

Fish Stock Survey of Transitional Waters in the Southern River Basin District – Barrow, Nore, Suir Estuary

2016

IFI/2019/1-4470



Iascach Intíre Éireann
Inland Fisheries Ireland

Inland Fisheries Ireland

National Research Survey Programme

Fish Stock Survey of Transitional Waters in the Southern River Basin District – Barrow, Nore, Suir Estuary 2016

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

CITATION: Ryan, D., Coyne, J., Putharee, D. and Roche, W. (2017). Fish Stock Survey of Transitional Waters in the Southern River Basin District – Barrow, Nore, Suir Estuary 2016. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Cover photo: Sampling the Barrow estuary © Inland Fisheries Ireland

© Inland Fisheries Ireland 2017

Acknowledgements

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in Inland Fisheries Ireland.

Project team

Senior Research Officer

Project Manager

Technician

Technician

Fisheries Assistant

Dr. William Roche

Dr. Diarmuid Ryan

Mr. Will Corcoran

Mr. John Coyne

Mr. Dylan Putharee (Jun 2016– Dec 2016)

The report includes Ordnance Survey Ireland data reproduced under OSI Copyright Permit No. MP 007508.

Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright.

© Ordnance Survey Ireland, 2017.

Table of Contents

1. Summary	1
2. Introduction	1
3. Methods.....	3
3.1 WFD Survey.....	3
3.2 Trawling Survey.....	5
4. Results.....	6
4.1 WFD Survey.....	6
4.1.1 Sampling.....	7
4.1.2 Abundant species.....	7
4.1.3 Key Species.....	10
4.1.4 Brown Trout	11
4.1.5 Smelt	12
4.1.6 Twait Shad.....	12
4.1.7 Eel.....	13
4.1.8 Bass	14
4.1.8 Thick Lipped Mullet.....	14
4.1.9 Dace	16
4.1.10 Other Species of interest	17
4.2 EMFI Quality Ratings.....	18
4.3 Trawling Survey.....	19
5. Discussion.....	24
6. References	26

1. Summary

This report presents fish capture data collected during Inland Fisheries Ireland (IFI) surveys of transitional waterbodies and draft Ecological Quality Ratings. Two separate surveys are discussed in the current report. One was conducted throughout the Barrow/Nore/Suir transitional water body complex to designate an ecological status based on fish populations, as per the requirements of the Water Framework Directive (Directive 2000/60/EC). The other was carried out to assess juvenile bass populations in the lower sections of the transitional water body complex under IFI's National Bass Conservation Project.

A number of fish sampling methods were used across the two surveys, which ensured that a range of habitat types were sampled, thus making it likely that all fish species present in the estuary were captured. Across both surveys, a total of 37 species and 10967 individual fish were captured. Where applicable, current data was compared to previous surveys to assess how fish populations have changed in the intervening years. Although overall fish population status have remained largely stable, changes in the population structure of some species, such as dace, an invasive, are noteworthy and are discussed. The presence of juvenile bass, plaice, cod and whiting highlights this estuary's importance as a nursery for these popular angling species.

2. Introduction

According to the WFD, ecological status of waterbodies must be assessed by both a number of physical and chemical characteristics and a range of biological indicators. Fish populations are one of the key biological indicators of ecological status in transitional waters. Essentially they are assessed by comparing data collected from monitoring against reference (natural) conditions. Fish status was assessed using the estuarine multi-metric fish index (EMFI) (Harrison and Kelly, 2013) to derive ecological status. As the Barrow/Nore/Suir estuary is subject to repeat surveys every three years as part of a surveillance monitoring programme, any change in fish population structure, and its derived EQR (Ecological Quality Rating) over time, will be evident.

The economic and ecological value of estuarine nursery function in supporting marine fish populations is well characterised (Able 2005; Beck *et al.* 2001). Larval/juvenile stages of many marine species are transported to estuaries where they may spend the first few years of life, taking advantage of the food availability, warm temperatures and shelter which estuaries provide (Vasconcelos *et al.* 2011; Gillanders *et al.* 2003).

European Sea Bass are probably the most popular angling species and their juvenile stages mature in estuarine habitats around Ireland, but a large range of flatfish and ray species also utilise these productive environments. Likewise, mullet species spend a large proportion of their lives within estuaries. Since estuaries are heterogeneous even at small spatial scales, due to factors such as variations in fluvial input and sediment deposition, an area within an estuary which may have limited nursery function for a particular species may play an important role for another. For this reason, a single estuary can accommodate a range of juvenile species with differing requirements (Vasconcelos *et al.* 2011; Ray, 2005), as well as supporting different life stages of the same species.

The main objectives of the current survey are:

- To measure the ecological status of fish populations in the estuary complex as per the requirements of the European Water Framework Directive (WFD; 2000/60/EC).
- To inform on the role of this waterbody in relation to important marine recreational fish species
- To identify potential nursery sites for species of angling importance
- To provide the basis for scientific advice to support any potential fish conservation measures within the estuary

Site characteristics

The Barrow, Nore and Suir estuaries combine near Waterford city to form a large, complex estuary system on the South-East coast of Ireland (Fig 1). As well as providing a nursery function for marine species, a number of diadromous species, such as Atlantic salmon, European Eel and twaite shad move through it as they complete their life cycles. As with many water bodies close to population centres, the Barrow/Nore/Suir estuary complex experiences a range of anthropogenic pressures, from pollution inputs to dredging and sea wall development.

The Barrow/Nore/Suir support populations of juvenile salmon and are important recreational salmon angling fisheries, although the Barrow has been closed as a salmon fishery for some years as it has not achieved its salmon Conservation Limit. In terms of accessible salmon habitat, the three rivers combined account for almost 20% of Ireland's total lotic wetted area habitat (Mc Ginnity *et al.*, 2003).

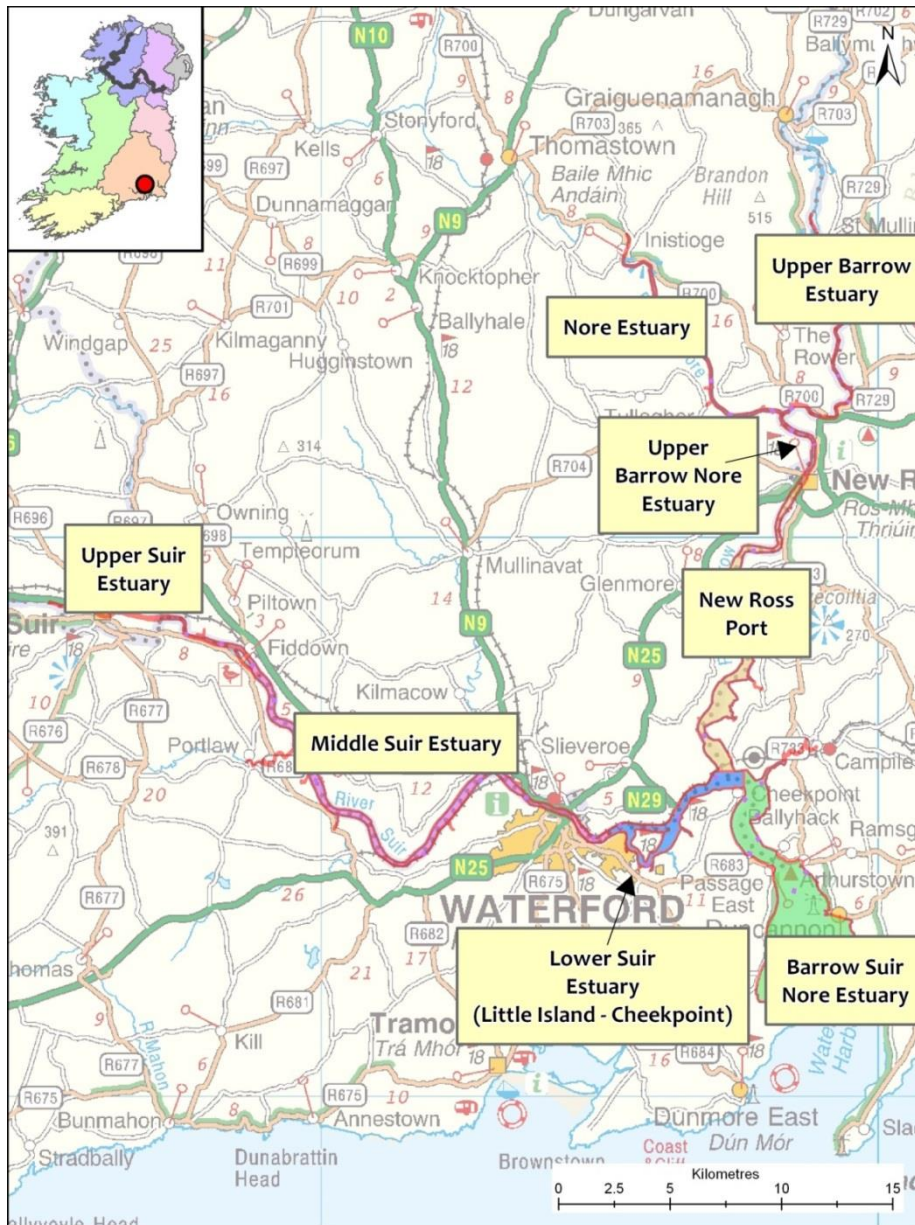


Fig. 1: Location map of the eight transitional water bodies sampled on the Barrow, Nore and Suir estuary system.

3. Methods

3.1 WFD Survey

For the purposes of WFD monitoring and reporting, the Barrow Nore Suir estuary system has been split into eight separate water bodies (Table 1). Fish stock surveys were conducted to ensure sufficient coverage of each separate water body so that stocks of each could be assessed. Sampling took place between 3rd and 14th October 2016. Habitat type across the

sites ranges from soft mud to hard sandy substrate and brackish to fully saline and all in between. The separate waterbodies are described in more detail in www.wfdfish.ie.

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 program. The methodology underpins the estuarine multi-metric fish index (EMFI) (Harrison and Kelly, 2013).

