) revealed a distribution of small numbers of eel (twelve at seven of the eleven sites) and lamprey (fifteen at six sites). One stickleback was found at LB1.

### 3.2 Tributaries of the River Lossie

**Table 3a: Densities of trout and salmon by age class and the numbers of other fish species captured at Lossie tributary electro-fishing sites during 2000 (from McRitchie and Loughton, 2000).**

2000 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
Lc1	0.00	0.00	0.00	0.02	0.12	0.05	0.02	
LA1	0.00	0.00	0.00	0.11	0.00	0.00	0.00	
LCB	0.00	0.03	0.00	0.05	0.28	0.01	0.00	E=3
LB1	0.38	0.05	0.00	0.20	0.03	0.01	0.00	L=1 S=1
LB2	0.00	0.00	0.00	0.08	0.29	0.10	0.05	L=1
LB3	0.00	0.00	0.00	0.27	0.20	0.05	0.00	E=1
LB4	0.00	0.00	0.00	0.37	1.62	0.00	0.00	
AL1	0.02	0.03	0.00	0.01	0.00	0.00	0.00	E=1 S=10
TY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	E=2 S=50
LW1	0.00	0.14	0.00	0.10	0.11	0.01	0.01	E=1 L=1 S=1
LW2	0.00	0.08	0.08	0.06	0.12	0.00	0.00	L=2 S=1
LW3	0.00	0.00	0.00	0.04	0.02	0.00	0.00	

E=Eel L=Lamprey S=Stickleback



**Table 3a: Densities of trout and salmon by age class and the numbers of other fish species captured at Lossie Tributary electro-fishing sites during 2010 (Laughton 2011).**

2010 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
LA1	0.15	0.01	0.00	0.15	0.00	0.01	0.01	E=1
LCB	0.00	0.00	0.00	0.00	0.02	0.00	0.00	
LB1	0.41	0.09	0.00	0.08	0.06	0.00	0.00	E=2 L=2 S=53
LB2	0.01	0.00	0.00	0.24	0.06	0.05	0.01	E=1 L=1
AL1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	S=25
TY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	S=4
LW1	0.11	0.00	0.02	0.05	0.01	0.02	0.00	E=1 L=1 S=2
LW2	0.00	0.00	0.00	0.06	0.06	0.06	0.01	E=1 L=1
LW3	0.00	0.00	0.00	0.25	0.05	0.00	0.00	E=3
LS1	0.00	0.00	0.00	0.04	0.00	0.00	0.00	

E=Eel L=Lamprey S=Stickleback

**Table 3b: Densities of trout and salmon by age class and the numbers of other fish species captured at Lossie Tributary electro-fishing sites during 2013.**

2013 Site	Salmon m <sup>-2</sup>			Trout m <sup>-2</sup>				Other Species
	Salmon 0+	Salmon 1+	Salmon 2+	Trout 0+	Trout 1+	Trout 2+	Trout 3+	
LB1	0.43	0.06		0.61	0.27	0.00		E=1 L=6 S=4
LB2	0.12	0.00		0.23	0.09	0.03		E=1
LB3	0.06	0.00		0.22	0.20	0.03		
LB4	0.00	0.00		0.12	0.04	0.00		L=2
LB5	0.00	0.00		0.00	0.43	0.17		E=2
LW1	0.13	0.02		0.22	0.01	0.00		E=4 L=3
LW2	0.00	0.00		0.01	0.02	0.00		E=2
LW3	0.00	0.00		0.73	0.13	0.00		E=1 L=1
LMFU	0.55	0.03		0.00	0.02	0.00		E=1 L=1
LAU1	0.12	0.00		0.33	0.27	0.00		L=2
LH4	0.00	0.00		0.66	0.06	0.00		

E=Eel L=Lamprey S=Stickleback

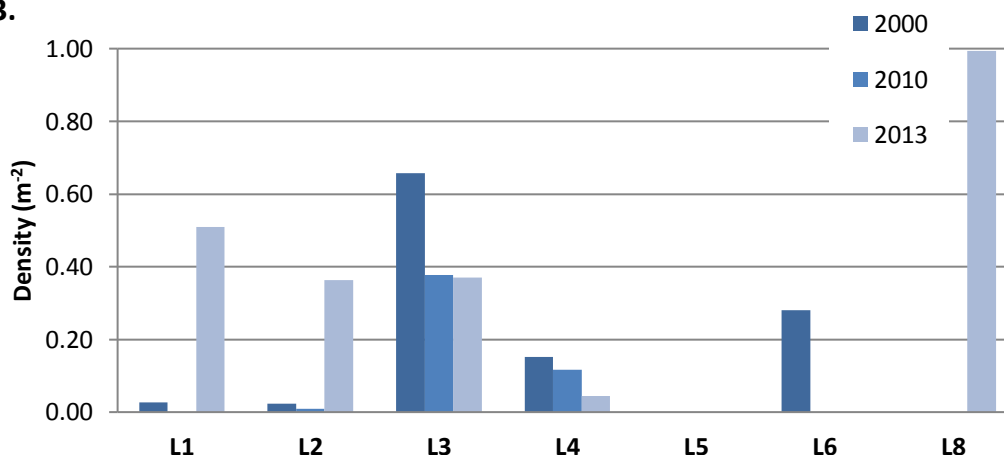
### 3.3 Juvenile Salmon and Trout Comparison 2000, 2010 and 2013.

