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Report on Salmon Monitoring Programme Funded under the Conservation Stamp Fund

2012

June 2013

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University College Cork, Ireland

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Salmon Monitoring: Report on projects to assess attainment of Conservation Limit for Atlantic Salmon in Irish Rivers

Project Personnel

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Acknowledgements

Much of the catchment wide electro-fishing programme was undertaken by the staff of the River Basin Districts (formerly the seven Regional Fisheries Boards). The excellent contribution and cooperation of the staff of each of the Boards during the fieldwork element of these projects is greatly appreciated.

The assistance of the Irish Air Corps in supporting salmon tracking operations is gratefully acknowledged.

The input of Dr Phillip McGinnity, UCC, Dr. Richard Kennedy, AFBINI (River Bush Research Station), Dr. Niall O'Maoileidigh, Dr. Elvira De Eyto and Dr. Jonathon White, & Nigel Bond (all MI), is acknowledged.

Contents

1. Executive Summary

- Funding was provided under the Salmon Stamp Conservation Fund to assess the status of salmon in selected catchments. There were three separate elements in the 2012 programme - **Catchment-wide Electro-Fishing, Development of a raising factor for a partial counter facility and Determination of the life history characteristics of adult salmon in selected catchments.**

- The objective of the catchment-wide (CW) electro-fishing programme is to develop an index of juvenile salmon abundance to support assessment of attainment of salmon conservation limits (CL) on individual rivers. Salmon conservation limits (the number of adult salmon required to spawn to maintain the population), or, as defined by NASCO as "the spawning stock level that produces maximum sustainable yield", were set for 148 Irish salmon rivers (SSC 2005).

- Catchment Wide electro-fishing was completed in 24 catchments in 2012 to assess abundance and distribution of salmon fry. A total of 530 sites were visited. In the first six years of the programme (2007-2012), 238 catchment surveys in 124 catchments have been undertaken comprising 4958 site surveys.

- A precautionary approach was adopted by the SCC (2009) for the provision of catch advice using the 2007, 2008 and 2009 catchment-wide electro-fishing results. After data analysis, the threshold value was lowered from 25 salfry/5mins (2007 & 2008) to 17 salfry/5mins as a cut off point for identifying rivers likely to be meeting CL. The majority of the rivers known to be meeting and exceeding CL have a fry index of 17 or higher.

- This threshold of 17 salmon fry was suggested by the SSC as a qualifying value for rivers to operate on a catch and release basis in 2012 where information is limited or insufficient. Where there are more than one year's fry indices available, the average should be equal to, or greater than 17 salmon fry.

- Five rivers, predicted not to have a salmon surplus in 2012, had an average salmon fry index ≥ 17 over the 2007-2012 period. These rivers (Liffey lower, Barrow, Carrownisky, Clady and Lackagh) were recommended for opening on a catch & release basis in 2012. C&R would also provide rod catch data for estimation of stock size in 2013.

- For the 24 salmon catchments surveyed in 2012, the salmon fry abundance for **this year alone** ranged from an average of zero fry on the Erne, to a catchment average of 37.21 salmon fry on the Clady. The Cloonaghmore, Garvogue, Bracky, Owenwee (Yellow), Leannan, Fane, Lackagh, Barrow, Erriff, Eany and Clady all recorded an annual catchment wide average of >17 fry. Salmon fry densities of over 15 Salfry/min were also recorded on the Owenwee (Belclare), Owenduff and Cloonee catchments.

- Generally there was good agreement between the Standing Scientific Committee scientific assessment of attainment of salmon conservation limit from rod catch or counter data and the results of the catchment-wide electro-fishing surveys. However, some rivers, primarily small rivers with a rod catch < 10 rivers, were, based on electro-fishing results, very

unlikely to be meeting their derived CL. (Dargle, Vartry, Emlagh, Isle Burn, Straid , Donagh, & Culoort).

- Results to date indicate that the catchment wide electro-fishing technique has good potential for salmon stock assessment. It is anticipated that at least 5 years data from many different catchments will be required before meaningful relationships between juvenile abundance and conservation limits can be developed. The technique is likely to provide the best estimate of salmon stock status in small rivers where rod catch was low (<10 salmon annual rod catch) and cannot be used to estimate salmon stock size currently.

- CW electro-fishing is also important in providing managers with detailed information on salmon fry distribution and abundance. The absence or low density of salmon fry may be related to water quality issues, obstructions, or habitat damage and areas of low abundance can be investigated. These data should be used to target any remediation works that may be required.

- An adult salmon tagging programme was undertaken on the Boyne to assess the salmon runs where the partial counter at Blackcastle weir only counts part of the run. An unquantified proportion ascends uncounted over the “open” part of this weir. Traditional draft net fishermen, under the supervision of staff from IFI Drogheda, sampled salmon in the tidal portion of the catchment in 2012 and a total of 232 fish were PIT tagged over the summer months. 14 salmon were detected passing the PIT tag readers at Blackcastle. Some PIT tagged fish were also radio tagged to determine the proportion of fish migrating to and above the weir. A full analysis of these data is ongoing.

- Salmon scales were collected and analysed from the commercial snap net fishery on the Suir and Munster Blackwater draft nets in 2012. Scales were also collected from salmon taken from the Ballinahinch salmon rod fishery. Scale reading from this, and previous years, showed that the percentage of grilse in each river varied from 47% in the Suir to 85% in Ballinahinch, Multi-sea winter fish comprised between 13% and 54%, previously spawned grilse made no more than 5% of the stock in any of these catchments.

2. Assessment of Attainment of Conservation Limits for Atlantic Salmon in Irish rivers in 2012: Report on Activities.

2.1. Introduction

In Spring 2009, scientists from the Standing Scientific Committee of the National Salmon Commission identified appropriate methods for assessment of attainment of salmon conservation limits (CL) on an individual river basis nationally. They also proposed a strategy for prioritisation of rivers for assessment of attainment of Conservation limits. This assessment was based on the feasibility of inserting new counters, undertaking redd counts, use of electro-fishing as an index of spawning, obtaining full counts from partial counters by tagging etc. on catchments and was linked to the current status of salmon stocks in each river (Anon 2009). Other data such as salmon rod catch, commercial catch by river, micro-tagging data, marine survival and fishery exploitation data are used annually by the Standing Scientific Committee to assess salmon stock status.

This report presents the results of activities undertaken in 2012 to assess attainment of salmon conservation limits nationally in line with assessment methods identified by the scientists.

An application was made to the Salmon Conservation Fund for funding for 2012 to assess attainment of salmon conservation limits nationally and €120,000 was provided for this project in 2012. The project had three elements:

1. Catchment wide Electro-Fishing Programme.

Undertake catchment-wide electro-fishing in selected catchments to assess abundance and distribution of salmon fry and to further develop an index of juvenile salmon abundance which can be used to assess attainment of salmon conservation limit. Resources and training in the catchment wide electro-fishing technique were also provided to IFI staff nationally.

2. Development of a raising factor for upstream counts at partial fish counters

Several existing fish counters are partial counters, i.e. they only cover a portion of the river and only count part of the salmon run. Examples include the Slaney, Blackwater, Bandon and Corrib where counters are usually located at the head of fish passes or traps. The recorded count on these rivers is raised by a factor to provide an estimate of the total upstream run. The project was designed to assess the feasibility of using the technology for assessing the efficiency of other partial counters. This work had progressed on the Boyne in 2011 and was continued on the Boyne in 2012 to develop robust data.

3. Biological Assessment of Salmon Populations

Knowledge of salmon life history strategies is required to understand and model salmon populations in different systems. Biological data on salmon including sea age, run-timing, sex ratio and fecundity are necessary to understand population dynamics within a river.

Changes to any of these inputs can influence the outcome of the production models used to predict the likely returns to a river and potential fishery performance. Life history traits such as smolt age, sea age, growth and frequency of spawning can be determined from scale reading. Combined with data on time of entry into the system, sex ratio and fecundity, which can be collected from any killed fish, the often complex make up of a population can be established and the models can be adjusted accordingly. Scales were collected from a range of commercial and rod fisheries in 2012.

This report presents the work undertaken on these programmes in 2012.

