



A review of Rotary Screw Trap operations on the River Faughan 2003-2016

Monitoring and Conservation

Loughs Agency of the Foyle Carlingford and Irish Lights Commission
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The long term Rotary Screw Trap project on the River Faughan including run timing, abundance and other key biological information from this important index catchment. The benefits from this multi species monitoring project are highlighted and discussed.

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Northern Ireland Water Ltd is also gratefully acknowledged for permitting access to the Faughan pumping station site.

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EXECUTIVE SUMMARY

An EG Solutions Inc. 5ft diameter Rotary Screw Trap (RST) has been deployed on the River Faughan from 2003 to 2009 and from 2014 to 2016. The data generated from this long term study has been used for a variety of purposes. The River Faughan RST project is now a well established index/reference site for a number of diadromous and resident fish populations that spend some or all of their life within the Faughan catchment.

In the period 2003-2009 the primary reason for deploying the RST was to capture migrating Atlantic salmon smolts for the purpose of Coded Wire Tagging (CWT). The results fed into national and international Coded Wire Tagging programmes. The information obtained from these projects was used for various purposes including to identify the nature of mixed stock interceptory fisheries and to manage these fisheries. No commercial fisheries for Atlantic salmon have operated in the Foyle area since 2009.

From 2014 to 2016 the RST on the River Faughan has been deployed to collect run timing, abundance and other key biological information from all fish species caught. The River Faughan RST annual deployment provides an indicative index for migrating Atlantic salmon smolts, Sea trout smolts, River Lamprey and Brook Lamprey and records other species encountered.

The key data sets for this period are outlined and a number of recommendations for the conservation and protection of monitored species have been made.

1.0 INTRODUCTION

The River Faughan and Tributaries is an Area of Special Scientific Interest (ASSI) and a Special Area of Conservation (SAC). Amongst other habitats and species it is designated for its populations of Atlantic salmon (*Salmo salar* L.). Since 2003 the Loughs Agency has operated a Rotary Screw Trap at the tidal limit during the spring smolt migration period. The information collected provides an important index for a number of species over time.

The River Faughan is an important Atlantic salmon and Sea trout fishery which has the potential to contribute significantly to the local rural economy. The 2015 five year average for returning adult Atlantic salmon as recorded by an electronic fish counter at Campsie Barrage on the lower River Faughan was 1869. The 2015 five year average rod catch for Atlantic salmon was 816 with a 40% rate of catch and release (five year average). The 2015 five year average rod catch for Sea trout was 125 with a 68% rate of catch and release (2015 only).

The River Faughan and Tributaries have an annual adult Atlantic salmon Management Target of 800 and a Conservation Limit of 640.

The Loughs Agency operates an audit point management system for Atlantic salmon following a life history model with audit points at key life history stages. Catch returns, electronic fish counts, timed catchment wide electrofishing surveys and spawning redd counts are all conducted to inform management decision making. In addition periodic assessments are made of the available in channel spawning, holding and nursery habitat, chemical and biological water quality and smolt migration. This information is available from the Loughs Agency upon request. Summary information is available in the annual Catchment Status Reports <https://www.loughs-agency.org/publications/>

The River Faughan has a catchment area of approximately 290km². The Main stem is approximately 31km in length with tributaries accessible to migrating salmon accounting for approximately 20km in channel length giving a total accessible channel length of approximately 51km.

Other species are also regularly recorded in the RST. The most notable of these being Sea trout (*Salmo trutta* L.) smolts, kelts and adults, adult River lamprey (*Lampetra fluviatilis*) and adult Brook lamprey (*Lampetra planeri*).

The fishing rights are owned by The Honourable The Irish Society and in the tidal river by the Loughs Agency, both areas are currently leased to the River Faughan Anglers Ltd.

2.0 METHODOLOGY

A 5ft diameter EG Solutions Inc. Rotary Screw Trap (RST) is deployed annually during the salmonid smolt run. It is positioned immediately downstream of a Denil fish pass located on Campsie Barrage. Campsie barrage is an impounding structure which facilitates the abstraction of raw water from the River Faughan and forms the upstream tidal limit during normal flow conditions. The abstracted water is then pumped to Carnmoney water treatment works. The RST is fixed to a sub aquatic concrete wall by two submerged brackets. The RST is then attached to the brackets by a series of chains. In recent years the RST has been constructed on builders trestles on a hard standing area adjacent to the pumping station and hoisted into position by a crane.





Fig 1. RST being hoisted into position at Campsie Barrage on the River Faughan, RST in fishing position in line with Denil fish pass.

Since monitoring began on the River Faughan in 2003 the earliest the trap was deployed was 24th March in 2015. The latest the trap was removed was 29th May 2015. Table 1 below outlines the operational periods for the Faughan RST.

Year	Number of Days Trap Operational	Start Date	End Date
2016	20	15/04/2016	20/05/2016
2015	25	24/03/2015	29/05/2015
2014	20	10/04/2014	02/05/2014
2009	18	16/04/2009	22/05/2009
2008	24	08/04/2008	14/05/2008
2007	31	03/04/2007	18/05/2007
2006	24	20/04/2006	23/05/2006
2005	35	12/04/2005	20/05/2005
2004	17	28/04/2004	26/05/2004

Table 1. RST Operational days and periods by year.

Periods of high flow were anticipated through close monitoring of the weather forecast and the trap was raised into the non-fishing position in advance of any significant flood.



Fig 2. RST in the non-fishing position with the drum raised. Note access gangway and boat used to access the RST.

During normal trapping operations debris build up in the trap holding tank and the RST structure was removed on a daily basis.