Table 4 shows which sites were fished in the 2000, 2010, and 2013. Figures 2a – 2d allow density comparisons to be made for juvenile salmon and trout at 0+ and 1++ ages at mainstem and tributary sites.

Table 4: Sites fished and not fished 2000, 2010, and 2013 to be used in conjunction with Figures 2a – 2d.

Site	2000	2010	2013	Site	2000	2010	2013
<b>Mainstem</b>				<b>Tributaries</b>			
L1	Y	N	Y	LC1	Y	N	Y
L2	Y	Y	Y	LA1	Y	Y	N(T)
L6	Y	N	N	LCB	Y	Y	N
L3	Y	Y	Y	LB1	Y	Y	Y
L4	Y	Y	Y	LB2	Y	Y	Y
L5	Y	Y	Y	LB3	Y	N	Y
L8	Y	N	Y	LB4	Y	N	Y
				LB5	N	N	Y
				AL1	Y	Y	N(T)
<b>Y = Quantative survey carried-out</b> <b>N = No Quantative survey carried-out</b> <b>N(T) = Timed only</b>				TY	Y	Y	N(T)
				LW1	Y	Y	Y
				LW2	Y	Y	Y
				LW3	Y	Y	Y
				LS1 (RWG3)	N	Y	N(T)
				LH4	N	N	Y
				LMFU	N	N	Y
				SC1	N	N	N(T)
				SC2	N	N	N
				RWC3 (MCH03) (LCB)	Y	Y	N(T)
				LD1	N	N	N(T)
				LAU1	N	N	Y

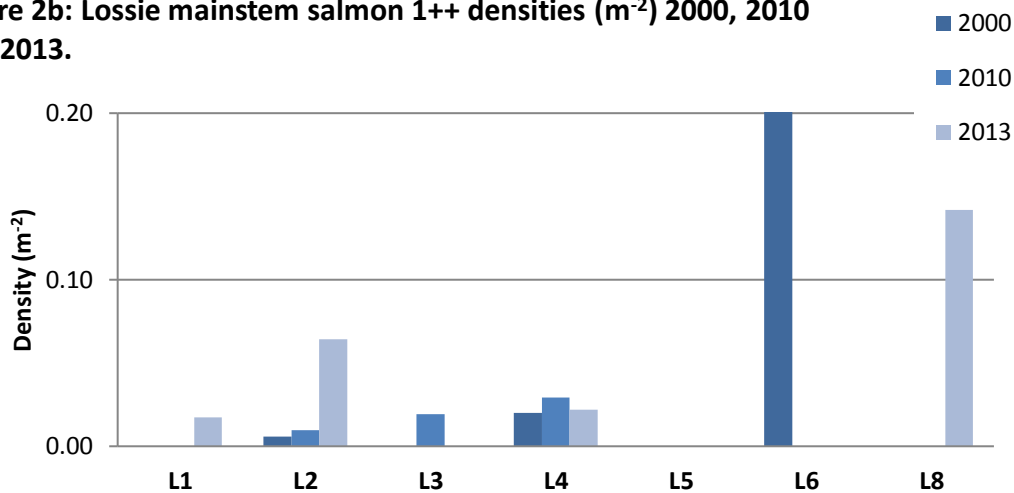
Figure 2a: Lossie mainstem salmon 0+ densities ( $m^{-2}$ ) 2000, 2010 and 2013.



All Lossie mainstem sites were fished in 2013 with the exception of L6. Salmon 0+ were absent in 2013 at L6. L1 showed a substantial 0+ increase over 2000 (not fished 2010). L2 showed a salmon 0+ increase over 2000 and 2010 (when none were caught). L3 showed salmon 0+ consistent with 2010 but substantially less than 2000. L4 shows a 0+ decline from relatively small numbers from 2000 to 2010 and 2010 to 2013. L5 was fished

