Report on a Salmon Survey in the Waterford Estuary in 2010

June 2011

Iascach Intíre Éireann
Inland Fisheries Ireland

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1. INTRODUCTION

Salmon Stock Status of Rivers in the Waterford Estuary

In recent years, the percentage of the conservation limit achieved by rivers in the Waterford district has varied, table 1.1 The river Barrow (including the Pollmounty river) has remained consistently below CL while the Nore has exceeded CL in the last two years. The Suir (including the Clodiagh, Lingaun and Waterford Blackwater rivers) has increased the proportion of CL being met annually since 2007.

	2010	2009	2008	2007
	%	%	%	%
Barrow	39	40	42	27
Nore	119	104	81	84
Suir	96	85	79	74

Table 1.1. Percentage of CL achieved by river, 2007-2010

For the 2010 season, the Barrow remained closed to salmon exploitation, the Suir was open for catch and release angling and the Nore had a surplus of 2,277 salmon.

Catchment wide electro-fishing has been used as a stock assessment tool in recent years to provide information on rivers where no other stock assessment method (counter, rod angling, redd count) is available. Catchment wide electro-fishing on the Barrow in 2007, 2009 and 2010 has provided a catchment average over three years combined of 11.7 salmon fry, which is below the threshold of an average of 17 salmon fry advised by the SSC to allow another index of salmon stock abundance to take place, i.e. catch and release angling.

2. Proposal for a Survey in Waterford Estuary in 2010

The Standing Scientific Committee has provided advice on the rivers entering Waterford estuary for 2010 (SSC Report 2010) which is based on the best information then available. In the context of the Rivers in Waterford estuary, The Standing Scientific Committee advises that:

- Harvest of salmon should only be allowed on stocks from rivers where there is a surplus above the Conservation Limit identified and that no more than this surplus should be harvested.
- Harvest fisheries should not take place on stocks from rivers without an identifiable surplus above the Conservation Limit.

- No harvest fisheries should take place in those rivers where the average rod catch has been less than 10 salmon annually and which are not meeting Conservation Limits, until such time as additional information becomes available to assess the status of these stocks relative to their Conservation Limits.

Due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status (ICES 2010). The objective of the catch advice from the SSC is to ensure that harvest fisheries only take place on river stocks meeting and exceeding Conservation Limits. The Conservation Limit for Atlantic salmon is defined by NASCO as the spawning stock level that produces long term average maximum sustainable yield. The means to achieve this objective is to only allow harvest fisheries which can specifically target single stocks which are meeting their Conservation Limits. The SSC strongly advise that all fisheries should operate only on the target stock as close to the river mouth or within the river to achieve this.

While the advice from the Standing Scientific Committee remains unchanged in this regard, there was a management proposal to conduct a survey which had the potential to lead to salmon mortality from stocks which are not meeting Conservation Limits. In this context the following proposal to minimize the risks to stock sustainability from the operation of such a survey was developed.

A proposal was made by the Waterford Estuary Fisherman's Association to the Minister of State at the Department of Communications, Energy & Natural Resources to conduct a survey fishery in Waterford estuary in 2010. The Minister gave approval for the proposal which had two primary objectives;

1. To determine genetically the current extent of Irish river of origin salmon captured in Waterford estuary and to also determine the presence, if any, of salmon from other countries in the estuary.

2. To capture salmon over an extended period in summer and autumn to determine river of origin by genetic analysis within the Barrow / Nore / Suir river complex to provide a qualitative assessment of salmon stock abundance on the river Barrow where no stock estimate is currently available. A stock quantitative abundance estimate is available for the Nore and Suir rivers based on rod catch.

Inland Fisheries Ireland authorized a survey of salmon stocks in the Waterford estuary under a section 18 Authorisation.

3. Survey Method

There was a priority to have as low a mortality of salmon as possible during the survey as both the Suir and Barrow rivers were below CL for 2010. The objective was to catch salmon, take a genetic and scale sample and release fish unharmed. A multi-mesh survey net, with seven mesh sizes ranging for 2-5inch randomly placed in the chain was the fish capture method chosen.

3.1. Location & Timing of Sampling

One of the objectives of the survey is to determine the proportion of the salmon run temporarily and spatially destined for the Barrow, Nore and Suir over the main period of the salmon run. Recent genetic analysis of salmon from the Waterford estuary indicates that it may be possible to distinguish genetically, salmon from each river with a high degree of certainty.

Five sampling locations were selected in the Waterford estuary to determine the mixed stock nature of the salmon run at varying distances along the estuary, fig 3.1. Sampling over discrete periods from June to early October period would allow the proportions of salmon from each river to be determined on a seasonal basis. Fishing was conducted during day light hours for health and safety reasons.

3.2. Sampling Methods

When salmon were encountered in the survey net, they were taken out immediately and transferred to a large tank of water in the sampling boat. Fish were then measured and a genetic sample (tail punch) taken and stored in alcohol. Data was recorded on a scale envelope and a data record sheet. A scale sample will also be taken for age analysis. All alcohol vials were individually numbered and cross referenced with the scale envelope. Genetic samples were delivered to UCC for analysis.

