Rampart Stream Fish Stock Survey

- Monitoring Report

Action E3

LIFE09 NAT/IE/000220 BLACKWATER SAMOK

2015

The IRD Duhallow LIFE Project is supported through the LIFE financial instrument of the European Community.

Contents

Executive Summary

In 2014, the old pitch ‘n’ putt course on the grounds of the James O’Keeffe Institute (IRD Duhallow Headquarters) was redeveloped and improved to encourage the local community to play the sport in Newmarket rather than travel to neighbouring towns. Part of the landscaping design was the restoration of a 200m section of the Rampart Stream. The plan was to improve the habitat of the stream and increase the fish population in the channel by adding such features as random boulders, gravel beds and pools.

An electrofishing survey was conducted along three sections of the Rampart Stream in July 2013. This was to serve as a baseline for further monitoring of salmonid stocks in the stream. Subsequent surveys (2014 and 2015) were then conducted to assess the impact, positive or negative on the densities of fish species in the stream.

Although a marked increase in the minimum density of trout was observed no statistically significant difference was found. The minimum densities for both salmon fry and salmon parr showed no improvement from a poor status. Increases in other fish species (stone loach, three-spined stickleback and European eel) were recorded.

Background

In 2014, the old pitch 'n' putt course on the grounds of the James O'Keeffe Institute (IRD Duhallow Headquarters) was redeveloped and improved to encourage the local community to play the sport in Newmarket rather than travel to neighbouring towns. Part of the landscaping design was the restoration of a 200m section of the Rampart Stream. The plan was to improve the habitat of the stream and increase the fish population in the channel by introducing new features such as random boulders, gravel beds and pools. The LIFE project was involved in advising on the restoration of the stream.

Pools and riffles provide refuge from high velocity waters and extreme temperatures, spawning sites for salmonid fishes, and attachment sites for benthic invertebrates and plants (Gore & Shields, 1995). If a section of channel is lacking in pools they can be formed by boulders or individual pieces of large woody debris. These pools can provide cover for salmon and trout (WRIA 1, n.d.). In terms of spawning habitats, salmonids tend to prefer areas of flow acceleration, typically at the downstream ends of pools where riffles are present. Salmon and trout require appropriately sized gravels with clean interstitial pore spaces and sufficient water depths and velocities to allow female fish to excavate redds (SEPA, n.d.).

An electrofishing survey was conducted along three sections of the Rampart Stream in July 2013. This was to serve as a baseline for further monitoring of salmonid stocks in the stream. Subsequent surveys (2014 and 2015) were then conducted to assess the impact, positive or negative on the densities of fish species in the stream, namely Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*).

