

# River Lossie Juvenile Fish Survey 2010

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## **Spey Foundation Report 02/11**

### **1. Introduction**

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. Occasionally accidents can happen leading to isolated pollution incidents. As a result damage assessment surveys have been carried out on affected watercourses, for example, an invertebrate and fish survey of the Linkwood burn was completed after an accidental spillage of pot-ale syrup (Morrison, 1997; Hynd, 1997). Distilleries also 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 well 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.

Other early 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, 2010) highlighted the need for better data on fish populations (FMP Action 3.1), and this survey aims to provide basic data on the juvenile fish species present within the Lossie and its tributaries and their relative abundance. The survey also revisited a number of the 2000 survey sites to allow a comparison after ten years.

## **2. 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. In addition a small tissue sample from the tail was collected at several sites for genetic analysis within the [FASMOP](#) project. The results from this study will be reported later. 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.

### 3. Results

Eighteen sites were electro-fished during 2000 (McRitchie and Laughton, 2000) and their relative location and details are presented in Figures 1a and 1b and Table 1. During 2010 thirteen of these sites were re-visited and one new site was established at LS1 on the Shougle Burn.

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

Date	Site Code	River/ Burn	Location	Grid Ref	Altitude (m)
Not Fished	L1	River Lossie	200m downstream of Calcots bridge	325400 863850	5
20/08/2010	L2	River Lossie	100m upstream of bridge	320200 858450	45
Not Fished	L6	River Lossie	Upstream of Blackhill Bridge	353950 853150	145
23/08/2010	L3	River Lossie	200yds downstream of bridge to Torchastle	312650 852600	155
23/08/2010	L4	River Lossie	Downstream of Bridge at Ballachraggan	313600 849100	210
23/08/2010	L5	River Lossie	Below bridge (Above Falls)	312400 847050	260
Not Fished	Lc1	Burn of Clashgour	Below Drainage pipes	312100 846750	275
25/08/2010	LA1	Yellowbog (Aultahurn) Burn	Downstream of bridge at Aultahurn	314050 849050	205
25/08/2010	LCB	Burn of Corrhathnich	Downstream of Roadbridge at Aultahuish	314050 849650	200
18/08/2010	LB1	Blackburn	Upstream of Miltoduff Distillery	318200 860100	30
18/08/2010	LB2	Blackburn	Downstream of roadbridge	313150 857100	70
Not Fished	LB3	Blackburn	Above Bridge at Briach	309400 854250	90
Not Fished	LB4	Blackburn	Below Bridge	308950 853900	110
18/08/2010	AL1	Mosstowie Canal (Aldroughy)	Downstream from roadbridge	317000 861950	20
18/08/2010	TY	Tyock Burn	Downstream of Ashgrove Depot	322800 862550	15
20/08/2010	LW1	Linkwood	Below Linkwood distillery	323500 861450	17
20/08/2010	LW2	Linkwood	Upstream of Linkwood distillery	322600 860950	22
20/08/2010	LW3	Linkwood	Downstream of Blossombank House	322400 859600	35
25/08/2010	LS1	Shougle	150M Downstream from Road Bridge	320750 855300	110

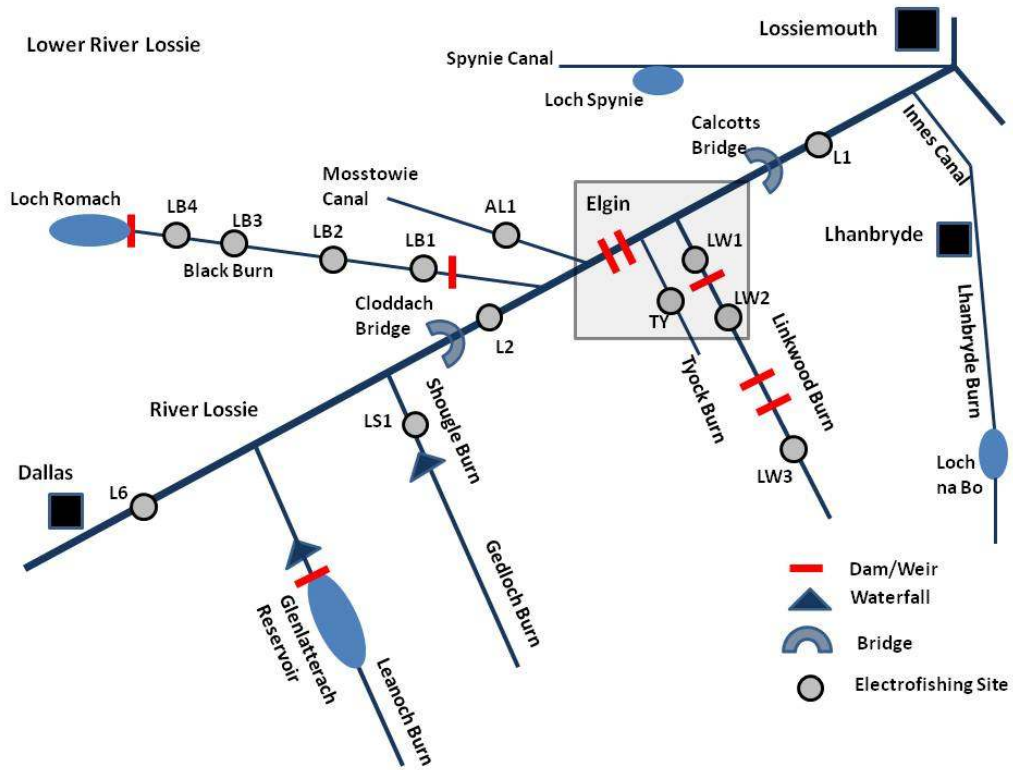


Figure 1a: Electrofishing sites on the lower River Lossie 2000 and 2010.

