

Sampling Fish for the Water Framework Directive

Transitional Waters 2014

**Shannon and Fergus
Estuaries**





Water Framework Directive Fish Stock Survey of Transitional Waters in the
Shannon International River Basin District – Shannon Estuary, Fergus Estuary
and Limerick Docks 2014

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1. INTRODUCTION

Fish stock surveys were conducted on the Upper Shannon Estuary, Lower Shannon Estuary, Fergus Estuary and Limerick Docks water bodies as part of the programme of fish monitoring for the Water Framework Directive (WFD), between the 6th and the 23rd of October 2014 by staff from Inland Fisheries Ireland (Table 1.1, Fig. 1.1).

The Shannon and its associated estuarine water bodies comprise a large, complex estuary system on the south-west coast of Ireland. For the purposes of WFD monitoring and reporting, this large estuary system has been split into four separate water bodies (Table 1.1), further details of which are given in each individual results section.

Table 1.1. Transitional water bodies surveyed for the WFD fish surveillance monitoring programme, October 2014 (FT=freshwater tidal, TW=transitional)

Transitional water body	MS Code	Easting	Northing	Type	Area (km²)
Limerick Docks	SH_060_0900	157383	157267	FT	2.49
Shannon Estuary, Upper	SH_060_0800	143538	159394	TW	39.5
Shannon Estuary, Lower	SH_060_0300	116583	152260	TW	123.1
Fergus Estuary	SH_060_1100	132035	165677	TW	64.8

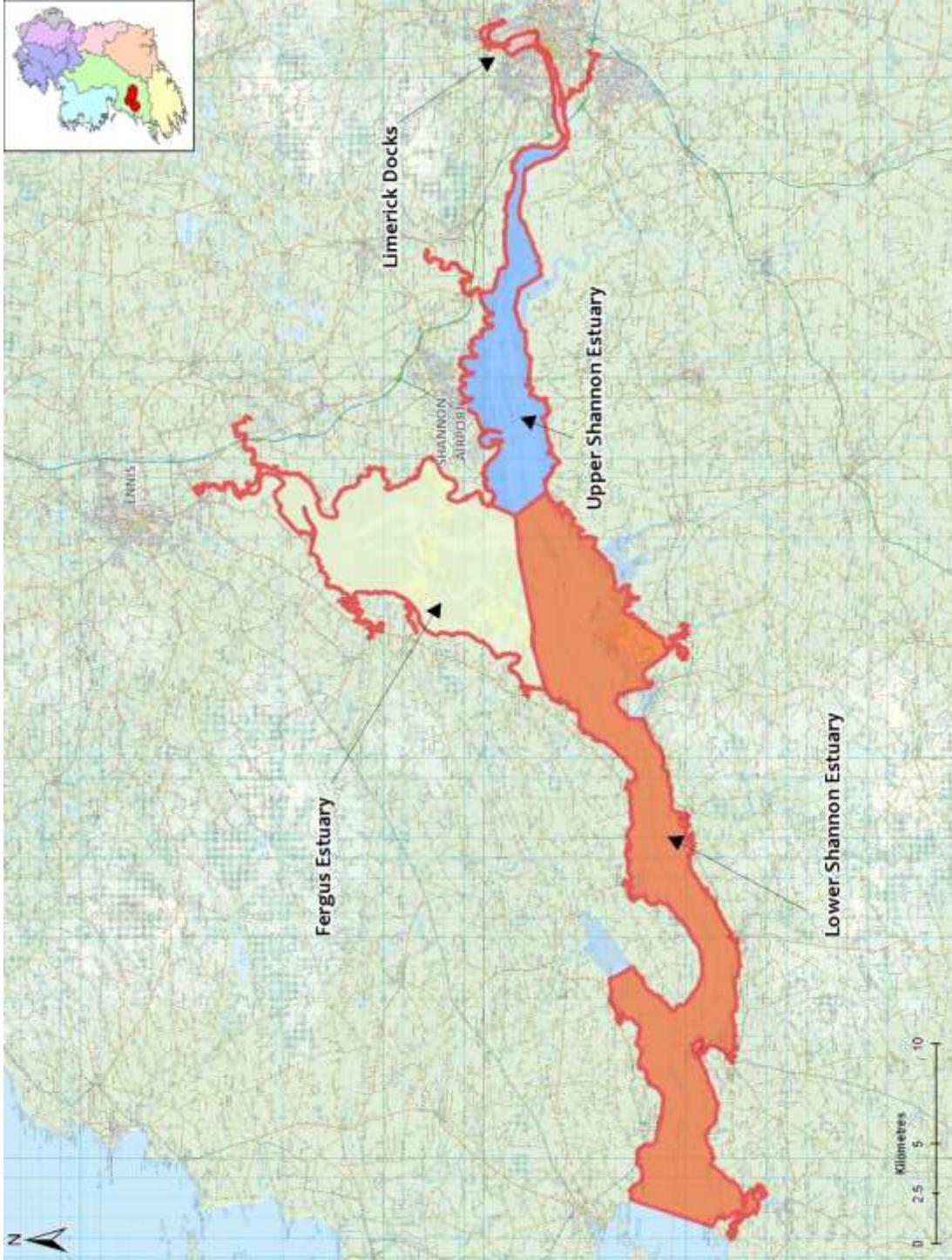


Fig. 1.1. Location map of the four transitional water bodies on the Shannon estuary system surveyed for WFD fish monitoring, October 2014



2. METHODS

Current work in the Republic of Ireland and United Kingdom indicates the need for a multi-method (beach seine, fyke net and beam trawl) approach to sampling fish in estuaries and these procedures are now the standard IFI methodology for fish stock surveys in transitional waters for the WFD monitoring programme.

Beach seining is conducted using a 30m x 3m net (10mm mesh size) to capture fish in littoral areas (Plate 2.1). The bottom of the net has a weighted lead line to increase sediment disturbance and catch efficiency. Fyke nets (15m in length with a 0.8m diameter front hoop, joined by an 8m leader with a 10mm square mesh) are used to sample benthic fish in the littoral areas. Beam trawls (Plate 2.2) are used for sampling benthic fish in the littoral and open waters, where bed type is suitable. The beam trawl measures 1.5m x 0.5m, with a 10mm mesh bag, decreasing to 5mm mesh in the cod end. The trawl is attached to a 20m tow rope and towed by a boat. Trawls are conducted along transects of 100m in length.

All nets are processed on-site by identifying the species present and counting the total numbers caught in each. Length measurements are recorded for each species using a representative sub-sample of 30 fish, while scales are only collected for certain species, such as salmon and sea trout. Unidentified fish specimens were retained for subsequent identification in the laboratory.