Site Description

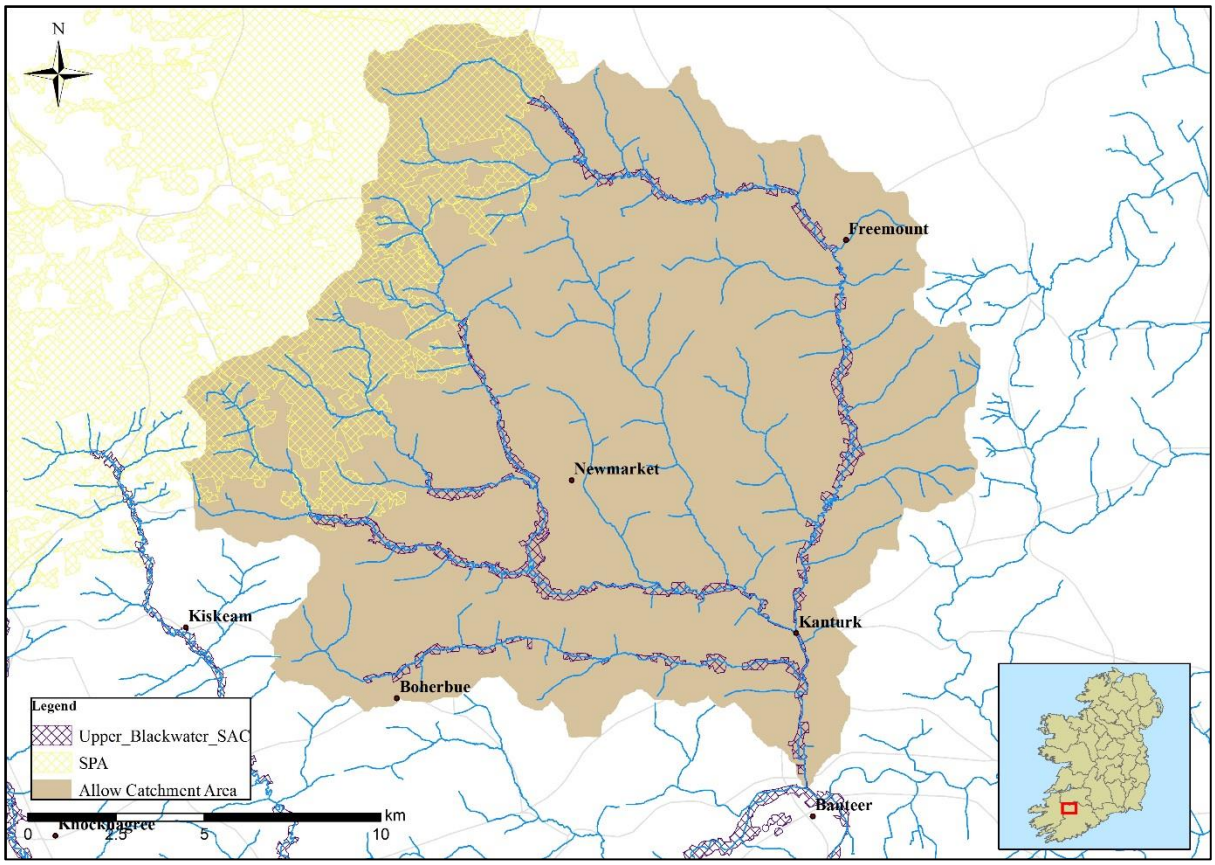

Figure 1 River Allow catchment area targeted by the DuhallowLIFE Project (LIFE09 NAT/IE/000220 Blackwater SAMOK)

River Allow Catchment

The River Allow catchment is 310km^2 (*Figure 1*). The three major rivers that drain the catchment are the Allow, Dalua and Brogeen. The main agricultural land use in the catchment is pasture with dairying and sucklers forming the majority of farming practices.

The majority (70%) of the soils in the Allow catchment are deep, poorly drained mineral soils. Blanket peat covers approximately 5% of the catchment, mostly in upland reaches. Mineral alluvium is associated with the river channels, while shallow well drained mineral soils make up the remaining soil type in the catchment (EPA/Teagasc, 2006; Tedd, 2014).

The River Allow catchment rivers (Allow, Dalua, Brogeen, Glenlara and Owenkeale) form part of the Blackwater River (Cork/Waterford) Special Area of Conservation (Natura 2000 site code: 002170). These tributaries provide important habitat for Freshwater pearl mussel *Margaritifera margaritifera,* Atlantic salmon *Salmo salar* and European otter *Lutra lutra*, all of which are listed in the Annex II of EU Habitats Directive.

The upper reaches of the Allow catchment contain the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Area, which was designated as such for Hen Harrier *Circus cyaneus* (listed in Annex I of the EU Bird's Directive).

Survey Methodology

- Electrofishing was carried out by trained operators employed by Inland Fisheries Ireland.
- Fishings were carried out to the depletion method (Zippin, 1958)
- Salmonid densities where calculated for all sites
- Microsoft Excel was used for statistical analysis and graphical presentation
- Distribution normality tests were conducted on Microsoft Excel using a formula provided by faculty.missouri.edu
- Kruskal-Wallis tests were conducted on Microsoft Excel using a formula provided by udel.edu

Bank based depletion electrofishing:

In wadeable waters (generally spawning and nursery waters) fish sampling was carried out using bank based electrofishing equipment. This consisted of one or more portable generators (220/240 v) with appropriate control units (DC converter) attached, along with a cathode (metal plate) and an anode (hand net) for each unit (plate 1). Generally speaking, most sites sampled this way were 30 to 40 metres long.