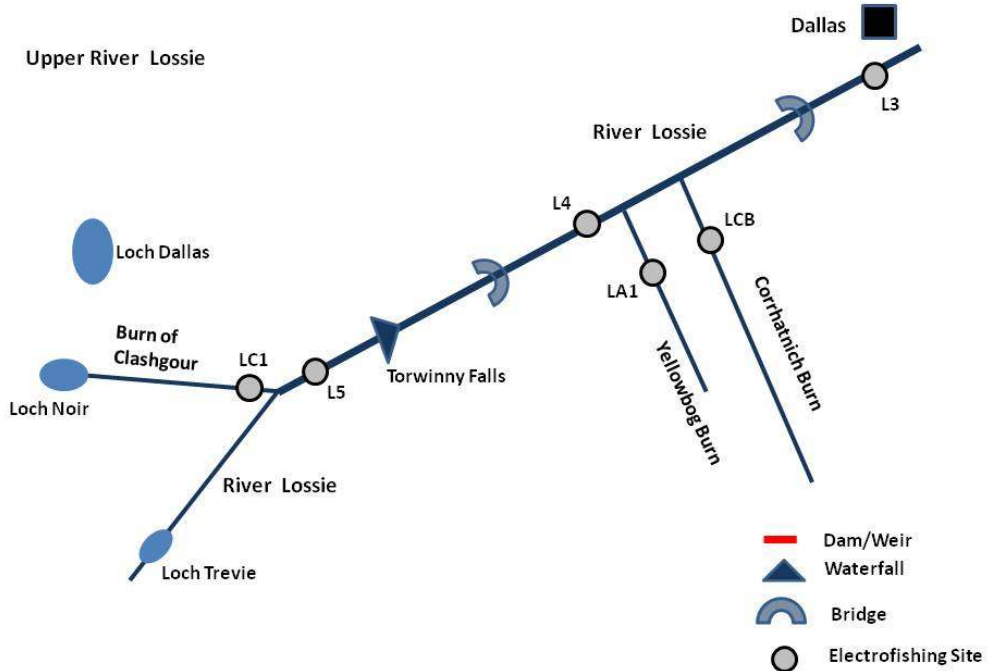


Figure 1b: Electrofishing sites on the upper River Lossie 2000 and 2010.

### 3.1 Main Stem 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).

Site	Salmon (m <sup>-2</sup> )			Trout (m <sup>-2</sup> )				Other Species
	0+	1+	2+	0+	1+	2+	3+	
L1	0.03	0.00	0.00	0.00	0.00	0.00	0.00	Eel (1) Flounder (1) Lamprey (1)
L2	0.02	0.01	0.00	0.07	0.00	0.00	0.00	Eel (1) Lamprey (1)
L6	0.66	0.00	0.00	0.08	0.03	0.00	0.00	
L3	0.28	0.26	0.00	0.16	0.01	0.01	0.00	
L4	0.15	0.02	0.00	0.21	0.02	0.00	0.00	Eel (1)
L5	0.00	0.00	0.00	0.19	0.09	0.04	0.01	

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.

Site	Salmon (m <sup>-2</sup> )			Trout (m <sup>-2</sup> )				Other Species
	0+	1+	2+	0+	1+	2+	3+	
L1	Not fished							
L2	0.01	0.01	0.00	0.01	0.00	0.00	0.00	
L6	Not Fished							
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	Eel (2)
L5	0.00	0.00	0.00	0.41	0.04	0.00	0.00	

#### *Salmon*

Table 2a indicates that six the mainstem sites established in 2000 and Table 2b shows that four sites were revisited during 2010. Three age classes of salmon (0+, 1+ and 2+) were captured in the mainstem Lossie during 2010. Salmon fry were present at three of these sites but absent at upper site L5. The middle and upper part of the Lossie produced the highest densities of salmon fry (Dallas (L3) at 0.38m<sup>-2</sup>, and Ballachragan (L4) at 0.12m<sup>-2</sup>). Salmon 1+ were also present at three of the four sites and densities were low at 0.01m<sup>-2</sup> or 0.02m<sup>-2</sup>. One 2+ salmon was found at L4.

#### *Trout*

Table 2b indicates that four age classes of trout were captured in the mainstem during 2010. Trout fry densities ranged from 0.01m<sup>-2</sup> at L2 to 0.41m<sup>-2</sup> at L5. In general higher densities of trout fry were recorded at the three upper sites. 1+ trout were recorded at three sites (L3, L4, L5) and densities ranged from 0.04m<sup>-2</sup> to 0.09m<sup>-2</sup>. A single 2+ trout was recorded at L4.

### Other Fish Species

Table 2b indicates that two eels were captured at site L4 on the mainstem during the 2010 survey.

### 3.2 Tributaries of the River Lossie

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

Site	Salmon (m <sup>-2</sup> )			Trout (m <sup>-2</sup> )				Other Species
	0+	1+	2+	0+	1+	2+	3+	
LW1	0.00	0.14	0.00	0.10	0.11	0.01	0.01	Eel(1) Lamprey(1) Stickleback(1)
LW2	0.00	0.08	0.08	0.06	0.12	0.00	0.00	Lamprey(2) Stickleback(1)
LW3	0.00	0.00	0.00	0.04	0.02	0.00	0.00	
TY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Stickleback(50) Eel(2)
AL1	0.02	0.03	0.00	0.01	0.00	0.00	0.00	Stickleback(10) Eel(1)
LB1	0.38	0.05	0.00	0.20	0.03	0.01	0.00	Stickleback(1) Lamprey(1)
LB2	0.00	0.00	0.00	0.08	0.29	0.10	0.05	Lamprey(1)
LCB	0.00	0.03	0.00	0.05	0.28	0.01	0.00	Eel(3)
LA1	0.00	0.00	0.00	0.11	0.00	0.00	0.00	
Lc1	0.00	0.00	0.00	0.02	0.12	0.05	0.02	
LB3	0.00	0.00	0.00	0.27	0.20	0.05	0.00	Eel(1)
LB4	0.00	0.00	0.00	0.37	1.62	0.00	0.00	
LS1	Not Fished							