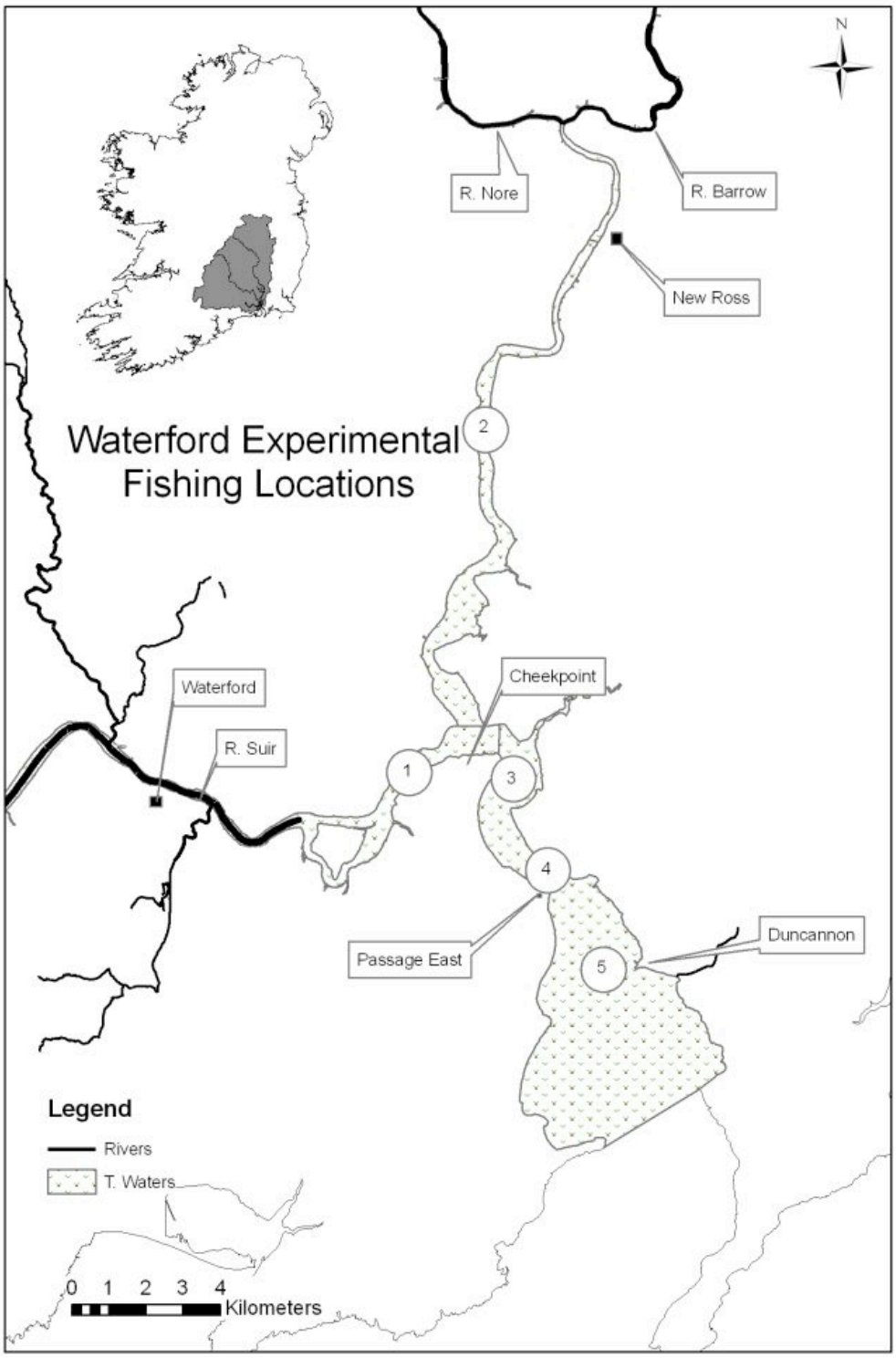

Figure 3.1: Locations for genetic sampling of salmon in the Waterford estuary

4. Survey Results

4.1 Number of Salmon Captured

IFI staff accompanied Waterford estuary fishermen on sixteen occasions over the period mid-July to late October to sample salmon for genetic analysis in the Waterford estuary, table 4.1.1. A total of 461 salmon were captured in five sampling locations. A by-catch of 15 sea trout, 5 shad, 12 bass and 13 mullet were also captured, table 4.1.2. In all 170 fishing hours were fished over the period, fig 4.1.3.

	Week	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
		14/07/2010	21/07/2010	28/07/2010	04/08/2010	11/08/2010	18/08/2010	25/08/2010	01/09/2010	08/09/2010	15/09/2010	22/09/2010	29/09/2010	06/10/2010	13/10/2010	20/10/2010	27/10/2010	
Location	1				18						38						9	65
	2		11				29					23				2		65
	3	4	3				5		51	3				56		2		124
	4	8		14		20		53	2	31			34		2	11		175
	5			9		15								1	6			31
		12	**14**	**23**	**18**	**35**	**34**	**53**	**53**	**34**	**38**	**23**	**34**	**57**	**8**	**15**	**9**	**460**

Table 4.1.1 Number of salmon captured over 16 sampling periods.

	By-Catch of other Fish Species							
Period	**Sea trout**	**Shad**	**Sea Bass**	**Mullet**	**Herring**	**Mackerel**	**Flounder**	**Dog fish**
1	6		1	2				
2	3	1		1				
3	1	1						
4				3				
5	2		3		1	2		
6		1	2					
7	1						3	
8						2		
9	1		1	2				
10							1	
11	1	1	4					
12						1		
13				5				
14		1						
15			1					
16								2
Total	15	5	12	13	1	5	4	2

Table4.1.2. By-Catch of fish species captured during the Waterford estuary survey.

Waterford Estuary Salmon Survey 2010				
Location	Date	Hours Fished	Salmon Caught	Mortalities
Period 1				
3	7/14/2010	4	4	
4	7/14/2010	4	8	1
Period 2				
2	23/0710	7.5	11	1
3	23/0710	2	3	
Period 3				
4	7/28/2010	6	14	2
5	7/28/2010	2.5	8	
Period 4				
1	8/6/2010	11	18	
Period 5				
4	8/11/2010	7	15	
5	8/11/2010	4	20	1
Period 6				
2	8/19/2010	2	29	
3	8/19/2010	9	5	5
Period 7				
4	8/24/2010	12	54	4
Period 8				
3	9/3/2010	12.5	51	1
4	9/3/2010	1.5	2	
Period 9				
3	9/10/2010	2.5	3	1
4	9/10/2010	5	21	3
5	9/10/2010	4	11	
Period 10				
1	9/17/2010	11.3	38	1
Period 11				
2	9/22/2010	10	23	0
Period 12				
4	9/29/2010	10.25	34	1
Period 13				
3	10/6/2010	12	57	2
Period 14				
4	10/13/2010	2	2	
5	10/13/2010	6	6	
Period 15				
3	10/22/2010	3	3	
4	10/22/2010	8.5	12	1
Period 16				
1	10/27/2010	10.5	9	
Total		170.05	461	24

Table 4.1.3. Hours fished, total salmon catch and number of mortalities

4.2. Salmon Catch by Location

Site 4 recorded the largest catch over the survey period with the lowest catch being recorded at site 5, (table 4.2.1, fig 4.2.1). Site 5 was the site located furthest down the estuary. The catch of salmon generally increased from week 29 to week 36 and decreased after week 41, fig 4.2.2.

Locatio	1	2	3	4	5	Al
Number of	6	6	12	17	2	45
Salmon	5	5	5	5	9	9

Table 4.2.1. Number of salmon captured by location, Waterford estuary.

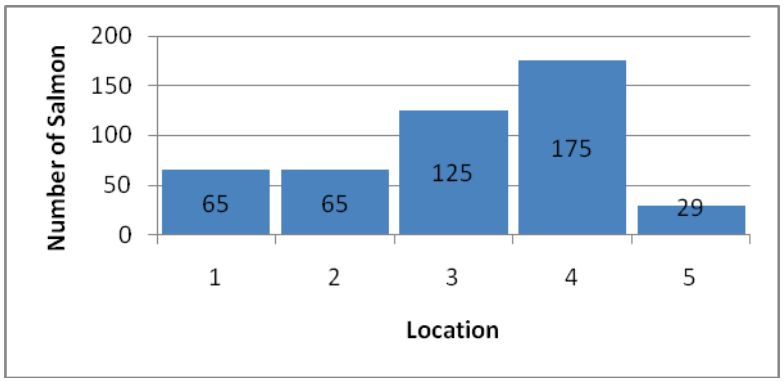

Figure 4.2.1. Number of salmon captured by location, Waterford Estuary.