A mobile sampling station/box trailer has been used in recent years in which fish caught within the RST are sampled. The RST is accessed by a small boat, the RST holding tank is emptied on a daily basis with all species identified and counted. The target species are collected and returned to the mobile sampling station/box trailer where they are anaesthetised using MS222, key biological data including lengths, weights scale and genetic samples are collected before all fish are returned to the river. From 2004-2009 Coded Wire Tagging was conducted on a sub sample of Atlantic salmon smolts as part of national monitoring programmes. The information collected through this study was used to inform key management decision making in relation to the closure of mixed stock interceptory drift net fisheries around the island of Ireland.

3.0 RESULTS

3.1 ATLANTIC SALMON AND SEA TROUT

The numbers of Salmon, Sea trout smolts and other life history stages and species captured by year are outlined in Tables 2, 3 & 4 below.

Year	Number of Salmon Smolts Caught	Number of Sea Trout Smolts Caught
2016	2132	93
2015	4011	338
2014	2434	379
2009	820	28
2008	2510	55
2007	2611	279
2006	1079	249
2005	3988	729
2004	2962	194

Table 2. Numbers of Salmon and Sea trout smolts caught by year

Year	Eels	Lamprey Sp	Sea Lamprey	River Lamprey	Brook Lamprey	R/B Ammocoetes	Salmon Parr	Trout Parr
2016	0	N/A	0	44	113	3	3	12
2015	4	N/A	1	103	729	16	129	7
2014	0	N/A	0	77	49	N/A	58	37
2009	4	45	N/A	N/A	N/A	N/A	33	8
2008	4	278	N/A	N/A	N/A	N/A	17	6
2007	3	437	3	N/A	N/A	N/A	18	N/A
2006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2005	14	56	N/A	N/A	N/A	N/A	1	2
2004	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3. Species caught by year

Year	Adult Salmon	Adult Sea Trout	3 Spined Stickleback	Roach	Flounder	Minnow	Stone Loach	Perch
2016	1	10	364	20	3	1	1	11
2015	2	3	548	36	21	50	5	0
2014	N/A	73	1156	43	4	3	N/A	N/A
2009	N/A	3	509	N/A	N/A	N/A	N/A	N/A
2008	1	4	N/A	14	3	N/A	15	N/A
2007	N/A	6	927	16	2	N/A	2	0
2006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2005	2	1	275	4	7	10	0	N/A
2004	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. Species caught by year continued

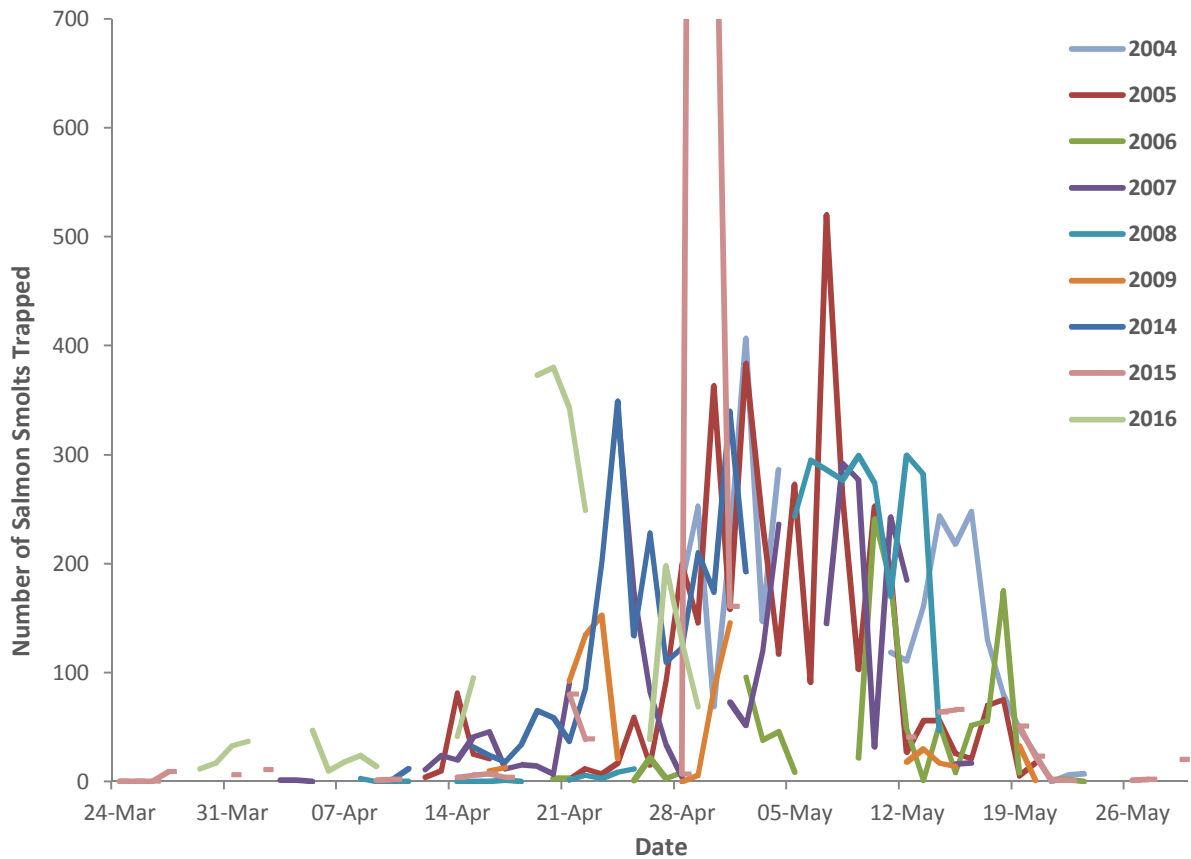


Fig 3. River Faughan Salmon smolt run timing and abundance 2004–2009 & 2014–2016. * Note in 2015 2441 salmon smolts were caught on the 29th April, this is marked on the graph above with a break in the line.