**Table 3b: Densities of salmon and trout by age class and the numbers of other fish species captured in the Lossie tributary electro-fishing sites during 2010.**

Site	Salmon (m <sup>-2</sup> )			Trout (m <sup>-2</sup> )				Other Species
	0+	1+	2+	0+	1+	2+	3+	
LW1	0.11	0.00	0.02	0.05	0.01	0.02	0.00	Eel (1) Lamprey (1) Stickleback (2)
LW2	0.00	0.00	0.00	0.06	0.06	0.06	0.01	Eel (1) Lamprey (1)
LW3	0.00	0.00	0.00	0.25	0.05	0.00	0.00	Eel (3)
TY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Stickleback (4)
AL1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Stickleback (25)
LB1	0.41	0.09	0.00	0.08	0.06	0.00	0.00	Eel(2) Lamprey(2) Stickleback (53)
LB2	0.01	0.00	0.00	0.24	0.06	0.05	0.01	Eel (1) Lamprey (1)
LCB	0.00	0.00	0.00	0.00	0.02	0.00	0.00	
LA1	0.15	0.01	0.00	0.15	0.00	0.01	0.01	Eel (1)
Lc1	Not Fished							
LB3	Not Fished							
LB4	Not Fished							
LS1	0.00	0.00	0.00	0.04	0.00	0.00	0.00	

## ***Salmon***

Table 3a provides the tributary survey data from 2000 while the data from 2010 is presented in Table 3b. Table 3a and 3b indicates that juvenile salmon distribution in the Lossie tributaries was sparse with only the Yellowbog Burn (LA1), Blackburn (LB1, LB2), and Linkwood (LW1) supporting populations. Similar to the mainstem three salmon age classes (0+, 1+, 2+) were recorded in both 2000 and 2010. Table 3b indicates that salmon fry were found at four sites in 2010. Site LB1, on the lower Blackburn, produced a good density of fry,  $0.41\text{m}^{-2}$  along with some 1+ salmon parr ( $0.09\text{m}^{-2}$ ). One salmon fry was recorded at the upper site LB2 on the Blackburn. Densities for salmon 0+ in 2010 ranged from  $0.01\text{m}^{-2}$  to  $0.41\text{m}^{-2}$ .

Salmon 1+ were only present at two of the sites, LA1, and LB1 while salmon 2+ were caught at LW1.

## ***Trout***

In contrast to salmon, juvenile trout were more widely distributed throughout the Lossie tributaries in both 2000 and 2010 (Tables 3a and 3b). During the 2010 survey trout were found at eight of the sites in varying numbers, no trout were present at the Tyock site (TY) or the Mosstowie Canal site (AL1) (Table 3b). Trout fry densities ranged from  $0.04\text{m}^{-2}$  (LS1) to  $0.25\text{m}^{-2}$  at LW3 in 2010. Trout 1+ densities were between  $0.02\text{m}^{-2}$  and  $0.06\text{m}^{-2}$ , with 2+ and 3+ trout also present in low densities at LC1, LB2 and LW2 during 2010.

## ***Other Fish Species***

Three other species of fish were captured in the Lossie tributaries during the 2010 survey (Table 3b) including eels (6 sites), 3 spined sticklebacks (4 sites) and lamprey (4 sites). The sticklebacks were generally found in high numbers in the Mosstowie Canal (AL1) and the lower Black Burn (LB1). Both have been canalised for agricultural drainage and currently support extensive marginal grasses and reeds offering good cover for sticklebacks. The lampreys captured were all ammocetes and were not fully identified to species.



### **3.3 Juvenile Salmon and Trout Comparison 2000 and 2010**

#### **3.3.1 Mainstem Sites**

Figures 2a to 2d provide a comparison of the juvenile densities of salmon and trout at four sites (L2, L3, L4 and L5) which were examined in 2000 and again in 2010. Data for older salmon (1+ and 2+) are combined and presented as salmon 1++ and similarly for older trout age classes (1+ to 3+) are combined.

Figure 2a and 2b provide a comparison for the salmon 0+ and salmon 1++ data. Figure 2a indicates that the sites in the middle reaches of the Lossie (L3 and L4) provide the higher densities of both age classes. Salmon were absent in both years from L5 above Torwhinny Falls. Salmon 0+ densities were lower at all three sites in 2010 than in 2000, however, older parr densities had remained similar or improved slightly.

Figure 2c and 2d provide a comparison for the trout 0+ and trout 1++ data. Figure 2c indicates that trout 0+ were present at all four sites and densities generally increased at the sites further upstream. Figure 2c indicates that clear trend is evident, some sites (L3 and L5) showing an increase in 2010 and the other two (L2 and L4) showing a reduction in trout 0+ densities. Figure 2d indicates that trout 1++ were missing at L2 in both survey years and no clear trend in the densities prevailed at the other three sites. However, it is notable that good densities of trout were present above the Torwhinny Falls at site L5.

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

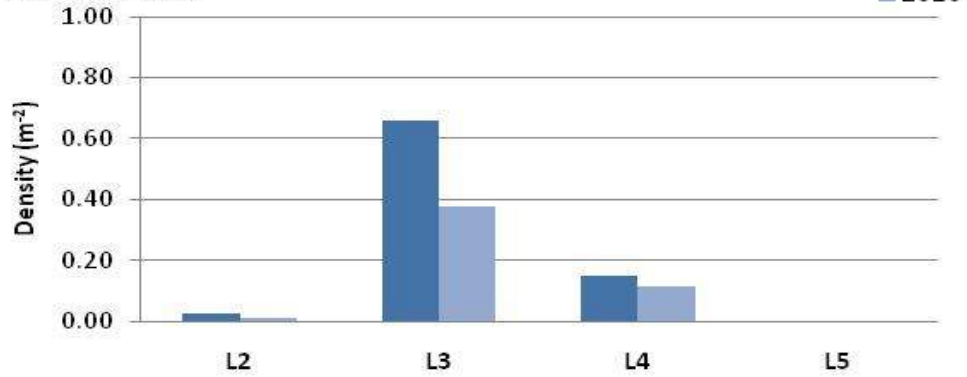


Figure 2b: Lossie mainstem salmon 1++ densities ( $m^{-2}$ ) 2000 and 2010.