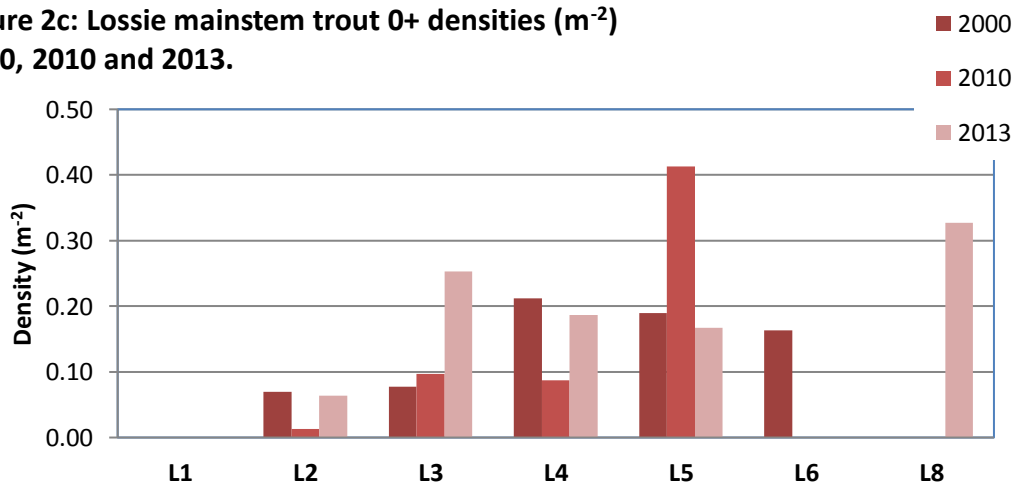
2000, 2010 and 2013 with 0+ absent in all years. L6 had 0+ present 2000 but was not fished in either 2010 or 2013. L8 is a new site for 2013 and showed the highest mainstem 0+ density.

**Figure 2b: Lossie mainstem salmon 1++ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



Salmon 1++ were present at L1 where none were found in 2000 (not fished 2010). L2 shows a 1++ increase on both 2000 and 2010. L3 had a small 1++ density in 2010 but none present in either 2000 or 2013. L4 had a low and consistent 1++ density in all three years' surveys. In L5 salmon 1++ (like 0+) were absent in all three years. L6 showed the highest density for 1++ for all mainstem sites but was not fished in 2010 or 2013. L8 showed a strong 1++ in 2013 (not previously fished).

**Figure 2c: Lossie mainstem trout 0+ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



At L1 Trout 0+ were absent in 2000 and 2013 (not fished 2010) (Figures 2c). L2 showed a 0+ low density in 2000 and 2013, and a very low density in 2010. L3 0+ densities has increased with each survey. L5 0+ density has fallen back to similar to the 2000 level after 2010 survey showed a marked increase. L6 was not fished either 2010 or 2013 but revealed reasonable 0+ density then. L8 revealed the highest 2013 0+ density.

