

Ecological Study of the Coastal Habitats in County Fingal

Phase III – Estuarine Fish

Fish



Fingal County Council
December 2004

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Ecological Study of the Coastal Habitats in County Fingal

Phase III – Estuarine Fish

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&

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December 2004



Acknowledgements and Project Personnel

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The Survey teams

The survey team was a 4-person unit, operating for a 4-day period in each estuary in late May 2004 and late September-early October 2004. Each team was imbued with enthusiasm and good humour and made the task an enjoyable one. The following staff combined to make up the individual survey team:

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1. Introduction

Because of the ecological importance of the Fingal coast, Fingal County Council initiated an ecological study of the coastal habitats in the County in 2003. This study is the first large-scale ecological study that is being undertaken as part of the county council's Local Biodiversity Action Plan Program. The study will provide detailed and up-to-date information on the status of the coastal habitats and species. This will allow for the preparation of tailor-made action plans for the coastal habitats and flora & fauna species. It is envisaged that the ecological study will be carried out in four phases over the 2003 – 2005 period. This will allow the action plans for the coastal habitats and associated species to be prepared at the end of 2005.

The estuarine fisheries study is part of PHASE III of the ecological study. After assessing the existing ecological data for the Fingal Estuaries it became apparent that data on the fish community was the only missing component of the aquatic system and that no fisheries data has ever been collected in Ireland on the type of estuary found in Fingal: relatively small sized, shallow and with muddy-sandy substrata. The proposal to work on the estuaries in Fingal, with an initial emphasis on Rogerstown and Broadmeadow, would therefore not only provide baseline data for the County's Biodiversity program, it also contributes to the national database on fish in transitional waters as required under the EU Water Framework Directive (WFD) and the data will also be of relevance to the Eastern River Basin District (ERBD) established under the WFD.

Many species avail of the highly productive nature of many estuaries and their use will vary with the seasons. Some fish species can be found in the estuaries the whole year round. Other fish are migratory, travelling through estuaries from the sea to reach spawning grounds in freshwater, such as salmon and lamprey, while others, such as eel, migrate down estuaries to the sea. The aim of this study is to provide a better insight into fish species can be found in the Broadmeadow and Rogerstown Estuaries throughout the year.

The objectives of the estuarine fisheries study are as follows:

- Establish which fish species can be found in the Broadmeadow and Rogerstown Estuaries.
- Establish seasonality patterns of estuarine fish community for Fingal estuaries
- Establish the conservation status of the fish present.
- Compare the fish community of the Fingal estuaries to other estuaries in Ireland

Fingal County Council commissioned the Central and Eastern Fisheries Boards to undertake the fisheries assessment. In addition to the scientific collection of information on fish species present, an educational element for primary schools was also included the surveys. The latter was facilitated through the Eastern Regional Fisheries Boards 'Dublin Angling Initiative'.



Fingal
Biodiversity
Programme

2. The Study Sites

Both estuaries are well-sheltered from the open sea, with ingress of salt water possible through a narrow channel in each case.

Rogerstown is the more northerly of the two estuaries. A long, very narrow channel leads from the open sea to the main chamber of the estuary. There is a strong surge of tide through this narrow channel during periods of falling and rising tide. The central channel here is the deepest area of the estuary and provides permanent mooring for yachts at all stages of the tide. The extreme western corner of Rogerstown is partly isolated by the viaduct carrying the Dublin – Belfast rail line. The freshwater inflows enter this western corner and merge to form the Turvey channel. There are extensive areas of mud and sand-mud flats in the area to the west of the railway viaduct. In the main basin, much of the open-water area is very shallow with a maximum depth, at high tide, little exceeding 2m. A large proportion of the main basin dries out at low tide. The bed in this area is composed of sand or sand-mud. Along its northern shoreline the sand gives way to a stony shingle area in the intertidal and high-tide zone. The eastern shore has a stony bed. The shoreline slope is very gradual in most of the estuary, with an elevated slope along the eastern side only.

Broadmeadow is similar to Rogerstown in having a narrow tidal raceway opening to a larger central basin, in being very

shallow throughout and in having large areas of exposed bed at low tide. The Dublin – Belfast rail line also crosses this estuary. Unlike Rogerstown, however, there is a very substantial retention of water on the western or upstream side of the viaduct at low tide. This means that, while the eastern side dries out to a very large degree at low tide, the western side of the rail line experiences a reduced tidal impact and small water level fluctuations. The Broadmeadow and Ward rivers discharge at the extreme western end of Broadmeadow estuary. The volume discharge of freshwater is substantially greater than that entering Rogerstown. There are extensive deposits of mud in the western area of the estuary while the main body to the west of the railway viaduct has a bed of sand or sandy mud.

Both estuaries are identified as important wildlife and leisure resources and have SAC, SPA and NHA status. Wild bird sanctuaries are established in both and Rogerstown is a designated nature reserve. The two estuaries provide safe harbour for yachting at Rush Sailing Club (Rogerstown) and at Malahide Marina (Broadmeadow). The inner waters of Broadmeadow, with its limited tidal range, is a Mecca for water-based sports and training schools for canoeing, wind-surfing and sailing flourish along the southern shore.

Typical beach-seine sampling sites in Rogerstown (R) and Broadmeadow (BM)



Sandy beach (BM)



Bank of mud / sand (R)



Sandy gravel with green seaweed (R)



Gravel / stony shore with brown seaweed (BM)

3. Sampling Methods

CFB has been sampling fish in estuaries in recent years, the impetus coming from interest in juvenile stages of bass and shad as well as in migrating anadromous lampreys. Simultaneously, the Water Framework Directive has led to a requirement to have knowledge on composition and abundance of fish communities in estuaries (or transitional waters). The sampling programme adds to our knowledge of fish distribution and status in Irish estuaries and contributes to fulfilling national requirements in regard to the Habitats Directive, Water Framework Directive and Biodiversity considerations.

Current work in the UK indicates the need for a multi-method approach to sampling for fish and this approach has also been adopted by CFB. The CFB approach involves beach seining with fine mesh nets and the setting of fyke- or ring nets overnight along with gill nets of different mesh size.

The sampling process is designed to collect in a series of littoral and open water sites characteristic of the estuary under study. The CFB approach has been to take single samples with beach seine over a range of bed types and shoreline slopes. The net is set in all tidal conditions – depending on the nature of the site and the flow conditions, as some sites are accessible, and present specific ecological conditions, at particular stages of the tide only. Naturally, the net cannot be deployed in situations of fast flow.

At the completion of each haul a list of all fish species encountered was compiled. Fish were sorted by species and batch weighed. Representative sub samples of species were measured (fork length) within 1cm length groups.

Fyke- and gill nets are allowed to fish overnight and the contents sampled, as above, the following day. Fyke nets operate in the manner of lobster pots, with the fish swimming in but unable to escape through the entry. These nets are set on the channel bottom and are ideal for catching cylindrical or snake-like fish such as lampreys and eel that would be too narrow in the body for capture in gill-nets. Gill nets are intended to capture fish swimming in open water, the nets forming a wall of netting in the water column. Two different mesh sizes were used in the netting operations, intended to intercept small and larger fish.

Table 1. Sampling effort in each of the estuaries in each season

Estuary	Season	No. beach Seines	No. fyke sets	No. gill sets
Rogerstown	Spring	11	3	2
	Autumn	16	5	3
Broadmeadow	Spring	9	4	3
	Autumn	12	9	4



All three netting operations were used in both Rogerstown and Broadmeadow. Sites for overnight fishing were limited due to the extreme changes in water level between low- and high tide, with many areas drying out completely at low tide.

Some potentially interesting sites for beach seining were inaccessible due to unsuitable tidal conditions for time-of-day. The location of sampling stations, and methods used, are shown in Figs 1.

Work in the UK has identified the desirability of netting in both spring and autumn, as different fish assemblages are present in each season. In the present study, netting was undertaken in late May and again in late September – early October.

Figure 1. Fish sampling Stations in the Broadmeadow and Rogerstown Estuaries, Autumn 2004



4. Findings from the Fisheries Study

4.1 Biodiversity in the estuaries

A total of 24 species or taxa were recorded, between the two estuaries, in the present study. The species captured represented those living in shallow water close to the shore (littoral species) as well as those living in open water (pelagic species) and those living on the bed in deeper water. Many of the species were small while some were captured as juvenile fish. In some cases, as with flounder and mullet, both adult and juvenile stages were taken.

Fish species in estuaries have been allocated to specific 'functional groups' based on their use of the habitats available in an estuary. This allocation has been applied to the species found in the current survey (Table 3). Estuarine Residents (ER) are those species considered to spend all, or the majority of, their life cycle in an estuary. In general, the most prominent members of this group are flounder and the gobies and this was also the case in both Rogerstown and Broadmeadow. Seven estuarine residents were recorded in this study (Table 3) and both flounder and goby were prominent and widespread in beach seine hauls. Six of the seven species were found in both estuaries with Pogge being the exception. A single individual of this species was found in one location, only, in Rogerstown.

Marine Juveniles (MJ) refers to those fish that have residency in an estuary as juveniles but who may spend much of the rest of their life cycle elsewhere, generally at sea. Of the six Marine Juveniles recorded in this study, five were recorded in both estuaries in both seasons (Table 3). The sixth Marine Juvenile was a single specimen of Black Sea Bream taken in Broadmeadow in autumn. Young cod were captured in the spring survey but larger numbers of larger gadoids, both cod and pollack, were taken in open water in fyke nets in the autumn survey. Of particular importance was the presence, admittedly in small numbers, of juvenile bass in both waters. The size range of the bass indicated the presence of more than one age group. Thus the estuaries act as refuge areas for these Marine Juveniles, some of which are of economic importance while others, such as the bass, are a much prized angling species. Stocks of bass have fallen to such low levels in Ireland that a special bass bye-law has been in place for many years. This restricts the size of fish that can legally be caught and has been keenly supported by anglers, conscious of the value and quality of bass angling. The Fingal estuaries were once prized as bass fishing spots, with their areas of surf beach, and the presence of juvenile bass in the present survey is considered to be very significant in conservation terms.