Beach seining is conducted using a 30m x 3m net (10mm mesh size) to capture fish in littoral areas (Fig 2). 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

Table 1: Transitional water bodies surveyed for the WFD fish surveillance monitoring programme, October 2016 (FT=freshwater tidal, TW=transitional)

Transitional water body	MS Code	Easting	Northing	Type	Area (km ²)
Barrow Estuary, Upper	SE_100_0300	273066	137640	TW	1.15
Barrow Nore Estuary, Upper	SE_100_0250	272129	128644	TW	0.64
Barrow Suir Nore Estuary	SE_100_0100	271527	107512	TW	28.21
New Ross Port	SE_100_0200	267862	117105	TW	6.71
Nore Estuary	SE_100_0400	265312	135294	TW	1.26
Suir Estuary, Lower	SE_100_0500	266073	112602	TW	4.32
Suir Estuary, Middle	SE_100_0550	249824	114070	TW	7.03
Suir Estuary, Upper	SE_100_0600	243887	121066	FT	1.09



Fig. 2: Closing the seine net at Cheekpoint in the Barrow Suir Nore estuary.

littoral areas. Beam trawls 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 if necessary. Unidentified fish specimens were retained for subsequent identification in the laboratory.

A handheld GPS was used to mark the precise location of each site. Physiochemical data were also collected at each site.

3.2 Trawling Survey

Separately, IFI conducted a trawl survey in the lower sections of the estuary (New Ross Port, Lower Suir Estuary and Barrow Suir Nore estuary) complex from 8th to the 9th September 2016 under the National Bass Conservation Programme

The survey method used was first developed by CEFAS (UK) in consultation with local skippers (Picket et al. 2002) primarily to sample juvenile bass populations. The survey vessel used had a registered length of 9.72m, a gross register tonnage (GRT) of 8.8 tons, engine power of 49 kw, and was equipped as a stern trawler (Fig. 3a).

The trawl was fished off the stern gantry using two sets of twin, 10 fathom bridles (Fig. 3b). The length of the tow warp varied depending on depth in the area being trawled. Trawls in less than 5 m of water used a 30 m tow warp and a 50 m tow warp was used for depths greater than 5 m. Depths ranged from 0.91 m to 17.0 m. Towing speed was maintained as close to 3 knots over the ground as was practicable. Two 1.0m steel trawl doors (60 kg) were attached to the bridles during towing to keep the net open. The trawl was based on CEFAS specifications with the exception of mesh size: 80 mm diagonal stretched mesh was used throughout instead of the 70 mm used by CEFAS in order to comply with minimum mesh sizes required with Irish trawls. The cod-end was fitted with a 20 mm mesh 'Herring Brailer' net.

For each tow a log was completed, recording shoot and haul times and position (longitude and latitude), starting and ending depth, salinity, weather conditions, and number of each species caught. On hauling, at the end of each tow, the cod-end was opened directly into a 60 gallon tub on deck and then sorted though. For each species of fish, a representative sub-sample of thirty fish was measured and any surplus fish were counted but not measured.

This method can target larger fish residing in deeper, wider sections of the estuary, which cannot be sampled by the other methods referred to above. The inclusion of these data in this report provides a more complete picture of the fish populations inhabiting the estuary complex.



Fig. 3a: The survey vessel and **3b.** Crew members deploying the trawl

4. Results

4.1 WFD Survey

4.1.1 WFD Sampling

Across the eight water bodies, a total of 107 samples were taken using three different sampling methods (Fig.4).

9449 individual fish were captured, counted and identified to species level prior to release. 29 different fish species were encountered over the course of the sampling programme (Table 2). Concerning individual waterbodies, Species richness and physiochemical characteristics, were dependent on waterbody (Table 3).

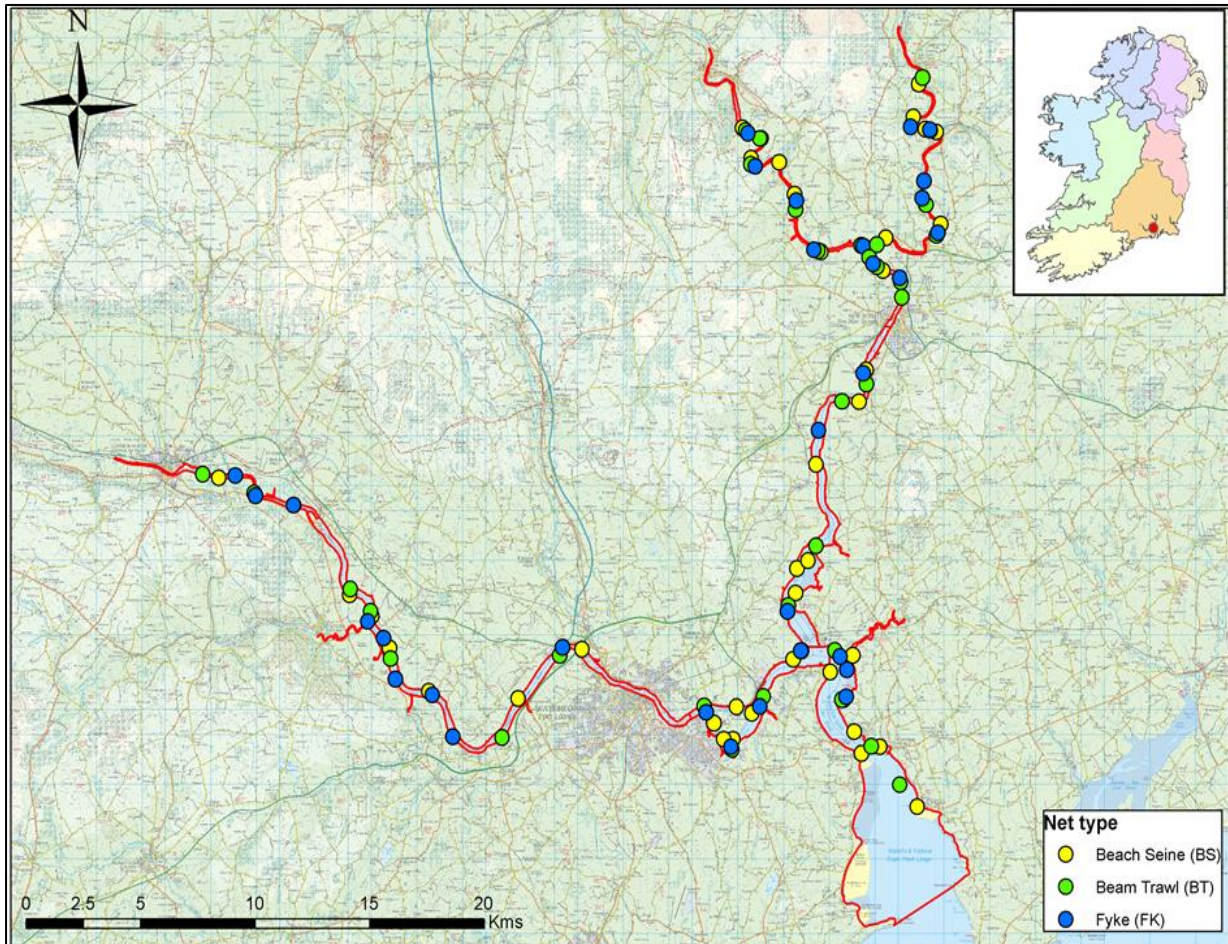


Fig. 4: Map of the Barrow Nore Suir Estuary complex showing all samples taken during the survey in October 2016.

4.1.2 Abundant species

In 2016, three species (flounder, sand goby and sprat) made up 62% of the total catch. The same species made up the majority of the catch during the previous two surveys (2013, 67%; 2010, 85%) (Fig. 5).

<i>Species (scientific name)</i>	<i>Species (common name)</i>	Total count	Count measured	Ave length(cm)	Max length (cm)	Min length(cm)	Relative abundance %
<i>Scophthalmus rhombus</i>	Brill	3	3	9.4	13.6	6.1	0.03
<i>Salmo trutta</i>	Brown trout	65	65	16.5	28.3	11.5	0.69
<i>Gadus morhua</i>	Cod	5	5	19.2	39	10.2	0.05
<i>Pomatoschistus microps</i>	Common goby	1273	499	3.4	7.6	1.2	13.47
<i>Solea solea</i>	Common sole	1	1	28.5	28.5	28.5	0.01
<i>Leuciscus leuciscus</i>	Dace	974	215	11.6	24.3	3.6	10.31
<i>Anguilla anguilla</i>	European eel	219	214	39.3	78	11	2.32
<i>Dicentrarchus labrax</i>	European sea bass	51	51	9.2	44.3	4.2	0.54
<i>Spinachia spinachia</i>	15 spined stickleback	1	1	13.5	13.5	13.5	0.01
<i>Ciliata mustela</i>	5 bearded rockling	31	31	17.1	22.4	12.5	0.33
<i>Platichthys flesus</i>	Flounder	2204	990	8.8	31.8	2.1	23.33
<i>Ammodytes tobianus</i>	Lesser sandeel	7	7	6.5	7.1	6.2	0.07
<i>Phoxinus phoxinus</i>	Minnow	4	4	4.1	4.3	3.7	0.04
<i>Syngnathus rostellatus</i>	Nilsson's pipefish	10	10	11.9	16	8	0.11
<i>Perca fluviatilis</i>	Perch	1	1	30.0	30	30	0.01
<i>Pleuronectes platessa</i>	Plaice	21	21	6.1	7.8	4.9	0.22
<i>Agonus cataphractus</i>	Pogge	11	11	12.1	18.1	9.4	0.12
<i>Pollachius pollachius</i>	Pollack	9	9	13.0	16.4	10	0.10
<i>Rutilus rutilus</i>	Roach	53	53	6.7	30	2.9	0.56
<i>Salmo salar</i>	Salmon	2	2	11.2	14.9	7.5	0.02
<i>Pomatoschistus minutus</i>	Sand goby	2218	475	4.4	8.9	1.9	23.47
<i>Salmo trutta</i>	Sea trout	9	9	23.6	28	17.2	0.10
<i>Osmerus eperlanus</i>	Smelt	541	241	6.4	22.5	3	5.73
<i>Sprattus sprattus</i>	Sprat	1462	257	6.2	11.6	2.4	15.47
<i>Chelon labrosus</i>	Thick lipped grey mullet	168	118	6.0	41.2	1.7	1.78
<i>Chelon ramada</i>	Thin lipped grey mullet	1	1	43.8	43.8	43.8	0.01
<i>Gasterosteus aculeatus</i>	3 spined stickleback	38	38	3.9	4.9	2.4	0.40
<i>Alosa fallax</i>	Twaite shad	42	42	7.9	10.2	2.7	0.44
<i>Merlangius merlangus</i>	Whiting	25	25	12.2	26	8.6	0.26

Table 2: List of species captured during the 2016 WFD survey of the Barrow Suir Nore estuary.