Sample sites are selected to represent the range of geographical and habitat ranges within the water body, based on such factors as exposure/orientation, shoreline slope, and substrate type. A handheld GPS unit is used to mark the precise location of each site.



Plate 2.1. Beach seining on the Limerick Docks water body, October 2014



Plate 2.2. Beam trawling on the Upper Shannon Estuary, October 2014



Plate 3.2. Limerick Docks, October 2014



Plate 3.3. Sorting a beach seine catch at Limerick Docks, October 2014

A total of six beach seines, six fyke nets and six beam trawls were deployed in Limerick Docks water body in October 2014 (Fig. 3.1).

Salinity values taken at beach seine sites ranged from 0.83ppt to 3.2 ppt. Temperature values taken at beach seine sites ranged from 12.8°C to 14.4°C.



Fig. 3.1. Location map of Limerick Docks indicating sample sites, October 2014

A total of 13 fish species were recorded in Limerick Docks in October 2014. Table 3.1 shows a comparison between 2014 and the previous survey in 2008. Flounder was the most abundant species, followed by smelt. In a similar trend to many of the other transitional water surveys, flounder was widespread, being recorded using all three netting methods.

A number of species were newly recorded in the 2014 survey, including lamprey sp., plaice, sand goby, smelt, sprat and thick-lipped grey mullet. Dace, an invasive species to this country, was also newly recorded in 2014. Common goby, pike and salmon were previously caught in 2008 but not captured in the 2014 survey. European eel, listed as critically endangered in the Irish Red Data Book (King *et al.*, 2011), was also recorded during this survey.



Table 3.1. Number of each species captured by each gear type in Limerick Docks, September-October 2008 and October 2014

Common name	Beach seine		Fyke net		Beam trawl		Total	
	2008 (6)	2014 (6)	2008 (4)	2014 (6)	2008 (0)	2014 (6)	2008	2014
Flounder	14	149	28	118	-	7	42	274
Smelt	-	134	-	3	-	1	-	138
Three-spined stickleback	8	51	-	0	-	-	8	51
Roach	25	36	4	2	-	-	29	38
European eel	3	-	18	30	-	-	21	30
Sprat	-	23	-	2	-	-	-	25
Dace	-	15	-	-	-	-	-	15
Perch	1	6	-	5	-	-	1	11
Sand goby	-	10	-	0	-	-	-	10
Brown trout	-	-	1	2	-	-	1	2
Lamprey sp.	-	-	-	-	-	2	-	2
Plaice	-	-	-	1	-	-	-	1
Thick-lipped grey mullet	-	1	-	0	-	-	-	1
Common goby	34	-	-	-	-	-	34	-
Pike	2	-	1	-	-	-	3	-
Salmon	3	-	-	-	-	-	3	-

A subsample of flounder (109) captured during the 2014 survey ranged in length from 4.2cm to 24.1cm (mean = 8.4cm) (Fig. 3.2). Flounder captured during the 2008 survey had similar lengths, ranging from 3.5cm to 21.0cm (mean = 10.7cm).

European eel captured during the 2014 survey ranged in length from 32cm to 67.0cm (mean = 45.6cm) (Fig. 3.3). European eel captured during the 2008 survey ranged in length from 9.4cm to 64.0cm (mean = 34.2cm).

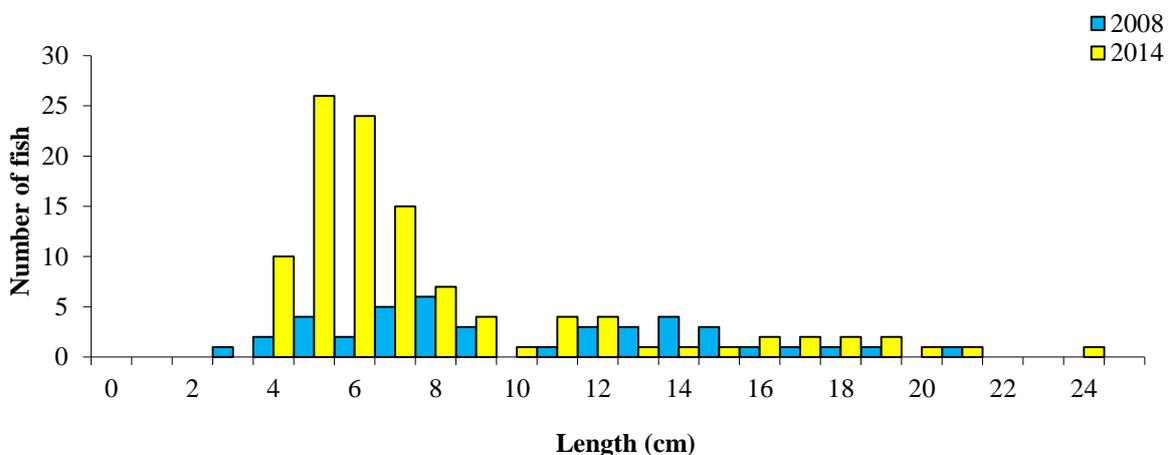


Fig. 3.2. Length frequency distribution of flounder in Limerick Docks, September-October 2008 (n = 42) and October 2014 (Sub-sample, n= 109)

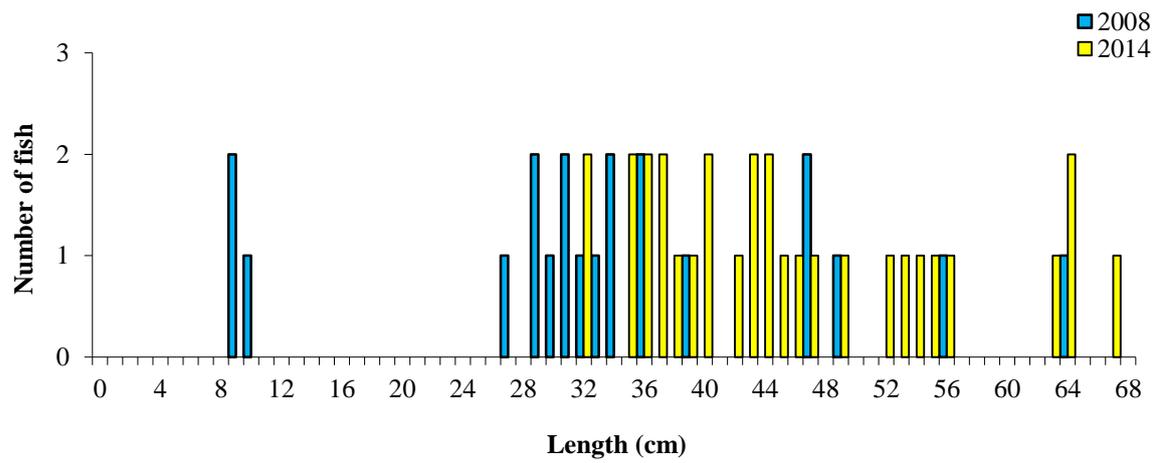


Fig. 3.3. Length frequency distribution of European eel in Limerick Docks, September-October 2008 (n= 21) and October 2014 (n= 30)

3.1.2 Upper Shannon Estuary

The Upper Shannon Estuary covers an area of 39.5km² stretching from Coonagh Point, near the Limerick Tunnel (N18), down as far as Moylaun's Rock and Shannon Airport (Plates 3.4 and 3.5 and Fig. 3.4). The land surrounding this water body is mainly used for agriculture but other activities also take place, including a number of quarries and Shannon Airport.