Results & Discussion

In 2013 a minimum density of Atlantic salmon found in the 250m section of the Rampart Stream was 0.00808m^{-2}. Although this increase to 0.024m^{-2} in 2014, the minimum density fell again to 0.006m^{-2}.

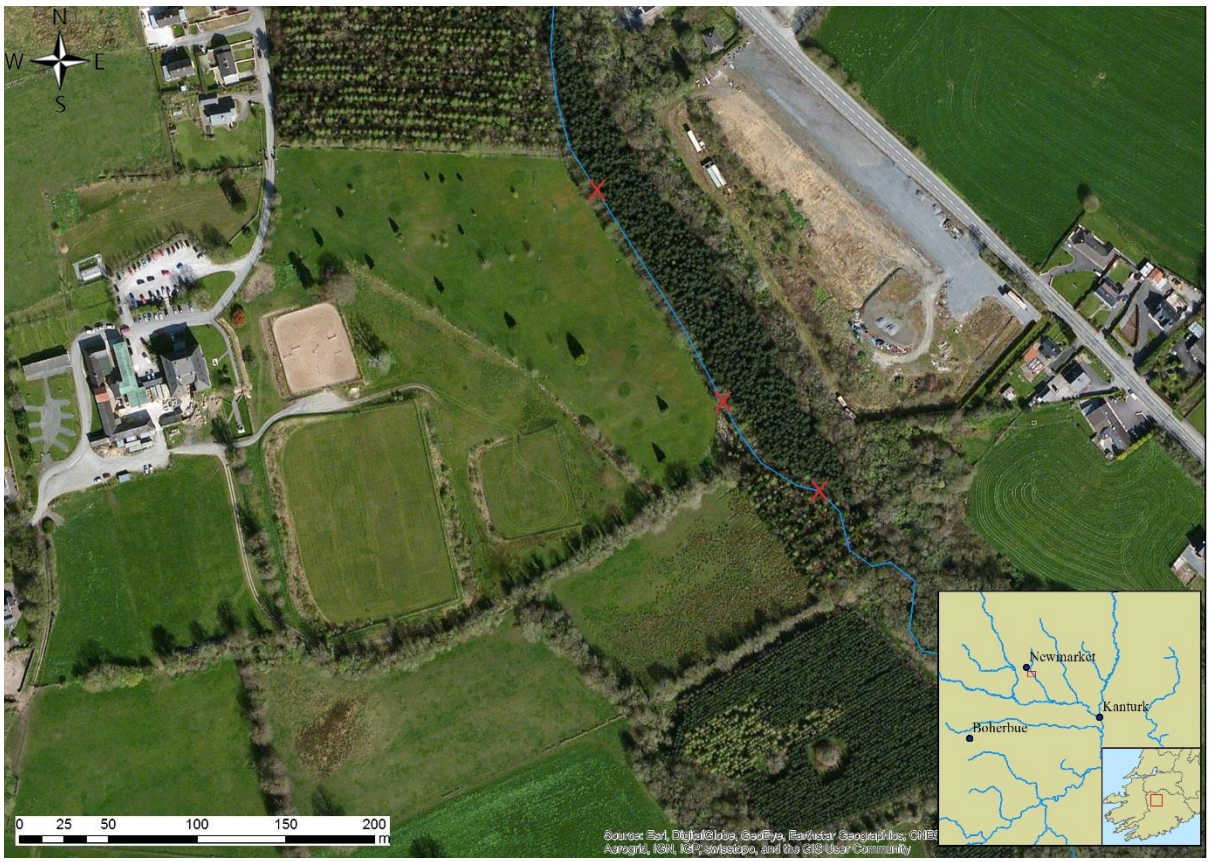

Figure 2 Locations on the Rampart Stream where efishing monitoring surveys were conducted

An Anderson-Darling Test was conducted to verify as to whether the data was normally distributed. When it was found that it was not normally distributed a Kruskal-Wallis test (McDonald, 2014) was conducted to compare the data over the three years, as opposed to a standard single-factor ANOVA test. The Kruskal-Wallis test that there was no statistically significant difference between any of the three survey data (Table 7.).