As the name suggests, the Marine Seasonal species move into estuaries on a seasonal basis and may not be present all year round, unlike the Marine Juveniles. Four Marine Seasonals were taken in the present study. The status of Sprat/Herring is indicative of a seasonal use of the estuary by a species (see Section 4.3.4 below). The mullet data showed a strong seasonal basis in the case of Broadmeadow, with an autumn presence of young-of-the-year and a spring presence of older fish in the 15 – 23 cm size range. The five-bearded rockling was found in both seasons in both estuaries in open water. Thus, in these estuaries it may have a less seasonal habit than in other waters.

The Marine Adventitious (MA) functional group reflects an opportunistic or haphazard movement from the marine area into coastal or estuarine waters. None of the three species recorded for this group in this study had a widespread distribution and the small number of specimens was taken in more marine locations of the estuaries. All of the lesser-spotted dogfish were taken in Broadmeadow adjacent to the marina and the south shore at the Grand Hotel. These areas are under full tidal influence and experience major water exchange at each tidal cycle.

Catadromous fish (CA) are those that spend part of their life cycle in fresh water and part at sea. Thus fish of this group use estuaries as a transit route between river and sea. The eel was the best-known of the three Catadromous fish recorded in the present study. Juvenile eel penetrate into the estuary having crossed the Atlantic Ocean from their birth area in the Sargasso Sea. A large haul of small eel of 'bootlace' size was



European eel – a Catadromous species

taken in Broadmeadow adjacent to the feeding area for swans at the mouth of the Broadmeadow River. Larger eel were taken in both estuaries. Some of these would maintain an estuarine residency while others would migrate up into the Ward and Broadmeadow Rivers and into the Turvey channels. Fish would grow on to maturity over many years in these rivers before finally descending down to sea, through the estuaries, to migrate to the spawning grounds in the Gulf of Mexico.

Table 3. A list of the species recorded in the present survey. Both common and scientific names are given. (For Functional Groups see text and foot of table)

Species Name	Common Name	Functional Group	Rogerstown	Broadmeadow
<i>Patichthys flesus</i>	Flounder	ER	Yes	Yes
<i>Gobio</i> spp.	Goby species	ER	Yes	Yes
<i>Spinachia spinachia</i>	15-spined stickleback	ER	Yes	Yes
<i>Myxocephalus scorpius</i>	Short-spined sea scorpion	ER	Yes	Yes
<i>Syngnathus</i> sp.	Pipefish	ER	Yes	Yes
<i>Pholis gunnellus</i>	Butterfish	ER	Yes	Yes
<i>Agonus cataphractus</i>	Hooknose or Pogge	ER	Yes	No
<i>Pleuronectes platessa</i>	Plaice	MJ	Yes	Yes
<i>Atherina presbyter</i>	Atherine	MJ	Yes	Yes
<i>Dicentrarchus labrax</i>	Bass	MJ	Yes	Yes
<i>Pollachius pollachius</i>	Pollack	MJ	Yes	Yes
<i>Gadus morhua</i>	Cod (codling)	MJ	Yes	Yes
<i>Spondyliosa cantharus</i>	Black Sea Bream	MJ	No	Yes
	Sprat / Herring	MS	Yes	Yes
<i>Crenimugil labrosus</i>	Thick-lipped grey mullet	MS	Yes	Yes
<i>Liza auratus</i>	Golden mullet	MS	Yes	Yes
<i>Ciliata mustela</i>	5-bearded rockling	MS	Yes	Yes
<i>Labrus bergylta</i>	Ballan wrasse	MA	Yes	Yes
<i>Blenius gattoruginae</i>	Tompot Blenny	MA	No	Yes
<i>Scyliorhinus caniculus</i>	Leser-spotted dogfish	MA	No	Yes
<i>Ammodytes tobianus</i>	Sandeel	ER/MA	Yes	Yes
<i>Liza ramada</i>	Thin-lipped grey mullet	CA	Yes	Yes
<i>Gasterosteus aculeatus</i>	3-spined stickleback	CA	Yes	Yes
<i>Anguilla anguilla</i>	Eel	CA	Yes	Yes

Key to Table for Functional Groups: ER = Estuarine resident; CA = Catadromous; MA = Marine adventitious; MJ = Marine juvenile; MS = Marine seasonal.

Estuarine Residents from Rogerstown and Broadmeadow:



Goby



Flounder





nder



Short-spined sea scorpion



Pipefish

15-spined stickleback

Sandeel

Marine Juveniles in Rogerstown and Broadmeadow



Cod



Small cod



Pollack



Tompot Blenny



Small Tompot Blenny



Ballan Wrasse



5-Bearded rockling



Black Sea Bream



Pogge

4.2 Overview of findings from each estuary

4.2.1 Rogerstown

Spring Survey: A total of 16 sites were examined over the four-day period 17-20th May 2004 (Fig. 1). Within these sites, 13 taxa were encountered (Table 1). The fish assemblages captured by beach seine were dominated by three groups – Flounder, 3-spined stickleback and Gobies. Each of these groups was present at, as a minimum, 10 of the sites surveyed (Fig 3). Flounder were captured in all net types while the gobies and stickleback were only captured in the fine-mesh beach seine. The majority of fish taxa were taken at a small number of stations, with five taxa recorded at one station each.

The beach seine captured the largest number of fish types, 10 in total. Mullet and flounder were taken in the gill nets. Both species were also taken in the beach seine but the gill net samples were of larger fish. The fyke nets captured eel, one of the principal targets of this net type. Five-bearded rockling were a common feature in the fyke nets.

Autumn Survey: The autumn survey took place from 28th September to 1st October. A total of 24 netting efforts took place yielding 15 species. Sprat/herring, flounder and goby were the dominant species in beach seine samples (Fig 4). The fyke nets captured eel and 5-bearded rockling in small numbers. Adult mullet, in small numbers were taken in the gill nets.

4.2.2 Broadmeadow

Spring Survey: A total of 16 sites were examined over the four-day period 25-28th May 2004 (Fig. 2). Within these sites, 16 taxa were encountered (Table 1). The fish assemblages were dominated by flatfish (plaice and flounder combined), 3-spined stickleback and Gobies. Each of these groups was present at, as a minimum, 8 of the sites surveyed (Fig 5).

Flounder were captured in all net types while the gobies and stickleback were only captured in the fine-mesh beach seine. The majority of fish taxa were taken at a small number of stations.

The beach seine captured the largest number of fish types, 14 in total. Dogfish was the sole species taken in the gill nets. The fyke nets captured eel, one of the principal targets of this net type, as well as a number of rockling. Very small eel, of glass eel and elver type, were taken in the beach seine at specific locations, most notably at one site close to the channel of the inflowing Broadmeadow River.

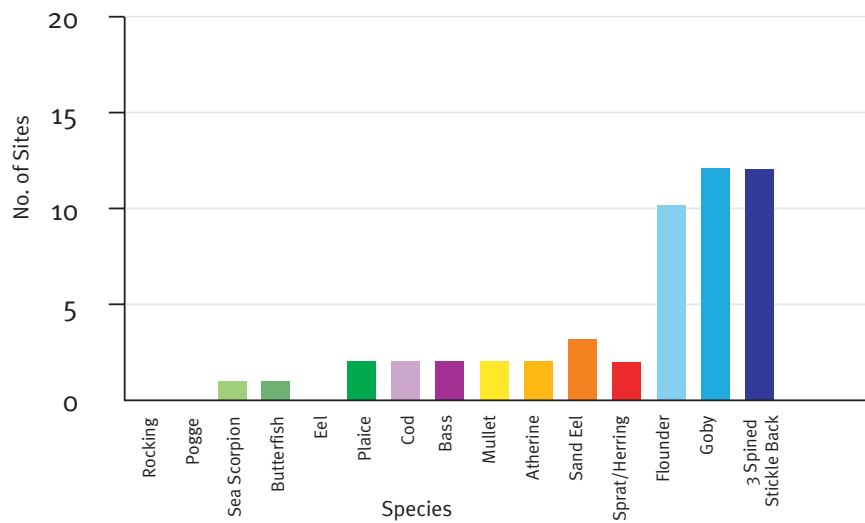
Autumn Survey: The autumn survey yielded 21 taxa, by all methods, in Broadmeadow. The number of taxa taken by each method showed an increase from the spring survey. Sprat/herring, flounder and goby were the most widely-recorded taxa in beach seines (Fig 6). Eight species were recorded as single individuals. The most unusual was a dogfish, of similar size to those taken in gill nets, taken at the shoreline under the Grand Hotel in Malahide. The fyke nets were very effective in the range of species captured in open water. In addition to the eel, flounder and rockling taken in spring, cod and pollock were captured along with short-spined sea scorpion. The gill nets captured dogfish, as in spring, in addition to a single young cod (40 cm) and a sea scorpion. No adult mullet were captured, unlike the spring survey and unlike the autumn findings in Rogerstown.

Table 2. Taxon distribution in each of the estuaries, by sampling method, in each season

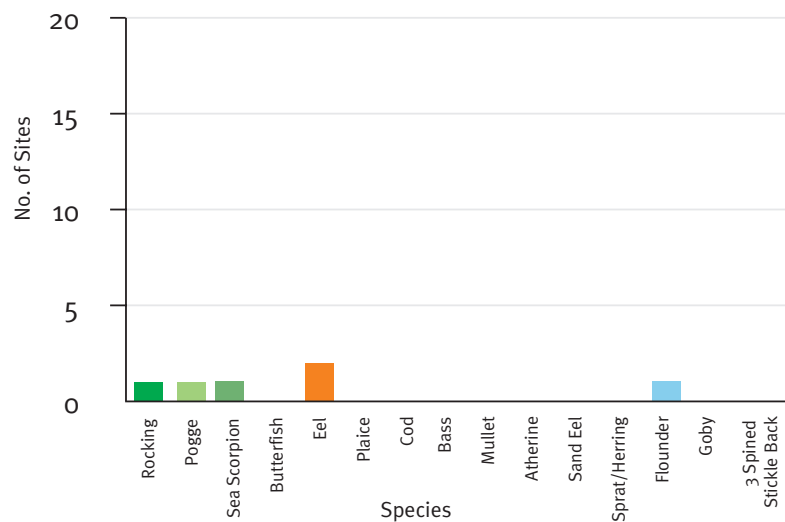
Estuary	Season	Species in beach seines	Species in fyke sets	Species in gill sets
Rogerstown	Spring	12	5	2
	Autumn	11	6	1
Broadmeadow	Spring	14	3	1
	Autumn	17	12	3