This water body is situated within the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA. A number of important habitats are present within this SAC, including mudflats and sandflats, listed in Annex I of the EU Habitats Directive. Annex II listed species present include lamprey and Atlantic salmon (NPWS, 2013).



Plate 3.4. Aerial photo of the Upper Shannon Estuary looking southwards (near Bunratty). Photo courtesy of IFI and No. 3 Operational Wing, Irish Air Corps [Aer Chór na hÉireann]



Plate 3.5: The Upper Shannon Estuary, October 2014.

Eleven beach seines, 11 fyke nets and 14 beam trawls were deployed in the Upper Shannon Estuary in October 2014 (Fig. 3.4).

Salinity values taken at beach seine sites ranged from 13.4 ppt to 133.9 ppt. Temperature values taken at beach seine sites ranged from 12.8°C to 13.9°C.

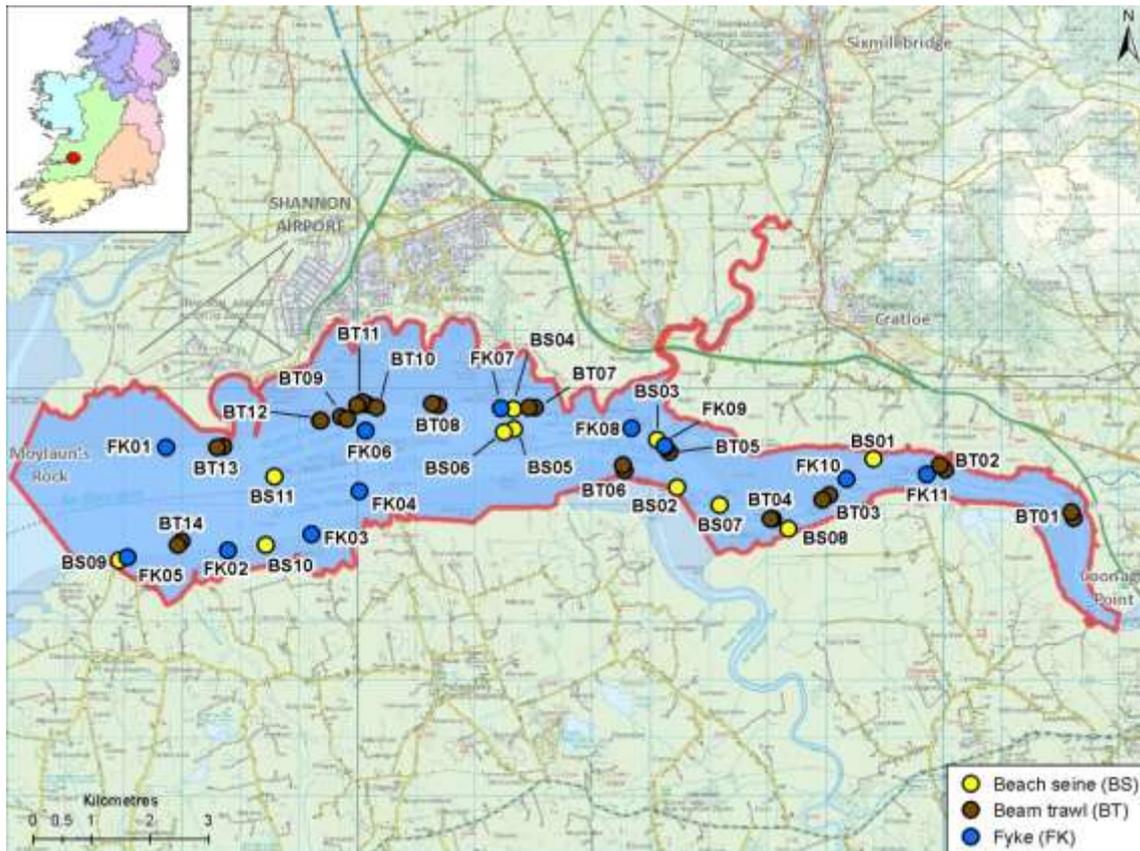


Fig. 3.4. Location map of the Upper Shannon Estuary indicating sample sites, October 2014

A total of 22 fish species were recorded in the Upper Shannon Estuary in October 2014. Table 3.2 shows a comparison between 2014 and the previous survey in 2008. Flounder was the most abundant species, followed by sprat and sand goby. Flounder was widely distributed throughout the water body, being captured using all three netting methods, while other species such as sand goby were more localised, only recorded in the shallow marginal areas using beach seines.

A number of species were newly recorded in 2014, including Atlantic horse mackerel/scad, bib, brill, coalfish/saithe, fifteen-spined stickleback, pogge and grey gurnard. Long-spined sea scorpion, perch, poor cod and short-spined sea scorpion were previously caught in 2008 but not captured in the 2014 survey. European eel, which is listed as critically endangered in the Irish Red Data Book (King *et al.*, 2011), was also recorded during this survey.