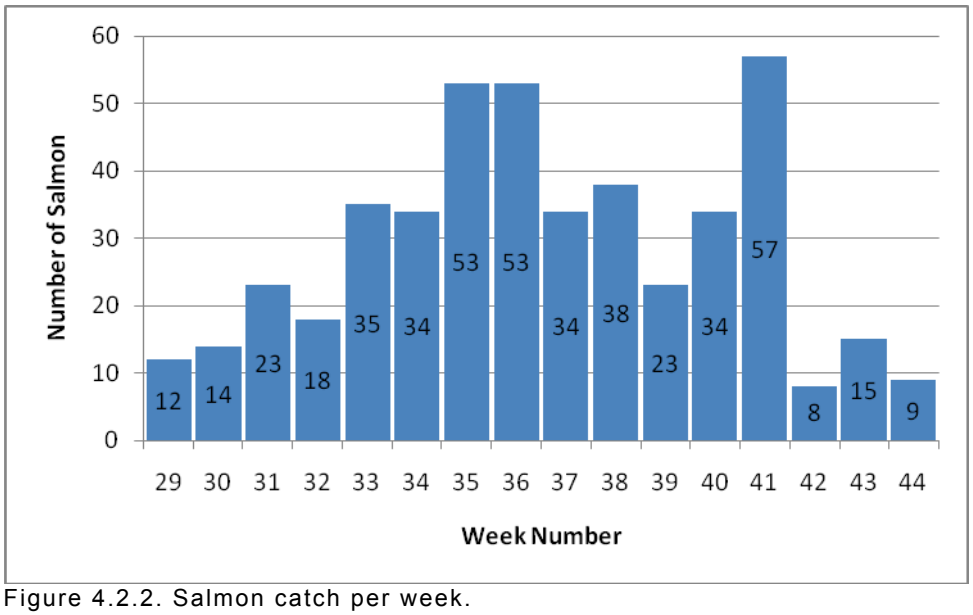

Figure 4.2.2. Salmon catch per week.

4.3 Catch Per Unit Effort

Catch per unit effort was generally at or above two fish per hour and highest during week 34. fig 4.3.1. The number of hours fished was constant over the time period and above eight hours on each occasion, fig 4.3.2. The average number of salmon caught per hour was highest at Site 2 and lowest at Site 1 &3, table 4.3.1, fig 4.3.3.

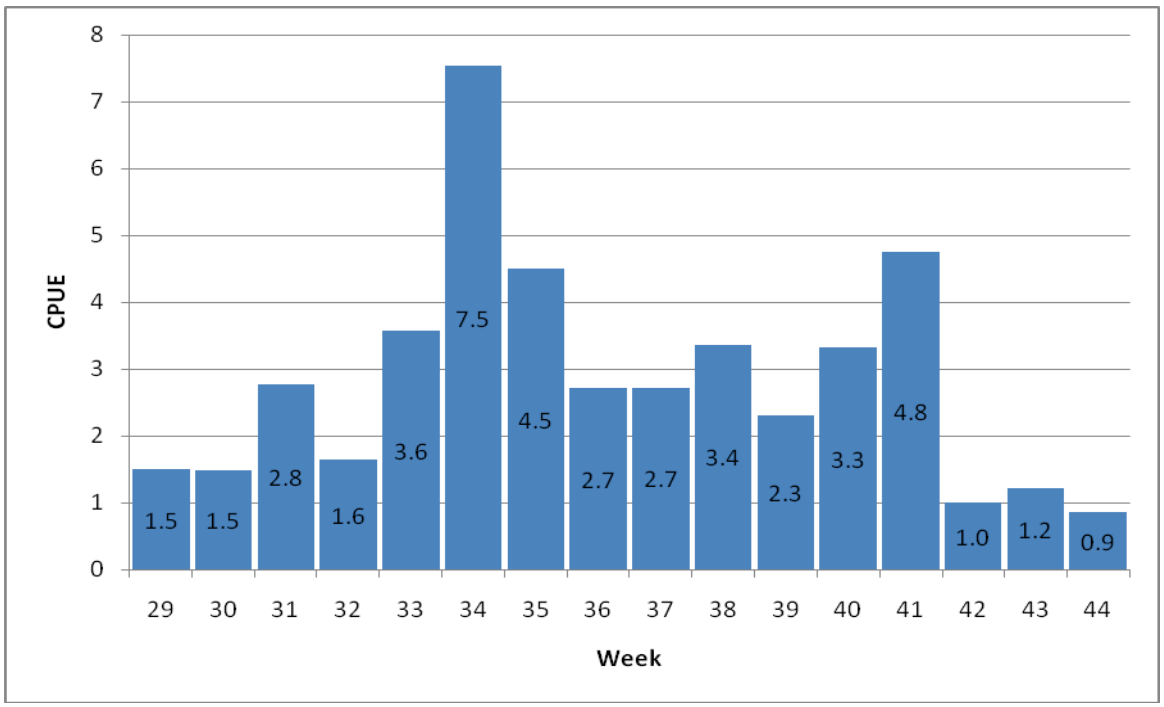

Figure 4.3.1: Cpue by week.