Fig 3. Occurrence of species among netting types, Rogerstown spring 2004

Rogerstown Estuary: 5 2004. (Beach Seine 11 sites)



Rogerstown Estuary: 5 2004. (Fyke Nets 3 sites)



Rogerstown Estuary: 5 2004. (Gill Nets 2 sites)

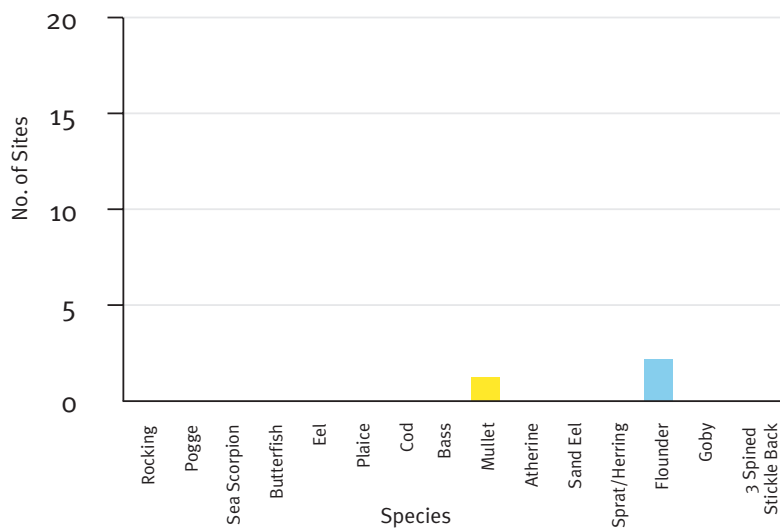
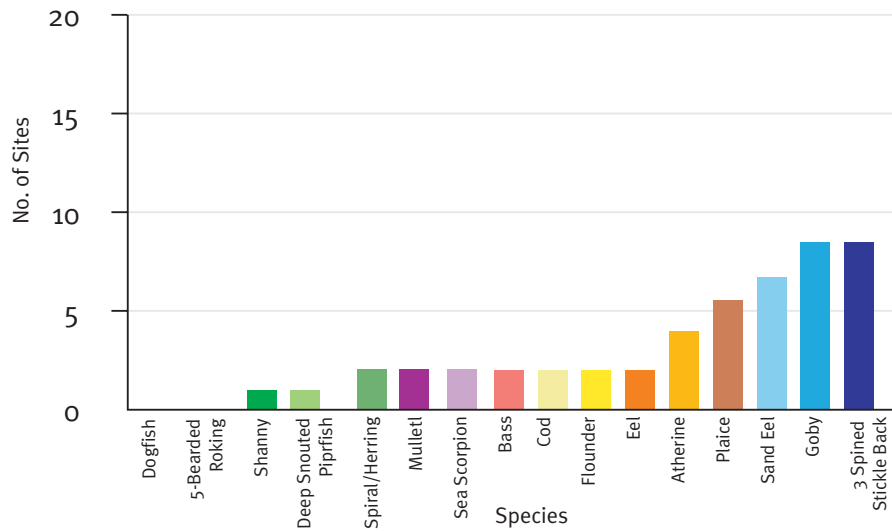
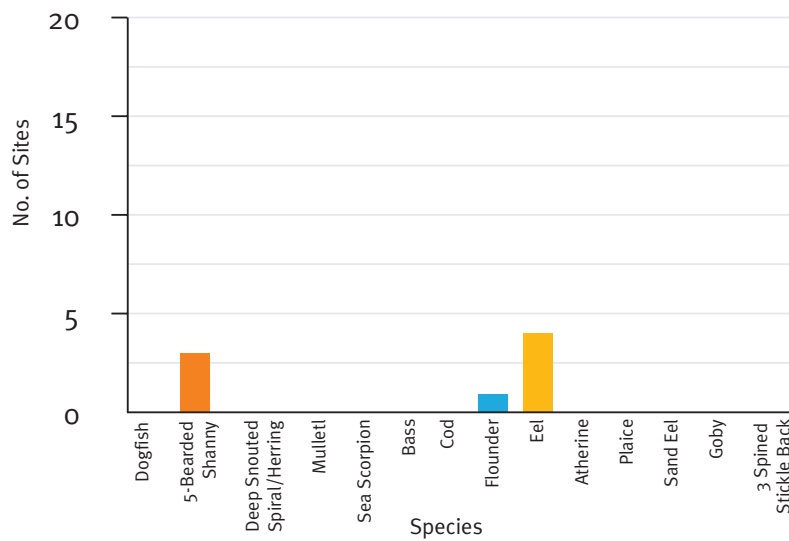


Fig 5. Occurrence of species among netting types, Broadmeadow spring 2004.

Broadmeadow: 5.2004 (Beach Seine 9 sites)



Broadmeadow: 5 2004. (Fyke Nets 4 sites)



Broadmeadow: 5 2004. (Gill Nets 3 sites)

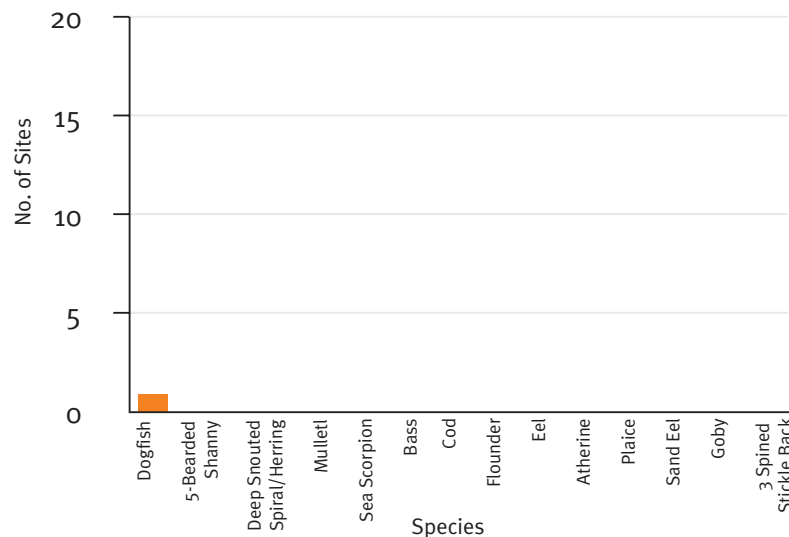
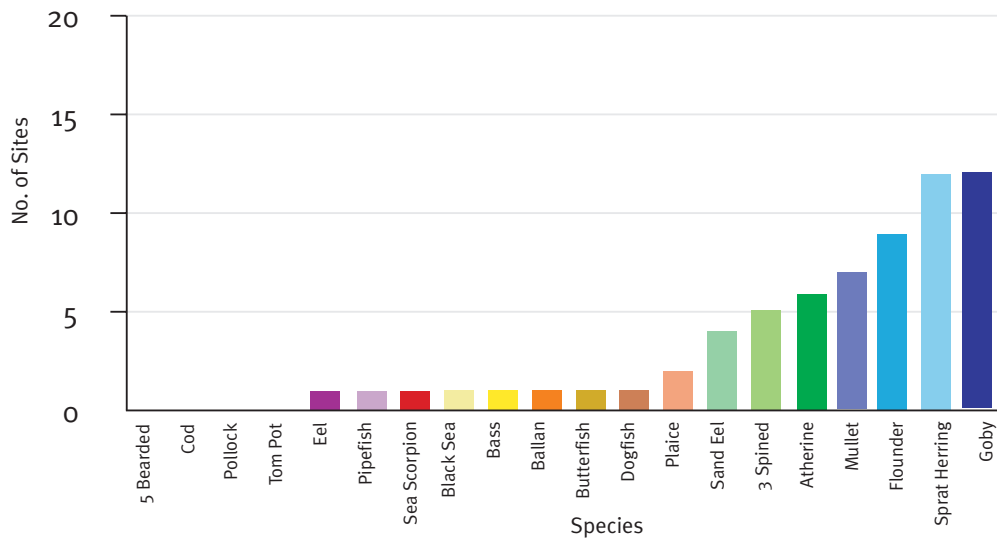
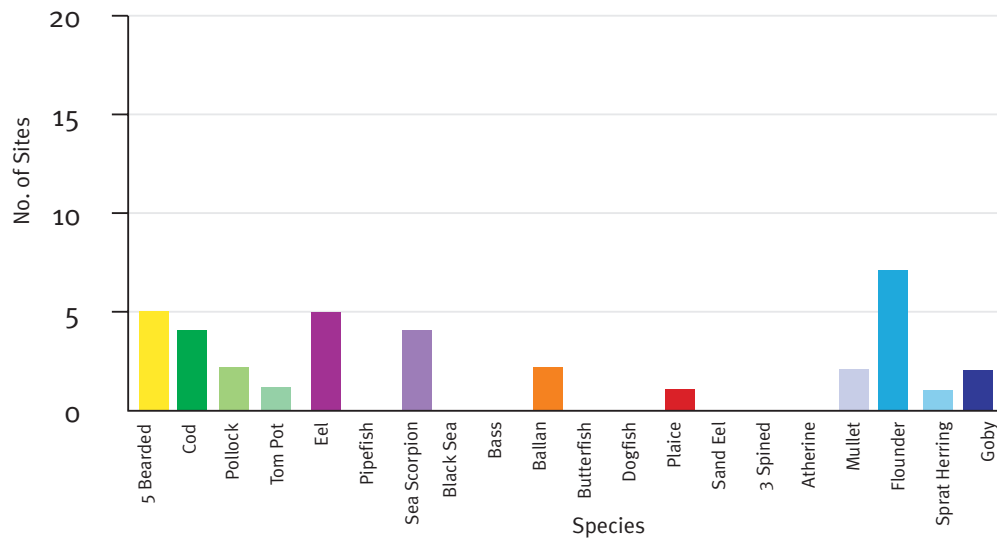


Fig 6. Occurrence of species among netting types, Broadmeadow autumn 2004.