3. Catchment-Wide Electrofishing Programme 2012

3.1. Sampling Methodology.

The sampling methodology was similar to that described in Gargan, P., Roche, W., Keane, S. & Stafford, T. 2008. Report on Salmon Monitoring Programmes 2008 (June 2009), Central & Regional Fisheries Board.

3.2. Results 2012.

During 2012 a total of 24 salmon catchments were surveyed nationally, partial surveys were undertaken on 4 other catchments; 530 sites were visited.

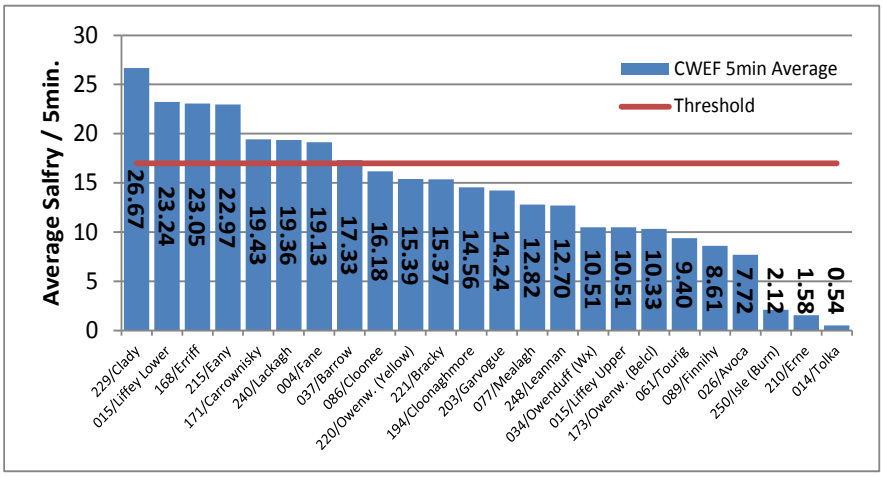


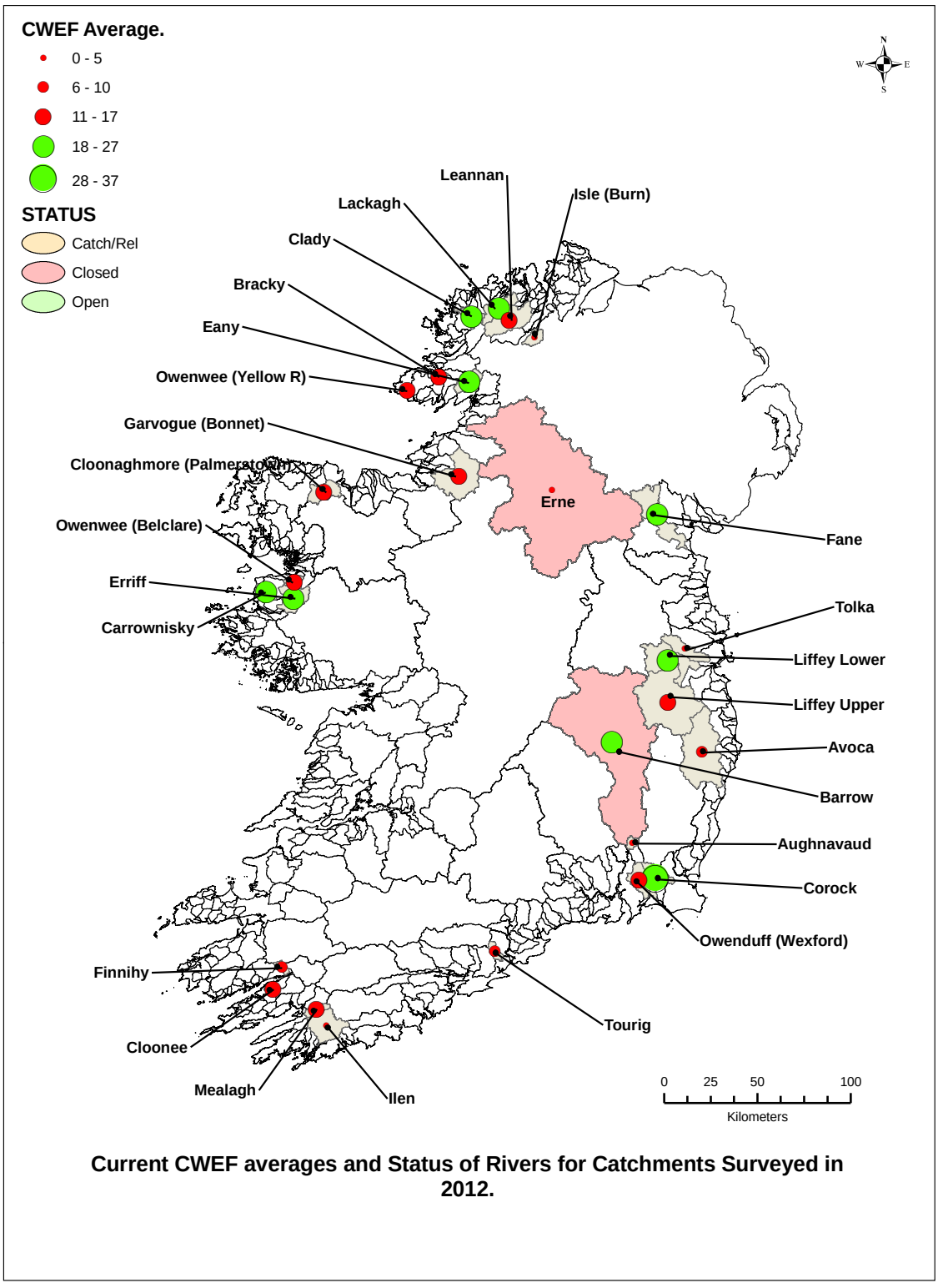
Chart 3.2.1: Summary of the 2012 Survey results from catchments surveyed in 2012. The red line represents the threshold of 17 salfry/5min.

The results for 2012 are summarised in Table 3.2.1 and Charts 3.2.1 and 3.2.2 and Map 3.2.1. The mean salmon fry abundance is presented in table 3.2.1 for all years where data is available and the catchments where the mean is >17 fry are highlighted. Eight catchments surveyed in 2012 had a mean catchment wide salmon fry average over all surveys years of 17 fry or greater: Clady, Liffey Lower, Erriff, Eany, Carrownisky, Lackagh, Fane and Barrow.

5 rivers predicted not to have a salmon surplus in 2012, that had an average salmon fry index ≥ 17 over the 2007-2012 period were recommended for opening on a catch & release basis in 2013, this would provide rod catch data for estimation of stock size. The rivers were Liffey lower, Barrow, Carrownisky, Clady, Lackagh.

IFI Code /River	2007		2008		2009		2010		2011		2012		Total # Sites	Surveys Mean (2012)
	# Sites	Avg	# Sites	Avg	# Sites	Avg	# Sites	Avg	# Sites	Avg	# Sites	Avg		
Neagh Bann IRDB														
004/Fane					5	16.17					7	22.09	12	19.13
Eastern RDB														
015/Liffey Lower			4	21.33	6	40.12	10	25.16	12	17.47	5	12.12	37	23.24
015/Liffey Upper			10	12.93	26	5.11	35	8.15	52	16.20	26	10.13	149	10.51
026/Avoca			16	3.79	29	5.56	24	5.20	65	18.88	23	5.15	157	7.72
South Eastern RDB													0	
034/Owenduff (Wexford)							3	4.97	6	10.65	6	15.91	15	10.51
037/Barrow	81	18.92			65	11.10	76	8.83	58	20.48	68	27.32	348	17.33
South Western RBD														
061/Tourig											8	9.40	8	9.40
077/Mealagh											7	12.82	7	12.82
086/Cloonee											6	16.18	6	16.18
089/Finnihy											6	8.61	6	8.61
Western RBD													0	
168/Erriff	44	29.51	46	24.10	33	16.03	46	20.43	32	20.86	25	27.40	226	23.05
171/Carrownisky			16	18.25							19	20.60	35	19.43
173/Owenwee (Belclare)							10	8.47	9	7.25	11	15.27	30	10.33
194/Cloonaghmore (Palmerstown)			40	8.96			33	9.71	27	22.27	33	17.32	133	14.56
203/Garvogue (Bonnet)	52	18.41	47	13.26	53	16.83	53	11.31	24	7.08	39	18.54	268	14.24
North Western RBD														
210/Erne			15	7.37	22	0.17	53	0.29	17	0.06	62	0.00	169	1.58
215/Eany							30	15.86			21	30.08	51	22.97
220/Owenwee (Yellow R)	9	21.45	3	5.00	8	14.81					4	20.31	24	15.39
221/Bracky			8	10.82							13	19.91	21	15.37
229/Clady			6	16.12							11	37.21	17	26.67
240/Lackagh			7	18.86	9	15.82			12	19.20	11	23.57	39	19.36
248/Leannan	9	9.47	29	7.41	29	8.73	29	16.71	28	12.36	28	21.51	152	12.70
250/Isle (Burn)											10	2.12	10	2.12

Table 3.2.1: Summary of Catchments fished during 2012.