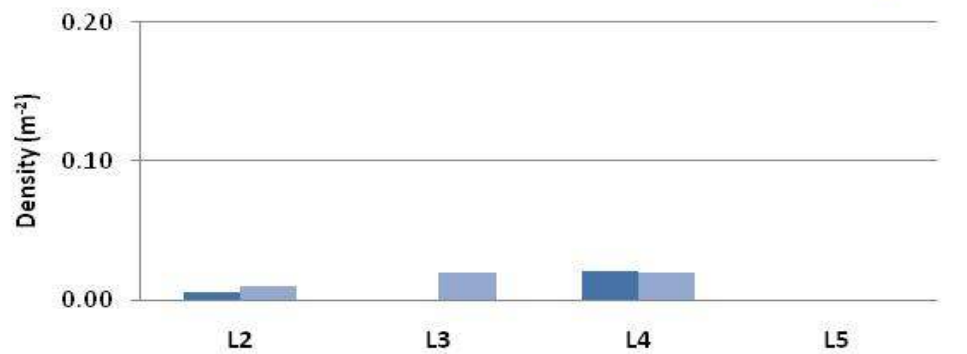
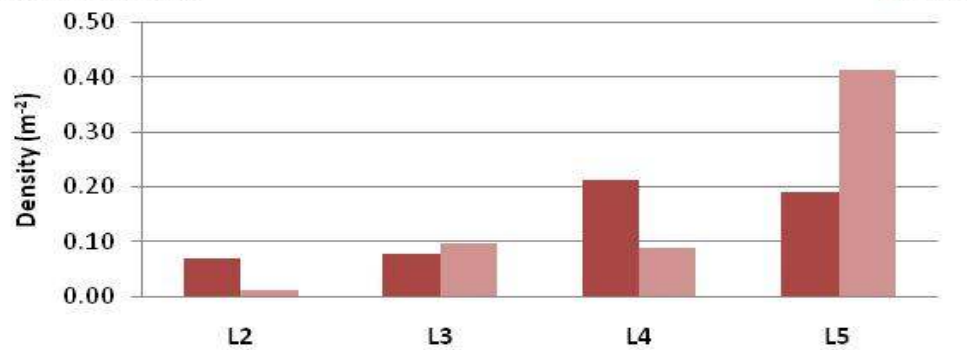
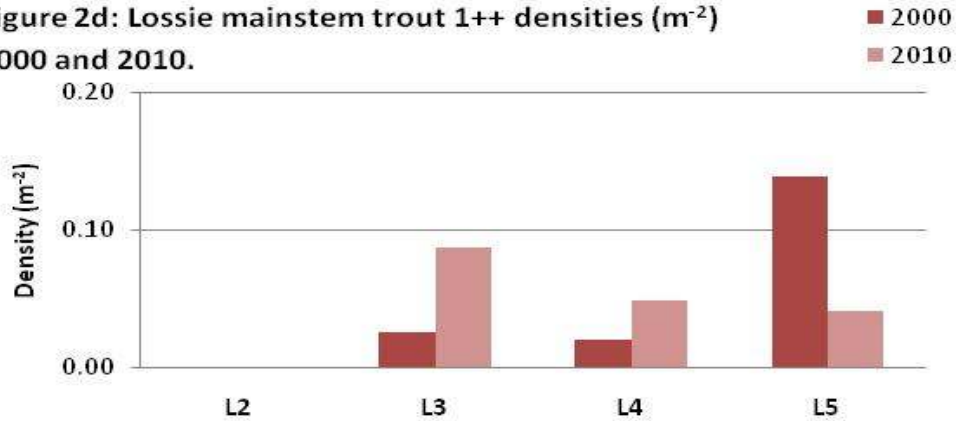


Figure 2c: Lossie mainstem trout 0+ densities ( $m^{-2}$ ) 2000 and 2010.



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



### 3.3.2 Tributary Sites

Nine sites on six tributaries were examined in both 2000 and 2010. Figure 3a and 3b compare the salmon 0+ and salmon 1++ densities in these tributary sites. Figure 3a indicates that salmon 0+ were scarce in the tributaries with only site LB1 on the lower Black Burn providing good densities ( $>0.30m^{-2}$ ) in both years. Salmon fry were also present at sites LW1 (Linkwood Burn) and LA1 (Yellowbog Burn) in moderate densities in 2010. A few fry were also captured at AL1 and LB2. Salmon were absent from the Tyock Burn site (TY). Figure 3b indicates that older salmon parr were present at six of the survey sites. However, similar to the salmon 0+ densities were low at most sites with LB1 on the lower Black Burn again providing the highest densities in both survey years. In general salmon parr were limited to one or two individuals at each of the other sites and not always present in both survey years. The presence of salmon parr at LW2 in 2010 was a surprise given that this site is above a distillery weir which appears impassable to adult salmon.

Figures 3c and 3d present the density data for trout 0+ and trout 1++ from the nine sites examined on six tributaries in 2000 and 2010. Trout were absent from the Tyock Burn site (TY) in both survey years and only a single trout fry was captured in the Mosstowie Canal (AL1) in 2000. Figure 3c indicates that trout 0+ were caught at all the other seven sites. Densities in both years were similar although at LB3 and LB2 a substantial increase in density was evident. Trout 1++ were also present at all seven sites but no clear trend is evident. Sites LW1, LB2 and LCB did show a considerable drops in older trout densities while the other four sites showed an improvement.