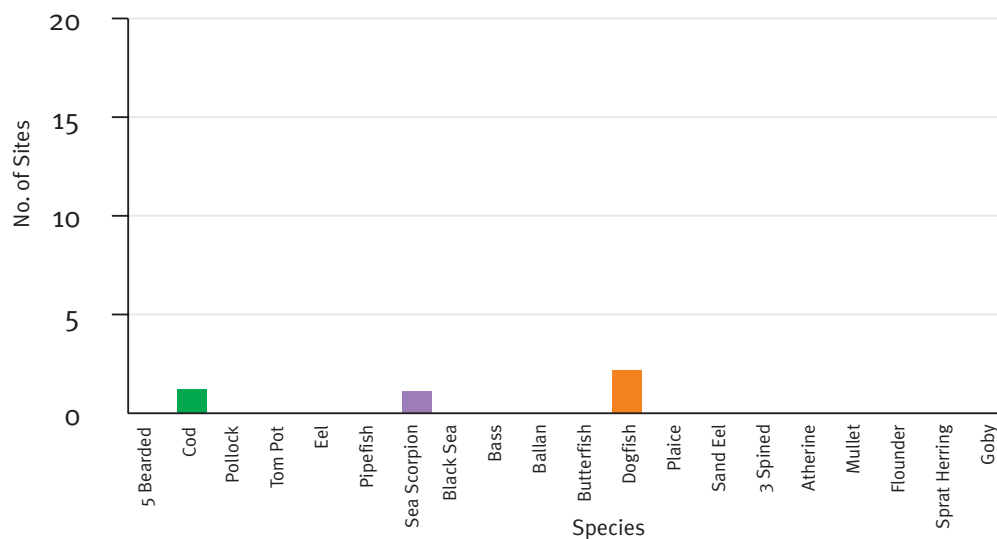
Broadmeadow: 10.2.2004 (Beach Seine 9 sites)



Broadmeadow: 5 2004. (Fyke Nets 4 sites)



Broadmeadow: 10.2004. (Gill Nets 3 sites)



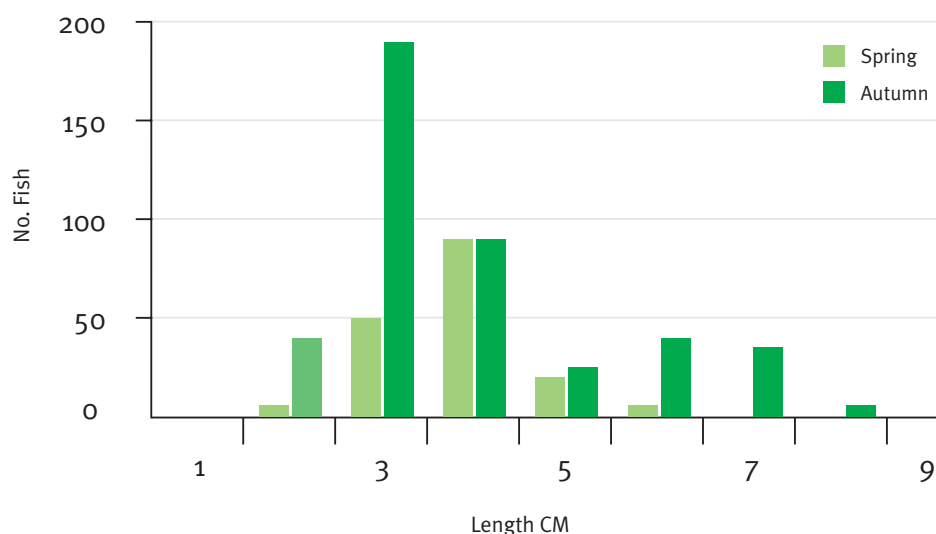
4.3 Individual fish species – comparison of the estuaries and profile of most common groups

4.3.1 Goby

Of the many goby species present in Irish estuaries, the sand goby and common goby are most common. They are difficult to distinguish in the field and are grouped here as generic 'goby'. Gobies were present in both estuaries in both sampling periods and were one of the most common and widespread species. The spring modal peak in both estuaries was at 4 cm, with very few fish larger than this. In contrast, two modal groups were recorded in the autumn survey – a large peak at 3 cm and a group in the 5 – 8 cm range. The peaks point to two age groups of goby being present. The large autumn peaks are associated with juveniles produced in the present year while the spring modes grew on to yield the autumn group of larger fish.

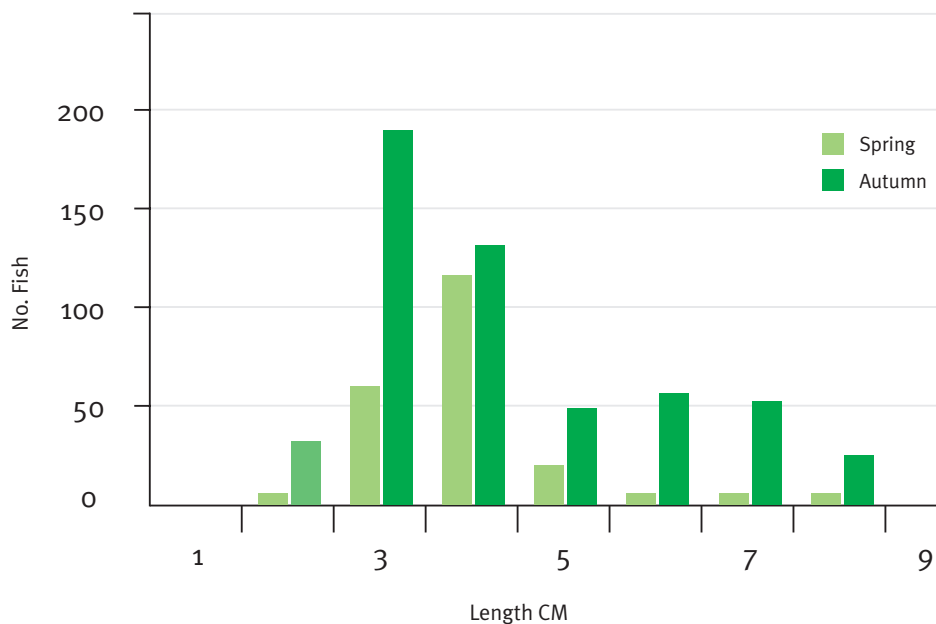


General: This group consists of small species generally found on the seabed in shallow water close to the shore. Two sets of dorsal fins. Pelvic fins fused by membrane to form single unit. Gregarious, found in loose shoals. Considerable secondary sexual differences between the two sexes. Identification to species difficult. However, the species appear to be highly selective in choice of habitat and thus identification can be made easier by knowledge of precise habitat from which specimen goby has come.



Rogerstown: Goby length frequency Spring V Autumn

Broadmeadow: Goby length frequency Spring V Autumn



4.3.2 Mullet

The length frequency data represent mullet captured in beach seining and clearly indicate several age groups. Mullet were taken in greater numbers in Rogerstown in autumn than spring, although two age groups, at least, were present in the samples in both seasons. The spring and autumn samples differed substantially in Broadmeadow. The autumn sample contained juvenile fish-of-the-year of 3 – 6 cm whereas the spring sample contained larger fish only, in the 15 – 24 cm range.

The gill net sampling yielded small numbers of large mullet in both estuaries.

Detailed examinations of the mullet indicated that three species were present in Broadmeadow – the thick-lipped, thin-lipped and the golden mullet. The thick-lipped mullet is the most common of the three in Irish waters. The others are less common, particularly the golden mullet. This species appears to be increasing its range in Irish waters and is occasionally encountered by anglers. Its presence in Broadmeadow will be a further stimulus to anglers using this resource.

General: The thick-lipped mullet is distinguished from other mullets by gross development of upper lip. Common inshore and estuarine species. Numbers increase in spring and summer, possibly due to migration. May hibernate in deep off-shore waters in winter. Feed as adults on diatoms and epiphytic algae. Spawning extends over several months (Jan – April in

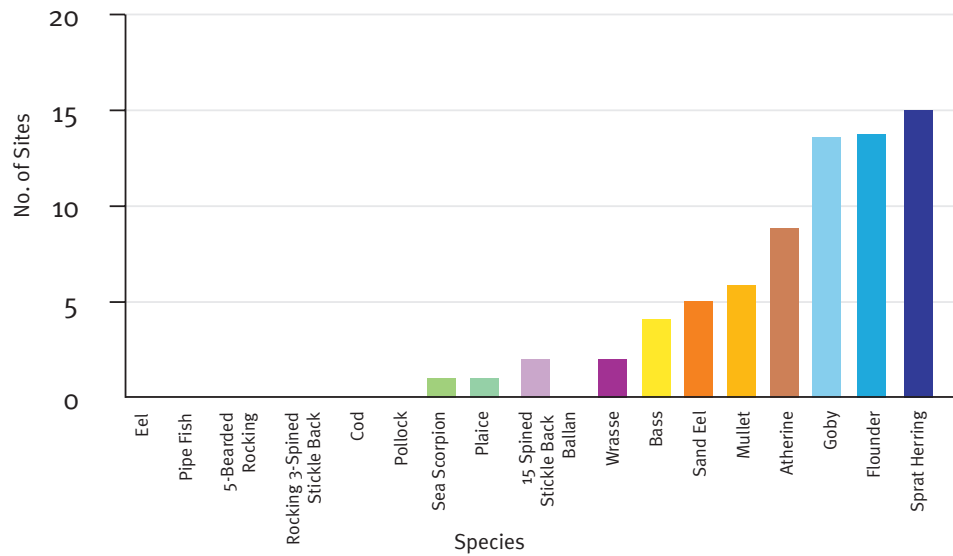
Biscay). Spawning 'behaviour' seen in British waters in April. Very young mullet common in intertidal pools in English Channel and south coast of Ireland in July – August – proof that spawning does occur locally. Long-lived-9-year-old fish recorded at 58cm. Samples of large mullet taken in the Fingal estuaries in this study ranged from 42 cm to 55 cm.