**Figure 2d: Lossie mainstem trout 1++ densities ( $m^{-2}$ ) 2000, 2010 and 2013.**

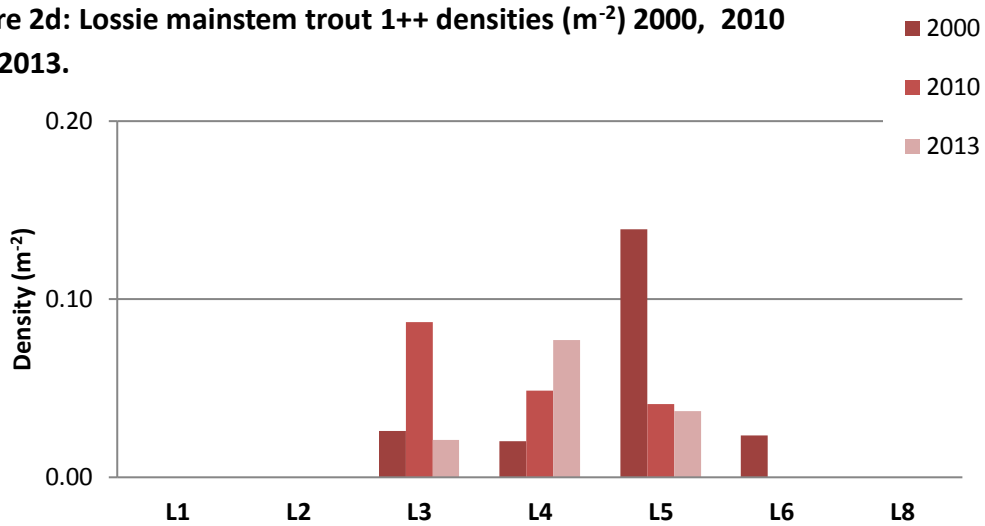


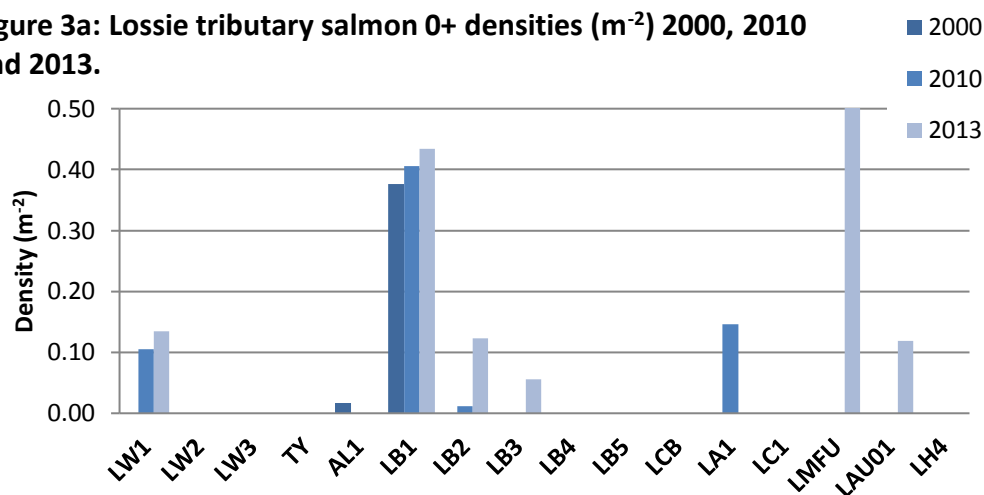
Figure 2d shows 1++ trout were absent at mainstem sites L1, L2, L6 and L8 in 2013. L3 1++ were low in 2000 and 2013 with a greater number found in 2010. L4 numbers have increased from 2000 to 2010 and again in 2013. L5 in 2000 had the highest mainstem 1++ density recorded ( $0.13 m^{-2}$ ) with numbers falling to about quarter of this in 2010 and 2013. L6 showed 1++ fish present at a low density in 2000 but has not been fished since. No 1++ trout were found at the not previously fished L8 site.

### 3.3.2 Tributary Sites

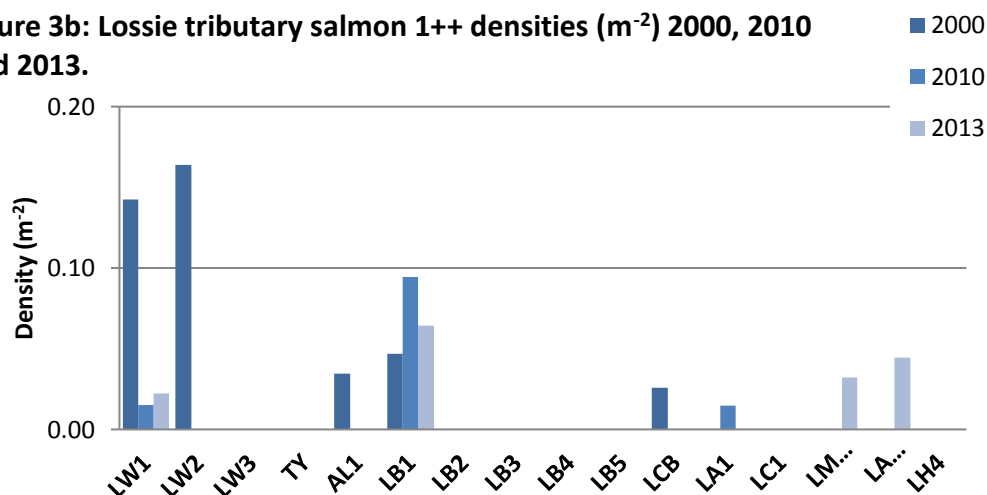
#### Salmon

Figures 3a – d. Tributary densities for salmon and trout. Use with table 4 to identify non-fished sites.

**Figure 3a: Lossie tributary salmon 0+ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



**Figure 3b: Lossie tributary salmon 1++ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



The Linkwood Burn LW1 site had no 0+ salmon in 2000 but a low density in both 2010 and 2013. There was a good density of 1++ fish in 2000 but low densities in 2010 and 2103. No 0+ salmon were found at the higher LW2 and LW3 sites. In 2000 only there were 1++ fish at LW2.

No salmon were found at the Tyock Burn site in 2000 and 2010 (not fished 2013). The Aldroughty Burn was fished in 2000 and 2010 with a low 0+ density (2 fish) caught in 2000. No salmon were caught in 2010 and AL1 was not fished in 2013.