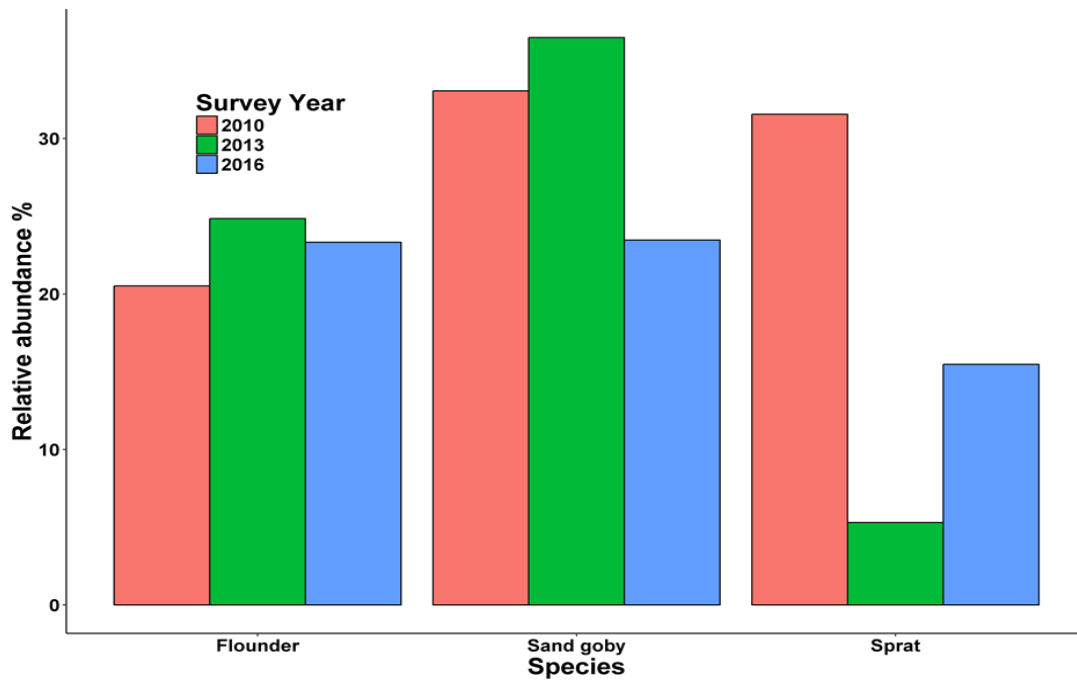


Fig 5: Relative abundance of the three most dominant species captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

Estuary	Sampling dates	Salinity Range (Average) ppt	Temperature range (Average) °C	Distance from Mouth (Km)	No. Beach Seine	No. Fyke net	No. Beam trawl	Species Richness
Barrow Upper	4 th -5 th Oct	0.02-0.3 (0.247)	13.3-13.9 (13.5)	32.8	6	5	5	11
Barrow Nore Upper	4 th -5 th Oct	(0.2)	(13.6)	28.7	2	4	2	10
Barrow Suir Nore	11 th -12 th Oct	19.9-35.9 (25.8)	13.3-14.1 (13.9)	0	7	3	4	16
New Ross Port	3 rd -5 th Oct	0.3-9.5 (4.8)	14.3-15.3(14.9)	12.7	6	3	4	16
Nore Estuary	6 th -7 th Oct	0.2-0.3(0.24)	12.7-13.5(13.1)	32.8	6	5	6	11
Suir Lower	11 th -13 th Oct	5.5-14.5 (11.0)	13.2-14.2 (14.0)	11.7	6	4	4	12
Suir Middle	10 th - 11 th Oct	0.2-5.8 (2.1)	14.8-13.1 (14.2)	18.9	6	6	5	12
Suir Upper	13 th -14 th Oct	0.2-1.8 (0.75)	10.2-11.5 (10.6)	44.2	2	3	3	15

Table 3: Survey details 2016

Flounder were present in large numbers throughout the estuary. There is a clear trend that larger flounder are found in the lower sections of the estuary, whereas smaller juveniles occur in the upper regions. This observation remained constant between sampling years (Fig. 6). It is likely that juvenile fish settle near the top of the estuary and gradually move downstream as they grow.

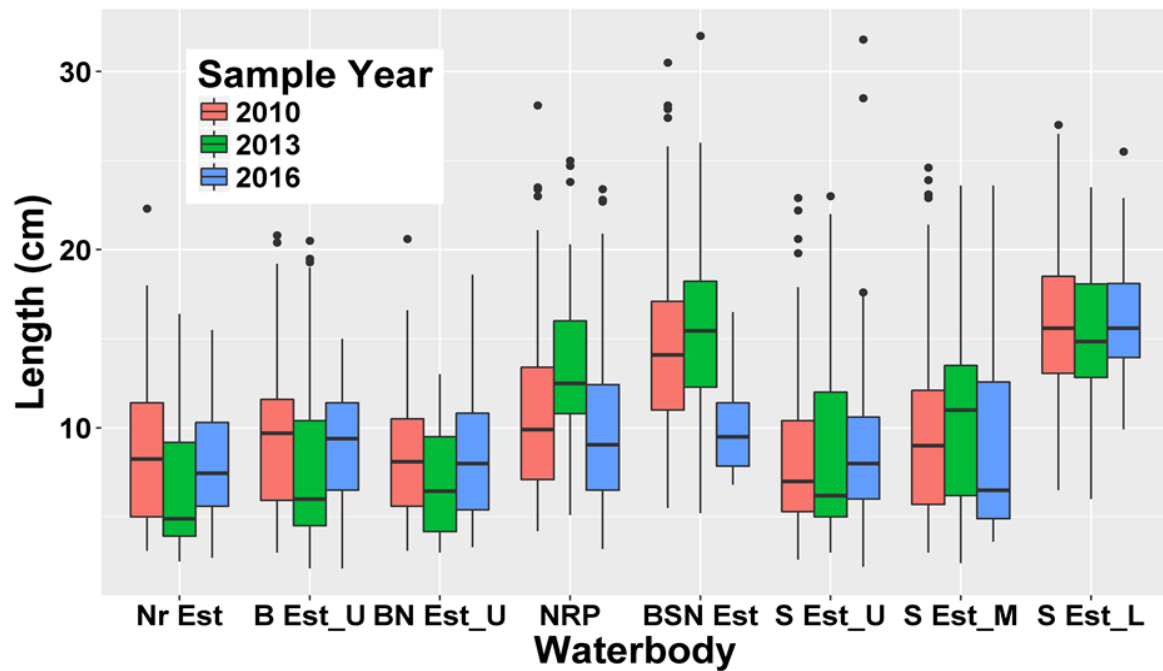


Fig 6: Average lengths of Flounder captured during the last three WFD surveys of the Barrow Suir Nore Estuary across all waterbodies. Nr Est: Nore, B Est_U: Barrow Upper, BN Est_U: Barrow Nore, NRP: New Ross Port, BSN Est: Barrow Suir Nore, S Est_U: Suir Upper, S Est_M: Suir Middle, S Est_L: Suir Lower.

Sprat were more abundant in 2010 than in the more recent surveys due to large numbers captured in the lower sections of the estuary. Otherwise, the proportion of these ubiquitous species within the estuary complex remained relatively constant between surveys.

4.1.3 Key Species

Seven species which are considered important for their conservation status (brown trout, smelt, twaite shad, European eel), angling value (Bass, thick lipped mullet), or as a potential invasive species (dace), also made up a sizable proportion of the total catch across all sampling years (2016, 22%; 2013, 28% ; 2010, 11%) (Fig. 7).

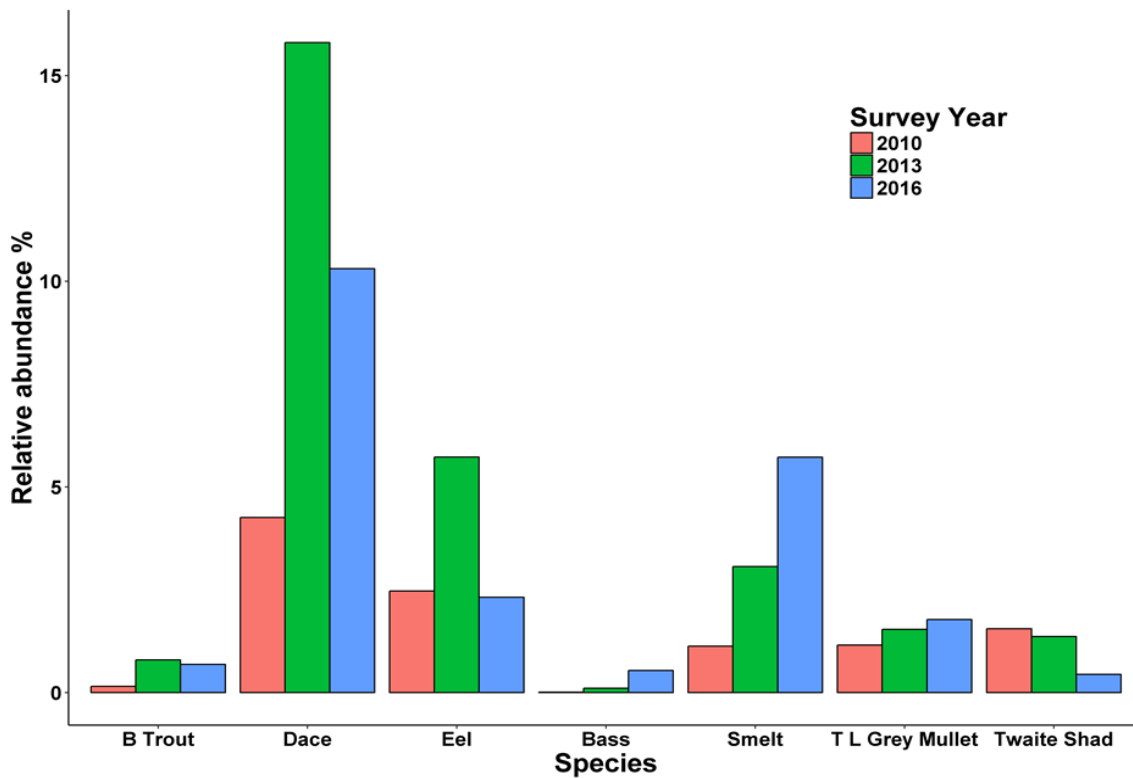


Fig 7: Relative abundance of important species captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