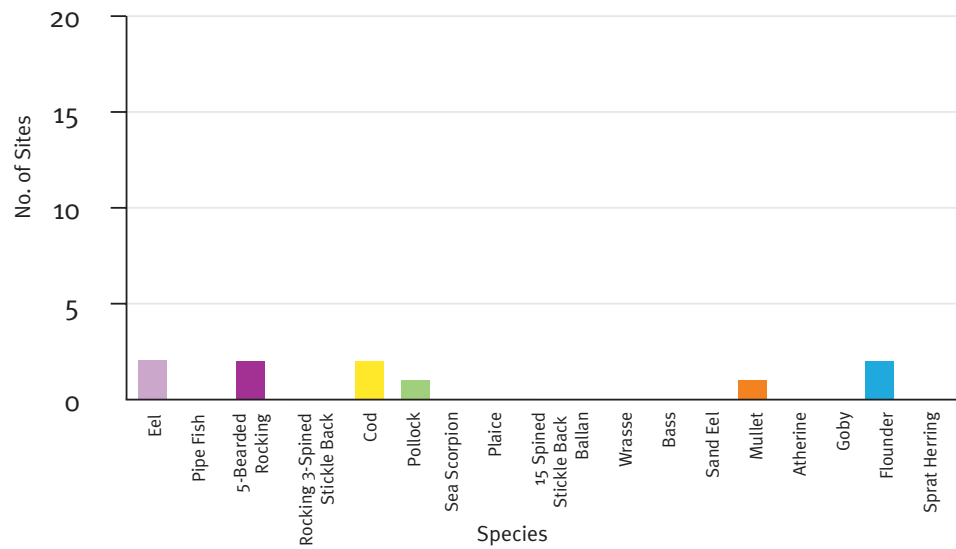
Mullet

Fig 4. Occurrence of species among netting types, Rogerstown autumn 2004.

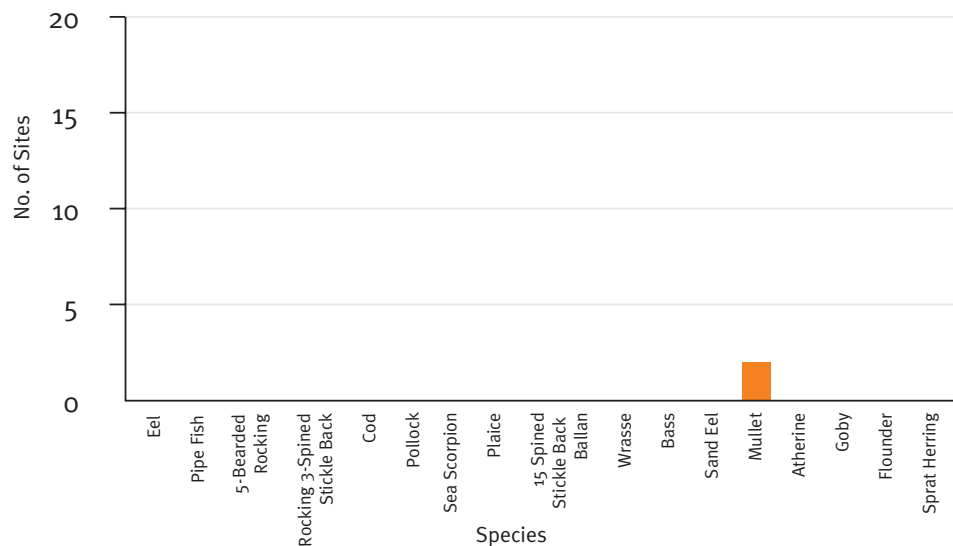
Rogerstown Estuary: 9 2004. (Beach Seine 16 sites)



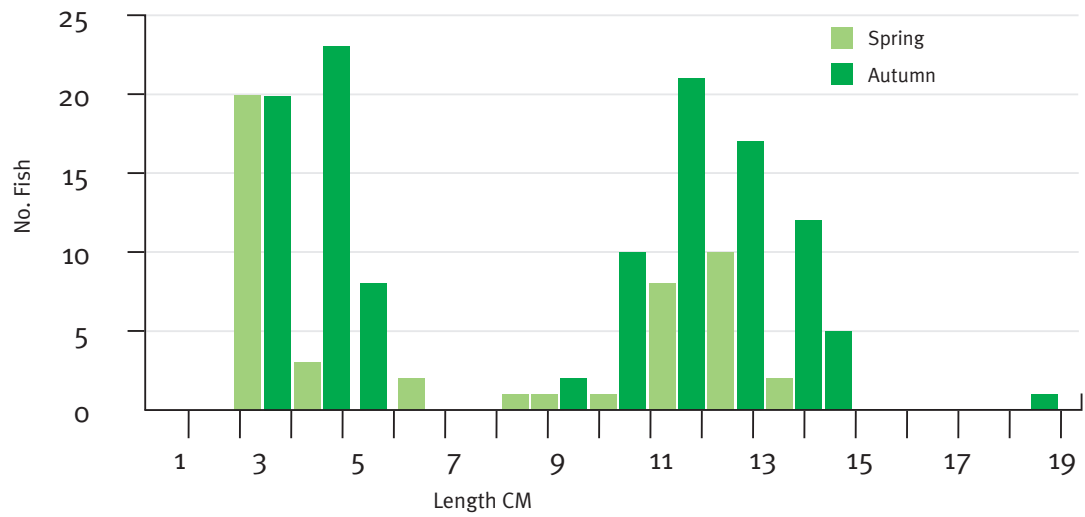
Rogerstown Estuary: 9 2004. (Fyke Nets 5 sites)



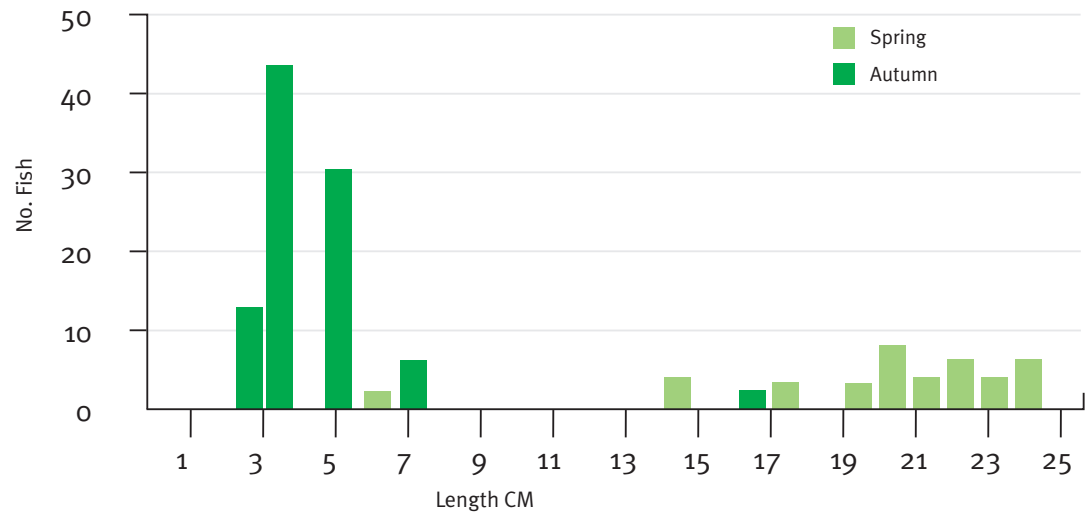
Rogerstown Estuary: 5 2004. (Gill Nets 2 sites)



Rogerstown: Mullet length frequency Spring V Autumn



Broadmeadow: Mullet length frequency Spring V Autumn



4.3.3 Flatfish

Both flounder and plaice were recorded in the present survey. Fish larger than approximately 5 cm can be distinguished in the field. However, fish smaller than this could not easily be allocated to either without microscopic examination in the laboratory. A similar pattern was observed in each season in both estuaries. There was a spring peak of small fish (1 – 5 cm) with smaller numbers of larger fish. Numbers recorded in autumn were very low in both estuaries. There was a shift in the length frequency range as small fish from the spring peak grew on over the summer months.

Small numbers of large fish, all flounder, were taken in both estuaries in the beach seining. Some of these were of a size that would provide good quality angling. Despite the substantial effort with fyke nets, few flatfish were taken with these nets. Given the bottom-dwelling habits of the flatfish and the placement of the fykes on the estuary bed, it is surprising that a larger number of flats was not taken. Flats are generally common in fyke nets.

General: Flounder is distinguished from the plaice by series of small prickles along the bases of the dorsal and anal fins. Flounder is the only European flatfish to penetrate well into estuaries and to live in freshwater. In Ireland it has been recorded in L. Leane, Killarney, some 20 km upstream of the estuary of the R. Laune. It also occurs in the R. Suir at Clonmel, 25 km upstream of the tidal limit. Primarily estuarine and is most common where water is of low salinity. It does not spawn in freshwater. Enters freshwater in summer.

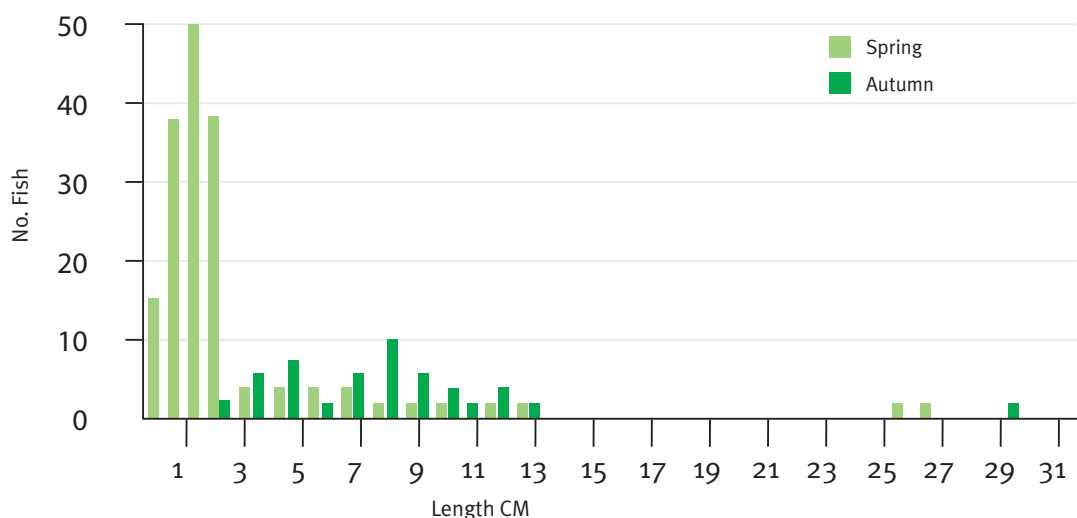
Feed mainly in summer. Young fish (<8cm) feed on copepods, diatoms and chironomid larvae. From 8 – 15cm they feed on shrimp, amphipods and young crabs. Larger fish feed on molluscs.