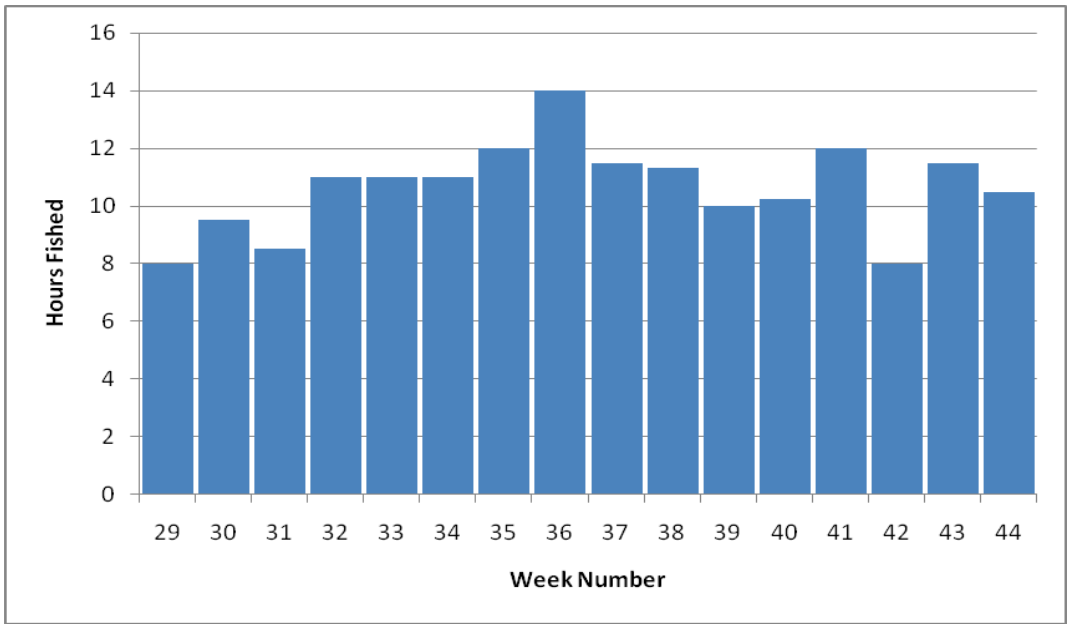

Figure 4.3.2: Fishing effort by week

Location	Period	Date	Week	Hours Fished	Salmon Caught	Sal/Hr
1	4	06/08/10	32	11.0	18	1.6
1	10	17/09/10	38	11.3	38	3.4
1	16	27/10/10	44	10.5	9	0.9
2	2	23/07/10	30	7.5	11	1.5
2	5	19/08/10	34	2.0	29	14.5
2	11	22/09/10	39	10.0	23	2.3
3	1	14/07/10	29	4.0	4	1.0
3	2	23/07/10	30	2.0	3	1.5
3	6	19/08/10	34	9.0	5	0.6
3	8	03/09/10	36	12.5	51	4.1
3	9	10/09/10	37	2.5	3	1.2
3	13	06/10/10	41	12.0	57	4.8
3	15	22/10/10	43	3.0	3	1.0
4	1	14/07/10	29	4.0	8	2.0
4	3	28/07/10	31	6.0	14	2.3
4	5	11/08/10	33	7.0	15	2.1
4	7	24/08/10	35	12.0	54	4.5
4	8	03/09/10	36	1.5	2	1.3
4	9	10/09/10	37	5.0	21	4.2
4	12	29/09/10	40	10.3	34	3.3
4	14	13/10/10	42	2.0	2	1.0
4	15	22/10/10	43	8.5	12	1.4
5	3	28/07/10	31	2.5	8	3.2
5	5	11/08/10	33	4.0	20	5.0
5	9	10/09/10	37	4.0	11	2.8
5	14	13/10/10	42	6.0	6	1.0

Table 4.3.1 Number of hours fished and catch of salmon at each location

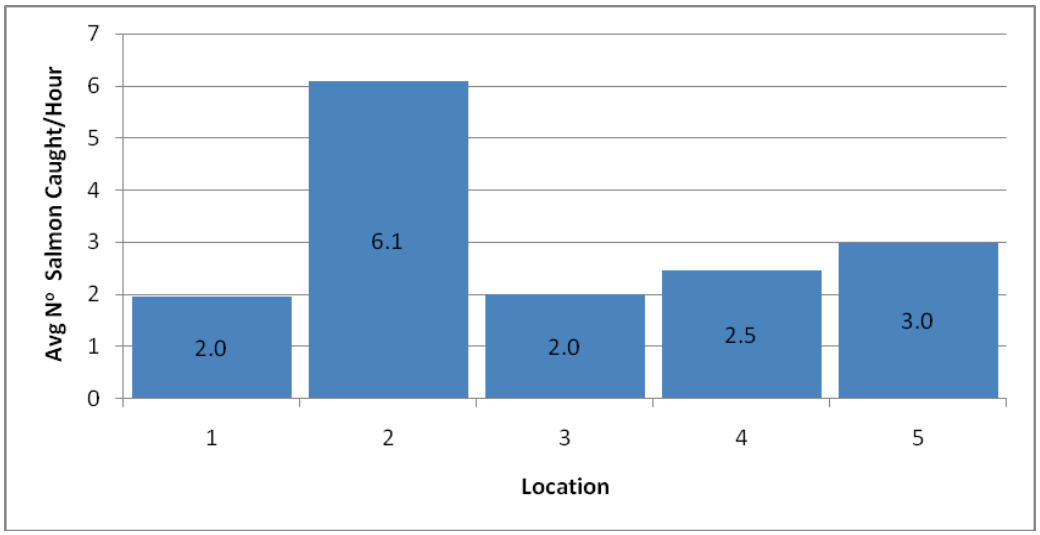

Figure 4.3.3. Average number of salmon caught per hour by location

4.4. Salmon Length Frequency

The length frequency of salmon captured is shown, fig 4.4.1. The majority of salmon ranged in length from 60 – 68cm with low numbers recorded above 70cm. The largest salmon captured was 97cm. The length of salmon captured by week is shown, fig 4.4.2. There was a general trend towards an increase in length from week 31 to week 38 after which length declined.

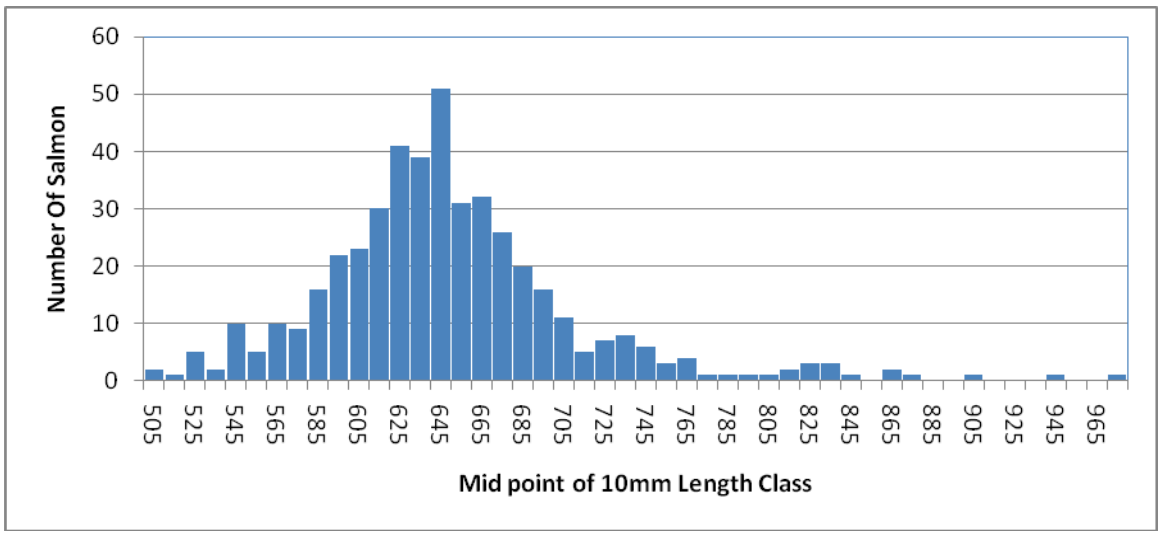

Figure 4.4.1. Length frequency of salmon captured.