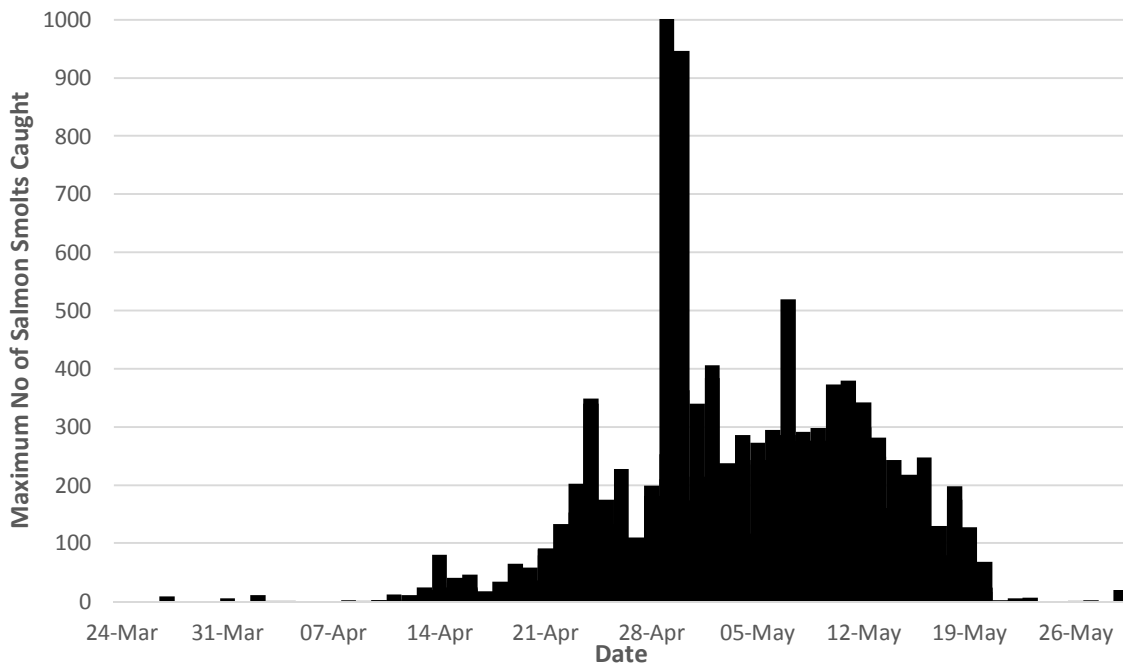


Fig 4. Maximum number of Salmon smolts caught on each day 2004–2009 & 2014–2016. * Note in 2015 2441 salmon smolts were caught on the 29th April.

Year	Salmon Smolts Mean Length (cm)	Sample Size (n)	Salmon Smolts Mean Weight (g)	Sample Size (n)
2004	13.4	1881	24.6	73
2005	No data	No data	No data	No data
2006	13.3	1059	25.36	95
2007	13.5	2083	27.09	65
2008	13.1	2482	22.1	50
2009	13.5	771	24.42	47
2014	13.5	314	25.1	314
2015	12.5	11	15.8	11
2016	13.7	16	26.66	16

Table 5. Mean Length (cm) and mean weights (g) by year for Salmon smolts caught in the Faughan RST 2004-2009 & 2014-2016