Spawning takes place in deep water off shore (27-54m) The eggs float near the surface before sinking as development

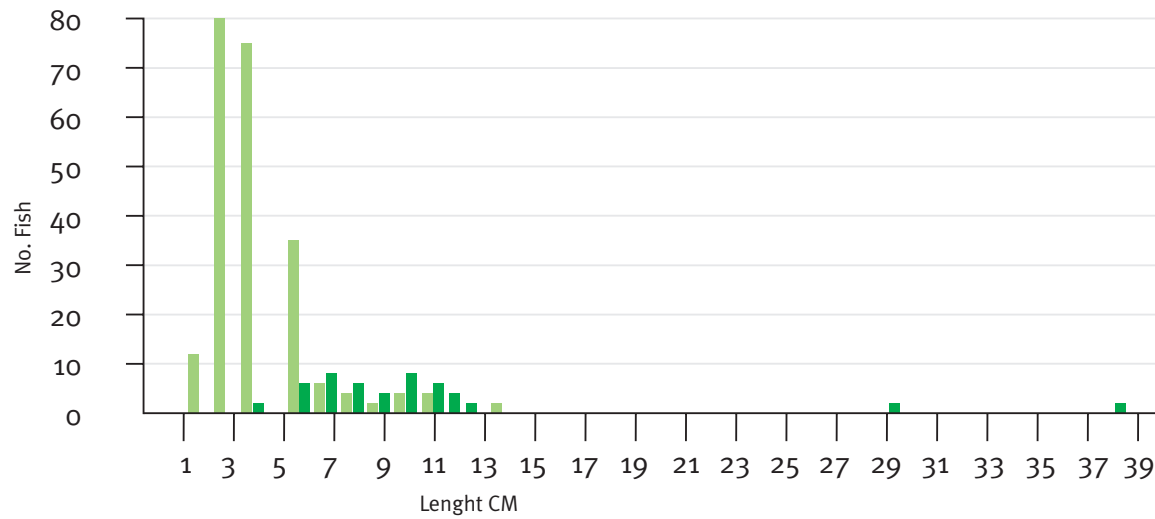


Flounder

occurs. Fish metamorphose at 15-30mm and are bottom-living. These young fish live close to shore and enter estuarine water. Growth rate is approx expressed in length at age: 8cm (end of year 1), 14cm (age 2), 19cm (age 3) and 24cm (age 4). Males are sexually mature at 11cm and females at 17cm.



Rogerstown: Flatfish length frequency Spring V Autumn



Broadmeadow: Flatfish length frequency Spring V Autumn

4.3.4 Sprat / Herring

Juvenile sprat and herring are very similar in appearance within the size range encountered in this survey and were grouped together here. Numbers were low in Rogerstown and at trace levels in Broadmeadow in spring. However, by the autumn, substantial numbers were present in both estuaries and this taxon was widespread in beach seine sites. The indications from the data collected are that these juveniles moved into both estuaries over the summer period and were using the estuaries as a nursery area on a seasonal basis.

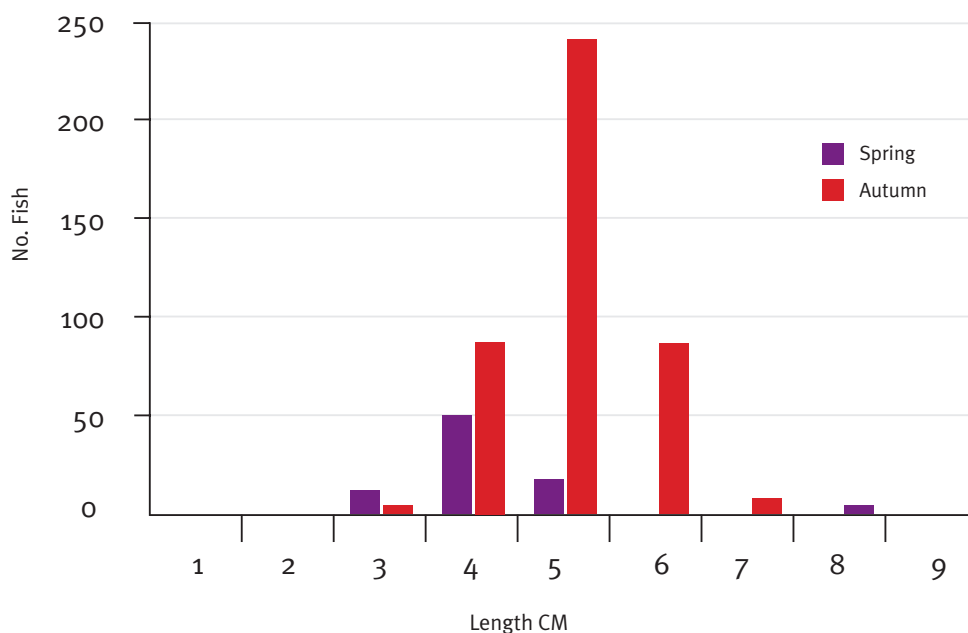
General: These two are very similar in appearance when taken as small specimens – those generally encountered in beach seine sampling. Adult sprat grows to 14cm whereas the adult herring grows to a much larger size of 40cm. Adults have sharp keel along ventral surface.

The sprat is coastal and lives in large shoals in shallow water. Tolerant of low salinities and enters estuaries. Spawning occurs in spring and summer. Differs from herring in that eggs are pelagic and float on surface or mid-water (25-50m). Spawn in open sea, eggs hatch in 3-4 days and larvae drift inshore.

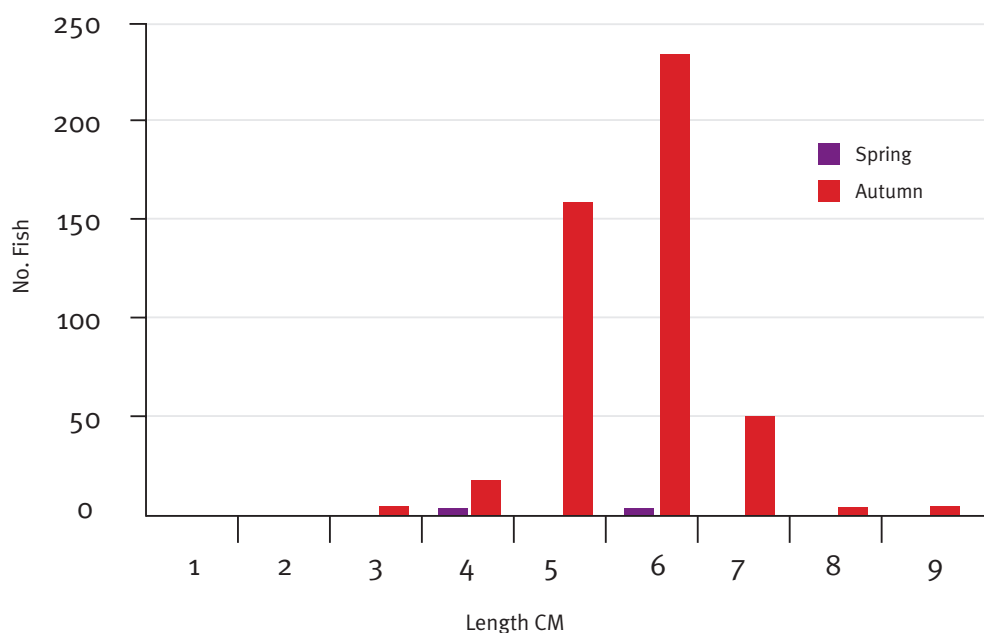
Young-of-the-year live inshore in shallow water, often in shoals with first-year herring. Grows up to 11cm in first year, 13-14 in year 2, and to 15 by year 4. Sexually mature in second year, rarely lives beyond fourth year. Feeds on planktonic crustacea.

Herring consists of different races along the North Atlantic – with 'spring' and 'autumn' spawning populations. Mainly a selective plankton feeder. Different races spawn at different times and in different grounds. The eggs sink and adhere to the bed material. They adapt a more pelagic life after hatching. Spend first two years of life in shallow water, moving to deeper waters in third year. Growth rates differ among different races but one example from North Sea is 7-9cm (year 1), 16-18cm (year 2), 21-23cm (year 3). Primarily pelagic as adults.

Rogerstown: Sprat length frequency Spring V Autumn



Broadmeadow: Sprat length frequency Spring V Autumn



4.3.5 Sandeel

Sandeel were best represented in areas of sandy beach. This may explain their limited distribution in the present study and the relatively small hauls taken at most locations. The length frequency data point to two age groups being present in both estuaries. Populations were larger in Broadmeadow in both seasons. This estuary had a spring peak with modal length 7 cm. By autumn, the size range extended between 8 and 12 cm for the dominant size group. This shift in size range was not evident in the Rogerstown sample.

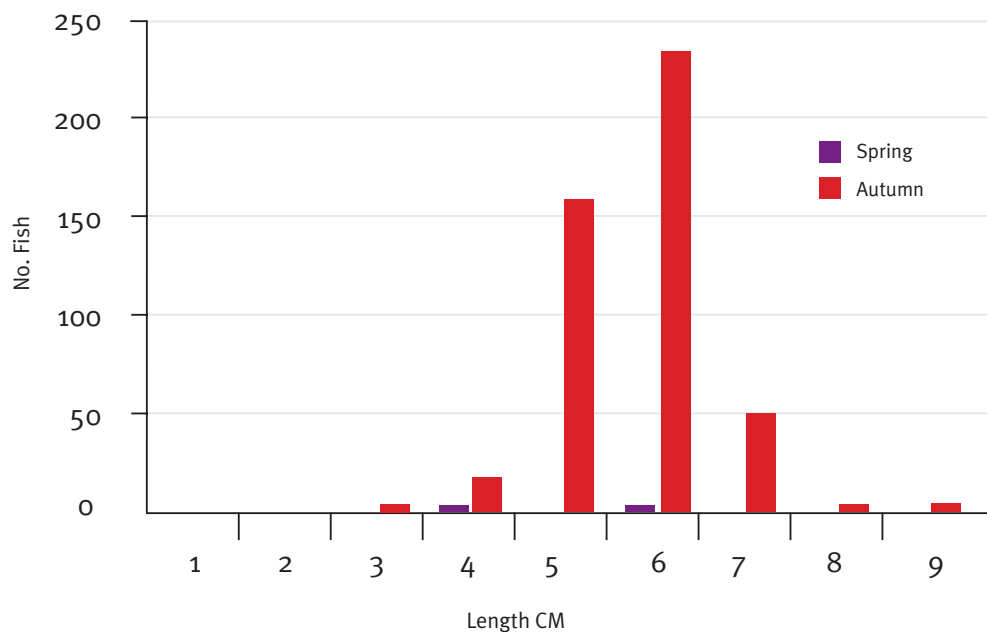
General: This is a small species of sand eel, growing to a length of 20 cm. Extremely common and abundant in inshore waters. Found from mid-tide on sandy shores to depths of 30 m. Spawns in autumn in English Channel and eggs are attached to sand grains. Adults found in vast shoals. Feeds on small fish and on segmented worms. Very important to commercial fisheries due to its enormous numbers, as other fish such as herring, mackerel and fish of the cod family feed extensively on sandeel.