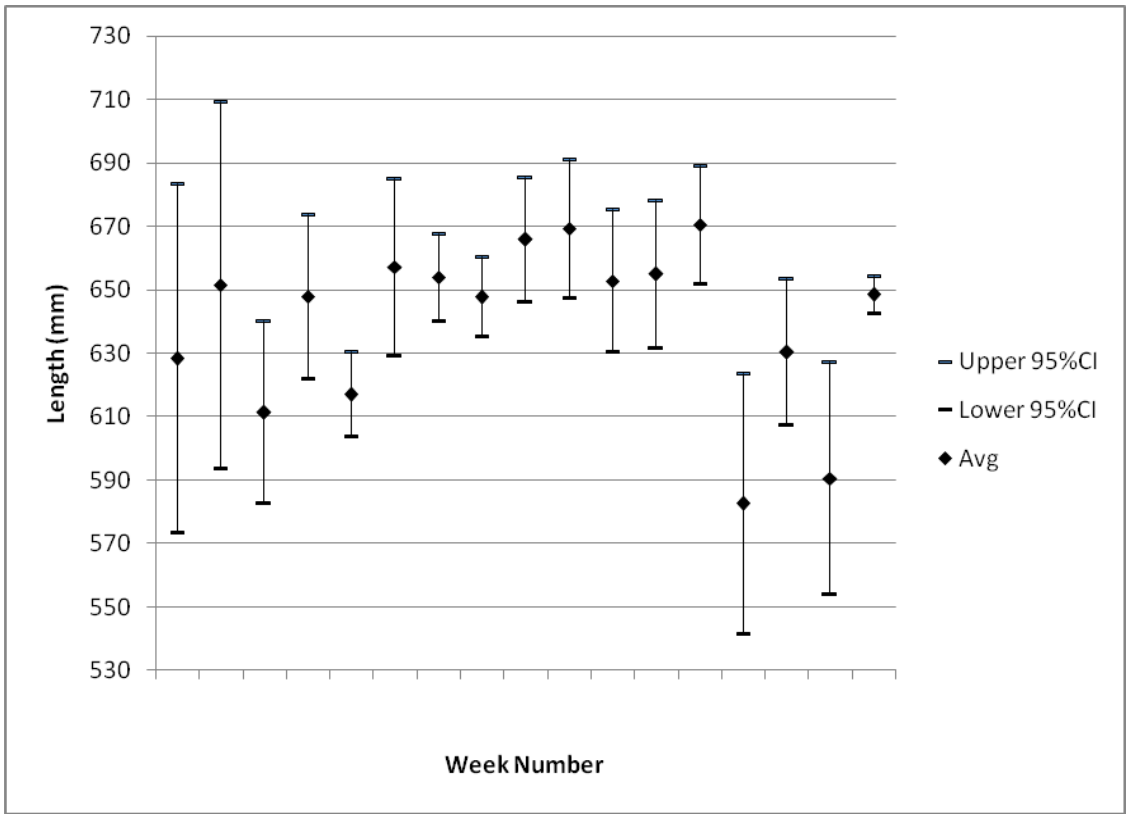

Figure 4.4.2. Length of salmon by week captured.

4.5. Age Determination

Of the 458 salmon scales sampled, 292 (63%) were analysed for age determination. 79% were one sea winter fish, 18% two sea winter fish and 2% were three sea winter salmon, table 4.5.1. A further 1% were unreadable scales. Of the scales read, 3.7% were previous spawners and one fish had spawned for a second time, table 4.5.2. This proportion of salmon in sea age categories may not reflect the overall salmon run to the Barrow, Nore and Suir rivers as it reflects only a sizable catch taken over the period early August to early October. Scale reading of salmon captured in draft nets on the Nore and Suir in June and July would have a much higher proportion of multi sea winter fish (summer salmon). Analysis of scales over the full duration of the salmon run would be required to accurately reflect the sea age composition of stocks.

Sea age is shown by salmon length, table 4.5.3 and fig 4.5.1, 4.5.2. With the exception of one 82cm grilse, fish greater than 78 cm were multi sea winter fish. The mean length of salmon in each sea age class was 64mm for 1SW, 72mm for 2SW and 87mm for 3Sw, (fig 5.4.3, and table 4.5.4).

		1	2	3	a	Total
Smolt Age	1	13	3			16
	2	195	40	5		240
	3	5	4			9
	A	17	6		4	27
	Total	**230**	**53**	**5**	**4**	**292**
		79%	18%	2%	1%	

Table 4.5.1: Proportion of salmon catch in sea age and smolt age categories. (Sub sample of 293 salmon)

		# Salmon	%
Spawning Marks	0	442	96.3%
	1	16	3.5%
	2	1	0.2%
	Total	**459**	**100.0%**

Table 4.5.2: Previous spawners.

10 mm Length Class	Aged Salmon				
		1	2	3	Total
	505	2			2
	515	1			1
	525	3			3
	535	1			1
	545	5			5
	555	5			5
	565	6			6
	575	7			7
	585	11			11
	595	11	3		14
	605	10	2		12
	615	14	2		16
	625	15	4		19
	635	9	1		10
	645	21	2		23
	655	12	1		13
	665	15			15
	675	25	1		26
	685	15	6		21
	695	12	3		15
	705	9	2		11
	715	4	1		5
	725	5	2		7
	735	4	4		8
	745	5	1		6
	755	1	2		3
	765	1	3		4
	775		1		1
	785		1		1
	795			1	1
	805		1		1
	815		2		2
	825	1	1	1	3
	835		3		3
	845		1		1
	855				
	865		2		2
	875			1	1
	885				
	895				
	905			1	1
	915				
	925				
	935				
	945		1		1
	955				
	965				
	975			1	1
	985				
	995				
	1005				
	Total	230	53	5	288
	Average (mm)	643	719	875	
	S.D (mm)	55	84	70	

10 mm Length Class	All Salmon				
		Sea Winters			
		1	2	3	Total
	505	2			2
	515	1			1
	525	5			5
	535	2			2
	545	10			10
	555	5			5
	565	10			10
	575	9			9
	585	16			16
	595	19	5		24
	605	20	4		24
	615	25	4		29
	625	32	9		41
	635	35	4		39
	645	47	4		51
	655	29	2		31
	665	32			32
	675	25	1		26
	685	15	6		21
	695	13	3		16
	705	10	2		12
	715	4	1		5
	725	5	2		7
	735	4	4		8
	745	5	1		6
	755	1	2		3
	765	1	3		4
	775		1		1
	785		1		1
	795			1	1
	805		1		1
	815		2		2
	825	1	1	1	3
	835		3		3
	845		1		1
	855				
	865		2		2
	875			1	1
	885				
	895				
	905			1	1
	915				
	925				
	935				
	945		1		1
	955				
	965				
	975			1	1
	985				
	995				
	1005				
	Total	382	71	5	458
	%	84%	15%	1%	100%

Table 4.5.3: Sub sample of scales for which age was determined on left, those proportions applied to whole sample on right.