Current CWEF averages and Status of Rivers for Catchments Surveyed in 2012.

Map 3.2.1: Catchment-wide electrofishing results for catchments surveyed in 2012 along with their status during the 2011 fishing season.

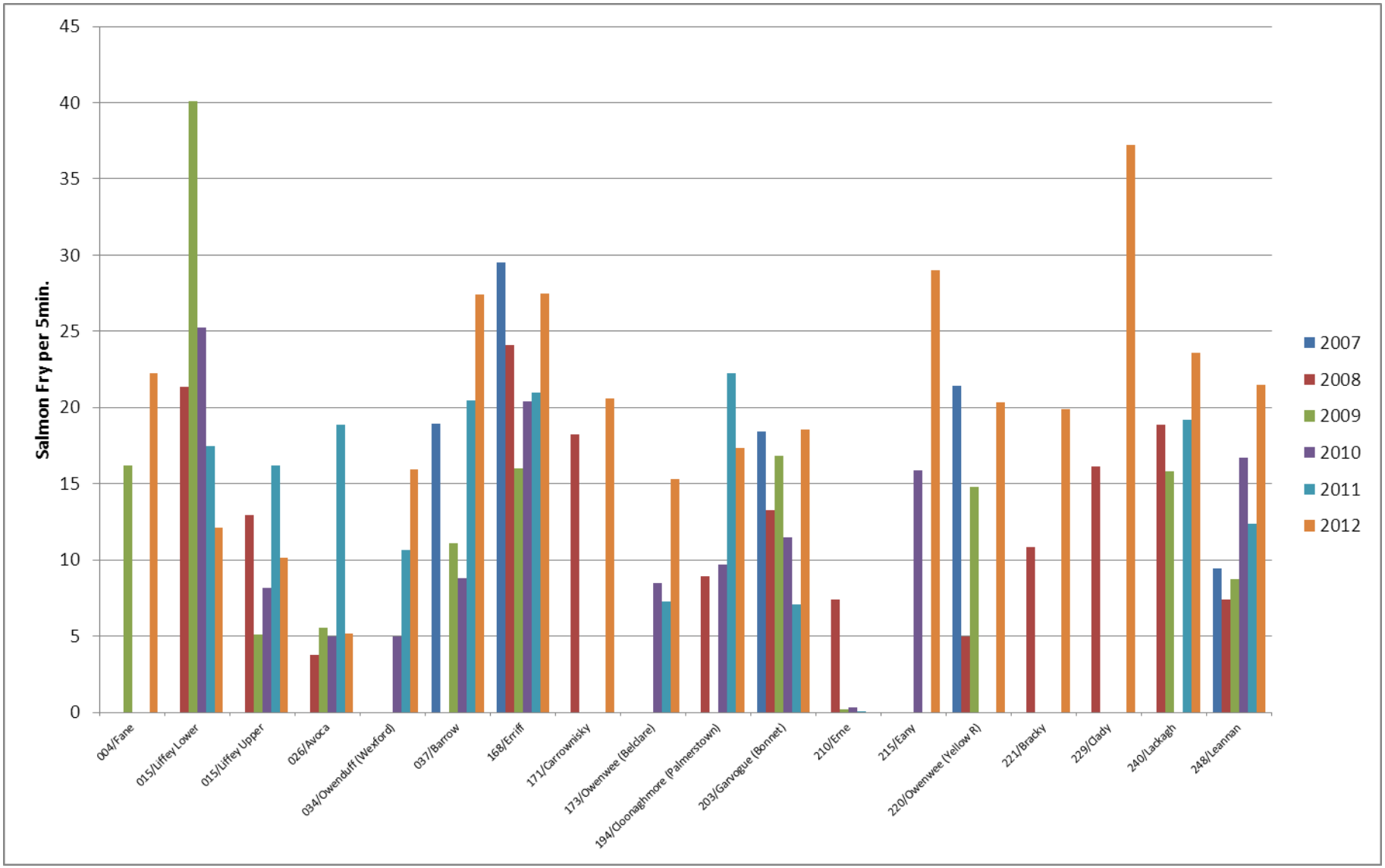


Chart 3.2.2. Showing all results of catchment wide electrofishing surveys for Catchments fished in 2012 that had been fished in previous years.

3.3. Results 2007 – 2012

Update for 2012

Over the 2007 to 2012 period, a total of 4958 site surveys have been have taken place in 238 catchment surveys on 124 separate nationally. For full results see appendix C.

Trends in Salmon Fry Abundance Over Time

Data in Fig 3.3.1 presents the catchment-wide electro-fishing mean abundances of salmon fry in 54 catchments where more than one year's electro-fishing results are available; Figure 3.3.2 Shows the current average salmon index for all catchments surveyed to date

High mean salmon fry abundance was recorded each year on the Boyne, Slaney, Inny, Maine, Owenascaul, Carrownisky and Erriff. A decrease in salmon fry abundance was observed on the Behy, Emlagh, Fergus, Newport, Glenamoy, Glenshelane and Glenna rivers. An increase in salmon fry abundance was observed on the Glyde, Dee, Dargle, Avoca, Barrow, Bride, Duff, and Oily, Lackagh and Leannan rivers, with recent increases after a declining trend on the Owenwee (Yellow) and Garvogue; a more detailed assessment of trends in salmon fry abundance by Fishery Region is provided in Appendix A.

A catchment-wide salmon fry average for rivers electro-fished from 2007 to 2012 is presented, Map 3.3.1. Generally, rivers fished along the east and south east coast recorded low salmon fry densities. Low fry densities were also recorded for rivers in the north-west and Donegal bay. Highest salmon fry densities were recorded in rivers in Kerry and Connemara.