A different picture was recorded in Broadmeadow where atherine were very poorly represented in both seasons. The spring sample was all taken at one site, only, and consisted of larger fish, 9 – 14 cm in length. No larger fish were taken in autumn and the species was represented by a few young-of-the-year fish.

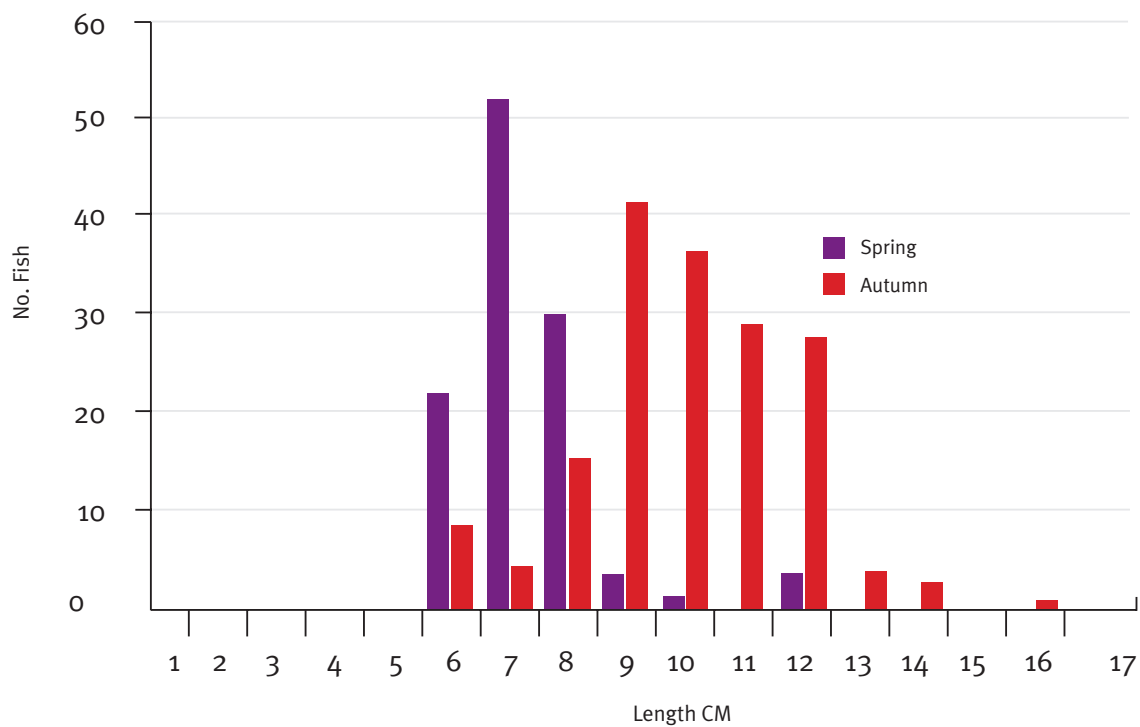
General: Small species with a notable silver line along side of body from head to tail. Northern limit is at north of Scotland. More common on all coasts in summer, possibly due to northward migration. Common inshore in late summer. Appears attracted to low salinities – frequently found in river mouths. Spawns in midsummer in shallows, eggs adhering to marine algae or to substrate by long filaments. Growth is up to 7cm in first year and to 15 cm as adult. Feed on small crustaceans and on fish larvae.

4.3.6 Atherine

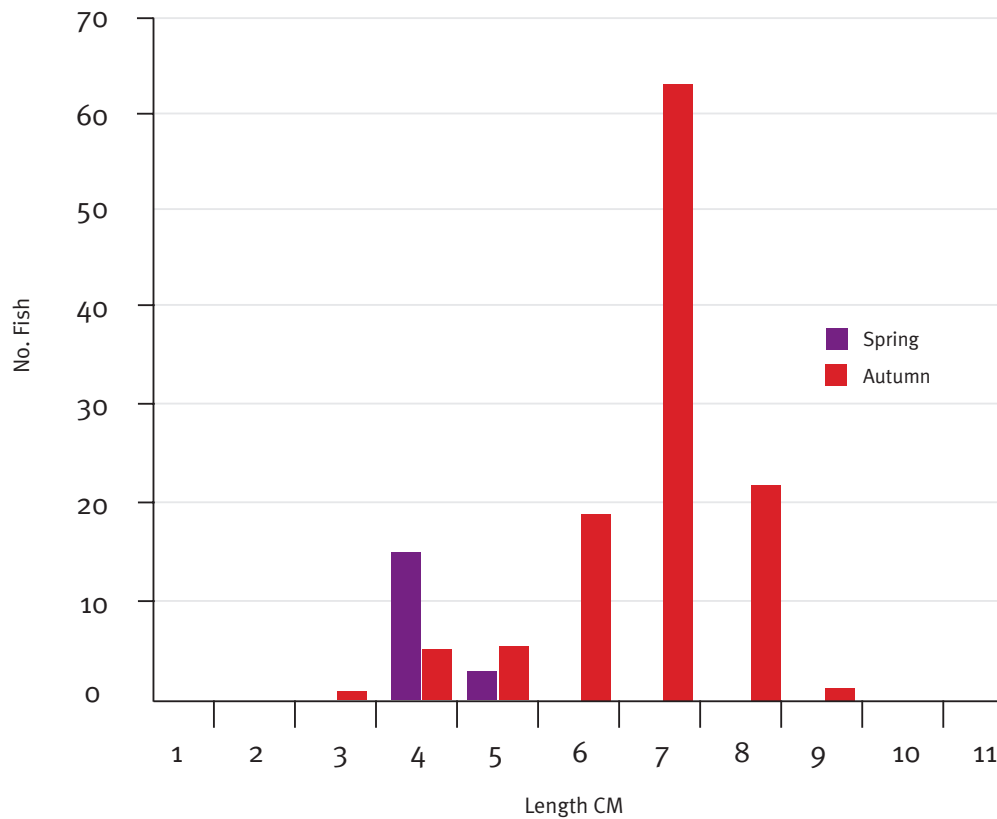
The atherine or sand smelt was recorded at relatively low levels in both waters. In Rogerstown, a small number of fish were recorded in spring, some almost transparent in colour. By autumn, this spring group had grown on and the species was well-represented at a number of sites throughout the estuary. A single age class, only, was present.



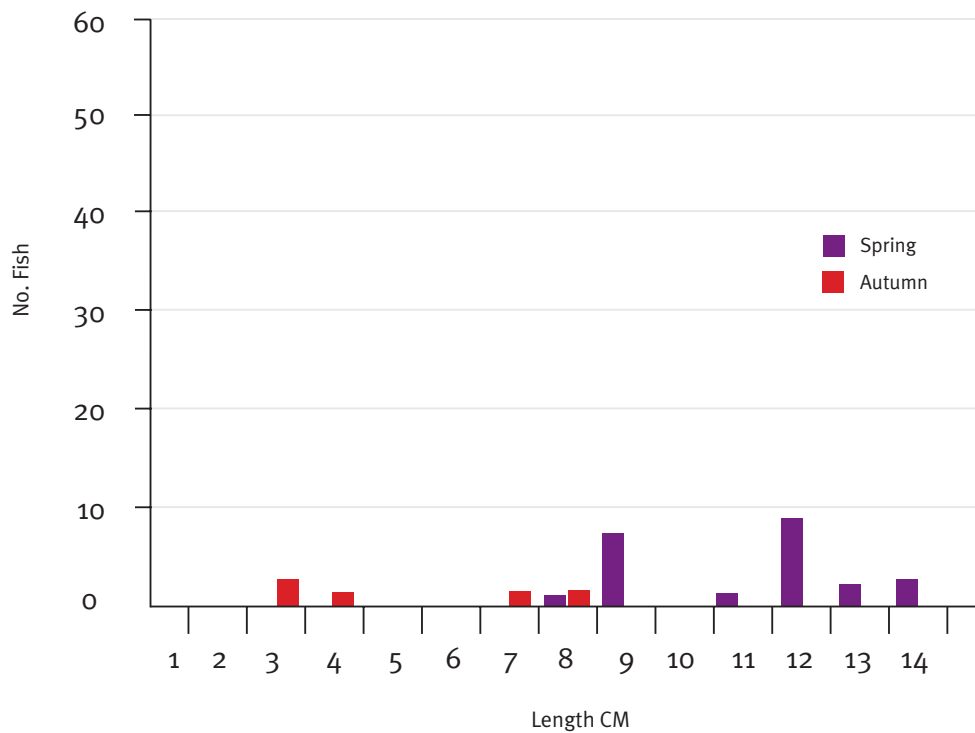
Rogerstown: Sandeel length frequency Spring V Autumn