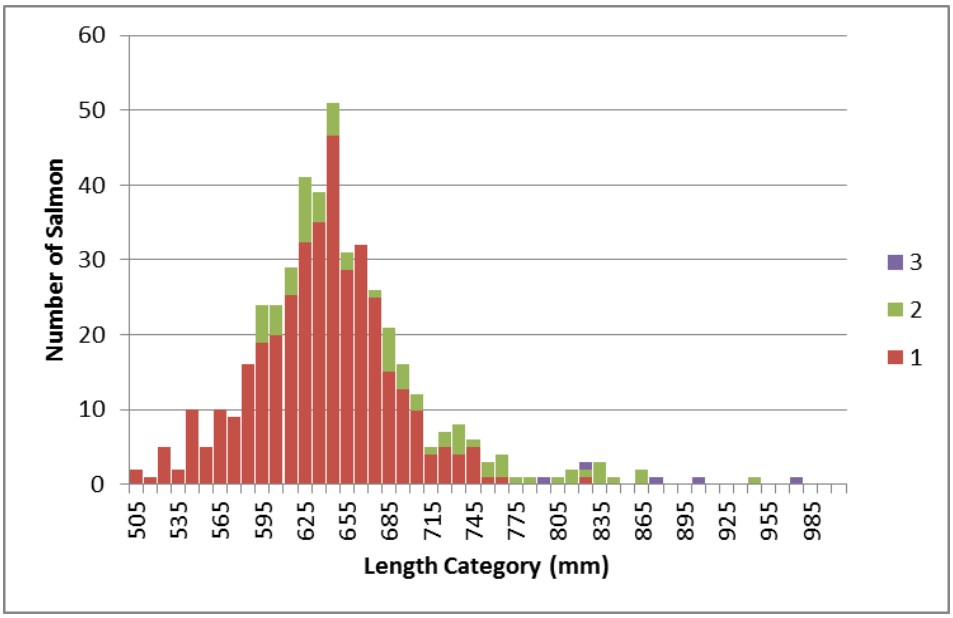

Figure 4.5.1: Sea age by salmon length.

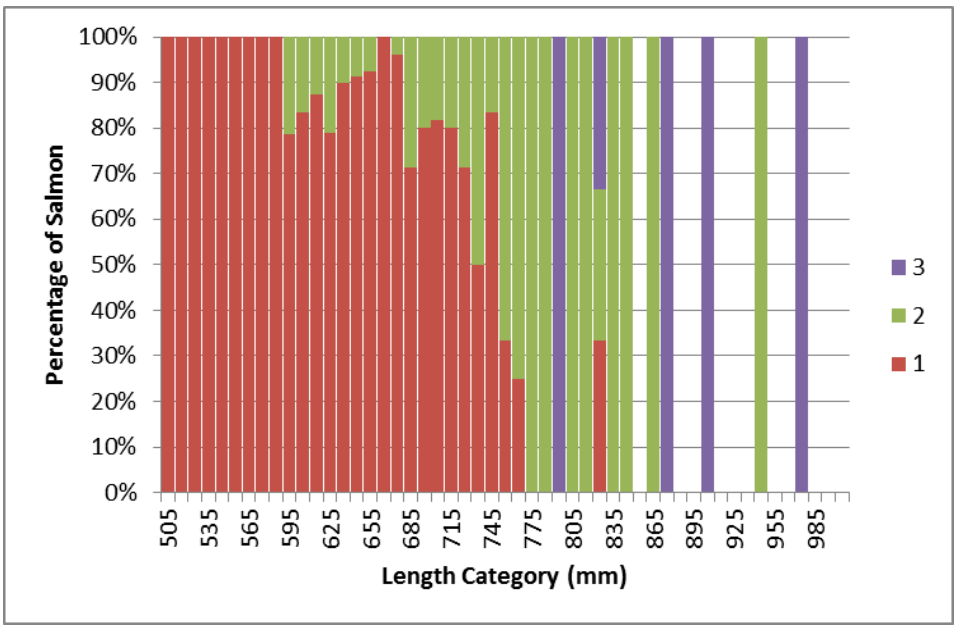

Figure 4.5.2: Sea age shown as a percentage in 10mm length classes.

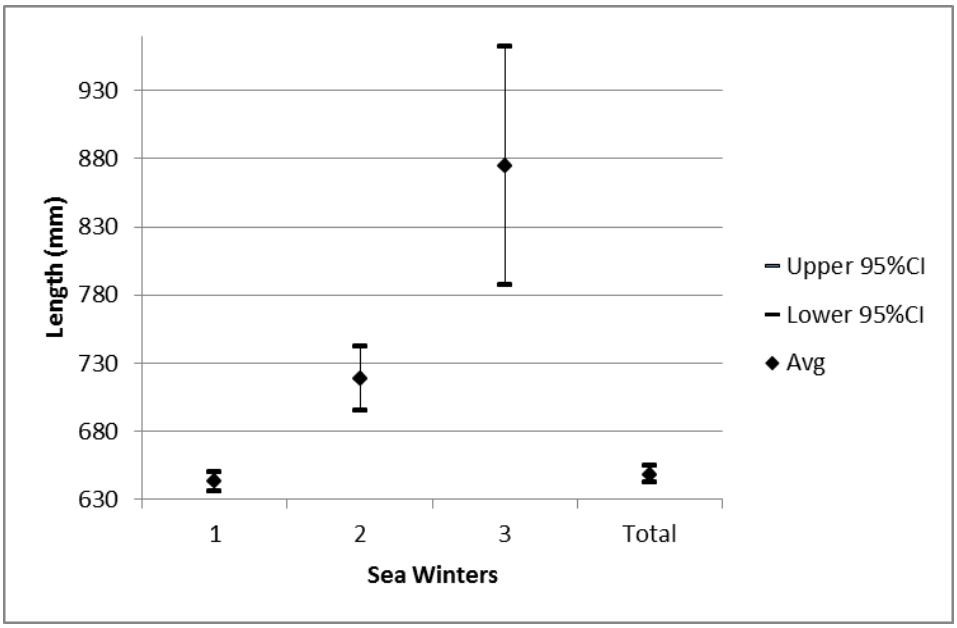

Figure 4.5.3: Mean Length (mm)and 95% confidence interval of fish in each age class.