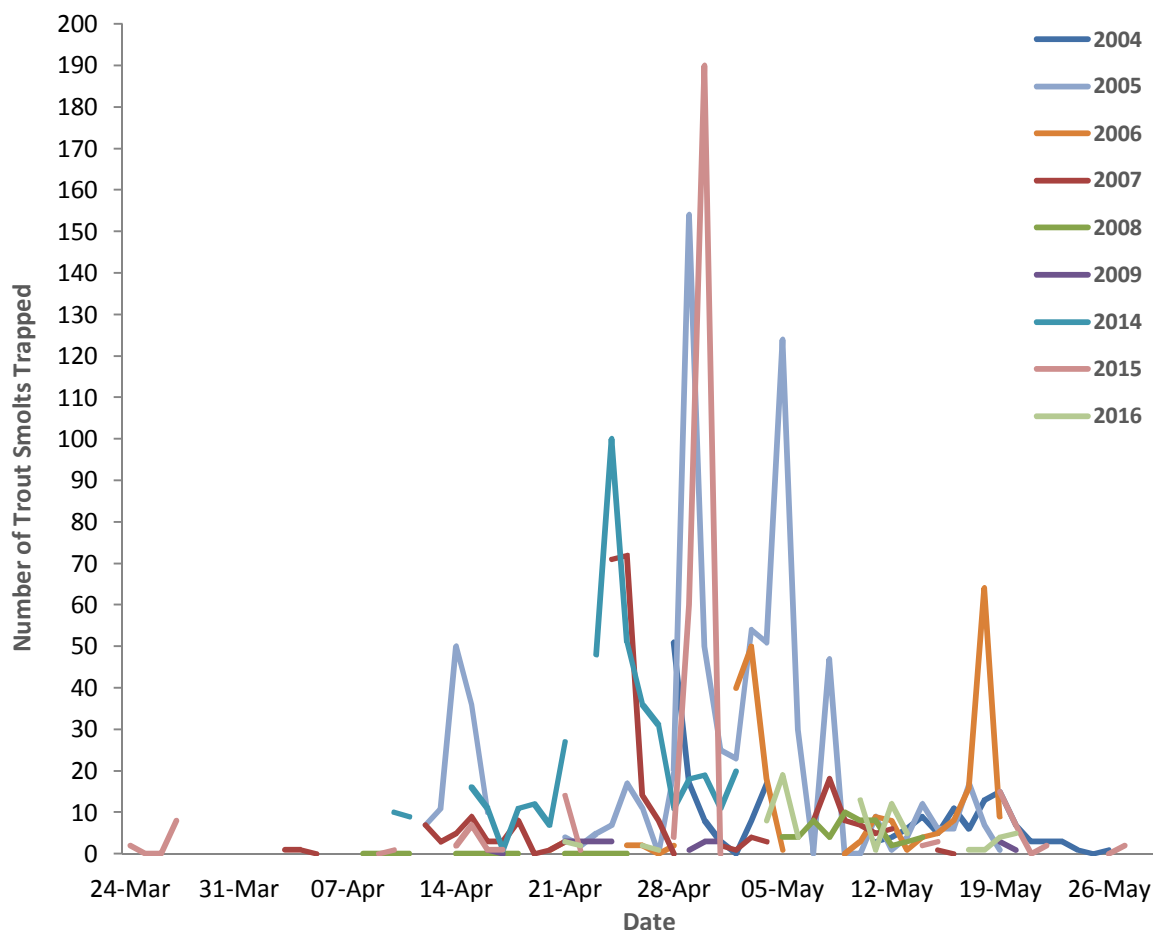


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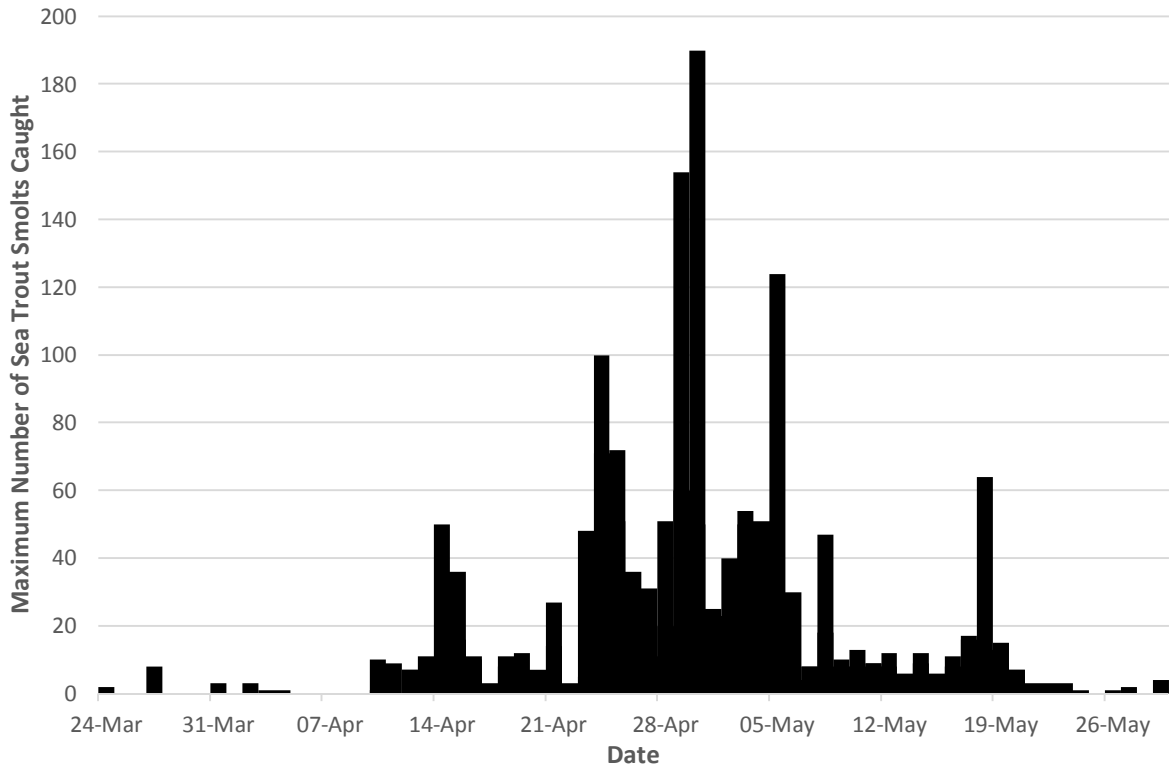


Fig 6. Maximum number of Sea trout smolts caught on each day 2004-2009 & 2014-2016.