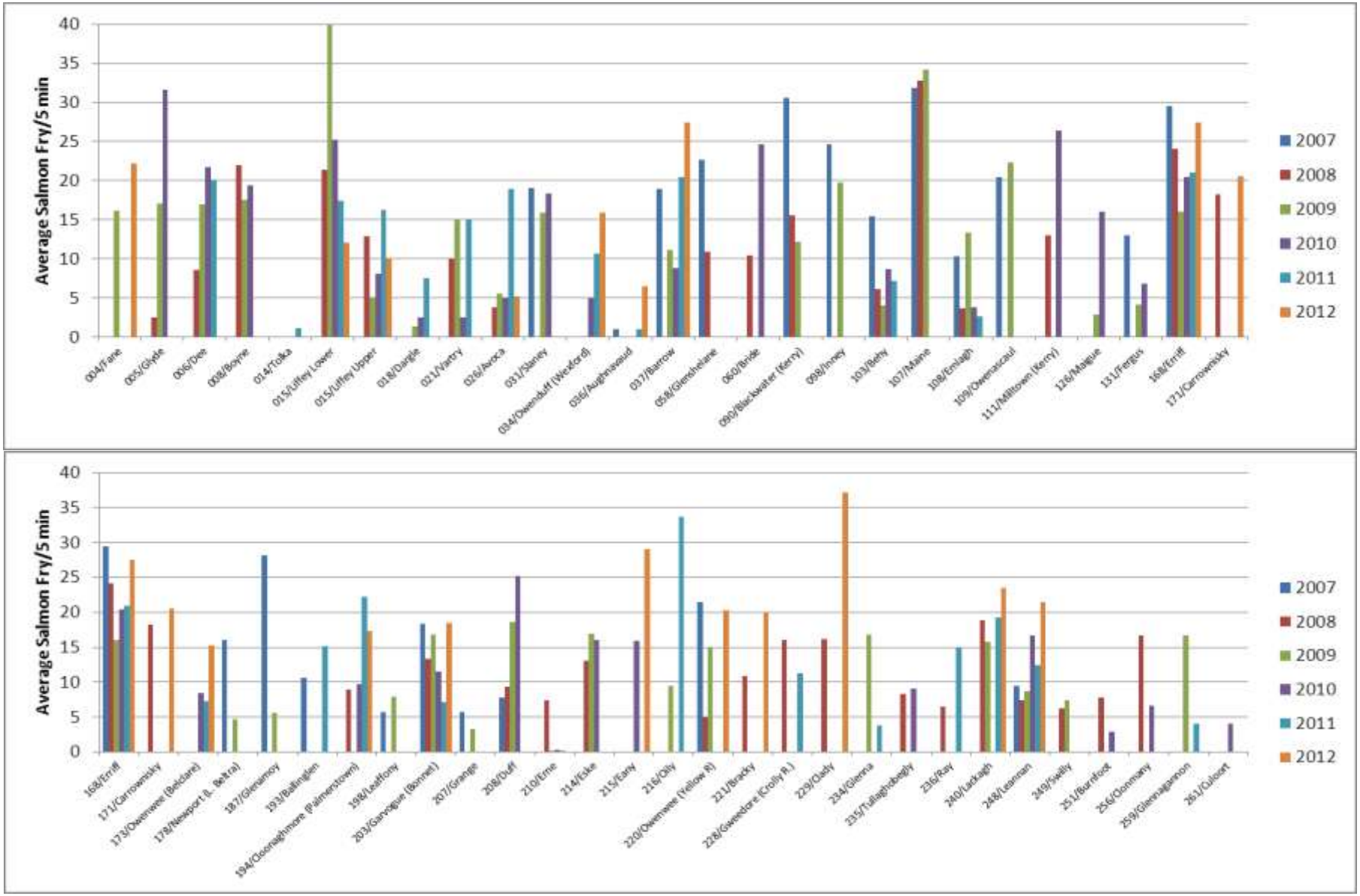


Fig 3.3.1: Annual Catchment-Wide Electrofishing results for Catchments which have been sampled more than once between 2007 and 2012.

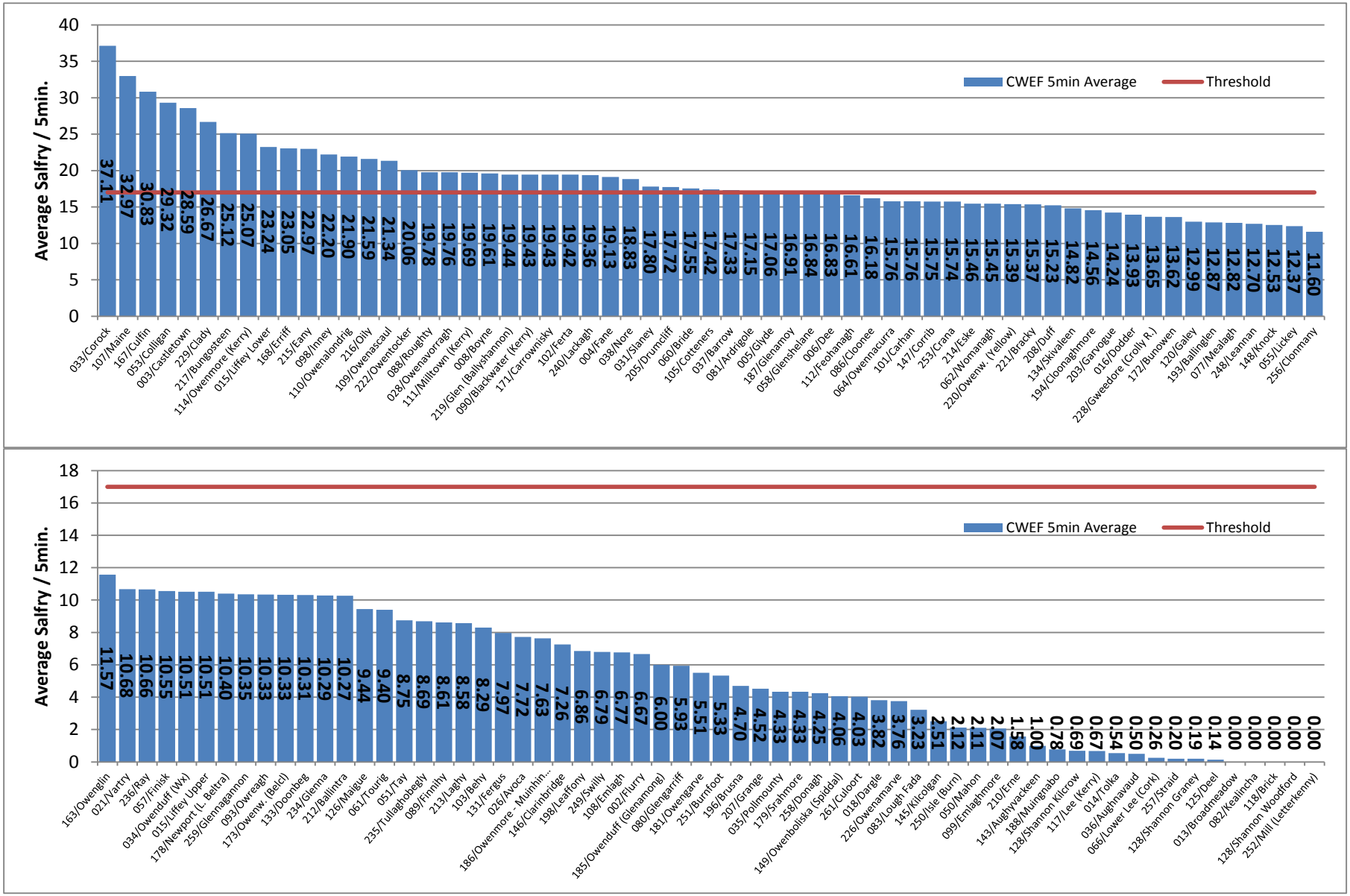
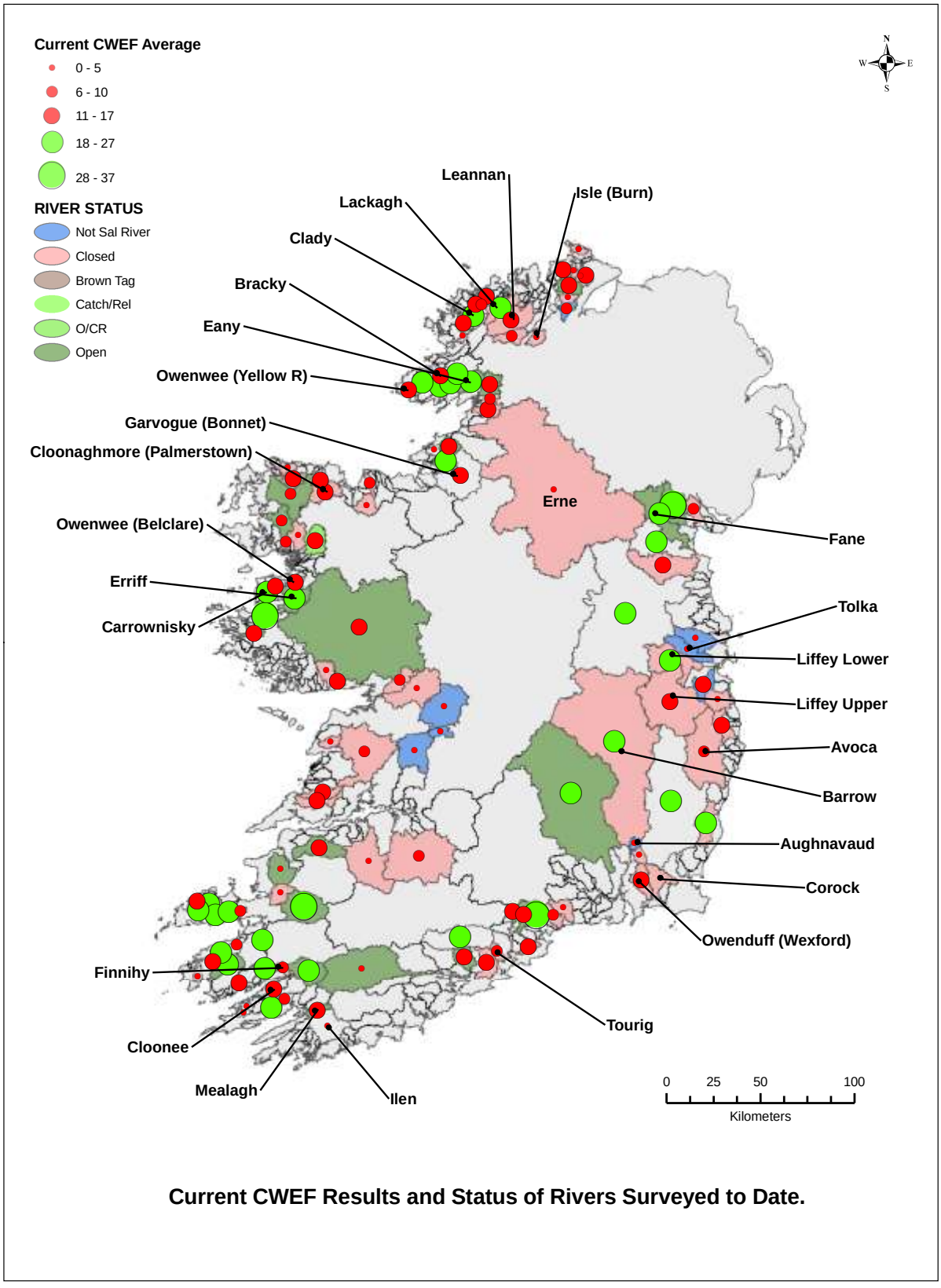