Table 3.2. Number of each species captured by each gear type in the Upper Shannon Estuary, September-November 2008 and October 2014

Common name	Beach seine		Fyke net		Beam trawl		Total	
	2008 (7)	2014 (11)	2008 (4)	2014 (11)	2008 (0)	2014 (14)	2008	2014
Flounder	47	70	28	77	-	52	75	199
Sprat	777	173	-	-	-	12	777	185
Sand goby	-	126	-	-	-	4	-	130
Three-spined stickleback	33	64	-	2	-	2	33	68
European eel	-	-	3	28	-	-	3	28
Nilsson's pipefish	-	20	-	-	-	7	-	27
Smelt	18	19	-	1	-	2	18	22
Five-bearded rockling	-	2	4	8	-	-	4	10
Plaice	-	-	1	8	-	1	1	9
Common sole	-	-	2	5	-	1	2	6
Fifteen-spined stickleback	-	5	-	-	-	-	-	5
Pogge	-	-	-	2	-	3	-	5
Thick-lipped grey mullet	-	5	-	-	-	-	0	5
Bib	-	-	-	4	-	-	-	4
Coalfish (Saithe)	-	-	-	3	-	-	-	3
Grey gurnard	-	-	-	3	-	-	-	3
Atlantic horse mackerel/Scad	-	2	-	-	-	-	-	2
Brill	-	2	-	-	-	-	-	2
European sea bass	1	1	-	-	-	-	1	1
Greater pipefish	170	-	2	-	-	1	172	1
Sand smelt	-	-	-	-	-	1	-	1
Whiting	-	1	1	-	-	-	1	1
Common goby	105	-	-	-	-	-	105	-
Unident. gadoid sp.	-	-	6	-	-	-	6	-
Long-spined sea scorpion	-	-	3	-	-	-	3	-
Perch	1	-	-	-	-	-	1	-
Poor cod	-	-	1	-	-	-	1	-
Short-spined sea scorpion	-	-	2	-	-	-	2	-

Flounder captured during the 2014 survey ranged in length from 5.1cm to 27.2cm (mean = 12.8cm) (Fig. 3.5). Flounder captured during the 2008 survey ranged in length from 5.5cm to 24.1cm (mean = 11.2cm) (Fig. 3.5).

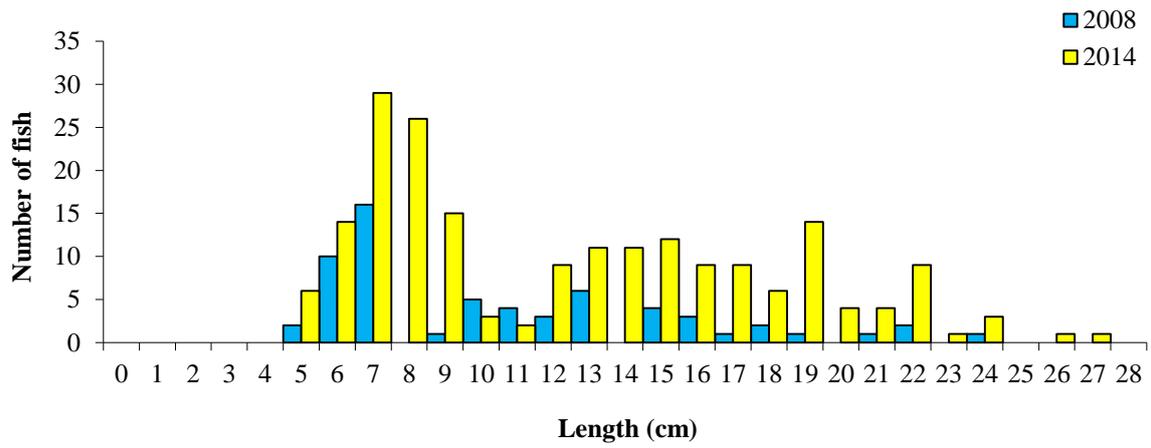


Fig. 3.5. Length frequency distribution of flounder in the Upper Shannon Estuary, September-November 2008 (sub-sample, n=62) and October 2014 (n=199)

3.1.3 Lower Shannon Estuary

The Lower Shannon Estuary is a relatively large transitional water body covering an area of 123.1km² (Plate 3.6 and 3.7, Figs. 3.6 and 3.7). It stretches from Moylaun's Rock near Shannon Airport down as far as Carrig Island near Ballylongford (Figs. 3.6 and 3.7). This water body is mainly bordered by agricultural land but it also has a number of significant industries nearby, including Shannon Airport, two power plants (Moneypoint and Tarbert), a bauxite refinery and a deepwater port (Foynes).

This water body is situated within the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA (see Section 3.1.1).



Plate 3.6. Aerial photo of the Lower Shannon Estuary looking northwest towards the Tarbet and Moneypoint Powerstations. (Photo courtesy of IFI and No. 3 Operational Wing, Irish Air Corps [Aer Chór na hÉireann])



Plate 3.7: Lower Shannon estuary, near Foynes, Co. Limerick, October 2014

Twenty beach seines, 12 fyke nets and 23 beam trawls were deployed in the Lower Shannon Estuary in October 2014.

Salinity values taken at beach seine sites ranged from 102.8ppt to 132 ppt. Temperature values taken at beach seine sites ranged from 13.0°C to 14.9°C.

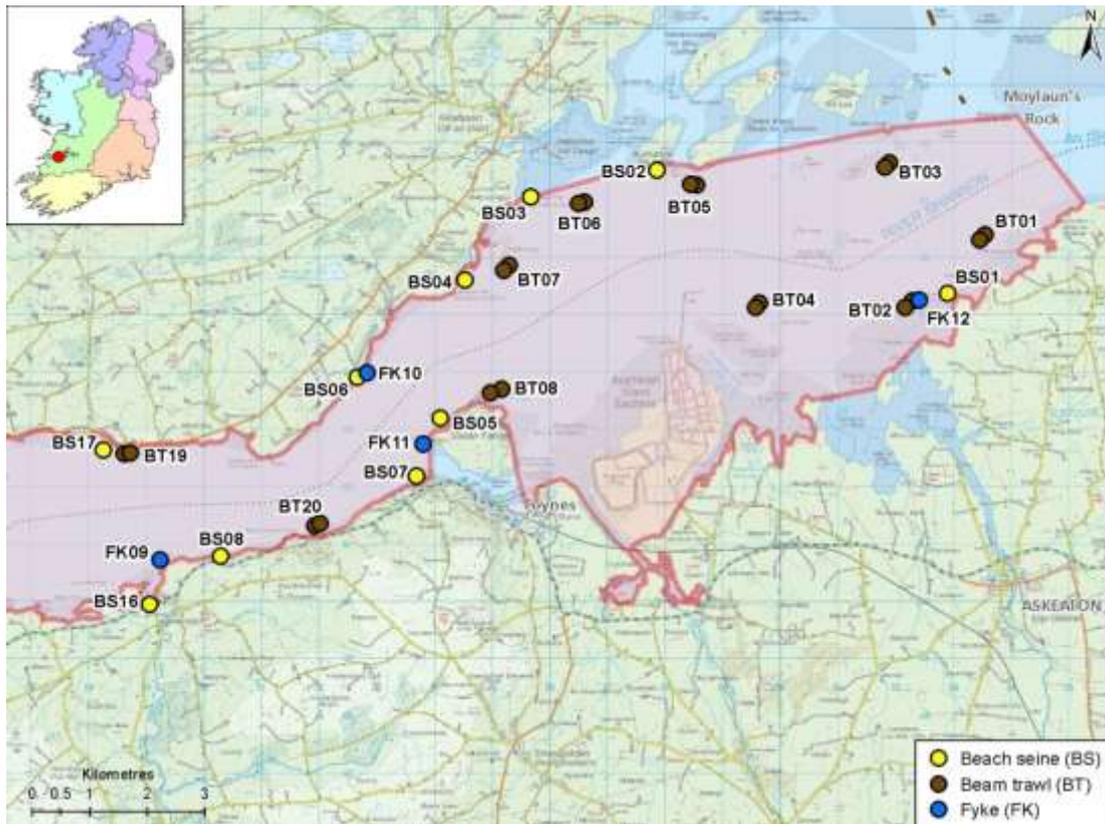


Fig. 3.6. Location map of the eastern Lower Shannon Estuary sample sites, October 2014