4.1.4 Brown Trout

The majority of Brown Trout captures were between 10 and 30 cm. Capture numbers have remained quite constant between sampling years (Fig. 8). All specimens were recorded in the upper sections of the estuary.

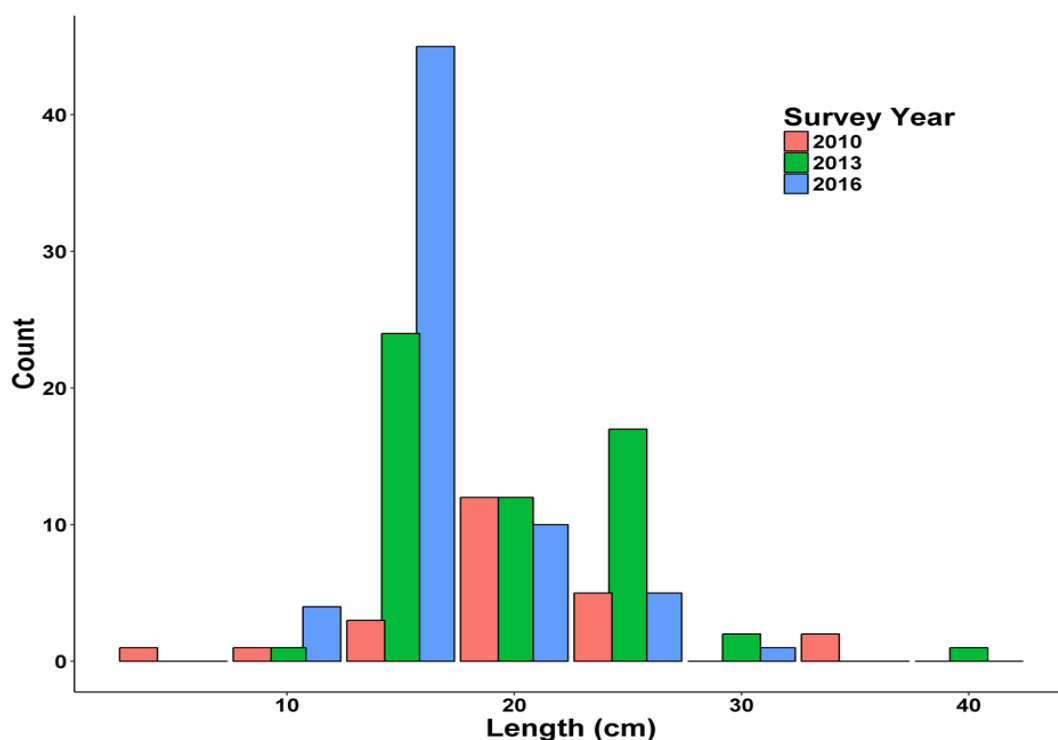


Fig 8: Length frequency analysis of Brown trout captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

4.1.5 Smelt

Relative abundance of Smelt in the estuary has continued to increase between sampling years (Fig. 7). The largest Smelt caught in 2016 was 22.5cm, however, the majority of captures were of juvenile fish, making the mean Smelt length 6.4cm (calculated from a subsample of 241 fish). Although widely distributed throughout the estuary complex, smelt were sporadically abundant, making up a far larger proportion of total catch in the middle sections of the estuary (New Ross Port and Suir Lower), than in other areas. This observation is quite consistent between sampling years (Fig. 9).

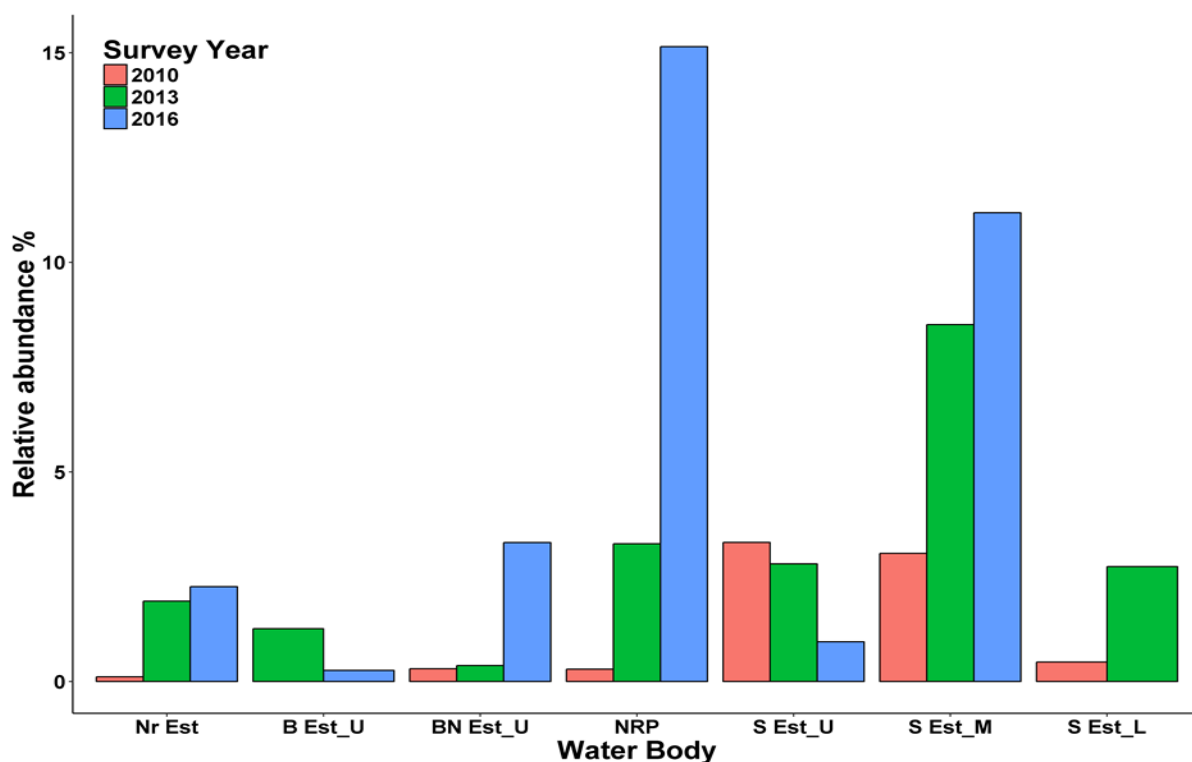


Fig 9: Relative abundance of Smelt captured within each site during the last three WFD surveys of the Barrow Suir Nore Estuary. Nr Est: Nore, B Est_U: Barrow Upper, BN Est_U: Barrow Nore, NRP: New Ross Port, BSN Est: Barrow Suir Nore, S Est U: Suir Upper, S Est M: Suir

4.1.6 Twaite Shad

Twaite Shad were present in low numbers during the 2016 survey. The average length was 7.9cm and the largest was 10.2cm. Relative abundance reduced slightly on the previous two surveys (Fig. 7). Although dispersed throughout the estuary, capture numbers were consistently low.

4.1.7 Eel

European Eel were recorded throughout the estuary in 2016. Lengths ranged from 11 to 78cm (Fig. 10). Relative abundance more than halved from 5.7 to 2.3 %, between 2016 and 2013, returning to 2010 levels (Fig. 7). Relative abundances varied within the various waterbodies but were present throughout in 2016, except for Suir Estuary Lower where no captures were made (Fig. 11).