	1	2	3	Total
No. Salmon	230	53	5	458
Average (mm)	643	719	875	649
StdDev	55	84	70	64

Table 4.5.4: Length by Sea Age

4.6 Net Capture and Mesh Size

Details were recorded of how a proportion of the salmon were captured in the survey net over the survey period. The majority of salmon were meshed or rolled in the survey net, table 4.6.1. The length of salmon by net capture revealed that the largest fish were caught by the snout or teeth, fig 4.6.1.

		How Caught								
		Bagged	Gilled	Head	Meshed	Rolled	Snout	Teeth	Unknown	Total
10mm Length Class	505		2							2
	515								1	1
	525	1				1			3	5
	535					1			1	2
	545		2		1	2			5	10
	555				4	1				5
	565				2	3			5	10
	575		2		4				3	9
	585	1			6	4	1		4	16
	595		1		7	6	2		8	24
	605		3		11				10	24
	615				5	7	1		16	29
	625	2	2		9	10	2		16	41
	635		1		11	5	3	1	18	39
	645		2		8	11	4		26	51
	655			1	13	3		1	13	31
	665		1	1	8	6	2		14	32
	675		1		5	4	1		15	26
	685		1		3	5	1		11	21
	695		2		3	2	3		6	16
	705				2	1	1		8	12
	715		1				1		3	5
	725					1	1	1	4	7
	735				2	2	1		3	8
	745				1	1			4	6
	755				2				1	3
	765						1		3	4
	775						1			1
	785					1				1
	795								1	1
	805								1	1
	815					1			1	2
	825				1	1			1	3
	835								3	3
	845								1	1
	865								2	2
	875								1	1
	905								1	1
	945					1				1
	975				1					1
	Total	**4**	**21**	**2**	**109**	**80**	**26**	**3**	**213**	**458**
	Avg	**590**	**617**	**660**	**639**	**645**	**666**	**672**	**656**	**649**
	StdDev	**47**	**61**	**7**	**57**	**66**	**51**	**47**	**66**	**64**

Table 4.6.1. Method of Net Capture

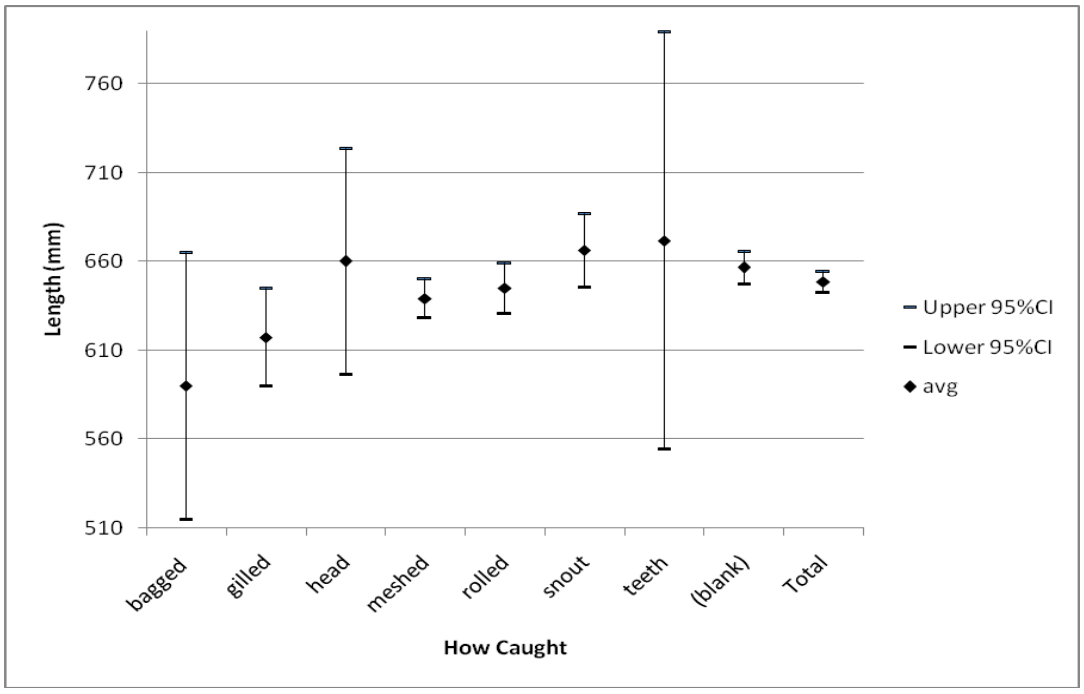

Figure 4.6.1. Method of net capture by fish length.

A proportion of the catch (25%) were examined for capture by mesh size, fig 4.6.2. While no clear differences were apparent, there was a trend of increasing mesh size from 3.5 to 4 7/8 capturing increasingly larger salmon.

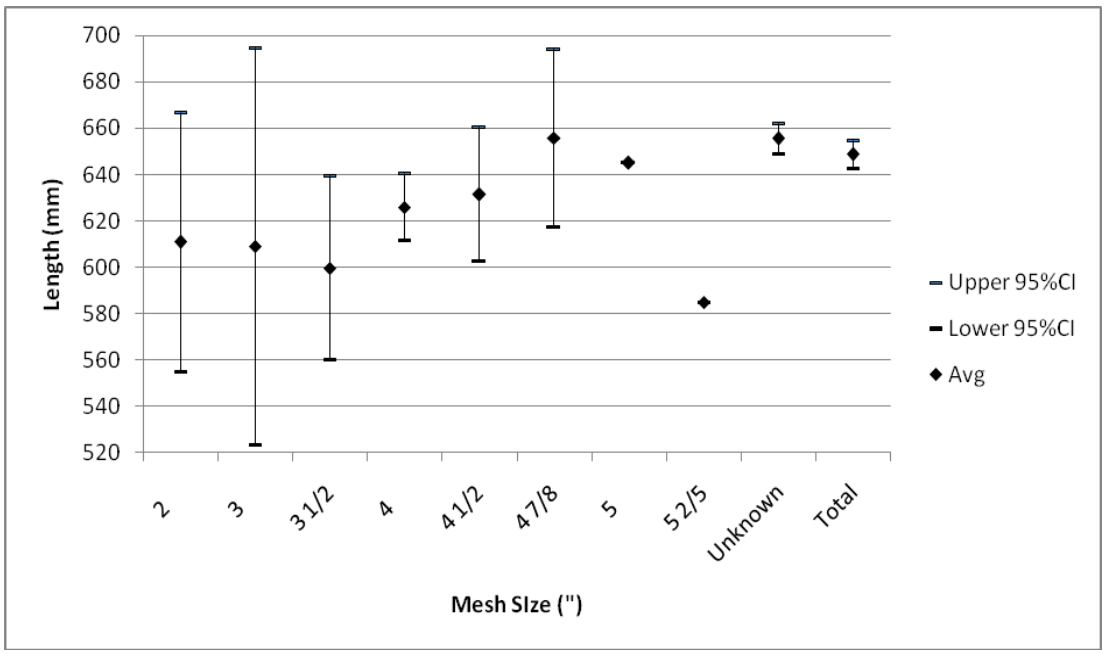

Figure 4.6.2 Length of salmon by mesh size.