The lowest Black Burn site (LB1) had good and consistent densities of (~0.40M<sup>-2</sup>) 0+ in all years and low but consistent densities of 1++ fish. Above this the LB2 site had no 0+ salmon in 2000, a very low density (0.01m<sup>-2</sup>) in 2010, but an increase in 2013. 1++ fish were absent in all years. LB3 had no salmon 0+ fish in 2000 and a low density in 2013

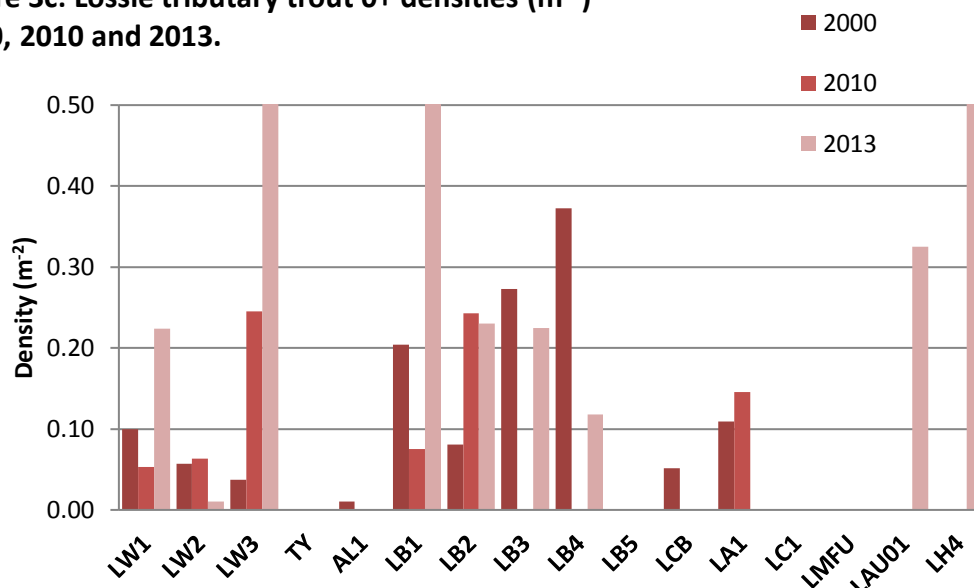
(not fished 2010). 1++ fish have been absent both 2000 and 2013. At LB4 Salmon were absent 2000 and 2013 (not fished 2010). LB5 was only fished in 2013 and yielded no salmon. However, the presence of salmon fry at LB2 and LB3 is encouraging since these sites are above the old gabion weirs which were removed in 2012 and indicate that some salmon have progressed upstream to utilise new spawning areas.

LCB and LA1 were not fished in 2013 and no salmon were caught in either 2000 or 2010. Salmon were absent at LC1 (fished 2000 and 2013). LMFU (new site 2013) had the highest 0+ density with a low density of 1++ Fish. LAU01 (new site 2013) yielded low densities of both 0+ and 1++ fish.

There were no salmon at the Lhanbryde Burn site (LH4) (fished in 2013 only).

### Trout

**Figure 3c: Lossie tributary trout 0+ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



Linkwood LW1 2013 showed increased 0+ trout but decreased 1++ density over previous years. LW2 had low densities in 2000 and 2010 and decreased densities of both 0+ and 1++ trout in 2013. LW3 0+ density has increased with each survey, from low in 2000 to good in 2013, and from low to slightly higher in 2010 and again 2013 for 1++ fish.

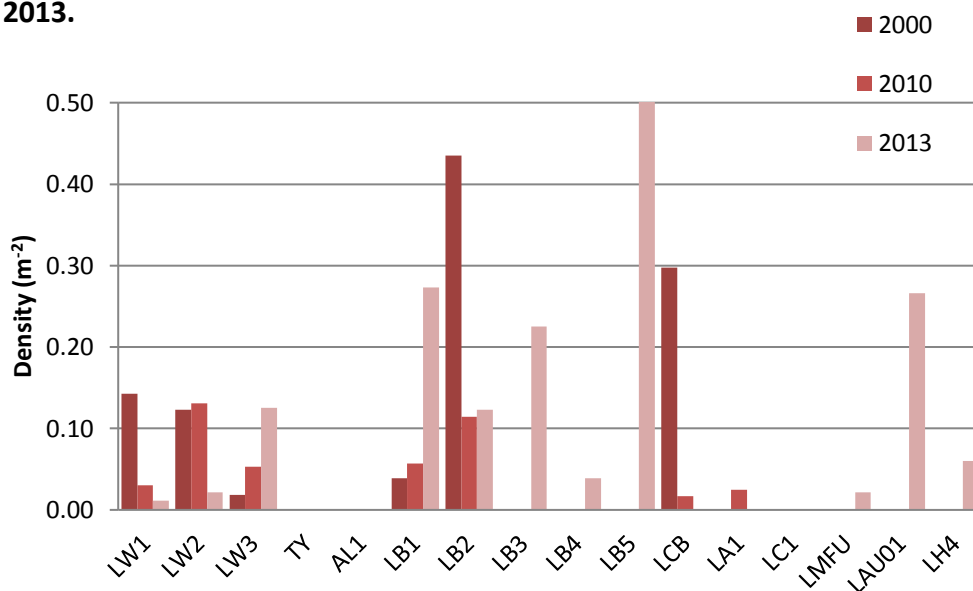
No trout were found in the Tyock Burn (TY) in either 2000 or 2010 (not fished 2013). The Aldroughty Burn had a very low density of 0+ fish in 2000 with no fish found in 2010 (not fished 2013).