Fig3.3.2: Mean Catchment-wide Electrofishing results for all catchments surveyed to 2012.



Current CWEF Results and Status of Rivers Surveyed to Date.

Map 3.3.1: Mean Salmon Fry indices for all catchments surveyed up to 2012 along with their status during the 2011 fishing season.

4. Development of a raising factor for upstream counts at partial fish counters

Several existing fish counters are partial counters, i.e. they cover a portion of the river and only count a proportion of the adult salmon run. Examples include the Slaney, Blackwater, Bandon, Corrib, and Moy where counters are usually located at the head of fish passes or traps. The recorded count on each of these rivers has to be raised by a factor to provide an estimate of the total upstream run. A project was undertaken in 2008 on the River Corrib to improve the accuracy of the raising factor applied to this count. The project was designed to assess the feasibility of using the technology for assessing the efficiency of all partial counters and it proved successful.

The basis for these site specific Passive Integrated Transponder (PIT) tag studies is a variation of a mark-recapture exercise. Adult salmon are tagged with an individual PIT tag (Passive Integrated Transponder tags); these are small uniquely coded microchips (about the size of a grain of rice). A tag is mounted on a floy tag and this floy tag/PIT tag assembly is attached to the salmon just under the dorsal fin using a hand-held applicator gun. A PIT tag scanner (antenna) is permanently positioned in or close to the fish counter and the scanner will read the electromagnetic code of the tag after a tagged salmon has passed through the counter. A de-coder stores the tag number and the date and time of this event. In its simplest application, in single channel counters, by determining the number of pit-tagged salmon passing through the counter relative to the total number of fish pit tagged, it is possible to determine, for the prevailing conditions, the total upstream run. To increase knowledge of upstream migrations related to local conditions pit tagging needs to be undertaken over a range of water heights as the usage of a fish pass and counter may change with changing river flow conditions. Results from the Corrib study have demonstrated that the technique has the ability to more accurately estimate total salmon runs at partial salmon count sites. Where the counter utilises multiple channels (i.e. the Boyne counter) the analysis is more complex.

Thanks to Francis Carolan (Inspector) and his staff on the Boyne; Maureen Byrne and Kevin O'Brien, and Nigel Bond (Marine Institute) this PIT tagging study was carried out on the Boyne in 2012 and was complemented by radio tagging of a sample of the PIT tagged fish. Radio tagging provided data on the number and proportions of all PIT tagged fish that migrated to the fish counting facility at Blackcastle on the River Boyne and a more accurate estimation of the numbers of salmon available to ascend through the multiple counter channels.

4.1. River Boyne.

An FS1001M multiplex PIT recording unit and customised antenna was installed by Biomark on the Boyne at Blackcastle weir on 9/7/2010. The system was commissioned immediately and has operated efficiently since that time. In 2010 it was monitoring one pass-through antenna situated upstream of the Vaki fish counter located off-centre in the weir. An off the shelf 24" square antenna was installed in August 2011 on the innermost counting channel at Blackcastle weir.

PIT tagging on the Boyne 2012

Sampling of adult salmon was undertaken, using a traditional draft net, by Boyne draftnet fishermen, under the daily supervision of Eastern RBD staff, based in Drogheda, in July and August 2012. A total of 232 salmon were PIT tagged at the draft net sampling station in the Boyne estuary at Mornington. Of the total, 50 (21.6%) were tagged in July with the majority 176 (75.9%) being tagged in August and 6 (2.5%) in September. One sea trout was tagged in September. Estimated weights over this period ranged from 0.91 to 6.8kg (n=95). A total of 14 PIT tagged salmon passed through the PIT tag antennae at Blackcastle representing 6% of the total tagged.

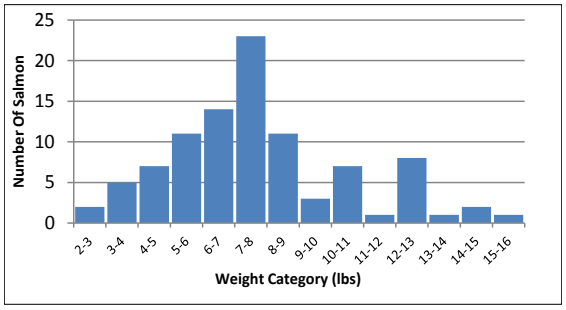
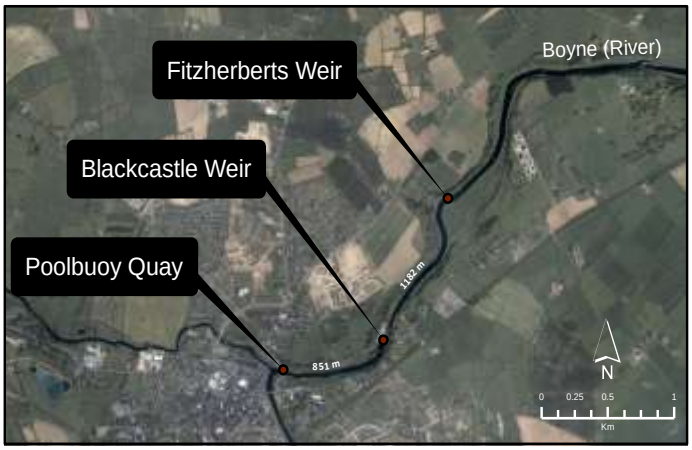


Figure 4.1. Length frequency Histogram of Salmon measured in 2012.

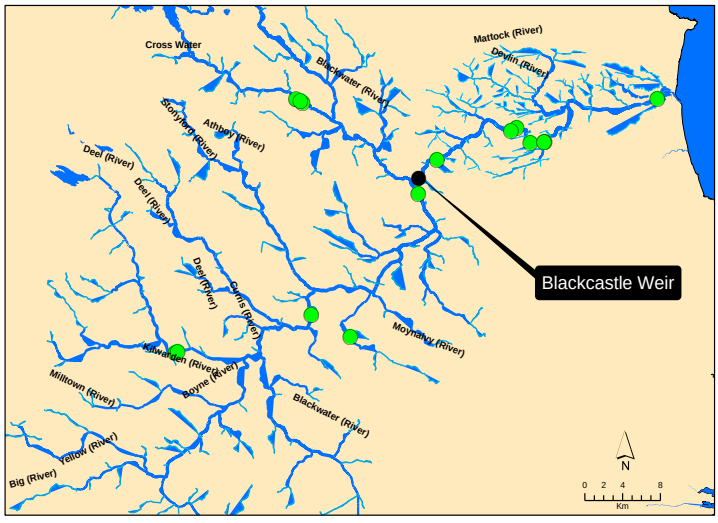
Radio tagging on the Boyne 2012

Three ATS radio receiver/dataloggers were installed at fixed locations along the Boyne in 2011. The locations, Fitzherberts weir, Blackcastle weir and Poolbuoy are close to Navan town, and were selected to quantify the escapement of salmon over the weir at Blackcastle. The receivers automatically detect radio tagged fish within their scanning range and store date and time of detection.