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

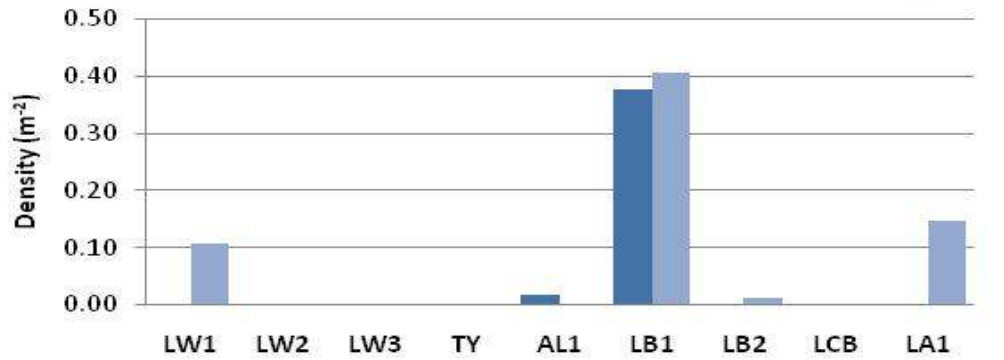


Figure 3b: Lossie tributary salmon 1++ densities (m<sup>-2</sup>) 2000 and 2010.

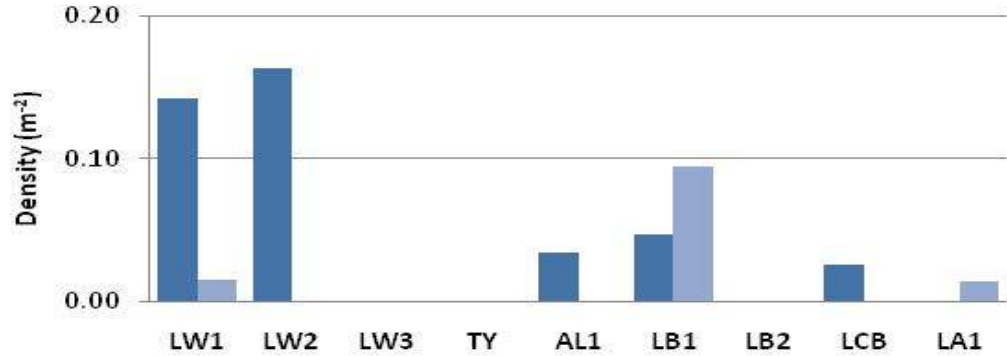
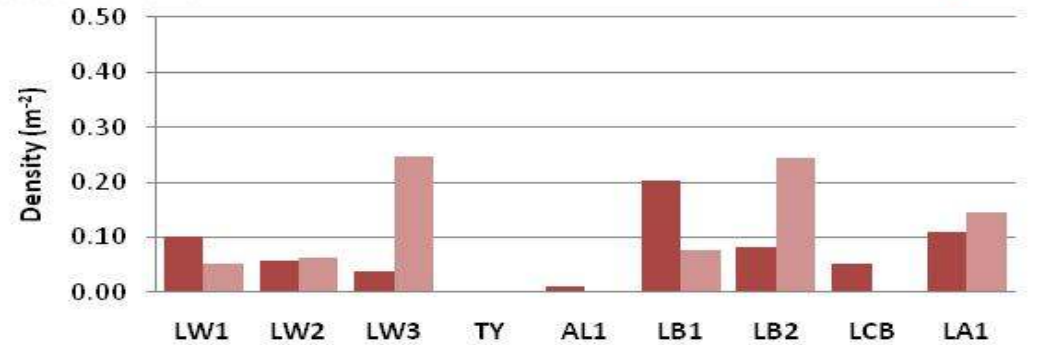
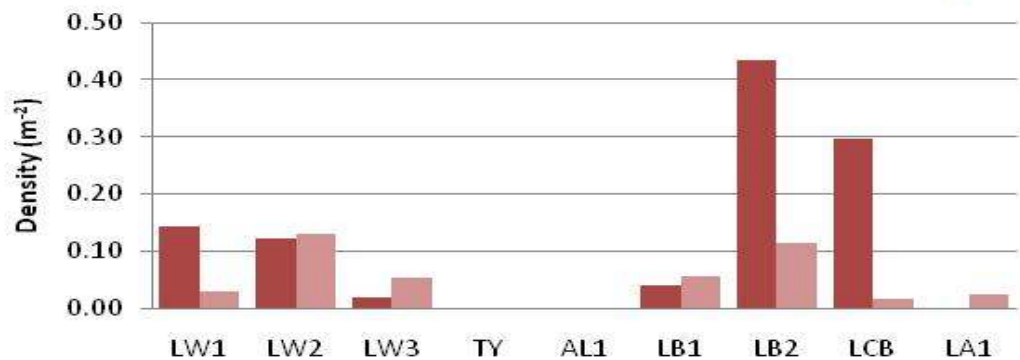


Figure 3c: Lossie tributary trout 0+ densities (m<sup>-2</sup>) 2000 and 2010.



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



**Table 4: Mean densities (m<sup>-2</sup>) of juvenile salmon and trout in the mainstem and tributaries of the Lossie during 2000 and 2010.**

	Mean Densities (m <sup>-2</sup> )			
	Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
2000 Mainstem	0.19	0.05	0.12	0.03
2010 Mainstem	0.13	0.01	0.15	0.03
2000 Tributaries	0.04	0.05	0.26	0.12
2010 Tributaries	0.07	0.01	0.09	0.05

Table 4 compares the mean densities of the juvenile salmon and trout in the mainstem and tributaries of the Lossie during 2000 and 2010. From Table 4 it is evident that the mean density of salmon 0+ and salmon 1++ in the mainstem was lower in the 2010 survey than in 2000. The trout 0+ density showed an increase while the trout 1++ remained the same. Within the tributaries the mean density of salmon 0+ improved while densities of older parr declined. Both age classes of trout showed a decline in the mean density from 2000 to 2010.