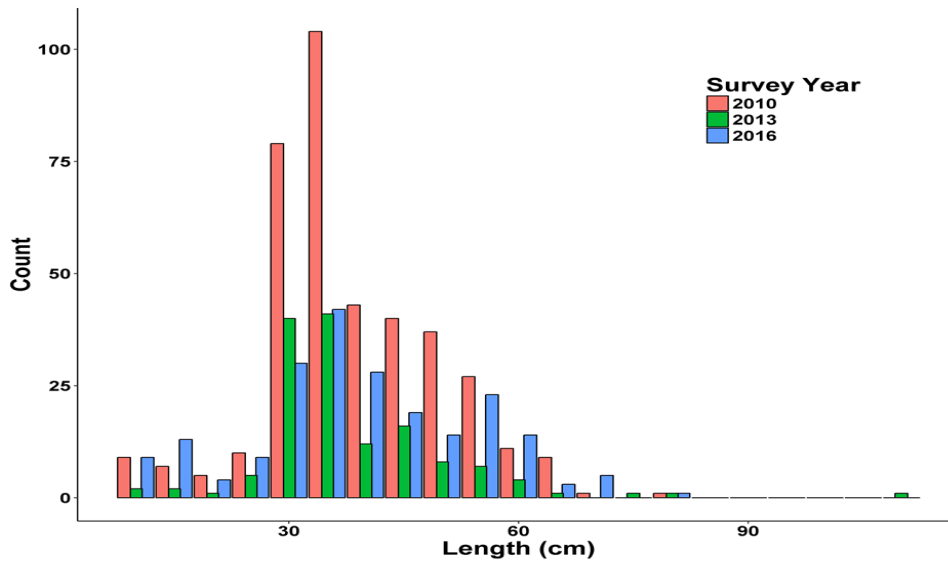


Fig 10: Length frequency analysis of European Eel captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

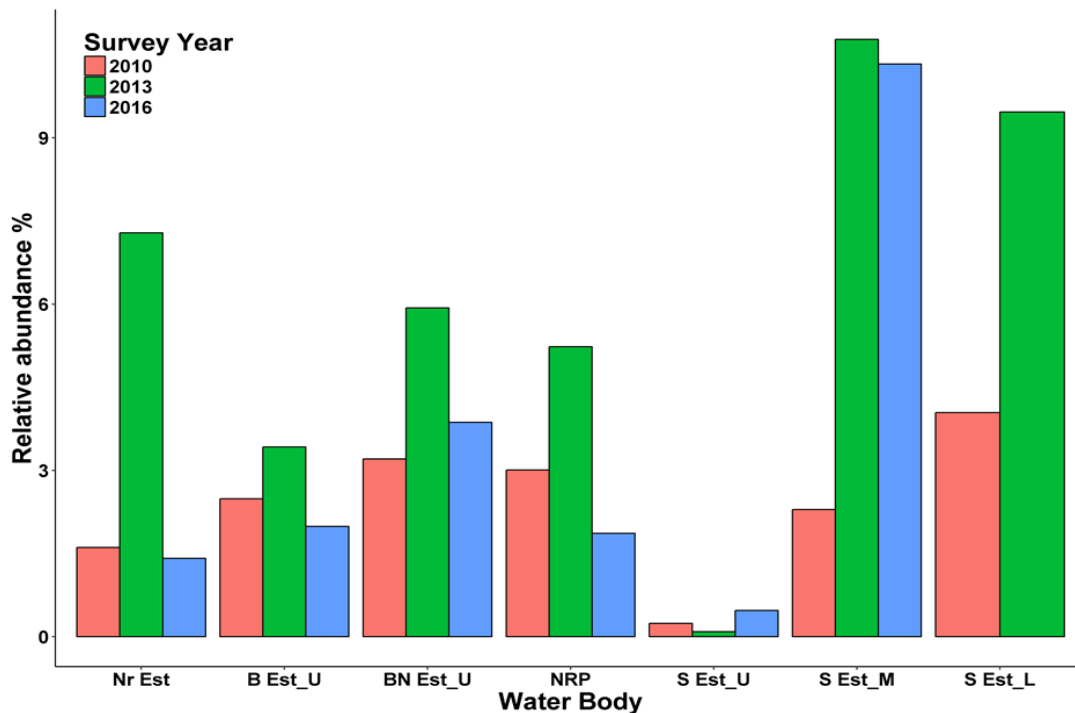


Fig 11: Relative abundance of European Eel captured within each site during the last three WFD surveys of the Barrow Suir Nore Estuary. Nr Est: Nore, B Est_U: Barrow Upper, BN Est_U: Barrow Nore, NRP: New Ross Port, S Est_U: Suir Upper, S Est_M: Suir Middle, S Est_L: Suir Lower.

4.1.8 Bass

Numbers of juvenile European Sea Bass encountered increased considerably in the 2016 survey (Fig. 12). As a result, overall relative abundance also increased (Fig. 7). Juvenile Bass were captured in relatively large numbers at particular sites, highlighting their patchy distribution. They made up 2% of all captures within the New Ross Port waterbody but were not found anywhere else in the estuary complex. Three larger specimens were captured in the lower sections of the estuary, Sizes ranged from 25-33cms.

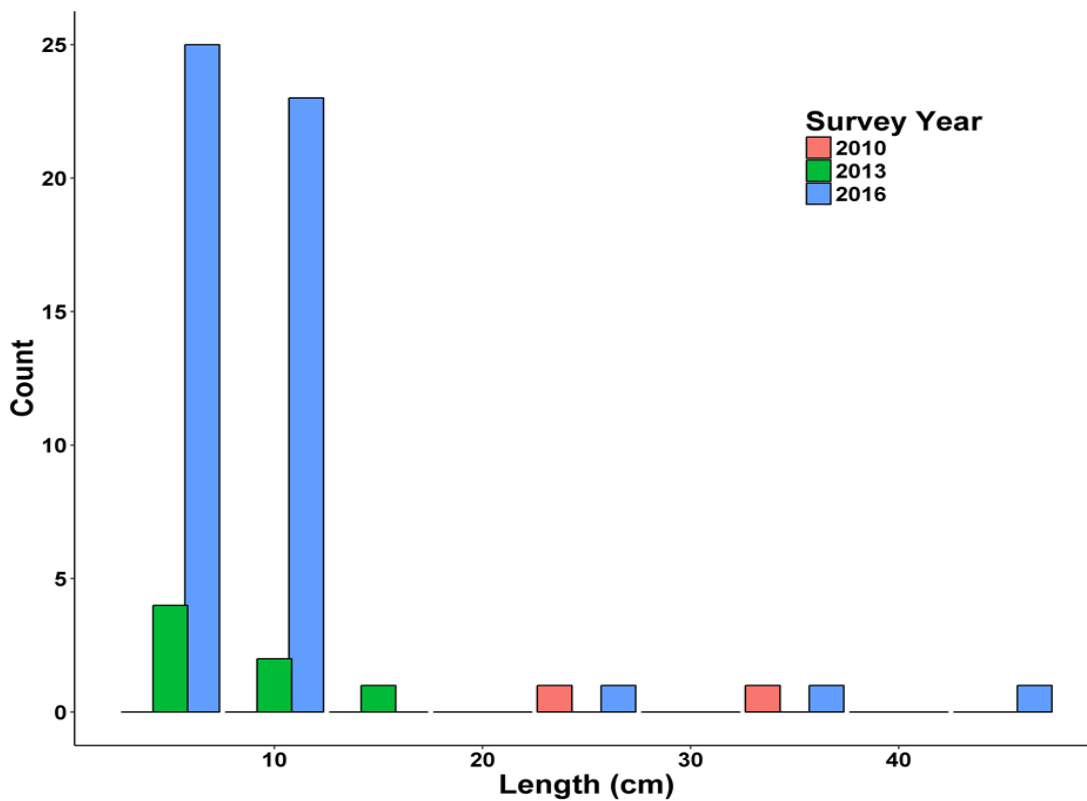


Fig 12: Length frequency analysis of Sea Bass captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

4.1.8 Thick Lipped Mullet

Large numbers of juvenile Thick Lipped Grey Mullet were captured in the estuary in 2016, similarly to the previous two surveys (Fig. 13). They are widely distributed throughout the lower sections of the estuary. Although, there is considerable variation as to where the largest proportions of juvenile mullet were encountered between sampling years, their presence was a constant (Fig. 14).

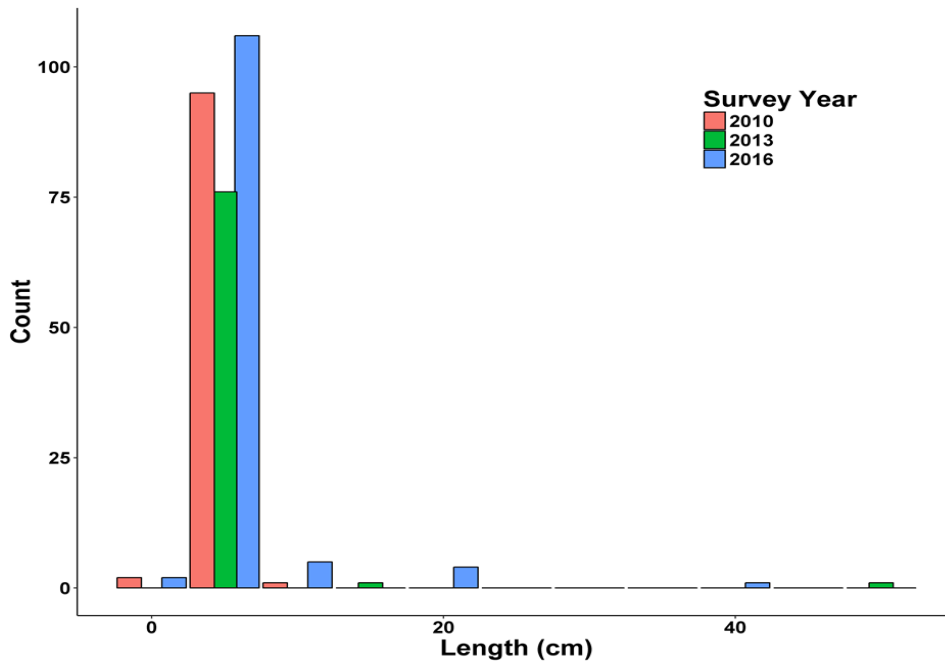


Fig 13: Length frequency analysis of Thick Lipped Grey Mullet captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