Map 4.4.1.1: Location of Radio receivers on the Boyne. Pit tag detectors are present at Blackcastle weir.

In 2012 a total of 25 salmon were radio tagged. Tagging was carried on various dates between 10th August and 5th September 2011 at the draft net sampling station. The fish ranged from 1.8-5.4kg (n=24).



Map 4.2: Locations of radio tagged salmon on 11/12/12, Fifteen fish were detected, 7 downstream and 8 upstream of Blackcastle.

Fifteen radio tagged salmon (60% of total tagged) were detected by their radio signal at Blackcastle weir up to the end of December 2012. On 11/12/12 an aerial survey, supported by the Air Corps, was carried out which identified the location of fifteen of the radio tagged salmon (map 2). , At this time 7 fish were located downstream of the Blackcastle weir; one of these fish had previously passed up through the weir. Four fish which had previously passed up through the Blackcastle weir were not detected by the aerial survey. Of the 25 salmon radio tagged 4 (16%) were

not picked up either during the aerial survey nor in at any of the static receiving stations. The fate of these fish is unknown, but it is possible that these fish left the system. The other 21 fish all remained in the system until at least 11/12/12.

Boyne Tagging – preliminary analysis

Preliminary radio tagging data show that only a proportion of salmon tagged in the estuary actually migrate to the counter at Blackcastle; during the four years studied this proportion has varied between 60% and 37% (average 46.6%). A proportion of the fish not passing the weir will spawn lower down in the system; also migration out the original tagging location/system is not uncommon as the fish may have been returning to another nearby system. Post-tagging behavioural change is also known to occur.

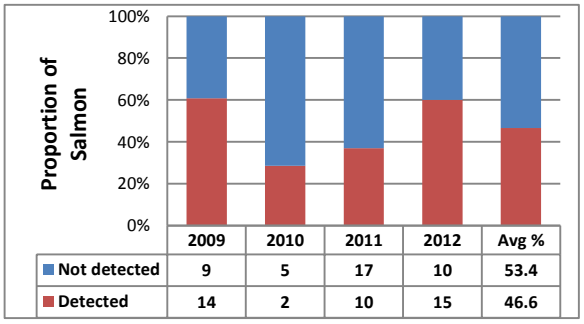


Figure 4.3: Numbers of Radio Tagged Salmon Detected/not detected at Blackcastle weir.

Preliminary counts have shown that between 5.3% and 1.5% (average 2.7%) of the fish pit tagged in the estuary have passed through the pit reader in channel 1 on the Blackcastle weir, and between 8.3% and 3% (average 5%) passed through channel two on the same weir since its' installation in 2011.

The actual proportions of fish ascending across different sections of the weir at any time will vary greatly dependant on factors such as water levels, partial blockages and closures etc. None of these variables are taken into consideration by this analysis. A detailed analysis of all of the PIT and radio tagging results from 2010 to 2012 is ongoing and the final results will be published, together with 2013 data, at a later date. These data will be used to investigate the actual individual channel count data at Blackcastle and ultimately provide a scientific basis to raise the overall count at Blackcastle.

5. Biological Assessment of Salmon Populations

Knowledge of salmon life history strategies is required to understand and model salmon populations in different systems. Biological data on salmon populations including sea age, run-timing, sex ratio and fecundity are necessary to understand population dynamics within a river. Changes to any of these inputs can influence the outcome of the production models used to predict the likely returns to a river and potential fishery performance. Life history traits such as smolt age, sea age, growth and frequency of spawning can be determined from scale readings. Combined with data on time of entry into the system, sex ratio and fecundity, which can be collected from any killed fish, the often complex make up of a population can be established and the models can be adjusted accordingly. For example, if the proportion of Multi-Sea-Winter (MSW) salmon entering a system is greater than previously known this would have the effect of reducing the CL as these fish are likely to have a higher female:male ratio and would transport a greater number of eggs into a catchment because of their greater size compared to grilse.

In order to enhance the quality of the existing models and to improve the quality of the scientific advice, particularly for rivers where the stock structure is complicated (e.g. river has significant spring salmon and a grilse component or other stock components) or has changed, it is important to obtain data on the stock. Run-timing of the different components may influence harvesting options. Figure 5.1 shows the proportions of fish of different lifestyles changing throughout the year. Sex ratio and fecundity may change in response to the composition of the total population. These data are required for the on-going scientific assessment of salmon fisheries in which IFI is intimately involved through the machinations of the Standing Scientific Committee.

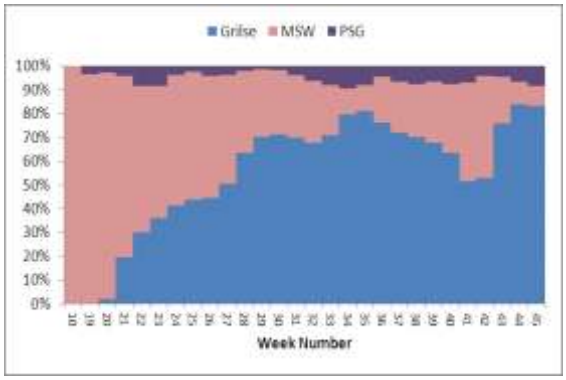


Figure 5.1: Occurrence of Salmon of each lifestyle type each week compiled from samples collected from Nore, Casltemaine, Suir, Ballinahinch, Blackwater, Sneem, Feale, Owenmore and Foyle, 2007 to 2012. (MSW=Multi-Sea Winter, PSG=Previously Spawned Grilse).

5.1. Salmon Life History.

Salmon scales were collected and analysed from the commercial snap net fishery on the Munster Blackwater in 2012. 134 Fish were sampled; all of these scales were examined. Nine scale samples were taken from fish from the Suir snap net fishery. Nine samples were also received from the Ballinahinch River, part of the Owenmore Catchment in Galway, from fish captured in 2011. These were also read. The proportions of the fish from each catchment occurring in each of the life history categories are shown below It can be seen that there was considerable variations in the life history profiles between the fisheries (Table 5.2), the percentage of grilse in each river varies from 74% in the Suir to 85% in Ballinahinch, previously spawned grilse are rare in all catchments; it should be noted that further sampling throughout the whole duration of the salmon run would be needed to fully explore sea age variations of stocks. Age profiles at length in figure 5.4 indicate that most fish below 630mm are Grilse where as those larger than that are more likely to be multi-sea winter salmon (MSW) or previously spawned grilse (PSG). The length of Grilse was lower than that of PSG and MSW in all cases (Table 5.3).

	Read Scales								
	Grilse	MSW	PSG	Unknown	Total	Unread	Grilse	MSW	PSG
Ballinahinch	**46**	**7**	**1**		**54**		**85%**	**13%**	**2%**
2007	11	1			12		92%	8%	
2008	16	2			18		89%	11%	
2009	12	2			14		86%	14%	
2010	1				1		100%		
2011	6	2	1		9		67%	22%	11%
Blackwater (Munster)	**113**	**72**	**5**	**12**	**202**		**59%**	**38%**	**3%**
2011	40	22	2	4	68		63%	34%	3%
2012	73	50	3	8	134		58%	40%	2%
Suir	**56**	**57**	**6**	**24**	**143**	**358**	**47%**	**48%**	**5%**
2010	5	1		2	8	2	83%	17%	
2011	46	53	6	21	126	356	44%	50%	6%
2012	5	3		1	9		63%	38%	
Total	**215**	**136**	**12**	**36**	**399**	**358**	**59%**	**37%**	**3%**

Table 5.1. Numbers of Salmon of different life histories obtained by scale reading from three fisheries. Also shown are the percentages of fish occurring in each life history category.