Table 1 Results from Kruskal-Wallis test on the three Salmon efishing surveys (2013, 2014 and 2015) conducted on Rampart Stream

Kruskal Wallis		Upstream	Downstream	Forestry
	H	0.985	0.423	0.431
	D	0.564	0.698	0.451
	adjusted H:	1.747	0.606	0.954
	d.f.:	2	2	1
	P value:	0.417	0.738	0.328

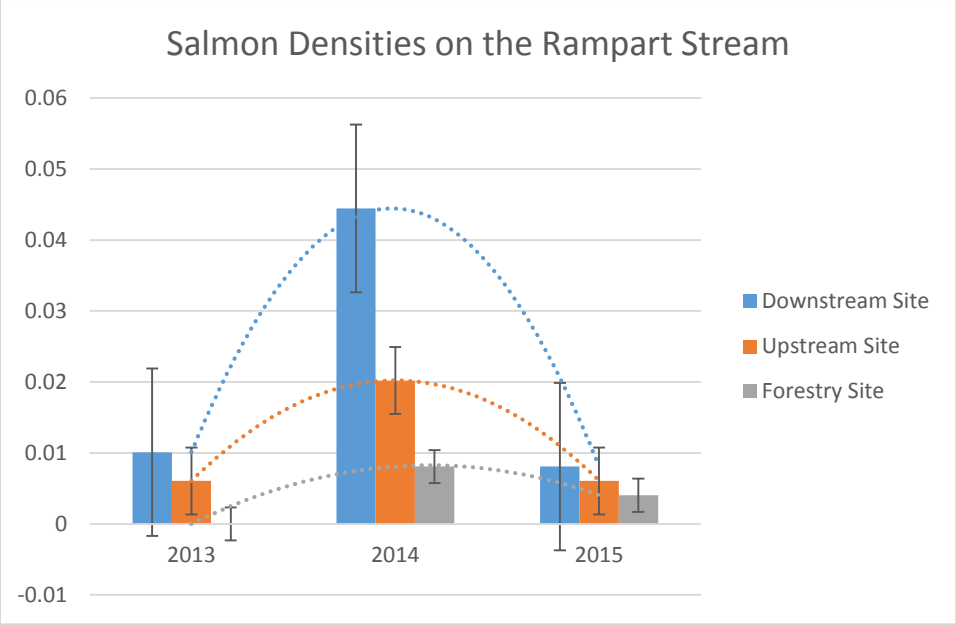

Figure 3 Fluctuation of minimum salmon densities fished in the Rampart Stream

Both the Anderson-Darling and Kruskal-Wallis tests were also used for the Brown Trout data (Table 8.). Although a marked increase in the minimum density of trout was observed ($0.03m^{-2}$ in 2013 to $0.09m^{-2}$ in 2015, *Figure 4*) no statistically significant difference was found (*p>0.05*).

Table 2 Results from Kruskal-Wallis test on the three Trout efishing surveys (2013, 2014 and 2015) conducted on Rampart Stream

Kruskal Wallis		**Upstream**	**Downstream**	**Forestry**
	H	1.249	0.655	0.052
	D	0.943	0.929	0.923
	adjusted H:	1.324	0.704	0.057
	d.f.:	2	2	1
	P value:	0.515	0.703	0.810