The lowest Black Burn site LB1 had substantially increased densities for both 0+ and 1++ trout over previous years. LB2 0+ density maintained its increased 2010 level over 2000, and 1++ fish density again remained consistent with 2010 although much lower than 2000. LB3 was fished in 2000 and 2013 with similar 0+ fish caught. 1++ trout were only found 2013.

LB4 (not fished 2010) yielded fewer 0+ fish than in 2000, and had a low density of 1++ trout. LB5 (fished 2013 only) yielded no 0+ fish and the highest tributary density of 1++ trout. LCB was not fished in 2013 but a low density of 0+ in 2000 and none in 2010. 1++ fish present 2000 but were sparse in 2010. The removal of the gabion weirs may have improved access for trout as well as salmon with a good distribution of juvenile trout found within the upper sites LB2 to LB 5 in 2013. However, densities were similar to previous years.

LA1(not fished 2013) had a low density of 0+ fish in 2000 and 2010 and a very low 1++ density in 2010 only. LC1 (not fished 2010) yielded no trout juveniles. LMFU (only fished 2013) had no 0+ and few 1++ trout. LAU01 (only fished 2013) yielded a moderate number of 0+ and 1++fish. LH4 (fished 2013 only) had a high density of 0+ fish and a low number of 1++ fish.

**Figure 3d: Lossie tributary trout 1++ densities (m<sup>-2</sup>) 2000, 2010 and 2013.**



### General Comparison of Salmon and Trout Densities

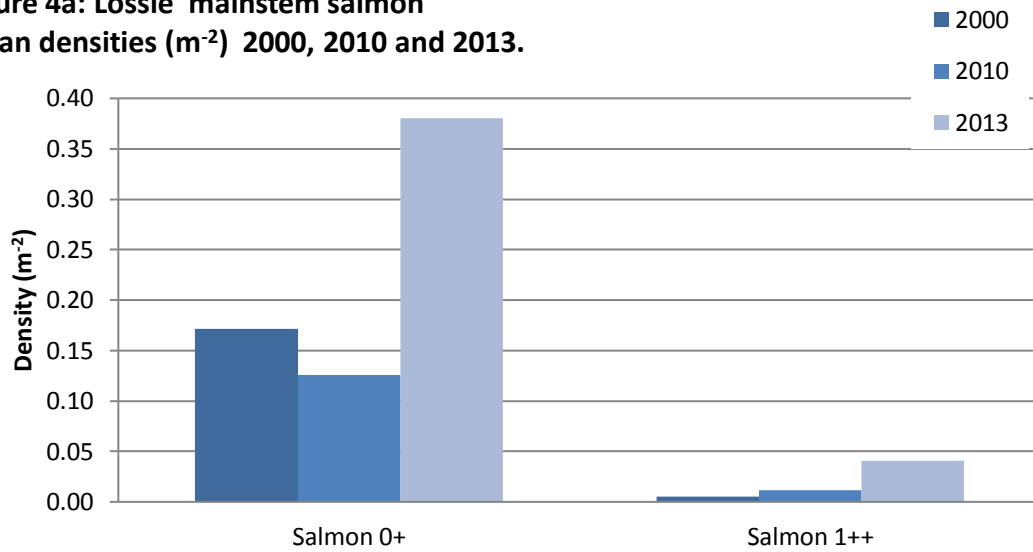
Mean densities of juvenile salmon and trout in the mainstem and the tributaries of the Lossie during 2000 and 2010 were compared with the mean density determined from the sites surveyed in 2013 the result are compared in Figures 4a and 4d.

The results are encouraging within the mainstem with both salmon 0+ and salmon 1++ increasing in mean density in 2013 when compared with the previous two survey years (Figure 4a). For trout 0+ mean densities also increased while older trout densities were very similar to the earlier survey years (Figure 4b).