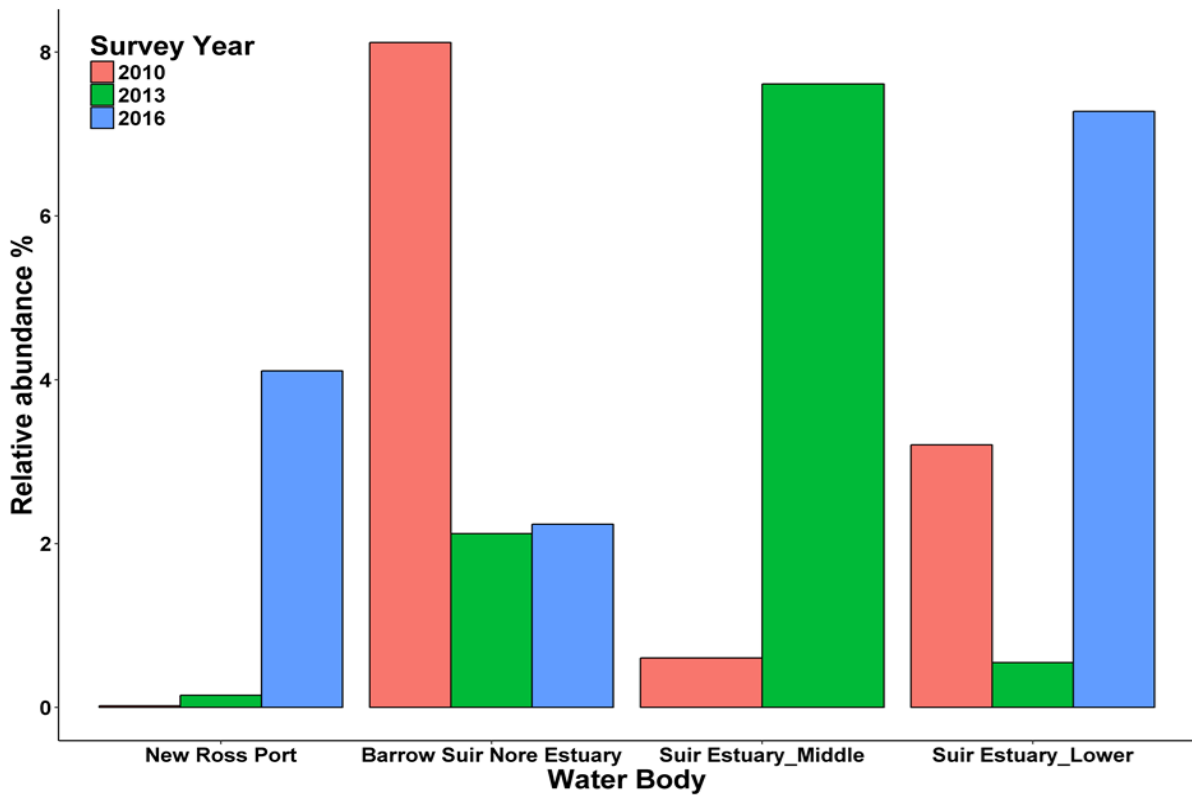


Fig 14: Relative abundance of Thick Lipped Grey Mullet captured within each site during the last three WFD surveys of the Barrow Suir Nore Estuary.

4.1.9 Dace

Dace were the dominant species captured in the Upper Barrow estuary. It was the same in 2013. Although not so dominant in The Nore Estuary, Dace still make up 20% of all fish captures. Only three Dace were captured in the upper Suir estuary, which is a large reduction on 2013, when they were the second most dominant species (Fig. 15). The population structure of Dace within the estuary complex indicates that while there are less small individuals than previous years, the population remains quite stable (Fig. 16).

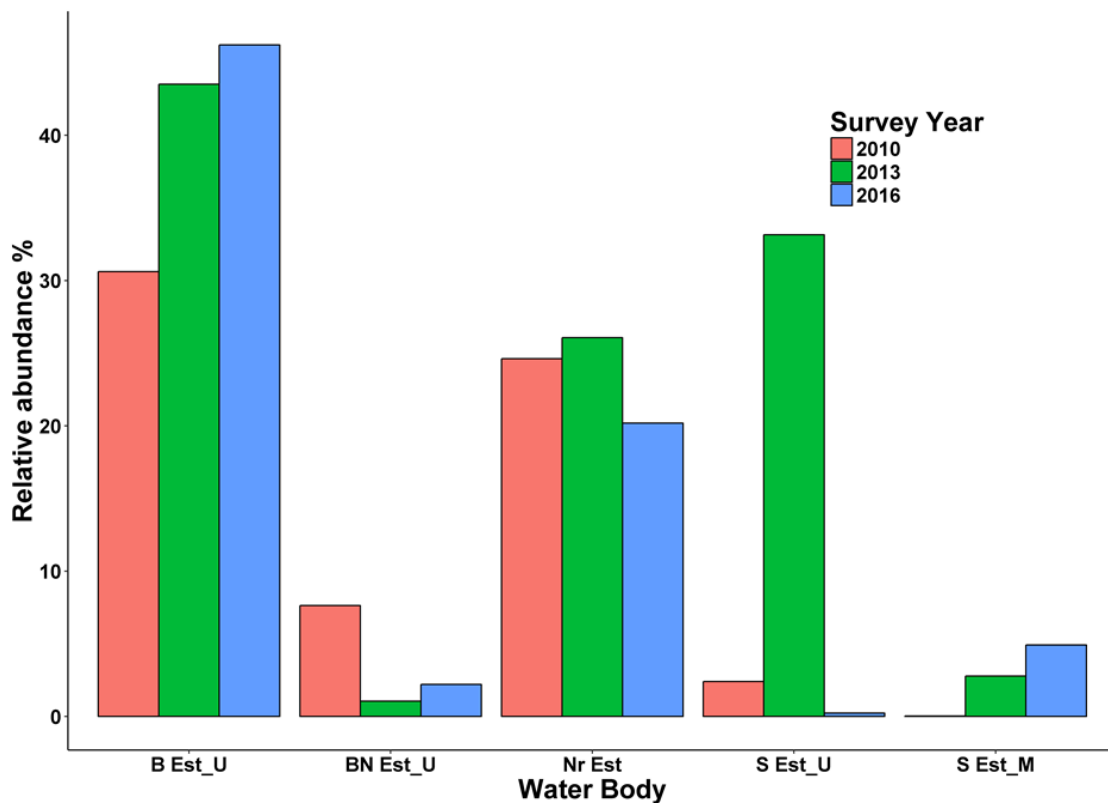


Fig 15: Relative abundance of Dace captured within the upper sites during the last three WFD surveys of the Barrow Suir Nore Estuary. B Est_U: Barrow Upper, BN Est_U: Barrow Nore, Nr Est: Nore, S Est_U: Suir Upper, S Est_M: Suir Middle.

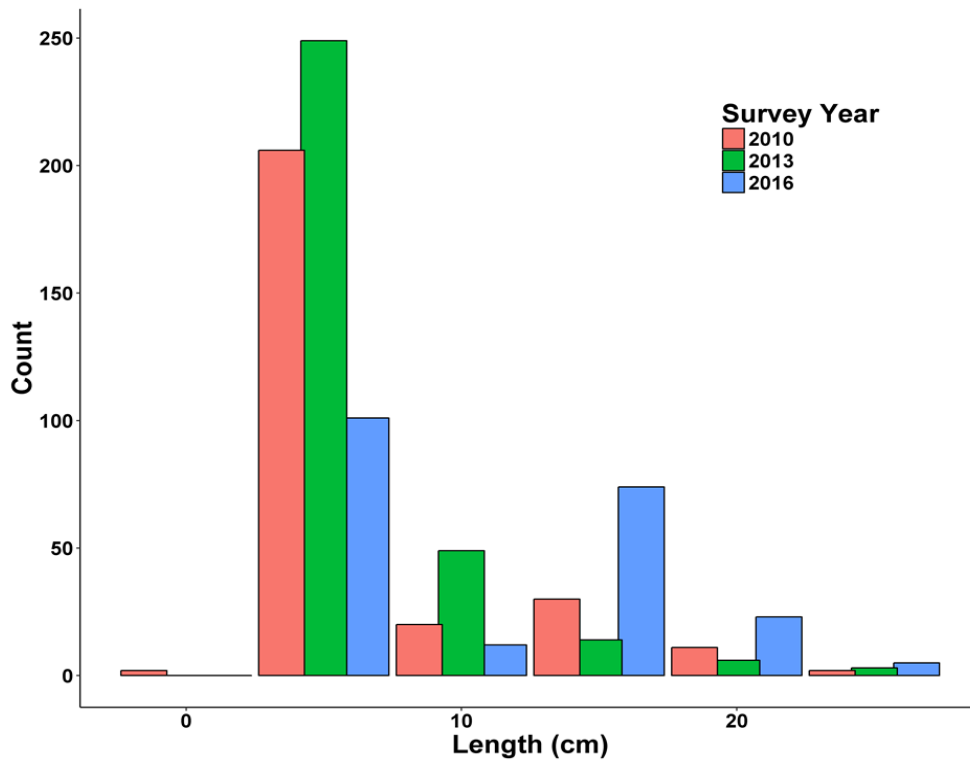


Fig 16: Length frequency analysis of Dace captured during the last three WFD surveys of the Barrow Suir Nore Estuary.

4.1.10 Other species of interest

Nine sea trout were captured in the upper sections of the estuary complex. Lengths ranged from 17-28cms.

Two salmon (7.5 and 14.9cm) were captured in the upper and middle Suir estuaries. A single 44cm thin lipped mullet was caught in the lower Suir estuary.

Twenty-one juvenile plaice were captured (4.9-7.8cm) in the lower section of the estuary within the Barrow Suir Nore water body in 2016. In fact, all plaice specimens were captured in a single netting effort, on a gently sloping sandy beach, in high saline conditions. The vast majority of juvenile plaice captured during previous surveys were in close proximity to the current netting location.

4.2 EMFI Quality Ratings

River basin District (RBD)	Transitional waterbody	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Eastern RBD	Boyne Estuary			Moderate			Good			Good	
	Avoca Estuary		Moderate		Good					Good	
Southern RBD	Barrow NoreT	Moderate			Moderate			Good			Good
	BarrowNore Suir T										Good
Southwestern RBD	SuirT	Good			Good			Good			Good
	Bandon Estuary			Good							Good
	Argideen Estuary		Moderate								
	Drongawn Lough										Moderate
Shannon iRBD	Castlemaine Harbour					Moderate				Good	
	Gill Lough									Moderate	
	Lee Estuary (Tralee)		Poor							Moderate	
	Shannon T		Moderate						Moderate		
Western RBD	Fergus Estuary		Moderate						Moderate		
	Kinvarra Bay			Good						Good	
	Camus Bay			Good						Good	
Northwestern iRBD	Ballysadare Estuary		Moderate							Good	
	Erne Estuary			Moderate			Moderate			Moderate	
	Gweebarra Estuary			Good			Moderate			Good	

Table 4: Schematic of EMFI quality ratings of all waterbodies sampled during the Transitional waterbody survey programme and their variation between sampling times. Rating in table equates to actual year of survey and ratings are extended to next survey.