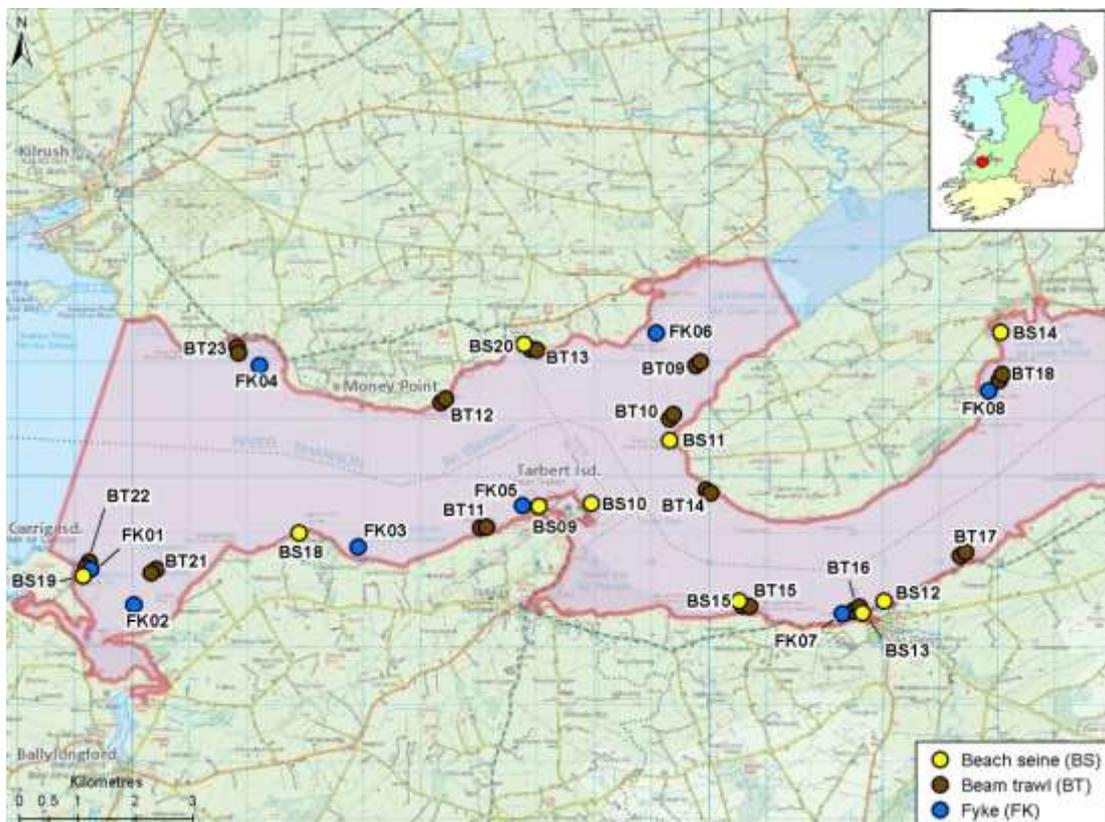


Fig. 3.7. Location map of the eastern Lower Shannon Estuary sample sites, October 2014



A total of 29 fish species were recorded in the Lower Shannon Estuary in October 2014 (Table 3.3). Table 3.3 shows a comparison between 2014 and the previous survey in 2008. Sprat was the most abundant fish species, followed by sand goby, thick-lipped mullet and sand smelt. Flounder was well distributed throughout this water body, being captured using all three netting methods (Table 3.3).

A number of species were newly recorded in 2014, including bib, coalfish/saithe, grey gurnard, mackerel and sand sole. A number of species were previously caught in 2008 but not captured in the 2014 survey, including black goby, cod, European sea bass and European eel. This was the only water body surveyed during 2014 in which thornback ray was recorded.



Table 3.3. Number of each species captured by each gear type in the Lower Shannon Estuary, September-November 2008 and October 2014

Common name	Beach seine		Fyke net		Beam trawl		Total	
	2008 (23)	2014 (20)	2008 (12)	2014 (12)	2008 (0)	2014 (23)	2008	2014
Sprat	16727	22859	-	-	-	1	16727	22860
Sand goby	1	214	-	-	-	43	1	257
Thick-lipped grey mullet	13	138	-	-	-	-	13	138
Sand smelt	161	127	-	-	-	1	161	128
Five-bearded rockling	1	2	12	19	-	-	13	21
Flounder	17	6	6	12	-	2	23	20
Corkwing wrasse	6	12	-	-	-	6	6	18
Fifteen-spined stickleback	1	18	-	-	-	-	1	18
Pollack	1	5	5	9	-	-	6	14
Poor cod	-	-	14	14	-	-	14	14
Plaice	19	2	6	3	-	7	25	12
Coalfish (Saithe)	-	2	-	4	-	-	-	6
Bib	-	-	-	5	-	-	-	5
Grey gurnard	-	-	-	-	-	5	-	5
Conger eel	-	-	1	4	-	-	1	4
Dab	-	-	4	1	-	3	4	4
Mackerel	-	1	-	3	-	-	-	4
Lesser spotted dogfish	-	-	19	2	-	-	19	2
Rock goby	-	-	-	2	-	-	-	2
Two-spotted goby	5	2	-	-	-	-	5	2
Ballan wrasse	11	1	3	-	-	-	14	1
Common dragonet	-	-	-	-	-	1	-	1
Common sole	3	-	7	1	-	-	10	1
Long-spined sea scorpion	-	-	-	-	-	1	-	1
Pogge	-	-	1	-	-	1	1	1
Sand sole	-	-	-	-	-	1	-	1
Smelt	-	-	-	-	-	1	-	1
Thornback ray	-	-	-	1	-	-	-	1
Three-bearded rockling	-	-	-	1	-	-	-	1
Black goby	1	-	-	-	-	-	1	-
Cod	-	-	43	-	-	-	43	-
Common goby	2164	-	-	-	-	-	2164	-
Cuckoo wrasse	-	-	3	-	-	-	3	-
Dragonet sp.	5	-	-	-	-	-	5	-
European eel	1	-	6	-	-	-	7	-
European sea bass	9	-	-	-	-	-	9	-
Greater pipefish	1	-	-	-	-	-	1	-
Gunnel (Butterfish)	2	-	-	-	-	-	2	-
Nilsson's pipefish	-	-	1	-	-	-	1	-
Short-spined sea scorpion	-	-	2	-	-	-	2	-
Snake pipefish	2	-	-	-	-	-	2	-
Three-spined stickleback	6	-	-	-	-	-	6	-

Flounder captured during the 2014 survey ranged in length from 8.2cm to 21cm (mean = 13.9cm) (Fig. 3.8). Flounder captured during the 2008 survey ranged in length from 6.7cm to 26.5cm (mean = 11.9cm).