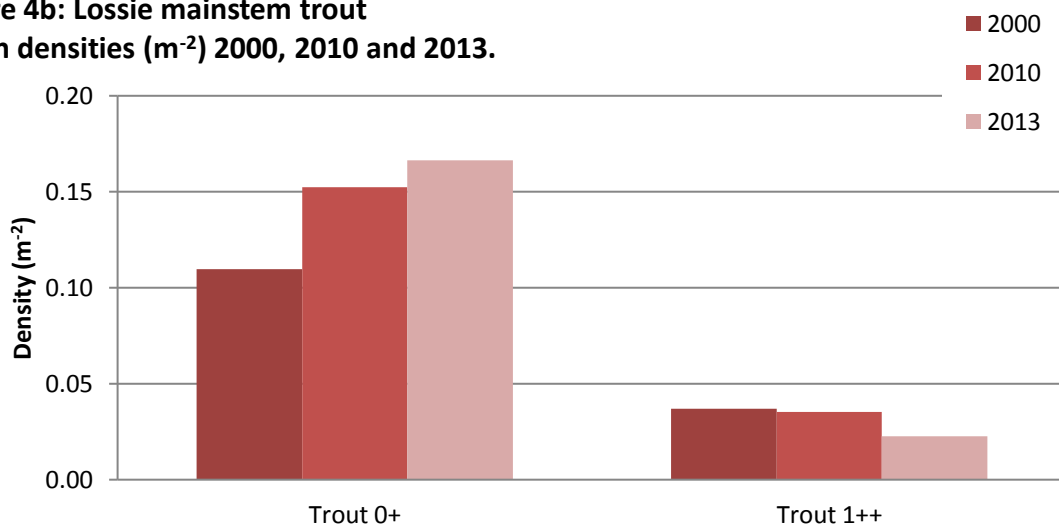
Figure 4c shows the mean densities of juvenile salmon in the tributaries Lossie during 2000 and 2010 compared with 2013. Similar to the mainstem results the densities of salmon 0+ was better than in 2000 and 2010. Mean densities of salmon 1++ were improved on the 2010 survey but less than the mean density recorded in 2000.

For trout the results were encouraging with both trout 0+ and older 1++ trout showing a higher mean density than in the two previous survey years (Figure 4d).