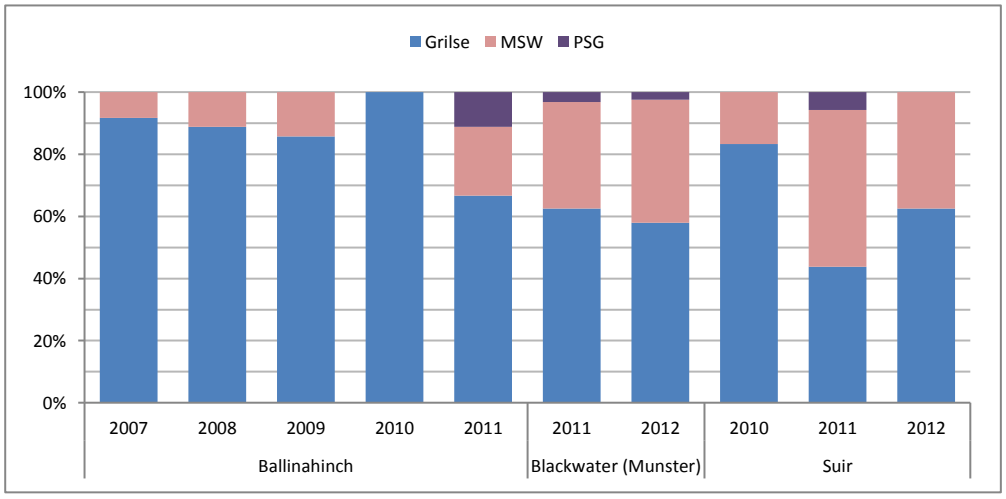
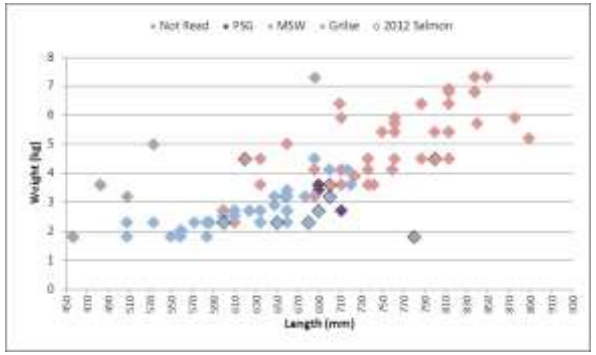
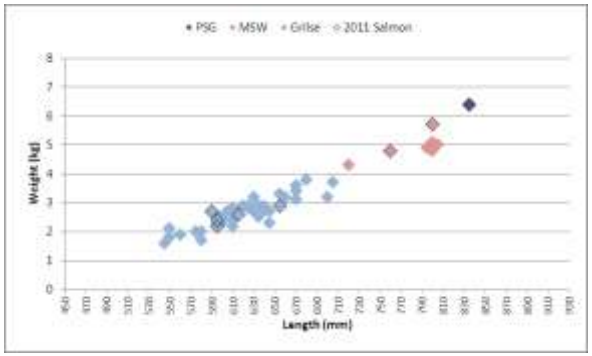


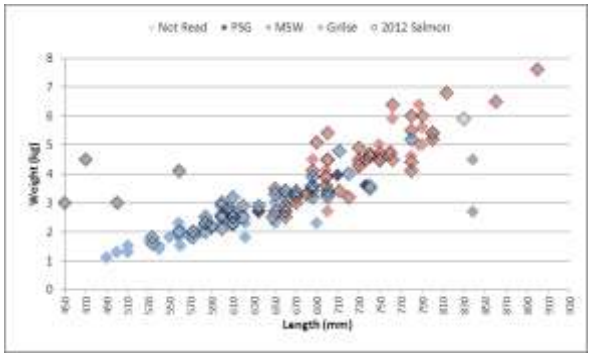
Figure 5.2: Percentage of Grilse, Multi-Sea Winter (MSW) and Previously Spawned Grilse (PSG) occurring in samples read each year.



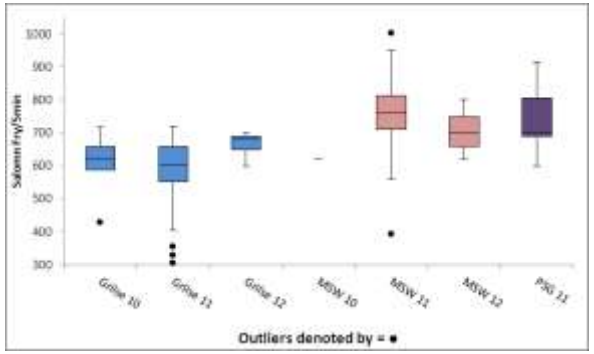
Suir; Length/Weight (All Years)



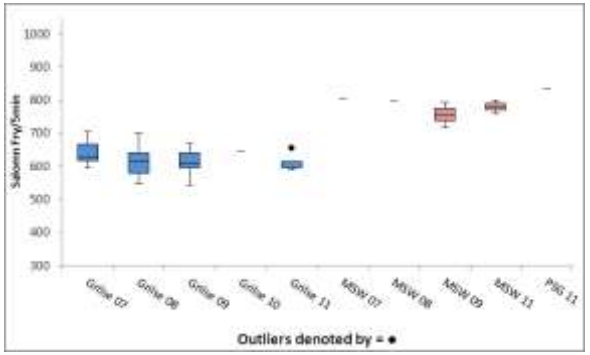
Ballinahinch; Length/Weight (All Years)



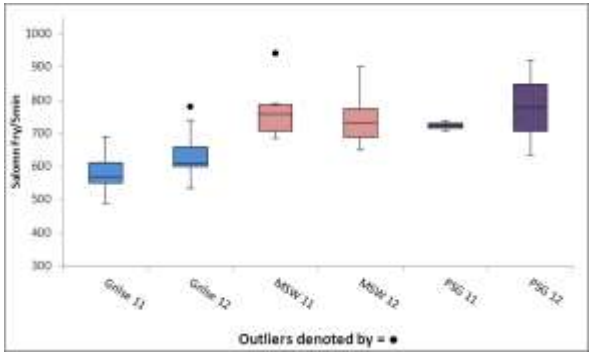
Munster Blackwater; Length/Weight (All Years)



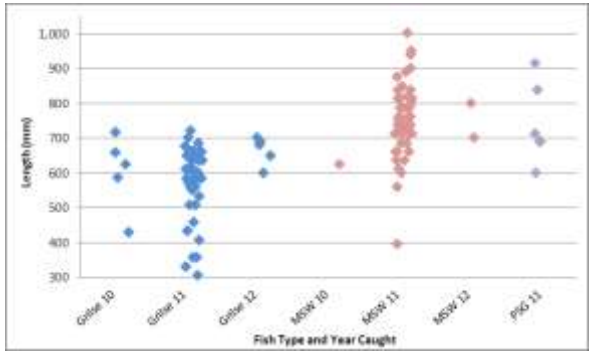
Suir; Boxplot of salmon lengths. (All Years)



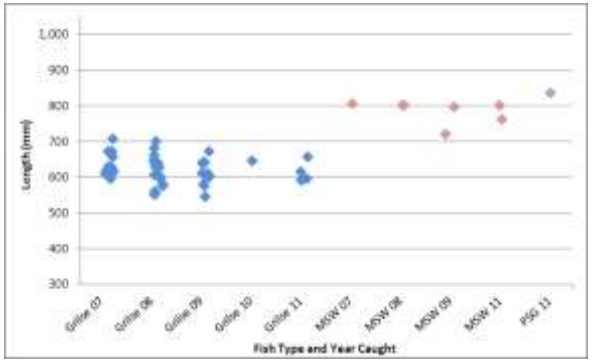
Ballinahinch; Boxplot of salmon lengths. (All Years)