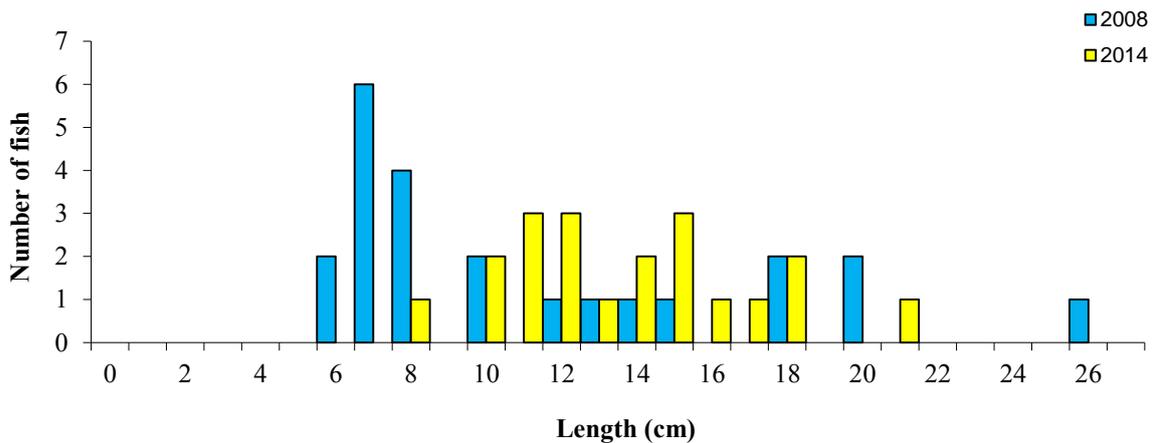


Fig. 3.8. Length frequency distribution of flounder in the Lower Shannon Estuary, September-November 2008 (n=23) and October 2014 (n=20)

Thick-lipped grey mullet captured during the 2014 survey ranged in length from 4.0cm to 8.1cm (mean = 5.8cm) (Fig. 3.9). Thick-lipped grey mullet captured during the 2008 survey ranged in length from 3.0cm to 25.8cm (mean = 14.9cm).

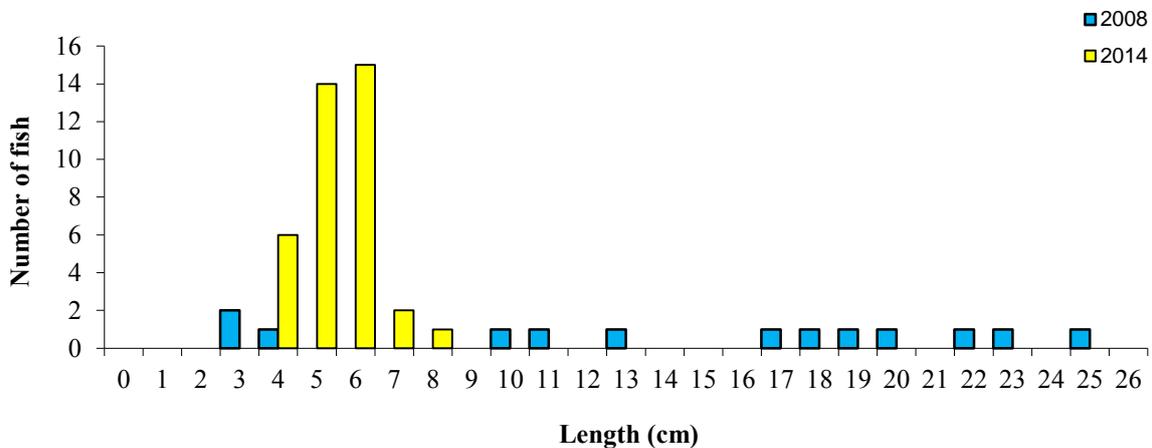


Fig. 3.9. Length frequency distribution of thick-lipped grey mullet in the Lower Shannon Estuary, September-November 2008 (n=13) and October 2014 (Sub sample, n=38)

3.1.4 Fergus Estuary

The Fergus Estuary is located just south of Clarecastle, which is just south of Ennis, Co. Clare. It stretches from Clarecastle on the north end to down just beyond Shannon Airport and covers an area of 64.8km² (Plate 3.8 and Fig. 3.10). The land surrounding this water body is predominantly used for agriculture, while Shannon Airport is situated on the southeastern side.

This water body is situated within the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA (see Section 3.1.1).



Plate 3.8. The Fergus Estuary, October 2014

A total of seven beach seines, nine fyke nets and ten beam trawls were deployed in the Fergus Estuary in October 2014.

Salinity values taken at beach seine sites ranged from 128.3ppt to 133.9 ppt. Temperature values taken at beach seine sites ranged from 12.2°C to 12.9°C.