5. Discussion

The purpose of the survey of salmon stocks in the Waterford estuary in 2010 was to capture salmon at various locations in the estuary over an extended period to subsequently determine the genetic make-up of individual fish. This objective was delivered in that 461 salmon were captured over the period 14th July to 27th October. All genetic samples were provided to University College Cork for genetic analysis.

During the course of the survey, the mortality of salmon was low at 5.2%. The fact that the fishermen and the IFI staff attended the net continually during the survey and removed salmon immediately into the recovery boat was a significant contributor to this low mortality rate. The by-catch of other fish species was also very low during the survey period.

6. Acknowledgements

The Waterford Estuary fishermen demonstrated great effort and commitment to this survey by fishing on sixteen occasions over the period July to October in conjunction with the staff of Inland Fisheries Ireland, Carrick-on-Suir base, South Eastern River Basin District. The dedication of both the fishermen and IFI staff to the survey and care taken to ensure salmon were released unharmed is greatly acknowledged. Special thanks are due to Inspector Tony O'Dwyer, IFI, Carrick-on-Suir and Michael Connors, Passage East, for their effort and commitment. Fran Igoe and Tony Holmes, IFI, are gratefully acknowledged for their assistance with data analysis and report compilation.

Appendix 1 - Protocol for a Salmon Survey in the Waterford Estuary in 2010

This current document sets out a specific Protocol for the operation of the survey which will be undertaken under the supervision of Inland Fisheries Ireland, South Eastern River Basin District, Clonmel with technical support from Inland Fisheries Ireland, Swords. A proposal for a survey, setting out the rational and general proposal was drawn up by the Central & Southern Boards and should be read in conjunction with this Protocol.

Survey Fishery Locations

The objective of the survey is to determine the proportion of the salmon run temporarily and spatially destined for the Barrow, Nore and Suir over the main period of the salmon run. Five locations are proposed to determine the mixed stock nature of the salmon run at varying distances along the estuary. The exact locations of sampling will be determined by IFI Clonmel staff in consultation with local fishermen. Sampling over five discrete periods from June to late October period would allow the proportions of salmon from each river to be determined on a seasonal basis. Fishing during day light hours would be important from a health and safety perspective.

Due to the varying topography and tidal conditions prevailing in the five study areas, sample locations will be selected, in consultation with local commercial fishermen, using the following criteria;

- Safety
- Areas where nets can/cannot be deployed
- Tidal conditions
- Weather/exposed areas
- Obstructions

Fishing Times

Sampling at five locations over five periods, June/ early July, late July / early August, late August / early September, late September / early October and late October with a target of 40 salmon per site on each of the five occasions results in an overall target sample of 1,000 salmon.

Fishing will take place to attempt to catch the target of 40 salmon at each of five locations over five time periods. Fishing one day will allow sites 3, 4 & 5 to be sampled on one tide. Should this operation not succeed in reaching the target sample size, fishing may be attempted on subsequent days. Fishing at locations 1 & 2 on one day in the time period will also be undertaken and on subsequent days if the target sample size is not reached.

No fishing will take place if, for any reason, Fisheries Board staff are not available to take, record and collect samples.

Fishing Operation

Fishermen will provide a boat to undertake the survey of salmon stocks. An IFI officer will be present in this boat at all times. Officers in an IFI RIB will also be present at each fishing. Any salmon encountered in nets will be transferred to the RIB and sampled by the IFI officers and returned alive. Two large buoys will be placed at the end of survey nets to mark the net. The IFI RIB will liaise with any shipping traffic and ensure the survey does not interfere with navigation. Nets will be hauled if necessary so as not to disrupt navigation.

Fishing Records & Labeling

Data on date, location, fisherman, fishing method, location, tide, weather, etc. and catch will be recorded on a Survey Record sheet. (see Appendix 1).

The following labeling will apply. Fish will be coded initially based on site code, then fishing period and then fish number. For example 8 fish caught at site 3 during the first sampling period will be coded S1: Per 1: No1 to S1: Per 1: No8. The fish number will increase sequentially for each fishing period at each site, for example, the next period fish are captured at site 3, the fish number will S1: Per 2: No 9, etc.

The same numbering will be put on the genetic sample bottle and scale envelope as the record sheet for each individual salmon. Information on bye-catch, how the salmon were caught or meshed in the net, mesh size etc will be recorded.

Sampling

Two biological samples will be taken and retained from all salmon captured during the survey;

1. A tail punch sample, which will be preserved in alcohol (95% ethanol) in an individual container
2. A scale sample, which will be preserved in an individual envelope

Sample Label

A label should be attached to each sample container. A label should also be placed in the genetic sample bottle in case the outside label becomes illegible. This should contain the sample number, and if room allows, the date of sampling.

Field Notebook

The IFI staff member present responsible for taking the samples will keep a field notebook. In this will be recorded data on each sample taken – sample number, date, location, type of sample, who caught the fish, etc. Also anything about the sample and the sampling that may be needed for future reference or that may have been unusual. Recording information like this may be important to explain unusual lab results and also to doubly verify the authenticity of a sample.

Salmon Mortalities

Any salmon mortalities resulting from the capture methods will be immediately tagged using an IFI carcass tail tag. A genetic and scale sample will be taken in the normal way and processed the same as the samples for salmon released. The IFI officer will obtain a destruction order for the fish. Biological data on sex, length/weight and parasites will be collected and the ovaries will be retained form female fish for fecundity analysis.

APPENDIX 2 - Survey Sheet

Waterford Estuary Fishing Survey Record Sheet

Date	
Location	
Fishing Method	
Fisherman	
Fishing Period	
Fishing Start time	
Fishing Finish time	
Weather Conditions	
Tide	

Bye-Catch	
Meshing	
Net damage	
Mesh Size	
Release information	

General Comments

Salmon Catch		**GPS**	**Fork**	**Genetic**	**Scale**
Total		**Location**	**Length**	**Sample**	**sample**
Fish Code No					
Fish Code No					
Fish Code No					
Fish Code No					
Fish Code No					
Fish Code No					
Fish Code No					
Fish Code No					