For the purposes of assigning quality status, the estuary complex is broken up as three self-sustaining transitional waterbodies made up of various combinations of the waterbodies described in Table 1. Barrow Nore Suir T (all eight water bodies), Barrow Nore T (Nore Estuary, Barrow Upper, Barrow Nore Upper, New Ross Port, Barrow Suir Nore) and Suir T (Suir Upper, Suir Middle, Suir Lower, Barrow Suir Nore). All transitional waterbodies remained at good status for 2016 (Table 4).

4.3 Trawling Survey – Bass oriented sampling

A total of 16 trawls were made in the lower sections of the estuary complex over two days (Fig. 17). 1018 individual fish were captured, counted and identified to species level prior to release. In total 26 different fish species were caught. This included eight species which were not encountered during the WFD survey (Table 5).

Whiting made up the largest proportion of the catch, with over 30% of all captures, followed by flounder and plaice (26% and 10% respectively). Plaice and whiting abundance was highly dependent on sampling area, with a higher proportion of total captures in the most downstream waterbody, than in the other two sampled. Flounder proportions were more even between the waterbodies (Fig. 18). Scad, a species which was not detected in the WFD survey made up close to 5% of total catch in the trawl survey. The catch was concentrated in New Ross Port (Fig. 18).



Fig 17: Map of the lower Barrow Suir Nore estuary, showing trawl tracks during the 2016 IFI trawl survey.

Species (Scientific name)	Species (Common name)	Total count	Count measured	Ave length (cm)	Max length (cm)	Min length (cm)	Relative abundance %
<i>Ciliata mustela</i>	5 Bearded Rockling	1	1	12.2	12.2	12.2	0.1
<i>Labrus bergylta</i>	Ballan Wrasse	1	1	16.0	16	16	0.1
<i>Dicentrarchus labrax</i>	European Seabass	39	39	25.4	46	16.5	3.8
<i>Scophthalmus rhombus</i>	Brill	3	3	16.3	21.6	12.6	0.3
<i>Gadus morhua</i>	Cod	16	16	14.4	20	10.8	1.6
<i>Solea solea</i>	Common Sole	9	9	20.1	26	18	0.9
<i>Limanda limanda</i>	Dab	9	9	20.6	31.5	14.1	0.9
<i>Anguilla anguilla</i>	Eel	1	1	53.0	53	53	0.1
<i>Platichthys flesus</i>	Flounder	271	138	17.6	135	9.1	26.6
<i>Pomatoschistus Sp.</i>	Goby	10	0	NA	NA	NA	1.0
<i>Clupea harengus</i>	Herring	21	21	20.3	26	9.5	2.1
<i>Syngnathus rostellatus</i>	Nilsson's pipefish	2	2	16.0	16.4	15.5	0.2
<i>Scylliorhinus canicula</i>	Lesser Spotted Dogfish	9	9	61.0	65	55	0.9
<i>Echiichthys vipera</i>	Lesser Weever	1	1	13.0	13	13	0.1
<i>Pleuronectes platessa</i>	Plaice	100	100	15.3	47.5	5.5	9.8
<i>Agonus cataphractus</i>	Pogge	12	12	10.8	14	8.5	1.2
<i>Pollachius pollachius</i>	Pollack	20	20	14.7	18.9	10.6	2.0
<i>Trisopterus luscus</i>	Pouting	2	2	11.3	13.5	9	0.2
<i>Trachurus trachurus</i>	Scad	49	46	8.1	13.6	5	4.8
<i>Salmo trutta</i>	Sea Trout	1	1	22.5	22.5	22.5	0.1
<i>Osmerus eperlanus</i>	Smelt	51	12	11.5	17.5	7	5.0
<i>Mustelus asterias</i>	Smoothhound	3	3	90.8	100.5	80	0.3
<i>Sprattus sprattus</i>	Sprat	25	7	6.9	9	5.1	2.5
<i>Chelon labrosus</i>	Thick Lipped Grey Mullet	36	26	37.5	61	23.3	3.5
<i>Chelidonichthys lucerna</i>	Tub Gurnard	19	19	23.3	32	9.5	1.9
<i>Merlangius merlangus</i>	Whiting	307	127	14.2	28	7.8	30.2

Table 5: List of species captured during the 2016 IFI Trawling survey of the Barrow Suir Nore estuary. Species not encountered in the WFD survey shown in bold.

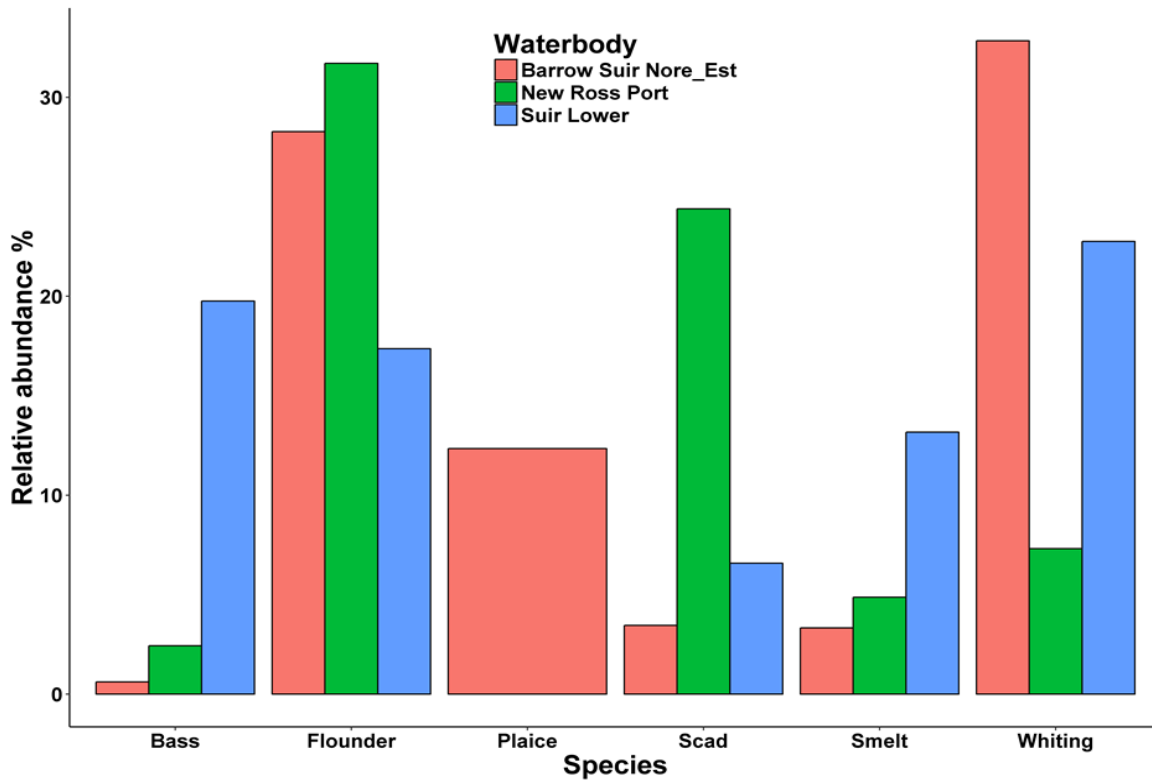


Fig 18: Relative abundance of named species within waterbody sections in the lower Barrow Suir Nore estuary complex captured during the WFD trawling survey 2016.

Otherwise, all other species captured in the trawl survey but not in the WFD survey, were caught in deep channels in the Barrow Suir Nore waterbody, with the exception of herring, where four specimens were caught further upstream.

A range of flatfish species of angling interest were captured during the survey. A diverse population of plaice was caught close to but in deeper water than the juveniles caught during the WFD survey. Brill, dab and common sole were also encountered albeit in smaller numbers (Fig. 19).

A diverse population of whiting was also encountered throughout the survey area, with lengths ranging from 7.8 to 28 cm. A number of juvenile cod and pollack were caught. (Fig. 20). All specimens were caught in the lowermost section of the estuary.

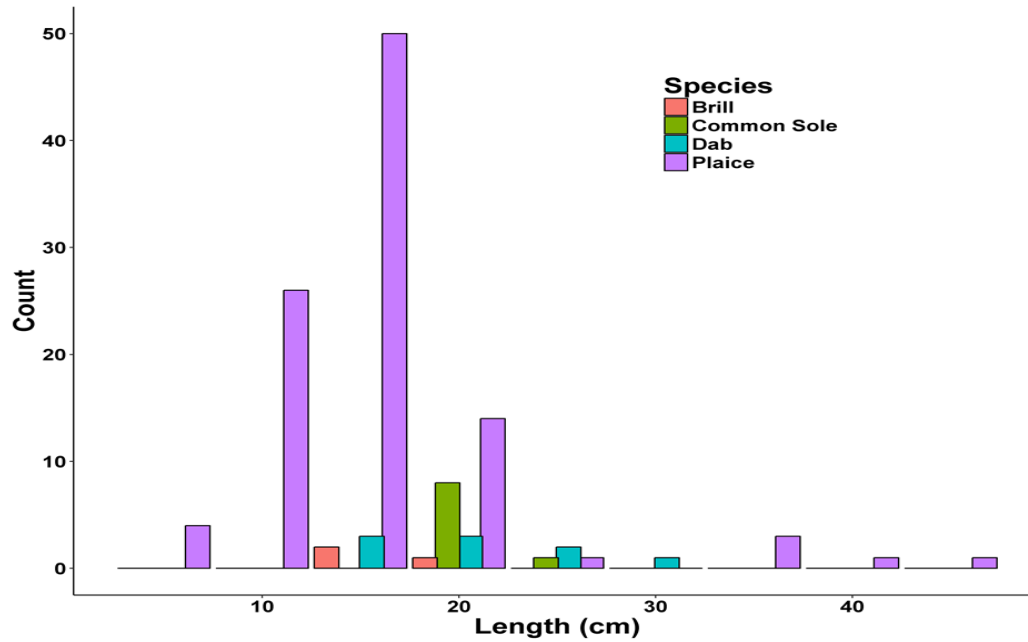


Fig 19: Length frequency analysis of selected flat fish species captured during the IFI trawling survey of the Barrow Suir Nore Estuary 2016.