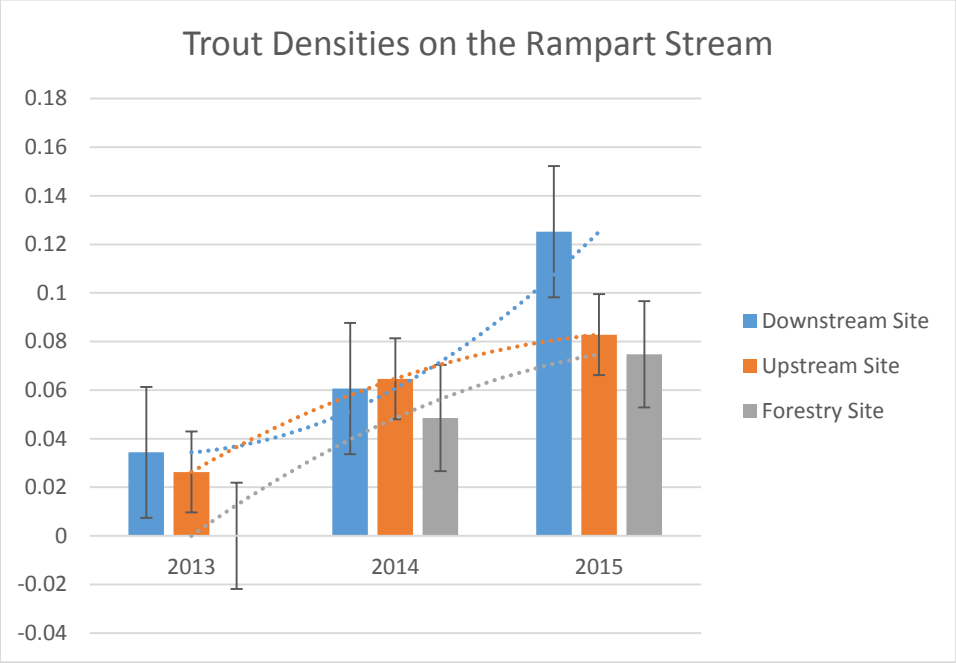

Figure 4 Chart showing the steady increase in minimum trout densities in the Rampart Stream from before habitat improvement works in 2013 to post-works (2014 and 2015)

Crozier and Kennedy (1994) rank densities of below 0.3 salmon fry per m^2 and 0.05 salmon parr per m^2 as poor and densities of >0.9 (fry) and >0.2 (parr) as excellent. On average, the densities of salmon fry and parr in the three comparison sites were $0.0083m^{-2}$ and $0.0084m^{-2}$, respectively, in 2013. In 2014, salmon fry and parr densities increased to $0.037m^{-2}$ and 0.016^{-2}, repsectively. The minimum densities for both fry and parr fell again to $0.0m^{-2}$ and $0.009m^{-2}$, respectiviely. According to Crozier and Kennedy (1994) the averages minimum densities recorded for salmon fry and salmon parr for each of the three surveys show no improvement from a poor status (*Appendix 1*).

Table 3 Minimum densities of salmonid fry and parr recorded during the monitoring programme in the Rampart Stream

	2013	2014	2015
Salmon Fry (minimum density; fish/m^2)	0.008	0.037	0
Salmon Parr (minimum density; fish/m^2)	0.008	0.017	0.009
Trout Fry (minimum density; fish/m^2)	0.022	0.044	0.166
Trout Parr (minimum density; fish/m^2)	0.0349	0.065	0.052

Table 4 Other fish species recorded during the monitoring programme in the Rampart Stream

Species	**2013**	**2014**	**2015**
Eel (*Anguilla anguilla*)	6	18	9
Three-spined Stickleback (*Gasterosteus aculeatus)*	0	3	3
Stone Loach (*Barbatula barbatula*)	0	9	6

Table 5 Classification system for salmon densities (Crozier and Kennedy, 1994; in Paul Johnston Associates, 2010)

Fry	**Parr**	

Density	Density	Classification
> 0.9	> 0.2	Excellent
0.6 - 0.89	0.1 - 0.199	Good
0.3 - 0.59	0.05 - 0.099	Fair
0.001 - 0.29	0.001 - 0.049	Poor
0	0	Absent

Increases in other fish species were recorded. Stone loach and three-spined stickleback were absent from this section of the Rampart in 2013. In 2014, three sticklebacks were recorded with the same numbers fished in 2015. The numbers of stone loach increased to nine individuals fished in 2014 (minimum density $0.16m^{-2}$). The minimum density fell slightly to $0.11m^{-2}$. Eel minimum densities, like salmon, fluctuated over the three years (2013: $0.1m^{-2}$, 2014: $0.32m^{-2}$, 2015: $0.16m^{-2}$).