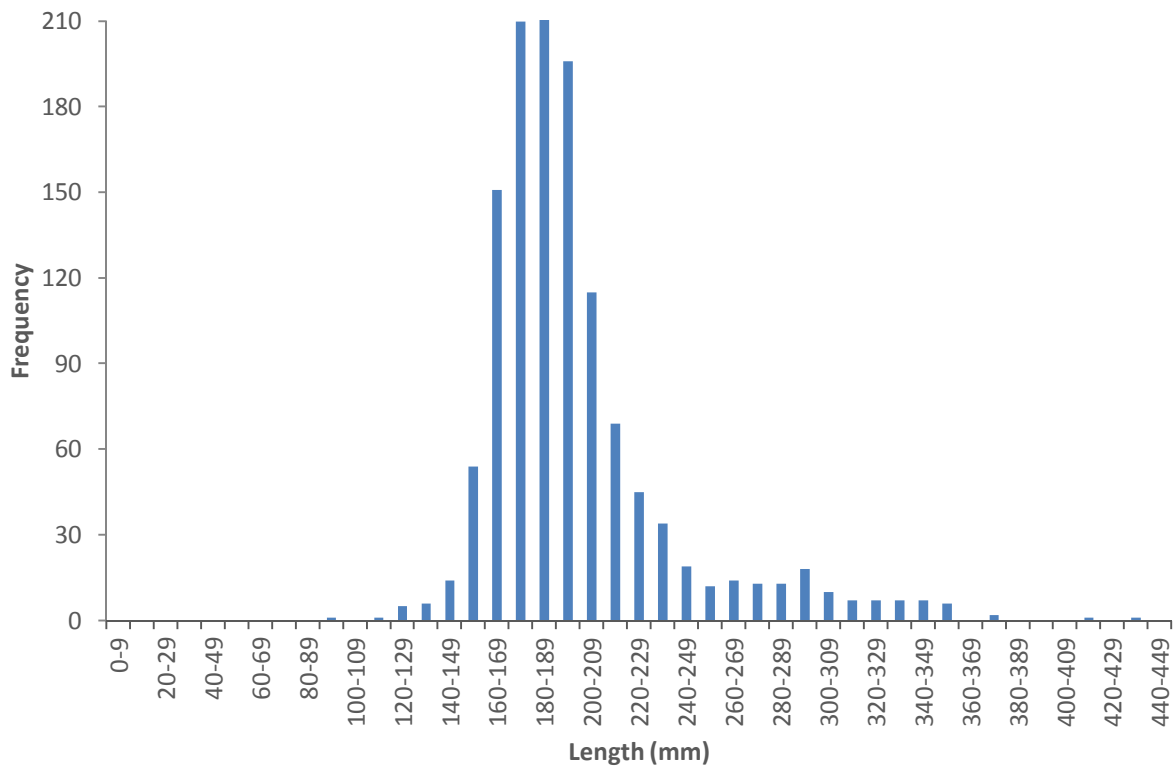


Fig 7. River Faughan Sea trout length frequency distribution 2006-2009 & 2014-2016 n = 1256

Figures 8 & 9 outline the cumulative % totals for both salmon and Sea trout smolts caught in the Faughan RST from 2004-2009 & 2014-2016. The 50% attainment line highlights the date on which 50% of the run recorded in each year was achieved.