### 3.4 Juvenile Fish Data from Previous Surveys

#### 3.4.1 1987 SOAFD (now MSS) Survey Data

The present survey is only the second attempt to gather data for the Lossie as a whole. However, there is some additional data collected by other agencies and companies which provides some opportunity for comparison. Table 5 provides data from four survey sites examined by the Scottish Office Agriculture and Fisheries Department (now Marine Science Scotland) in 1987. The survey sites established in 2000 and 2010 were positioned as close as possible to the 1987 sites and the site codes for the respective sites is shown in Table 5. Data for 2000 and 2010 are presented in Tables 2a-2b and Tables 3a-3c.

Although only a limited dataset the data for site L1 indicates that densities of salmon and trout were very similar in both 1987 and 2000. Higher upstream at L3 salmon 0+ densities were varied but generally quite good but densities of older salmon parr were much lower in 2000 and 2010. In the tributary sites LCB and LB2 salmon 0+ densities were the similar in the three sample years while salmon 1++ were lower in the more recent surveys. Trout age classes were also lower in the latter surveys years.

**Table 5: Juvenile salmon and trout densities (m<sup>-2</sup>) at four survey sites on the Lossie during 1987. (Data courtesy of Iain Maclaren, MSS, Freshwater Fisheries Lab, Pitlochry)**

River	Equivalent Site Code	1987 Densities (m <sup>-2</sup> )			
		Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Lossie	L1	0.01	0.01	0.00	0.02
Lossie	L3	0.44	0.86	0.01	0.01
Corrhatnich Burn	LCB	0.00	0.23	0.20	0.12
Black Burn	LB2	0.00	0.00	0.19	0.15

#### 3.4.2 1997 Data

There are several distilleries within the Lossie catchment area, which in general adhere to strict guidelines regarding water uptake and discharge. Occasionally accidents happen which lead to isolated pollution incidents. As a result damage assessment surveys have been carried out on affected watercourses, for example, a

fish survey of the Linkwood burn was completed after an accidental spillage of potato syrup in 1997 (Hynd, 1997). Data from Hynd (1997) report was converted into densities and is presented in Table 6.

**Table 6: Juvenile salmon and trout densities (m<sup>-2</sup>) at two survey sites on the Lossie during 1997. (Data reconstructed from Hynd 1997).**

River	Equivalent Site Code	1997 Densities (m <sup>-2</sup> )			
		Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Blackburn	LB1	0.24	0.37	0.68	0.54
Linkwood Burn	LW3	0.00	0.02	0.02	0.39

The lack of information on precise site situation, especially from Hynd (1997), made it hard to locate the original survey sites but using grid references and site descriptions the 2000 and 2010 survey sites were positioned as close as possible to the originals. Comparisons with the 2000 and 2010 data indicate salmon 0+ at increased in density at LB1 while older salmon parr declined. No salmon fry were present at LW3 in any survey year although Hynd does indicate a salmon parr present in 1987. Trout densities were lower in 2000 and 2010 than in Hynds 1997 survey. However, these following comparisons must be treated with some caution since we cannot guarantee electro-fishing took place in the exact location it is not clear how the electro-fishing was conducted.

### 3.4.3 Mainstem Data 2002

Table 7a provides the location data for two sites on the mainstem Lossie surveyed in 2002, (Laughton and Burns, 2002). Table 7b provides the juvenile survey data for each site. The 2002 data indicates that salmon 0+ densities can be high in this area of the mainstem and older salmon were also present in good numbers. Trout 0+ were also present but older trout were limited to one or two individuals.

**Table 7a: Electro-fishing site locations for the mainstem sites 2002.**

Date	Site Code	River/ Burn	Study Area	Grid Ref	Altitude (m)
21.10.02	LMFL	Lossie	250m downstream from Outlet	320301 860981	20
15.10.03	LMFU	Lossie	Mayne Farm	320480 860594	20

**Table 7b: Densities (m<sup>-2</sup>) and mean length (mm) of juvenile salmon and trout caught at each mainstem survey site during 2002 (from Laughton and Burns 2002).**

River	Site Code	2002 Densities (m <sup>-2</sup> )			
		Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Lossie	LMFL	0.35	0.03	0.13	0.01
Lossie	LMFU	2.68	0.24	0.25	0.00

#### 3.4.4 Moray Flood Alleviation Scheme Data

There is fairly detailed data available for the Linkwood Burn (Table 8) and the lower mainstem Lossie (Table 8) from surveys commissioned by the Moray Flood Alleviation scheme during the last few years (Aquaterra Ecology 2009a-d, Era 2004, Era 2006a-c). The data is presented as mean densities calculated from a range of survey sites completed in 2006 and 2008. Table 8 indicates that the Linkwood Burn has good populations of juvenile salmon in the lower reaches, with high densities of salmon 0+ and salmon 1++ present at the core sites. The upper control sites are close to site LW1 in the 2000 and 2010 survey and densities for salmon 0+ and 1++ were generally similar to the current (Tables 3a and 3b). Table 8 also indicates the lower Linkwood is an important rearing area for juvenile trout.

**Table 8: Mean densities (m<sup>-2</sup>) of juvenile salmon and trout from at survey sites examined as part of the Elgin Flood Alleviation scheme on the Linkwood Burn during 2006 and 2008. (Data from Era 2006c and Aquaterra Ecology 2009c).**

River	Year	Mean Densities (m <sup>-2</sup> )			
		Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Linkwood Burn (Core Sites)	2006	0.53	0.27	0.10	0.14
Linkwood Burn (Core Sites)	2008	0.30	0.18	0.03	0.06
Linkwood Burn (Control Sites)	2008	0.07	0.04	0.67	0.08



**Table 9: Mean densities ( $m^{-2}$ ) of juvenile salmon and trout from survey sites on the Lossie downstream from Elgin, within Elgin and above Elgin examined as part of the Elgin Flood Alleviation scheme during 2006 and 2008. (Data from Era 2006a, Era 2006b and Aquaterra Ecology 2009a).**

River	Year	Mean Densities ( $m^{-2}$ )			
		Salmon 0+	Salmon 1++	Trout (All Age Classes)	
Downstream Elgin	2006	0.38	0.15	0.01	
Downstream Elgin	2008	0.68	0.18	0.01	
Within Elgin (Urban)	2006	0.25	0.39	0.03	
Within Elgin (Urban)	2008	0.73	0.21	0.02	
Above Elgin (Control)	2008	0.49	0.13	0.06	

Table 9 provides data on juvenile salmon and trout in the mainstem Lossie through above Elgin (Control), through Elgin (Urban) and below Elgin (Downstream). Salmon 0+ and 1++ densities are generally very good indicating the mainstem is an important rearing area. Densities of trout are very much lower. There are no comparable survey sites within the current survey.