Atlantic salmon and European eels are migratory fish species and depend on unimpeded waterways to reach spawning (Hendry & Cragg-Hine, 2003) and feeding sites (Arai, Kotake, & McCarthy, 2006), respectively. The fluctuation in the numbers recorded may be due to impedance further down the catchment for these migratory species. Eels tend to be difficult to electrofish and it is possible that the numbers recorded in 2015, and even 2013, do not equate to the actual numbers of eels at the sites Gillespie (pers. comm., 2015).

The increase in the brown trout population in the Rampart Stream is evident that the restoration works conducted had a positive effect on some fish species. Salmon number fluctuations in small tributaries can occur Gillespie (pers. comm., 2015) and further monitoring of the site would provide additional data the use of the Rampart by salmon.

The restoration of the stretch of the Rampart Stream that skirts the pitch ‘n’ putt course has not only improved habitat for a variety of fish species but has also added amenity value to the site. The loop-walk around the course is a popular destination for casual and dog walkers. The 2015 and 2014 efishing surveys attracted a number of intrigued members of the public (Figures 5 & 6, Appendix 2). This is an example of how conservation and restoration works not only improve habitat for many species but improve public perception and increase public awareness.

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Appendix 1 Results from monitoring

Site 1

Upstream Section

Irish Grid Coordinates: 132302, 106986

Table 6 Count and minimum densities of Atlantic salmon fished in the Upstream section over the three years

Upstream Site (75m^2)						
Atlantic Salmon						
Length (cm)	2013 (July)		2014 (August)		2015 (July)	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	0	0	0	0	0	0
2.1 - 4.0	0	0	0	0	0	0
4.1 - 6.0	0	0	0	0	0	0
6.1 - 8.0	0	0	4	0.088	0	0
8.1 - 10.0	0	0	3	0.066	0	0
10.1 - 12.0	2	0.044	0	0	0	0
12.1 - 14.0	1	0.022	2	0.044	2	0.044
14.1 - 16.0	0	0	1	0.022	1	0.022
16.1 - 18.0	0	0	0	0	0	0
18.1 - 20.0	0	0	0	0	0	0
20.1+	0	0	0	0	0	0
Average	**0.272**	**0.006**	**0.909**	**0.020**	**0.272**	**0.006**

Table 7 Count and minimum densities of Brown trout fished in the Upstream section over the three years

Brown Trout						
Length (cm)	2013		2014		2015	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	0	0	0	0	0	0
2.1 - 4.0	0	0	0	0	0	0
4.1 - 6.0	3	0.067	0	0	3	0.067
6.1 - 8.0	0	0	6	0.133	12	0.267
8.1 - 10.0	0	0	1	0.022	1	0.022
10.1 - 12.0	0	0	0	0	0	0
12.1 - 14.0	3	0.067	3	0.067	1	0.022
14.1 - 16.0	2	0.044	7	0.156	11	0.244
16.1 - 18.0	2	0.044	9	0.2	10	0.222
18.1 - 20.0	2	0.044	1	0.022	1	0.022
20.1+	1	0.022	5	0.111	2	0.044
Average	**1.182**	**0.026**	**2.909**	**0.065**	**3.727**	**0.083**

Site 2

Downstream Section

Irish Grid Coordinates: 132380, 106897

Table 8 Count and minimum densities of Atlantic salmon fished in the Upstream section over the three years