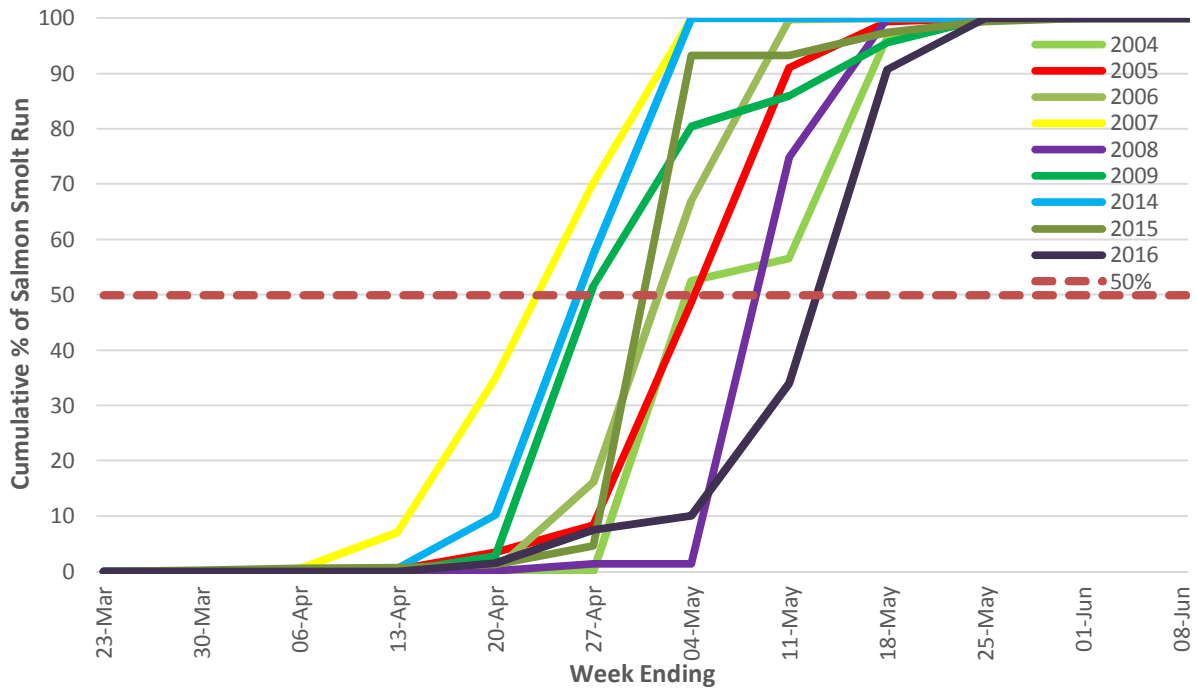


Fig 8. Cumulative % Salmon smolt catch and 50% attainment dates

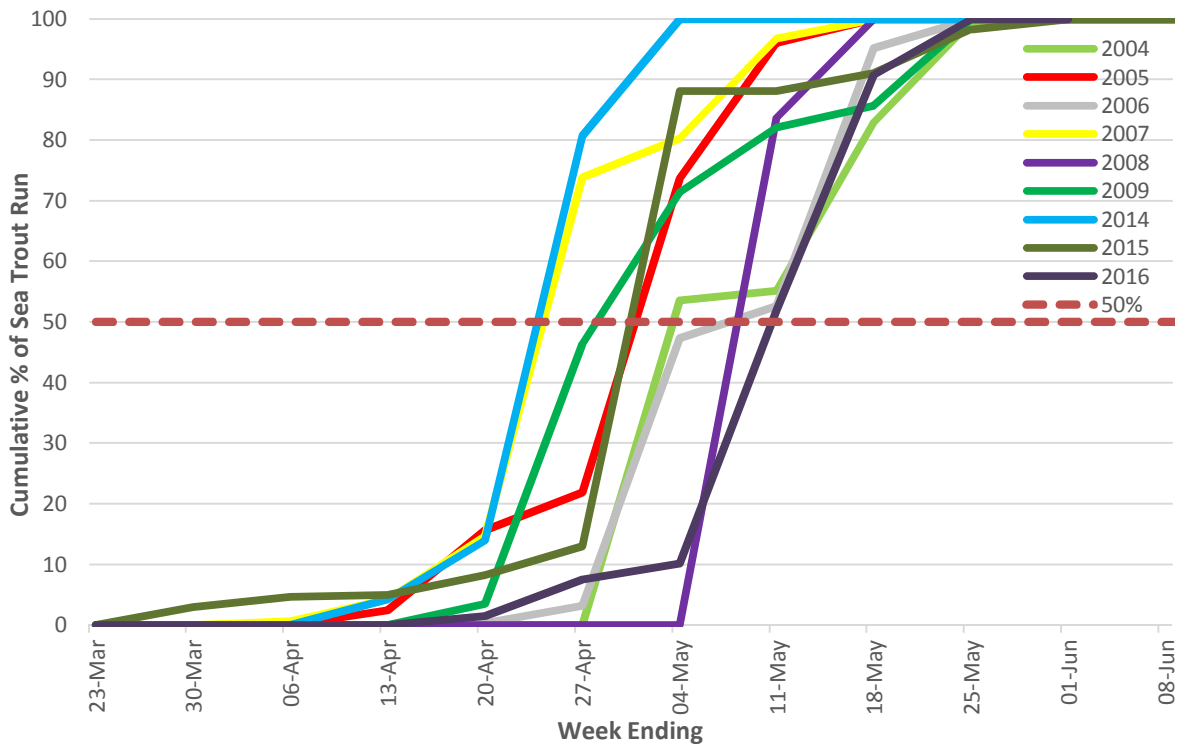


Fig 9. Cumulative % Sea trout smolt catch and 50% attainment dates

Year	Trout Smolts Mean Length (cm)	Trout Smolts Mean Weight (g)	Sample Size (n)
2014	19.86	78.6	354
2015	18.30	63.2	332
2016	17.15	56.2	86

Table 6. Mean Length (cm) and mean weights (g) by year for Sea trout smolts caught in the Faughan RST 2014-2016

3.2 SALMON SMOLT AGE

In 2004 seventy two sets of Salmon smolt scales were read using a Bell Howell C100 microfiche reader to determine age at smolting. Scale samples were collected in other years and are stored in the Loughs Agency scale archive. It is recommended that additional ageing is conducted on both Salmon and Sea trout smolts to determine if the age at smolting has varied over time.

Age	1	2	3
Number	9	60	3
Percentage %	13	83	4

Table 7. River Faughan Salmon smolt age

3.3 SALMON SMOLT PRODUCTION ESTIMATE

An intensive mark recapture study to estimate the total out migrant Salmon smolt run was conducted in 2004. On a daily basis a proportion of Salmon smolts captured in the RST were marked with a day specific batch code and transported 1.8 km upstream from the capture site and released. The mean recapture rate for marked Salmon smolts in 2004 was 10.5%. Using Darrochs method utilising the DARR model it was possible to estimate that approximately 33,000 +/-5000 Atlantic salmon smolts made a seaward migration in the spring of 2004. Table 8. outlines the 2004 smolt production estimate using the DARR model and also the population estimates for 2004-2009 and 2014-2016 by applying the generic 10.5% capture efficiency rate of the trap as estimated in 2004 to the entire data set. This is a crude estimate of total smolt production over these years.

Year	Number of Salmon Smolts Caught in Faughan RST	Total Salmon Smolt Out Migration	Total Salmon Smolt Out Migration Population Estimate
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		Population Estimate by DARR	(10.5% trap efficiency value)
2016	2132	N/A	20304
2015	4011	N/A	38200
2014	2434	N/A	23180
2009	820	N/A	7809
2008	2510	N/A	23904
2007	2611	N/A	24866
2006	1079	N/A	10276
2005	3988	N/A	37980
2004	2962	33,000	28209
Mean	2818		26868

Table 8. Salmon smolt production estimates for the Faughan catchment 2004-2009 & 2014-2016

The approximate wetted area of the Faughan catchment accessible to Atlantic salmon is estimated as 825,466m². Table 9. Outlines the estimated Salmon smolt production per 100m² across the survey years.

Year	Estimated Atlantic salmon smolt production per 100m²
2016	2.46
2015	4.63
2014	2.81
2009	0.95
2008	2.90
2007	3.01
2006	1.24
2005	4.60
2004	3.42

Table 9. Faughan catchment estimated wild Atlantic salmon smolt minimum production per 100m².

3.4 CODED WIRED TAGGING (2002 – 2009)

The numbers of salmon that survive to return to the freshwater environment are greatly influenced by conditions in the marine environment. Climate change leading to changes in sea surface temperatures, prey abundance, high seas fishing, marine pollution, sub lethal levels of pollution and predation all have an effect on the Atlantic salmon and indeed other migratory fish species chances of survival. Marine survival trends are monitored on a number of Index Rivers in the North East Atlantic where total trapping facilities are available for both migrating juvenile and adult populations. Total trapping allows for an accurate count of all migrant smolts (total freshwater production) and returning adults to be made and therefore an accurate estimate of marine survival. These projects are facilitated by the use of Coded Wire Tags (CWT). Coded wire tags are small (2-3mm long) micro tags that are injected automatically by a CWT device into the snout cartilage of anaesthetised fish remaining there for the duration of the life of the fish. CWT fish also have their adipose fin (small fin between the dorsal fin and caudal fin (tail fin) removed so that they can be identified in the various fisheries that may intercept them.