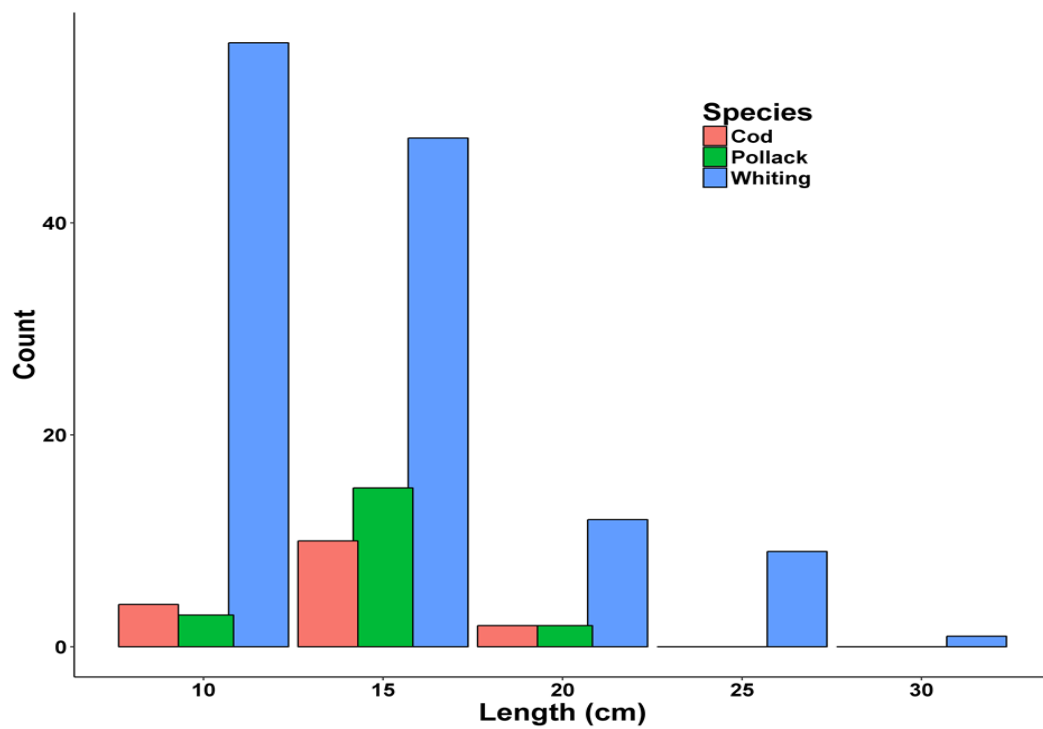


Fig 20: Length frequency analysis of selected codfish species captured during the IFI trawling survey of the Barrow Suir Nore Estuary 2016.

Juvenile bass were caught in relatively high numbers, nearby the sites which produced a high abundance of smaller juvenile Bass during the WFD survey. A range of Thick-lipped Grey Mullet was also captured throughout the survey area. The biggest of which was 61cm (Fig. 21).

5. Discussion

The Barrow Nore transitional waterbody improved from “moderate” to “good” status between 2010 and 2013 up to the current survey (2016). This improvement was due largely to a reduction in the relative abundance of sprat captures. In 2007 and 2010, sprat dominated the catch, resulting in a reduction in the EQS score for the waterbody. This is because environmental stress in a habitat generally results in a change in relative abundance from ‘diverse’ communities consisting of many fish species in relatively low proportions to ‘simple’ assemblages dominated by a few species (Harrison and Kelly 2013). However, sprat is a highly mobile marine species which tends to shoal in autumn around the Irish coast. If shoals have entered an estuary during sampling it is likely that large numbers will be caught. However, this is not necessarily an indication that the habitat is under environmental stress but rather due to sprat biology.

Flounder and sand goby consisted of nearly half of all captures during the survey, which is indicative of transitional waterbodies which have a large fluvial influence. Both gobies and juvenile flounder are associated with muddy substrates caused by fluvial deposition, where they feed on plant matter and invertebrates associated with mud (Aarnio *et al.* 1996). Subsequently, these species provide an abundant and important food source for piscivorous fish feeding within the shelter of the estuary.

The WFD data collected over the previous six years provides evidence that the estuary consistently supports large population of juvenile mullet, European sea bass and twaite shad. It is likely that the estuary complex provides an important nursery function for the these species in and around the estuary.

WFD survey data provides good evidence that a gently sloping beach close to the limit of the Barrow Nore Suir Estuary complex is likely to be a highly productive nursery area for plaice populations around the south coast of Ireland. Larger juveniles were captured close by, but further into the channel, during the IFI trawling survey. This provides further evidence of an important nursery function where spatial stratification between age classes is evident.

According to WFD data collected, no common goby were captured in 2013 or 2010. However, a number of the sand goby captured were recorded in the upper sections of the estuary. It is well known that it is extremely difficult to distinguish between sand and

common goby in the field and a published rule of thumb is if it is in the upper estuarine and salinity is lower than full strength sea-water, it is more likely to be a common goby, (Henderson, 2014).

Dace were first reported in the Barrow River in 1994. Since then they have thrived within the river system (Delanty *et al.* 2017). They have also established themselves in the upper Barrow estuary to such an extent that they are now the dominant species in that particular section of the estuary complex. Although no dace fry were detected, it is possible that spawning is occurring in the upper estuary, as per dace populations in the Upper Thames estuary (Thomas 1998). Otherwise, the population must depend on migrants from the riverine habitat upstream. The fact that an introduced species is now the dominant species in upper sections of the estuary is likely to have an effect on current and future ecosystem functioning, potentially influencing EQR status in the future.

Comparisons between the current and previous WFD surveys suggest that there was a substantial increase in age 0 bass abundance. However, potential bass nurseries with regard to particular site characteristics were targeted for sampling in 2016, which was not the case in previous WFD surveys. This may be the reason for more captures and not only that more larval bass settled in the estuary in 2016. The trawling survey encountered older juvenile bass in the 1 and 2 age classes. These results provide evidence of a well-functioning and stratified nursery, in which juveniles are successfully developing within the estuary system.

A large number of species were recorded in the estuary during the IFI trawling survey, which were not caught during the WFD survey. These species are associated with the marine, but were captured well within the environs of the estuary. The work provides evidence that if a complete picture of species richness is required within larger estuaries, such as the Barrow Suir Nore complex, a method which can effectively sample deep sections of the water body should be included as part of the overall sampling protocol. Cost can be a deterrent against conducting a trawling survey but the disparity in species between two different sampling approaches is noteworthy.

The Barrow Nore Suir transitional waterbody is one of the largest in the country. Not only is the estuary a vital transit route for diadromous species of international importance, such as salmon, eels and twaite shad, this report has shown its importance as a nursery for marine species of both angling and commercial importance. Currently fish populations are sufficiently diverse for it to achieve good status. However, it is adjacent to some large population centres, namely Waterford city and New Ross, which may periodically influence its status. The invasion of dace throughout the upper sections of the estuary is another clear pressure which should continue to be monitored.

6. References

Aarnio, K., Bonsdorff, E., & Rosenback, N. (1996). Food and feeding habits of juvenile flounder *Platichthys flesus* (L.), and turbot *Scophthalmus maximus* (L.) in the Åland archipelago, northern Baltic Sea. *Journal of Sea Research*, 36, 311-320.

Able, K. W. (2005). A re-examination of fish estuarine dependence: evidence for connectivity between estuarine and ocean habitats. *Estuarine, Coastal and Shelf Science*, 64, 5-17.

Beck, M. W., Heck Jr, K. L., Able, K. W., Childers, D. L., Eggleston, D. B., Gillanders, B. M., Halpern, B., Hays, C.G., Hoshino, K., Minello, T.J. & Orth, R.J. (2001). The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates: a better understanding of the habitats that serve as nurseries for marine species and the factors that create site-specific variability in nursery quality will improve conservation and management of these areas. *Bioscience*, 51, 633-641.

Delanty, K., Kelly, F.L., McLoone, P., Matson, R., O' Briain, R., Gordon, P., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., Feeney, R., Morrissey, E. (2017) Fish Stock Assessment of the River Barrow Catchment 2015. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Gillanders, B. M., Able, K. W., Brown, J. A., Eggleston, D. B., & Sheridan, P. F. (2003). Evidence of connectivity between juvenile and adult habitats for mobile marine fauna: an important component of nurseries. *Marine Ecology Progress Series*, 247, 281-295.

Harrison, T. D., & Kelly, F. L. (2013). Development of an estuarine multi-metric fish index and its application to Irish transitional waters. *Ecological indicators*, 34, 494-506.

Henderson, P. A. (2014). *Identification Guide to the Inshore Fish of the British Isles*. Pisces Conservation.

Pickett, G.D., Brown, M., Harley, B. and Dunn, M.R. (2002). Surveying fish populations in the Solent and adjacent harbours using the CEFAS bass trawl. Scientific Series Technical Report, CEFAS Lowestoft, 118: 16pp.

Thomas M. (1998). Temporal changes in the movements and abundance of Thames estuary fish populations. In: Attrill M.J. (eds) *A Rehabilitated Estuarine Ecosystem*. Springer, Boston, MA

Vasconcelos, R. P., Reis-Santos, P., Costa, M. J., & Cabral, H. N. (2011). Connectivity between estuaries and marine environment: Integrating metrics to assess estuarine nursery function. *Ecological Indicators*, *11*, 1123-1133.