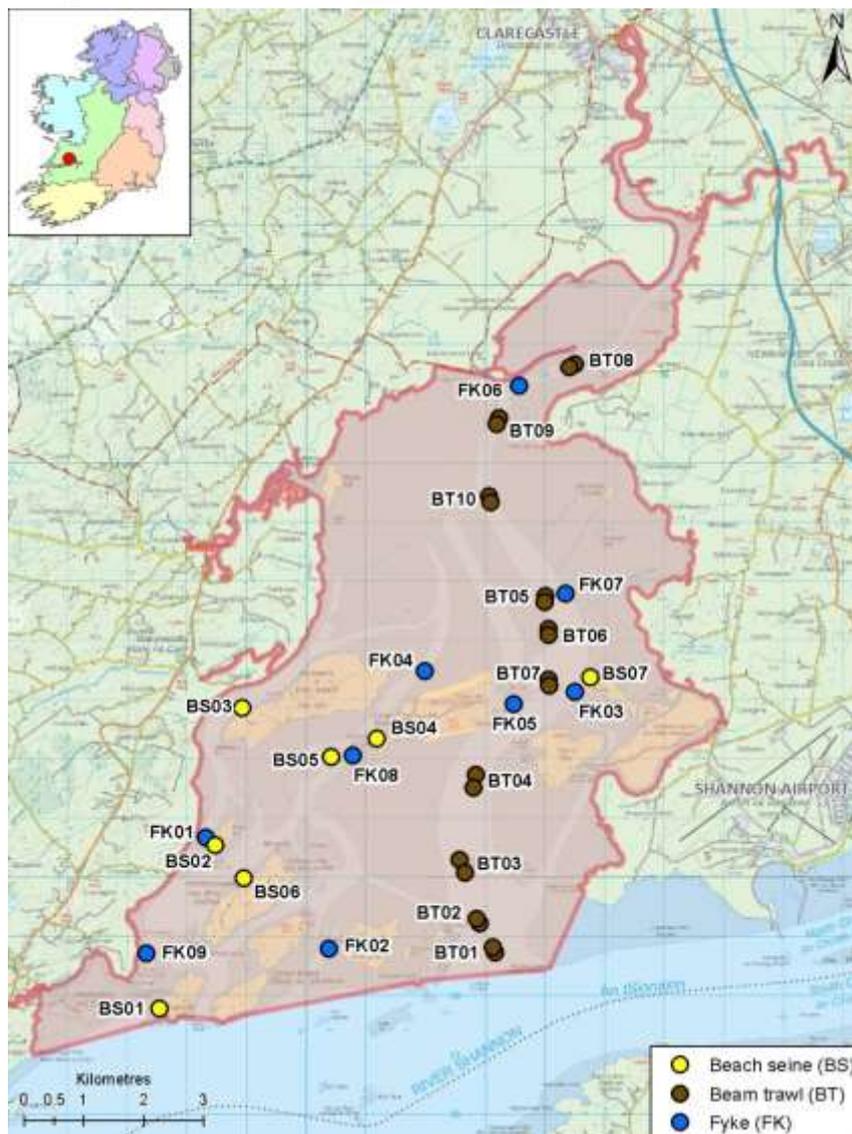


Fig. 3.10. Location map of Fergus Estuary, indicating sample sites, October 2014

A total of 19 fish species were recorded in Fergus Estuary water body in October 2014 (Table 3.4). Sprat was the most abundant species, followed by sand goby and flounder. Flounder was distributed throughout the water body, being captured by all three sampling methods.

A number of species were newly recorded in 2014, including bib, common sole, dab, sand sole and whiting. Conger eel, greater pipefish and thick-lipped grey mullet were previously caught in 2008 but not captured in the 2014 survey.



Table 3.3. Number of each fish species captured by each gear type in the Fergus Estuary, September-November 2008 and October 2014

Common name	Beach seine		Fyke net		Beam trawl		Total	
	2008 (13)	2014 (7)	2008 (7)	2014 (9)	2008 (0)	2014 (10)	2008	2014
Sprat	3076	827	-	-	-	2	3076	829
Sand goby	-	133	-	-	-	-	-	133
Flounder	21	4	55	9	-	55	76	68
Pogge	-	-	-	16	-	8	-	26
European eel	-	-	6	23	-	-	6	23
Five-bearded rockling	-	-	9	19	-	1	9	20
Smelt	3	3	-	1	-	6	3	10
Fifteen-spined stickleback	1	8	-	-	-	-	1	8
Poor cod	-	-	2	1	-	5	2	6
Bib	-	-	-	3	-	-	-	3
Plaice	-	-	1	1	-	2	1	3
Sand sole	-	-	-	-	-	3	-	3
Common sole	-	-	-	2	-	-	-	2
Whiting	-	-	-	2	-	-	-	2
Dab	-	-	-	1	-	-	-	1
European sea bass	4	-	6	1	-	-	10	1
Nilsson's pipefish	-	1	-	-	-	-	-	1
Sand smelt	10	1	-	-	-	-	10	1
Three-spined stickleback	1	-	-	-	-	1	1	1
Common goby	637	-	-	-	-	-	637	0
Conger eel	-	-	1	-	-	-	1	0
Greater pipefish	73	-	-	-	-	-	73	0
Thick-lipped grey mullet	2	-	-	-	-	-	2	0

Flounder captured during the 2014 survey ranged in length from 6.4cm to 22.5cm (mean = 11.8cm) (Fig. 3.11). Those captured in 2008 ranged in length from 6.3cm to 28.1cm (mean = 13.0cm).

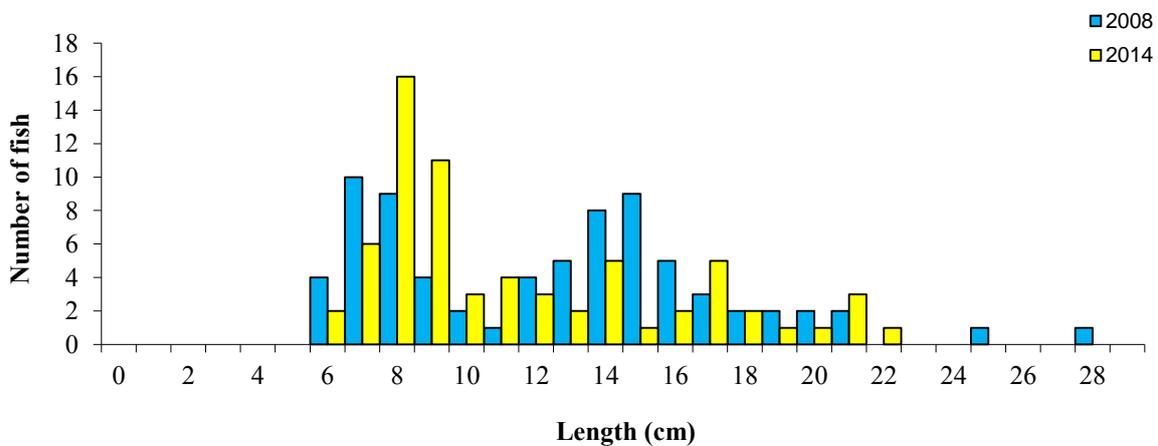


Fig. 3.11. Length frequency distribution of a sub-sample of flounder in Fergus Estuary, September 2008 (sub-sample, n = 74) and October 2014 (n = 68)

3.2 Species richness

A total of 38 fish species were recorded (sea trout are counted as a separate variety of brown trout) within the four transitional water bodies surveyed on the Shannon and Fergus Estuarine systems during 2014. The greatest species richness (27 species) was recorded on the Lower Shannon Estuary (Fig. 3.12). This was followed by the Upper Shannon Estuary (20 species), Fergus Estuary (17 species) and Limerick Docks (12 species). Five species were captured in all four water bodies, plaice, smelt, flounder, sand goby and sprat (Table 3.5).