In 2002 migrating Atlantic salmon smolts were first captured in a smolt trap situated at the fish counter in Killygordon on the River Finn. Trapping and coded wire tagging continued at this site until 2006. In 2003 Salmon smolts were first captured in the rotary screw trap at the tidal barrage on the River Faughan. Trapping and coded wire tagging continued at the Faughan site until 2009. Coded wire tags were inserted into the Salmon smolts before they were released. The information collected contributed towards the coded wired tagging projects in Northern Ireland and the Republic of Ireland. Table 10 below shows the numbers of Salmon smolts tagged at each location.

YEAR	RIVER	NUMBER SALMON SMOLTS TAGGED
2002	Finn	1035
2003	Finn	3005
2003	Faughan	2113
2004	Finn	1030
2004	Faughan	2500
2005	Finn	520
2005	Faughan	2210
2006	Finn	1039

2006	Faughan	1025
2007	Faughan	2062
2008	Faughan	2486
2009	Faughan	748

Table 10. Number of Salmon smolts tagged (CWT) River Finn & Faughan 2002 -2009.

Table 11 below shows the numbers of smolts tagged on the River Finn and Faughan. It also shows the number of coded wire tags recovered and the year in which they were recovered. In 2010 the commercial mixed stock drift net fisheries were closed. This had been the main recapture method for Salmon smolts containing coded wire tags.

YEAR	RIVER	No SALMON TAGGED	YEAR RECOVERED	NUMBER RECOVERED
2002	Finn	1035	2003	10
			2004	1
2003	Finn	3005	2004	25
	Faughan	2113	2004	12
2004	Finn	1030	2005	8
	Faughan	2500	2005	16
2005	Finn	520	2006	1
	Faughan	2210	2006	3
2006	Finn	1039	2007	8
			2008	1
	Faughan	1025	2007	2
2007	Faughan	2062	2008	2
			2009	1
2008	Faughan	2486	-	0
2009	Faughan	748	-	0

Table 11. Recovery of coded wire tags from smolts tagged on the River Finn & Faughan 2002 -2009.

3.2 LAMPREY

From 2014 the RST has been used to capture high resolution data on adult River, Brook and Sea lamprey. It was previously observed that the RST caught significant numbers of adult Lamprey during the annual smolt migration period. From 2014 the RST was deployed earlier to attempt to catch adult Lamprey prior

to their annual spawning period. It is assumed that River Lamprey are caught in the RST as they attempt to travel upstream through the Denil fish pass and get washed into the RST during these attempts. It is unknown at present if the adult Brook lamprey are caught for the same reasons. They may alternatively have travelled down river and entered the trap from this direction. The current Denil fish pass may form a barrier to upstream migration for diadromous Lamprey.

The River Faughan index site has and will continue to facilitate research into these issues. The Loughs Agency has collaborated with QUB through a recent PhD to investigate Lamprey populations within the Faughan catchment. Detailed analysis of the genetic diversity within and between the River and Brook lamprey populations of the Faughan should enlighten contemporary thinking on future conservation management actions.





Fig 10. Pictures of from top of previous page, female Brook lamprey with eggs visible in abdomen, adult Sea lamprey, adult River lamprey oral disc, Sea lamprey oral disc and River lamprey male with close up of genital papilla.

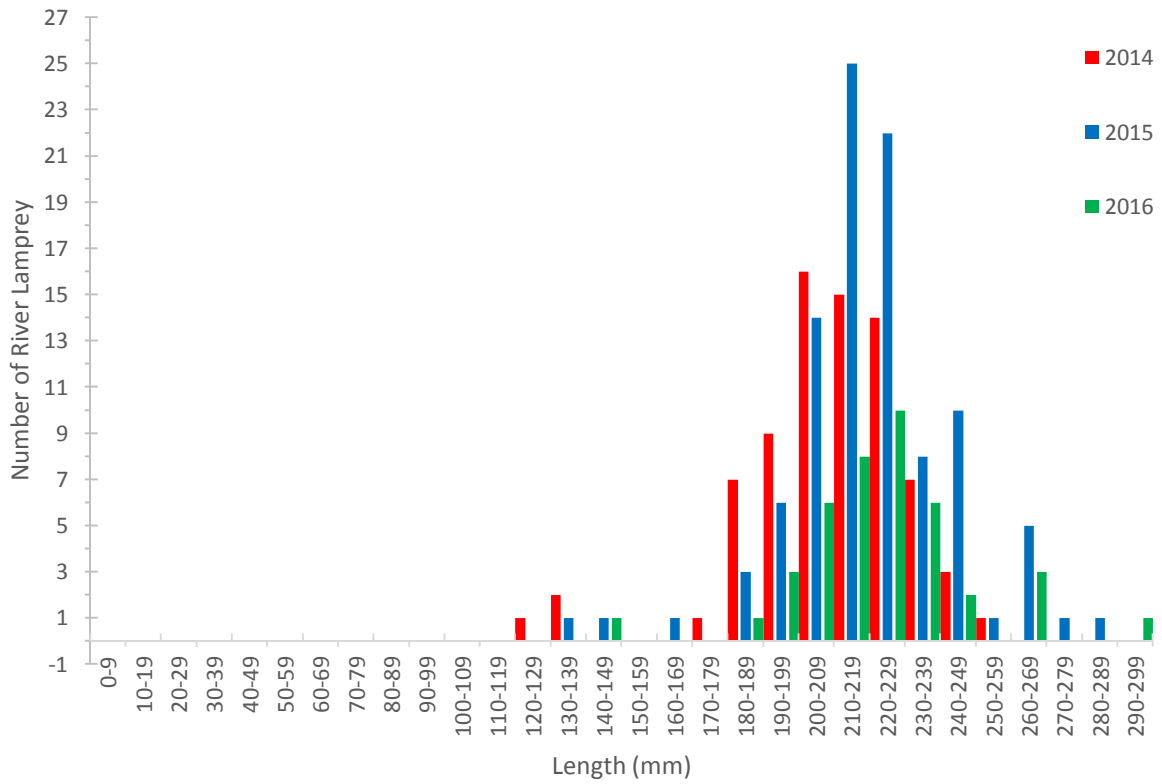


Fig 11. Length frequency of adult River Lamprey caught in the Faughan RST 2014 n = 76, 2015 n = 99 & 2016 n = 42