**Figure 4a: Lossie mainstem salmon mean densities ( $m^{-2}$ ) 2000, 2010 and 2013.**

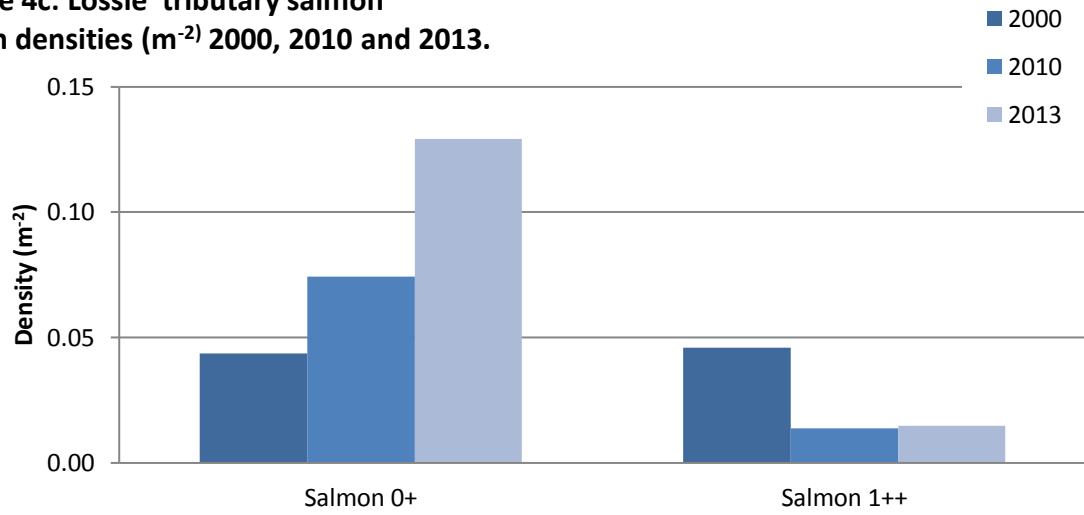


**Figure 4b: Lossie mainstem trout mean densities ( $m^{-2}$ ) 2000, 2010 and 2013.**

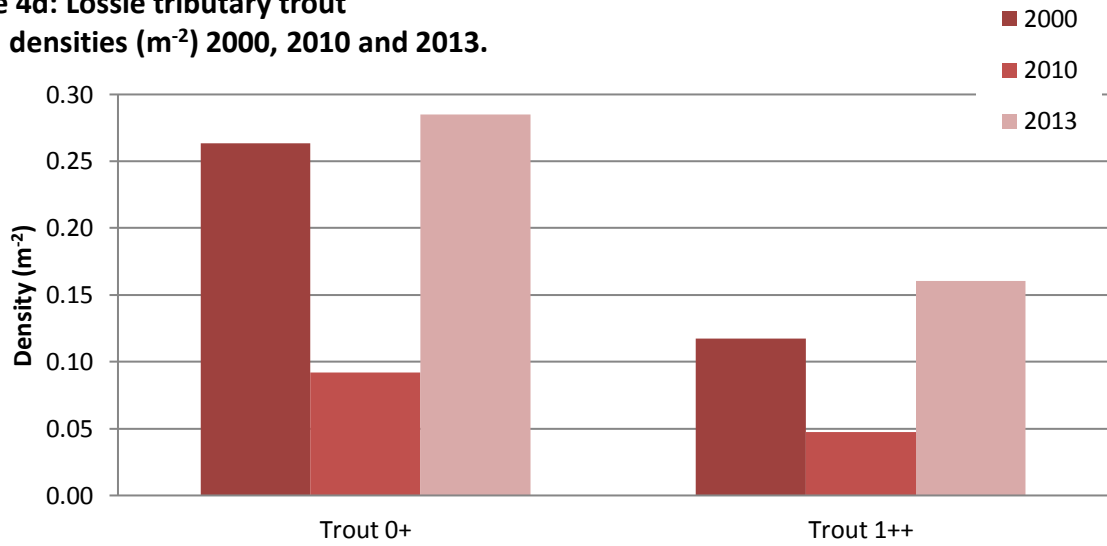




**Figure 4c: Lossie tributary salmon mean densities ( $m^{-2}$ ) 2000, 2010 and 2013.**



**Figure 4d: Lossie tributary trout mean densities ( $m^{-2}$ ) 2000, 2010 and 2013.**



#### **4. Discussion**

The 2013 electrofishing survey provided additional data on the distribution of salmon, trout and other species of fish within the River Lossie. It also allowed comparison with the similar survey completed in 2000 and 2010 (McRitchie and Laughton 2001, Laughton 2010).

The main indications from this survey and the various others is that juvenile trout are present throughout the Lossie catchment. They are present in the mainstem although densities are generally low and also present in most of the tributaries. Many of the tributaries such as the Linkwood, Blackburn Corrhathnich etc contain relatively good stocks of trout fry and older trout parr indicating that they are important areas for sea trout spawning. Above the waterfall at Torwinny good densities of resident brown trout were determined. The 2013 survey showed an encouraging increase in mean densities of both trout 0+ (fry) and older 1++ trout when compared with the 2000 and 2010 surveys.

Previous surveys of juvenile salmon indicate they are more restricted in their distribution with the mainstem from Dallas downstream to the mouth providing the best densities (Aquaterra Ecology 2009a, Era 2006a-b, Laughton and Burns 2002, McRitchie and Laughton 2001, Laughton 2010). The current survey also showed this and both salmon 0+ and 1++ showed improved mean densities than the previous surveys in 2000 and 2010.

Juvenile salmon were less well distributed in the tributaries but still showed an encouraging increase in the mean density of salmon 0+ when compared with 2000 and 2010.

Juvenile densities can vary considerably along the length of a tributary and even adjoining electro-fishing sites can have considerable differences in fish density (Amiro, 1990) as well as vary from year to year. This was clearly evident within the 2000 and 2010 survey with wide variations in salmon and trout densities from site to site. The surveys of the mainstem (Aquaterra Ecology 2009a, Era 2006a-b) also illustrate. Variations arise from many factors, both natural and man-made. Natural factors including ease of adult access, the availability of suitable habitat for spawning and juvenile development, and the presence of good riparian bank flora and fauna.

Many of the upper burns had good riparian vegetation and undercut banks were often present offering good habitat for juvenile trout. However, juvenile salmon prefer faster flowing riffle

areas and wider more open streams in their juvenile stages. Given that the general gradient of the Lossie is low in many areas, there may be a limit on this type of habitat.

A number of obstructions that affect fish passage have been identified throughout the Lossie, including weirs on the mainstem in Elgin, and on the Linkwood Burn and waterfalls on the Lossie and Gedloch Burn.

Given the distribution of juvenile salmon and trout, adults can clearly ascend the weirs in Elgin. However, any moves to remove these would certainly make their passage easier. Salmon were absent above the waterfall on the upper Lossie but good numbers of trout were present. This may indicate that sea trout can ascend but not salmon. So additional work to determine whether sea trout ascend the waterfall using an isotope technique is planned for 2014-15.

The Linkwood is also affected by weirs and their removal or any remedial action to improve fish access would be beneficial to both salmonids and other species such as eels and lamprey. Discussions with the distillers and SEPA are at an early stage to improve the overall status of the burn.

On a more positive note the removal of the gabion weirs on the Black Burn in 2012 may have influenced the fish populations in the upper part of the burn. The presence of salmon 0+ at sites LB2 and LB3 indicate that some adult salmon had progress further upstream to utilise new spawning areas. The benefits for trout were not so clear.

The current survey added to the previous data sets for juvenile fish within the Lossie and indicated positive trends in overall density for both salmon and trout. This was encouraging given recent downward trends in adult salmon trout catches.

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