#### 3.4.5 Lhanbryde Burn Survey

A survey of the Lhanbryde Burn was commissioned by the Moray Flood Alleviation group in 2001 (Laughton 2001). Five sites were examined along the length of the burn and juvenile trout were found at all five locations. Densities for 0+ trout ranged from  $0.02m^2$  to  $0.69m^2$ , for trout 1+ densities ranged from  $0.03m^2$  to  $0.06m^2$ , and a single 2+ trout was also captured. Trout growth was good indicating good feeding conditions within the burn. Habitat variations from site to site accounted for much of the variation in trout numbers captured. Other fish species captured included eels, lamprey and three-spined stickleback but salmon were absent.

### 3.5 Habitat Features Affecting Fish Distribution

#### 3.5.1 Man-made Obstructions

**Table 10: Selection of man-made obstructions present on the River Lossie and tributaries.**

River	Type	Location (OS)	Fish Accessibility	Notes
Lossie	Bridge Apron	Calcotts Bridge	Passable	Concrete bridge apron which may be problematic for fish passage at low flows.
Lossie	Weir (x5)	Kingsmill Old Mills Sherrifmill Bishopmill Deanshaugh	Passable	Weirs passable situated on the Lossie within Elgin. All passable for fish but would be improved by removal. Assessment of options for the weirs underway through flood alleviation scheme. May be possibilities for fish counting.
Lossie	Bridge	Cloddach (320200, 858400)	Passable	Bridge apron under Cloddach bridge has resulted in narrow passage for fish to ascend. Fish often accumulate below bridge leading to poaching issues. Moray Council have plans to replace bridge and in 2010 modifications to the restriction were carried out to ease fish passage.
Linkwood Burn	Weir (x3)	1. Linkwood Distillery Weir 2. Ben Riach Distillery weir (322950, 858600) 3. Longmorn Distillery Weir	Impassable Impassable Passable	Off take weirs for water supply to distilleries.
Black Burn	Weirs	Lower Reaches (319200, 860950)	Passable	Series of gabion basket weirs installed to assist field drainage know as Tumbling Bays. Fish can ascend but awkward at low flows.
Black Burn	Dam	Loch Romach (307300, 851900)	Impassable	Large dam no fish passage provision
Leonach Burn	Dam	Glenlatterach Reservoir (319500, 853500)	Impassable	Large dam no fish passage provision

A number of natural obstructions and man-made features are present in the Lossie which affect the distribution of fish populations, details of most of these features is presented in the Lossie Fisheries Management Plan (Laughton, 2010) and a Wiid

Trout Trust advisory visit in 2010 (Walker 2010a-b). A summary of each feature is presented in Table 10.

#### *River Lossie Obstructions*

Although there are several obstructions along the length of the lower Lossie, none of these fully prevent adult salmonid fish passage. Evidence from the Moray Flood Alleviation Scheme surveys indicate that juvenile salmon numbers are high throughout the lower Lossie where good habitat is present confirming that access is not too problematic. However, the weirs do alter the habitat of the river from flowing water to more static water so removal of the weirs may lead to improved habitat for salmon. The bridge apron at Calcotts Bridge may be problematic in low flows. It is beginning to break up on the downstream side and could become more of a barrier if left un-repaired or if replaced with a badly designed apron. However, the apron may provide an opportunity for a fish counter and so is worthy of some further discussion with Moray Council. Improvements to easy fish passage were completed at Cloddoch Bridge in 2010.

#### *Linkwood Burn Distillery Weirs*

Three weirs are present on this burn to provide water to three of the distilleries. The lower one at Linkwood Distillery appears impassable to adult salmonids although salmon parr were recorded above it in 2002. The Ben Riach weir is impassable and the one for Longmorn is passable. Apart from the occasional salmon parr only trout were present in the above these weirs. The burn should support a run of sea trout and so removal or alleviation of access through the weirs is desirable. Salmon may also benefit given the good densities present in the lower reaches. Screens for the distillery water offtakes also need to be improved.

#### *Black Burn Weirs*

A series of gabion basket weirs installed in the lower Black Burn which appear to hamper salmon access to the upper reaches. Salmon are present downstream of the lowest weir but only an occasional parr above. They may also affect sea trout access although densities of trout above the weirs were generally good reflecting the good habitat available. Removal of the weirs to improve adult access is recommended.

### *Glenlatterach and Romach Dams*

Large water abstraction dams with no fish pass provision. Only trout found upstream in the Leanoch Burn but there is also a waterfall downstream from the Dam which will prevent adult access. Romach Dam is at the headwaters of the Black Burn so improving fish access may be of limited benefit.

### 3.5.2 Natural Obstructions

Waterfalls were observed at Torwhinny on the upper Lossie, on the lower Shougle (Gedloch) Burn and downstream from Glenlatterach Reservoir. Trout populations were present above all three waterfalls and indicated a healthy resident population.

### 3.5.3 Canalisation

Several burns within the Lossie have been canalised or dredge and re-channelled for drainage purposes. The most significantly affected are Spynie Canal, Mosstowie Canal and Tyock Burn although others such as Lhanbryde Burn, Linkwood burn and Black Burn have also been modified.