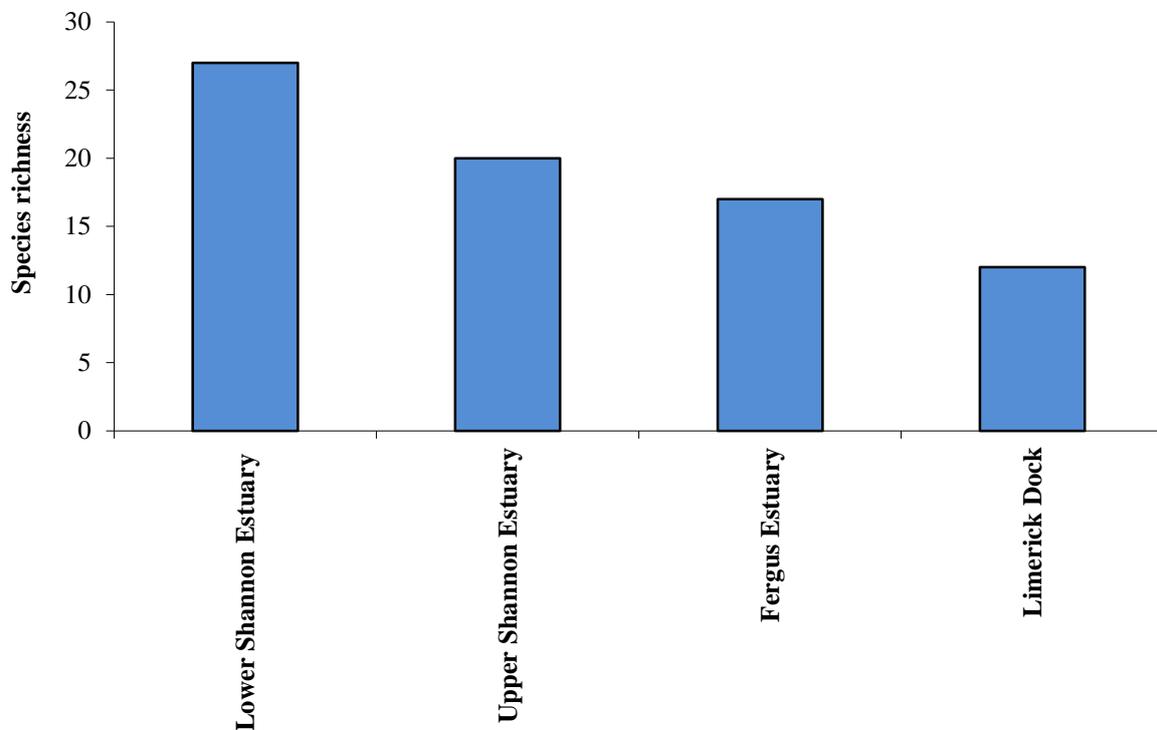


Fig. 3.12. Species richness for all four water bodies surveyed on the Shannon and Fergus Estuarine systems for WFD SM monitoring 2014



Table 3.5. Number of water bodies where each species was recorded in the Shannon and Fergus estuarine systems, 2014

Species	Total	Species	Total
Plaice	4	Brown trout	1
Smelt	4	Perch	1
Flounder	4	Dace	1
Sand goby	4	Roach	1
Sprat	4	Common dragonet	1
Three-spined stickleback	3	Three-bearded rockling	1
Sand smelt	3	Ballan wrasse	1
Common sole	3	Thornback ray	1
Bib	3	Long-spined sea scorpion	1
Fifteen-spined stickleback	3	Rock goby	1
Five-bearded rockling	3	Two-spotted goby	1
European eel	3	Lesser spotted dogfish	1
Pogge	3	Conger eel	1
Thick-lipped grey mullet	3	Mackerel	1
Dab	2	Grey gurnard	1
European sea bass	2	Pollack	1
Whiting	2	Greater pipefish	1
Poor cod	2	Brill	1
Coalfish (Saithe)	2	Atlantic horse mackerel/Scad	1



4. SUMMARY

The four transitional water bodies within the Shannon and Fergus Estuarine systems vary greatly in size and both environmental and physical characteristics. This is reflected in the fish species composition recorded in each water body. As expected with decreasing salinity levels, higher numbers of freshwater fish were recorded in the upper estuaries, while in contrast more marine species were recorded in the water bodies lower down the system. This was a trend that was also observed in other transitional water bodies surveyed previously for the WFD surveillance monitoring programme. Plaice, smelt, flounder, sand goby and sprat were among the most abundant and widespread species recorded, while other fish such as brown trout and dace (an invasive fish species in Ireland) were only recorded in one water body each. European eel, a vulnerable fish species, as well as a number of economically important species, including European sea bass, mackerel and pollack, were also recorded.

An essential step in the WFD monitoring process is the classification of the status of transitional waters, which in turn will assist in identifying the objectives that must be set in the individual River Basin Management Plans.

A WFD fish classification tool, Transitional Fish Classification Index or TFCI, has been developed for the island of Ireland (Ecoregion 1) using IFI and Northern Ireland Environment Agency (NIEA) data. This is a multi-metric tool based on similar tools developed in South Africa and the UK (Harrison and Whitfield, 2004; Coates *et al.*, 2007). The TFCI has recently completed the intercalibration process.

Using this approach, the four individual SHIRBD transitional water bodies have been assigned draft ecological status classifications based on the fish populations present (Table 3.6). The Limerick Docks, Upper Shannon Estuary and Lower Shannon Estuary water bodies were classed as Moderate, Good and Moderate respectively. The Fergus estuary was assigned a draft classification of Good status (Table 3.6).

Some water bodies were also combined together for more practical whole estuary classifications; these include Limerick Docks, Upper Shannon Estuary and Lower Shannon Estuary waterbodies to become the “Shannon Estuary”. This combined water body was classed as “Good” (Table 3.6).



Table 3.6. Draft ecological status classifications for the Shannon Estuary and Fergus Estuary transitional water bodies, 2014

Water body	TFCI	
	EQR	Class (& EO)
Limerick Docks	0.55	Moderate
Upper Shannon Estuary	0.75	Good
Lower Shannon Estuary	0.55	Moderate
Combined water bodies		
Shannon Estuary	0.70	Good
Fergus Estuary	0.63	Good



5. REFERENCES

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