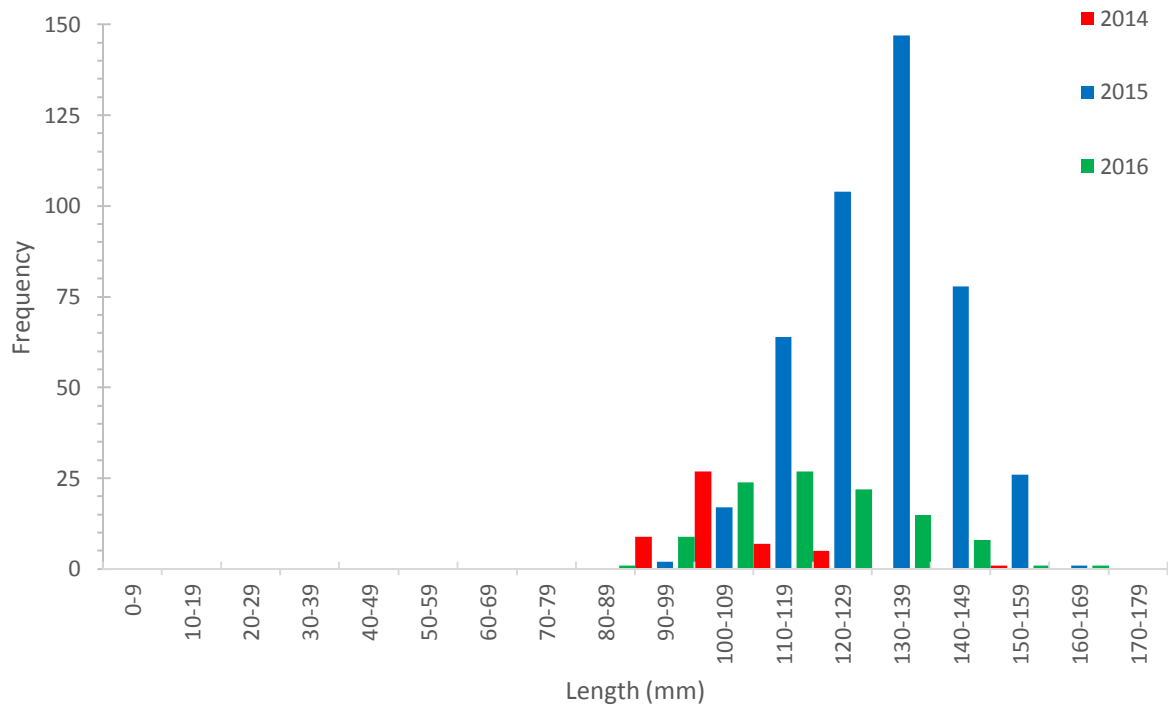


Fig 12. Length frequency of adult Brook Lamprey caught in the Faughan RST 2014 n = 49, 2015 n = 439 & 2016 n = 108

5.0 DISCUSSION

The deployment of the RST at the River Faughan site has been extremely successful. The initial deployment to capture Salmon smolts for the purpose of coded wire tagging from 2003 to 2009 established an important record of where Faughan/Foyle salmon were intercepted and in what fisheries. In addition it established a project which captured other key biological information from a wide variety of species and life history stages. From 2014 the focus of this work has been on continuing the Salmon smolt census, the collection of key biological information including the run timing and abundance of Sea trout smolts and adults, the collection of Lamprey genetic samples and key biological data and the census of all other species. The configuration of the barrage structure has facilitated the long term monitoring project at this site. In addition to having a secure site from which to base trapping operations the fish pass configuration has facilitated the effective and efficient capture of a range of resident and diadromous fish species. This site could be further configured to facilitate more detailed studies on the survival and migration patterns of both Salmon and Sea trout.

Northern Ireland Water Ltd are gratefully acknowledged for their continued support in facilitating the long term fisheries monitoring project on the River Faughan at Campsie pumping station. This includes the electronic fish counting facilities used for counting numbers of returning adult Atlantic salmon to the Faughan catchment.

6.0 RECOMMENDATIONS

- Investigate the potential for using the smolt production estimates as part of a numerical life history stage model.
- Eel and Lamprey passage should be developed at this site. Consideration should first be given to upstream baseline genetic assessments of the Lamprey populations. This should utilise the Loughs Agency juvenile Lamprey baseline assessment conducted in the Faughan catchment in 2012.

- A Sea trout specific mark recapture study should be considered to provide a Sea trout specific trap capture efficiency value and out migrant Sea trout smolt population estimate.
- Additional resources to be allocated towards scale reading. Contemporary and historical information on the age at smolting for Atlantic salmon and Sea trout within the Faughan catchment would be worthwhile.
- Acoustic tagging of out migrant Sea trout smolts and subsequent tracking throughout Lough Foyle and neighbouring areas to ascertain migration pathways and feeding territories.
- Expand the trout genetic baseline for the Faughan catchment and conduct a revised Genetic Stock Identification exercise of Sea trout to ascertain a more detailed understanding of the location of Sea trout spawning and nursery areas.
- Sea trout adult and kelt floy tagging
- Continue RST trapping operations for all species
- Investigate the potential for developing trapping facilities for upstream moving fish
- Investigate the potential for installing a PIT array on the existing fish pass structure
- Investigate alternative fish counting technologies for monitoring upstream moving fish