The Spynie Canal was not surveyed in the current study but would be worth examining in the future since no fish data is available for the water course. In the Mosstowie Canal and Tyock the effects of dredging and re-channelling had clearly affected the fish populations. Fish populations were mostly sticklebacks and an occasional eel or lamprey. The substrate was generally silty or muddy, with dense instream vegetation also present. The Tyock is also heavily affected by roads and culverts as it passes through Elgin.

## **4. Discussion**

The 2010 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 some indications of trends in the juvenile fish populations to be determined. A review of other survey data was also incorporated into this report which allowed a more detailed description of the fish populations within the Lossie and its tributaries.

The main indications from this survey and the various others is that juvenile trout are present throughout the 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 waterfalls such as Torwhinny, good densities of resident brown trout populations were determined.

Juvenile salmon 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). Indeed the densities of salmon through Elgin were very encouraging. Juvenile salmon were less well distributed in the tributaries. The lower Linkwood burn (Aquaterra Ecology 2009c, Era 2006c) and lower Black Burn indicate good densities but weirs appear to limit their upstream progress. In the upper burns and upper Lossie the salmon distribution and density is more patchy, the Corrhathnich Burn and the Yellowbog Burn both appear to have good habitat but they are not always present. Similarly the upper Lossie from Dallas up to the Torwinny Falls has good habitat but limited salmon densities. It is not clear what may be limiting salmon in this area and further investigations in to water quality and other factors is required.

The data collected in 2010 was compared the previous survey in 2000. From site to site there was considerable variation between the two survey years and difficult to discern any clear trend. Analysis of the mean densities (Table 4) in the mainstem and tributaries of the Lossie during 2000 and 2010 indicated that salmon 0+ and salmon 1++ in the mainstem was lower in the 2010 survey than in 2000. The trout 0+ mean density showed an increase while the trout 1++ remained the same. Within the tributaries the mean density of salmon 0+ improved while densities of older parr declined. Both age classes of trout showed a decline in the mean density from 2000 to 2010.

Some further comparisons to older data from previous surveys conducted in 1987 (data supplied by Iain Maclaren, MSS FW Fisheries Lab, Pitlochry) and 1997 (Hynd (1997)) were also possible. In general salmon 0+ densities and trout densities were similar but there were some indications that older salmon were less abundant than in

these earlier surveys. However, the data is from only a few sites and a more robust dataset from a range of sites would be desirable.

Additional problems also arose in this process. To allow a comparison between years, accurate identification of the location of survey site is required. This is best achieved using OS co-ordinates, several site photographs and detailed descriptions. Aligning the site to a recognisable long-term feature (large tree, bridge, dyke etc) is also advisable. Co-ordinates and good site descriptions were supplied for the 1987 data from the FW Fisheries Lab so our survey sites should be close to their original locations. Thus allowing a useful comparison of data. However, Hynd (1997) provides no site details other than an indication of the area fished. In addition the data presented within Hynd's 1997 report is unclear and some extrapolation was required to allow comparison. Thus the comparison with his data should be treated with caution.

The 2000 and 2010 current survey has improved on the earlier surveys by photographing each site in an upstream and downstream direction with photographs of the upper and lower limits of the site encompassing bankside features also compiled. This should allow future surveys to re-examine the same areas more readily.

Despite difficulties in comparing site densities some trends were evident. In general the areas surveyed in 1987 and 1997 that contained salmon also produced salmon in 2000 and 2010. There was also evidence that salmon fry densities are similar to previous years. For the juvenile trout the results were mixed but in general the distribution of trout was similar to previous surveys.

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 were identified through this survey and others (Walker 2010a-b). These included waterfalls and man-made obstructions mostly weirs. The dams will certainly prevent upstream fish movements and may have an effect on the trout populations in the area. 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. 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. The Linkwood and Black burns are also both 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.

The Lossie has also been extensively affected by canalisation and drainage for agriculture. This was particularly evident in the Mosstowie Canal where the substrate was devoid of any features and consisted almost entirely of silt. Fish populations have been affected and salmonids are now largely absent. However, returning this burn to its former structure would be a supreme challenge. Canalisation of the Linkwood and Black Burns was also evident.

Forestry in the upper reaches of the Black Burn and the upper Lossie and Yellowbog Burn was also considered to be worthy of further investigation. These forests are approaching maturity but have been planted right up to the edge of water courses leading to some erosion problems and loss of habitat. There may also be an issue with water quality during rainfall events. Some of the trees are being felled particularly around the upper Yellowbog and Tippochs Burns. However there is scope for identify other stretches where buffer strips could be cleared back from the burns to allow more native plants to re-establish, for example the upper Black Burn.

Two other factors are also likely to impinge on the Lossie in the next few years. The Elgin flood alleviation scheme has begun and this will have some effects on the lower Lossie, the Linkwood and Tyock Burns. In general this scheme is likely to be carried

out to very exacting standards so there may well be improvements in the habitat for fish populations. However, close liaison with the developers is recommended. The other is the quarrying activities downstream from Cloddach. It is not clear what happens here but gravel has been removed from the Lossie in this stretch from time to time possibly to alleviate flooding. The 2002 survey indicated that this area is a very good rearing area for juvenile salmon so more protection against these activities is required.

The current survey combined with the other datasets has provided a useful indication of the distribution and population density of salmon, trout and other fish within the catchment. Resources are limited for carrying out yearly surveys so a three year programme managed by the Findhorn, Nairn and Lossie Fisheries Trust is recommended. This should build into a valuable dataset. Some further development of the sites surveyed is also required in particular within the lower Lossie and the upper tributaries.

## **5. Recommendations**

- i. Establish a core of electro-fishing sites from the various surveys that can be monitored on a three yearly basis to provide suitable data on juvenile population trends.
- ii. Conduct appraisal of man-made obstructions and develop plans for improving fish access and egress.
- iii. Identify areas where habitat is unfavourable for fish populations and develop remedial actions.
- iv. Examine water quality with the Lossie and its tributaries, particularly in the upper reaches, and identify any problem areas.



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