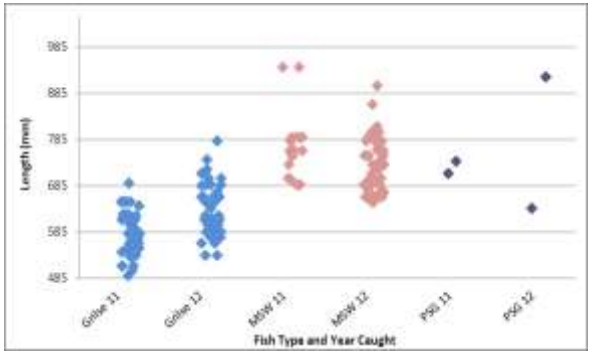
Munster Blackwater; Boxplot of salmon lengths. (All Years)



Suir; Scatterplot of salmon lengths. (All Years)

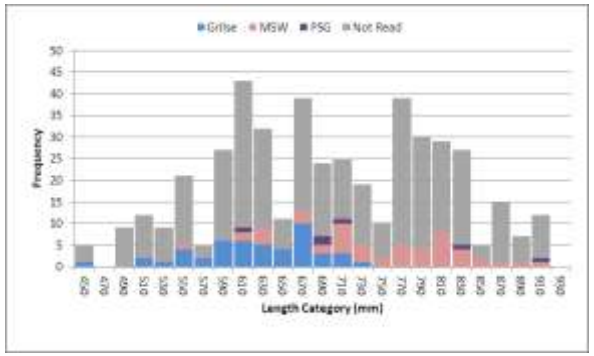


Suir; Scatterplot of salmon lengths. (All Years)

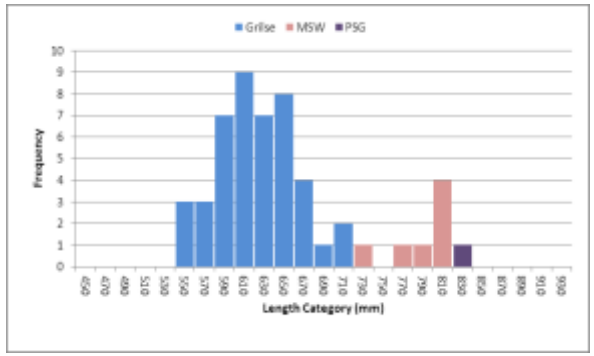


Suir; Scatterplot of salmon lengths. (All Years)

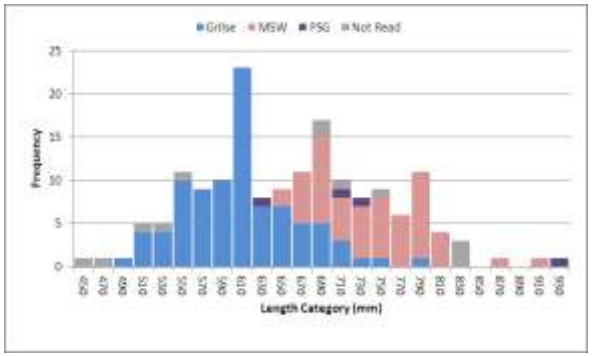
Figure 5.3: Descriptive figures for three catchments from which scales read in 2012 were sourced. The length/weight charts show all fish sampled to date, the samples that were read this year are highlighted; The length profile charts show all fish read to date; The Boxplots and Scatter diagrams show lengths each year of individual fish of each type: Grilse, MSW (Multi-Sea winter fish) and PSG (Previously Spawned Grilse) .



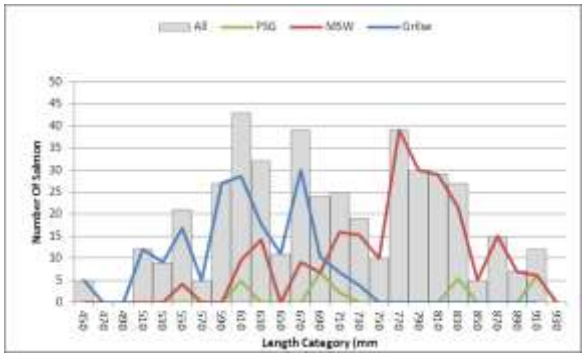
Suir; Length Frequency (all Years).



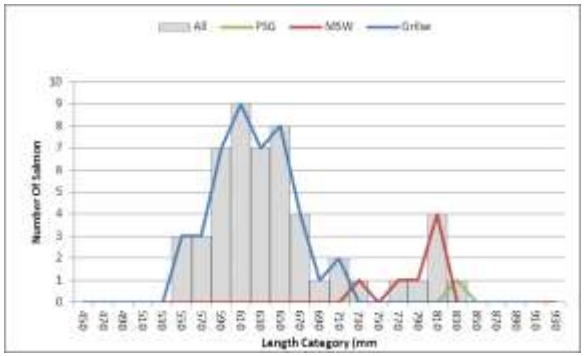
Ballinahinch; Length Frequency (all Years).



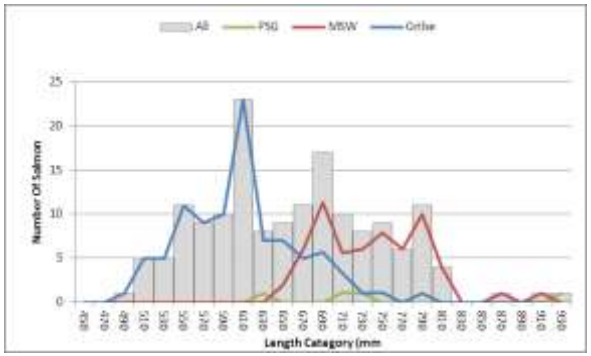
Munster Blackwater; Length Frequency (all Years).



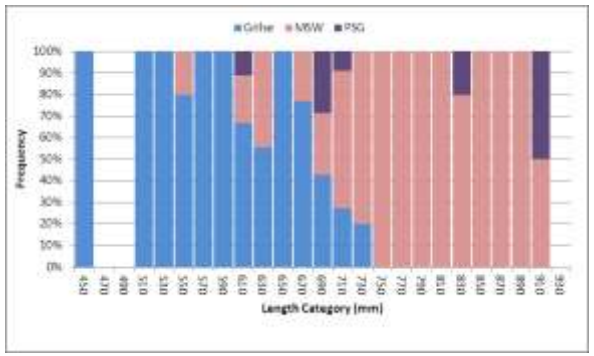
Suir; Frequency andexpected age profile (all Years).



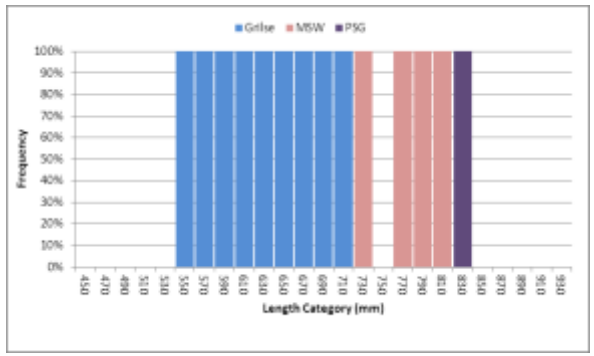
Ballinahinch; Length Frequency andexpected age profile (all Years).



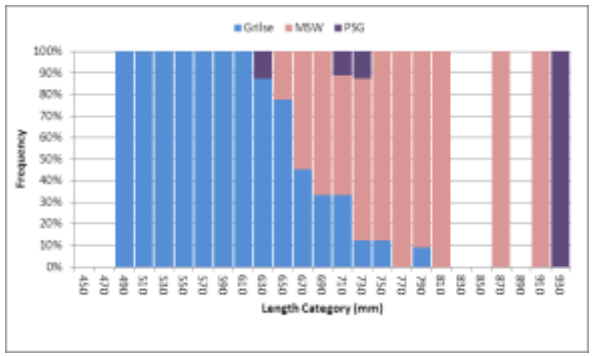
Munster Blackwater; Frequency andexpected age profile (all Years).



Suir; Representation of lifestyles in length classes (all Years).



Ballinahinch; Representation of lifestyles in length classes (all Years).



Munster Blackwater; Representation of lifestyles in length classes (all Years)

Figure 5.4: Descriptive figures for three catchments from which scales read in 2012 were sourced. The length/weight charts show all fish sampled to date, the samples that were read this year are highlighted; The length profile charts show all fish read to date; The Scatter diagrams show lengths each year of individual fish of each type: Grilse, MSW (Multi-Sea winter fish) and PSG (Previously Spawned Grilse) .

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