Downstream Site (45m^2)						
Atlantic Salmon						
Length (cm)	2013 (July)		2014 (August)		2015 (July)	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	0	0	0	0	0	0
2.1 - 4.0	0	0	0	0	0	0
4.1 - 6.0	2	0.044	3	0.066	0	0
6.1 - 8.0	1	0.022	12	0.266	0	0
8.1 - 10.0	0	0	6	0.133	0	0
10.1 - 12.0	1	0.022	0	0	2	0.044
12.1 - 14.0	1	0.022	0	0	1	0.022
14.1 - 16.0	0	0	1	0.022	1	0.022
16.1 - 18.0	0	0	0	0	0	0
18.1 - 20.0	0	0	0	0	0	0
20.1+	0	0	0	0	0	0
Average	**0.454**	**0.010**	**2**	**0.044**	**0.363**	**0.008**

Table 9 Count and minimum densities of Brown trout fished in the Upstream section over the three years

Brown Trout						
Length (cm)	2013 (July)		2014 (August)		2015 (July)	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	0	0	0	0	0	0
2.1 - 4.0	0	0	0	0	0	0
4.1 - 6.0	5	0.111	0	0	6	0.133
6.1 - 8.0	0	0	11	0.244	39	0.866
8.1 - 10.0	1	0.022	3	0.066	9	0.2
10.1 - 12.0	2	0.044	1	0.022	0	0
12.1 - 14.0	3	0.066	3	0.066	1	0.022
14.1 - 16.0	5	0.111	7	0.155	3	0.066
16.1 - 18.0	1	0.022	4	0.088	3	0.066
18.1 - 20.0	0	0	1	0.022	0	0
20.1+	0	0	0	0	1	0.022
Average	**1.545**	**0.034**	**2.727**	**0.060**	**5.636**	**0.125**

Site 3

Forestry Section

Irish Grid Coordinates: 132451, 106825

Table 10 Count and minimum densities of Atlantic salmon fished in the Upstream section over the three years

Forestry Site (45m2)						
Atlantic Salmon						
Length (cm)	2013		2014 (August)		2015 (July)	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	n/a	n/a	0	0	0	0
2.1 - 4.0	n/a	n/a	0	0	0	0
4.1 - 6.0	n/a	n/a	0	0	0	0
6.1 - 8.0	n/a	n/a	1	0.022	0	0
8.1 - 10.0	n/a	n/a	0	0	0	0
10.1 - 12.0	n/a	n/a	1	0.022	0	0
12.1 - 14.0	n/a	n/a	2	0.044	2	0.044
14.1 - 16.0	n/a	n/a	0	0	0	0
16.1 - 18.0	n/a	n/a	0	0	0	0
18.1 - 20.0	n/a	n/a	0	0	0	0
20.1+	n/a	n/a	0	0	0	0
Average	n/a	n/a	**0.363**	**0.008**	**0.182**	**0.004**

Table 11 Count and minimum densities of Brown trout fished in the Upstream section over the three years

Brown Trout						
Length (cm)	2013		2014		2015	
	Count	Density	Count	Density	Count	Density
0.0 - 2.0	n/a	n/a	0	0	0	0
2.1 - 4.0	n/a	n/a	0	0	0	0
4.1 - 6.0	n/a	n/a	0	0	15	0.333
6.1 - 8.0	n/a	n/a	7	0.156	15	0.333
8.1 - 10.0	n/a	n/a	1	0.022	0	0
10.1 - 12.0	n/a	n/a	0	0	0	0
12.1 - 14.0	n/a	n/a	2	0.044	3	0.067
14.1 - 16.0	n/a	n/a	7	0.156	2	0.044
16.1 - 18.0	n/a	n/a	4	0.089	1	0.022
18.1 - 20.0	n/a	n/a	1	0.022	0	0
20.1+	n/a	n/a	2	0.044	1	0.022
Average	n/a	n/a	**2.182**	**0.048**	**3.364**	**0.075**

Appendix 2 Photos

Figure 5 Members of the public observing IFI staff during survey work on the Rampart in 2014

Figure 6 Children observing and engaging with the Rampart monitoring survey, conducted by IFI in 2015