Broadmeadow: Sprat length frequency Spring V Autumn



Rogerstown: Atherine length frequency Spring V Autumn

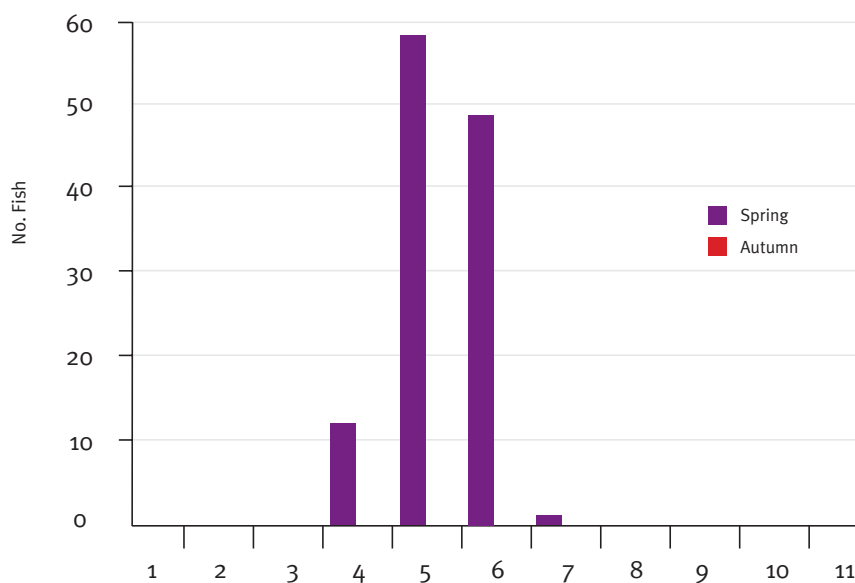


Broadmeadow: Atherine length frequency Spring V Autumn

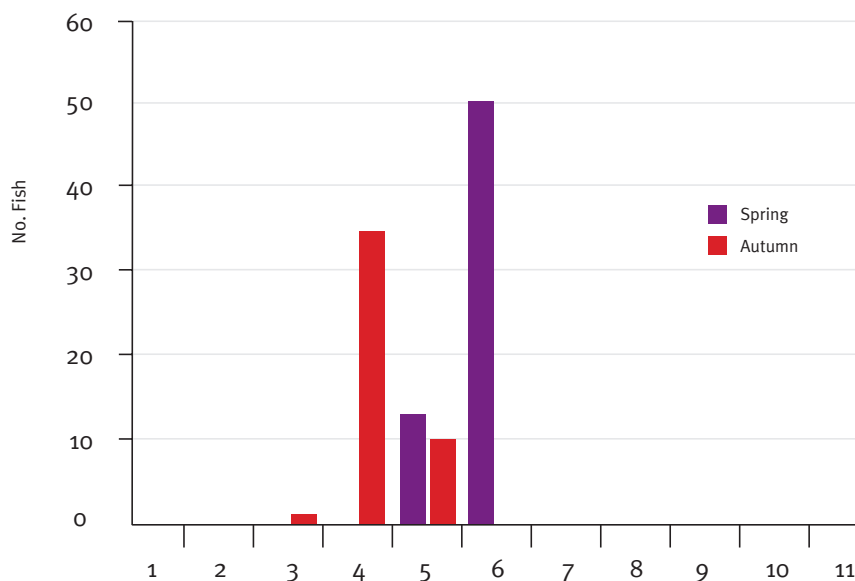
4.3.7 Three-spined stickleback

This species, common in backwaters in streams and in ponds, was a prominent feature of both estuaries in the spring surveys, more so in Rogerstown than in Broadmeadow. It was taken in a number of sites in both waters, with a size range of 4 – 6 cm. By autumn, three-spined stickleback was absent from Rogerstown. It was taken in Broadmeadow but at fewer sampling sites. In addition, the autumn sample was composed of smaller fish than the spring sample. This suggests that the fish present in spring had moved out of the estuary and were replaced by younger fish.

General: While most familiar as a fish of freshwater, the 3-spined stickleback is commonly found in estuaries. Spawning occurs in April – May and male fish are very brightly coloured during this period.



Rogerstown: 3 Spined Stickleback length frequency Spring V Autumn



Broadmeadow: 3 Spined Stickleback length frequency Spring V Autumn

4.4 Salinity and water temperature data from the fish survey

Both salinity and water temperature data were collected at a number of the fish sampling sites. The majority were taken at shoreline locations of beach seining but some were also taken at open-water sites of gill- or fyke net sampling. The data are presented in graphic form below show the data from individual sites. They do not represent data collected in summer and autumn at the same set of locations. Rather, they represent the range of data collected in each season.

Full salinity is considered at 35 parts per thousand (ppt). The majority of samples from both spring and autumn in Rogerstown lay in the range 31 – 34 parts per thousand of seawater. The autumn data set showed a greater variability with two, of twelve, figures between 25 and 30 ppt.

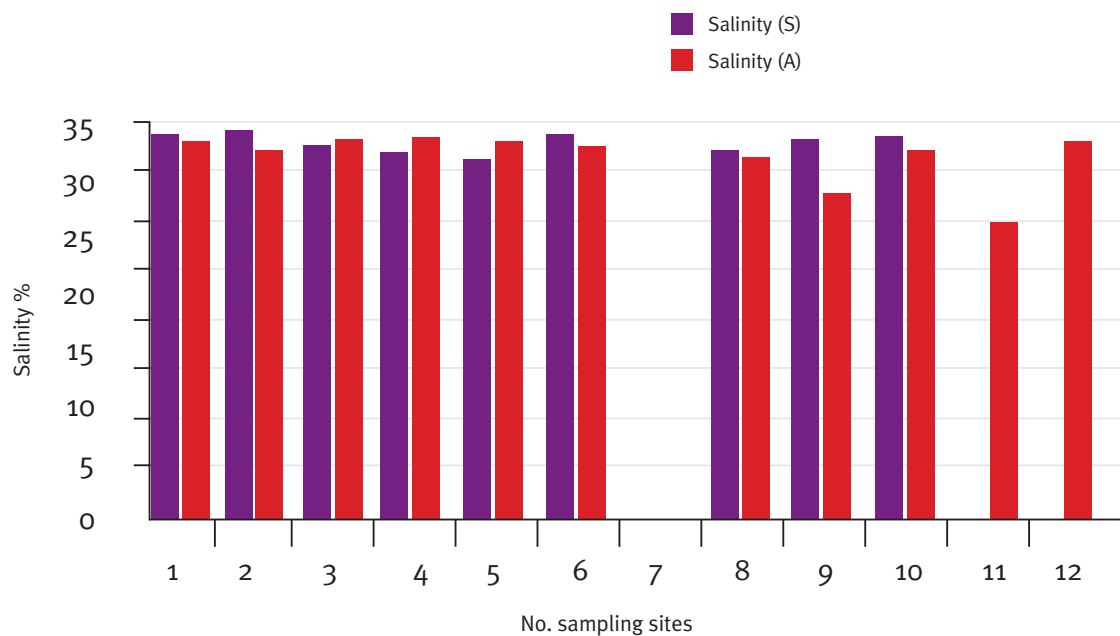
The Broadmeadow data for salinity showed a greater degree of variability than that from Rogerstown. The spring data was less variable than that from autumn, with seven of the nine values at or exceeding 30 ppt. The lowest value recorded was 21 ppt. All but one of the autumn data were below 30 ppt. Four of the data points registered below 25 ppt and one value of 1.5 ppt was recorded. Some of the reduced-salinity values were recorded in the inner basin in Broadmeadow. The extremely low value was recorded at low tide on the northern shore of the inner basin where discharge from a small surface water channel was obviously dominating the sample's character.

The temperature regime was constant for each season in Rogerstown. Spring data ranged from 14.2 – 17.2°C while the autumn data set ranged from 13.1 – 17.1°C.

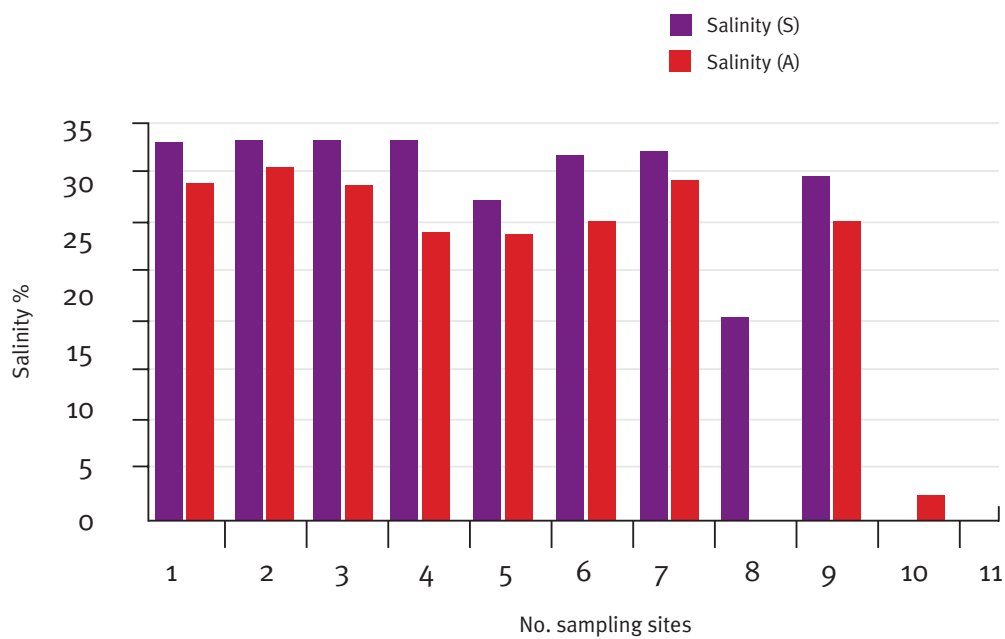
As with salinity, there was a greater degree of variation shown in Broadmeadow. Spring temperatures were generally substantially higher than those in autumn. The spring data displayed a wide range, from 15.9 to 22.8°C. The autumn temperatures ranged from 10.8 – 13.4°C.

The salinity data demonstrate the strong tidal influence, with all of Rogerstown and the outer part of Broadmeadow stripping out at low tide and filling with seawater. Thus the freshwater influence is low and this is registered in the high salinity values. Rogerstown would be classified as euhaline (salinity values > 30ppt) whereas Broadmeadow shows evidence of polyhaline status (18 – 30 ppt) and euhaline status. Broadmeadow has a greater degree of freshwater intrusion and this influence is increased by the incomplete emptying of the inner basin with falling tide.

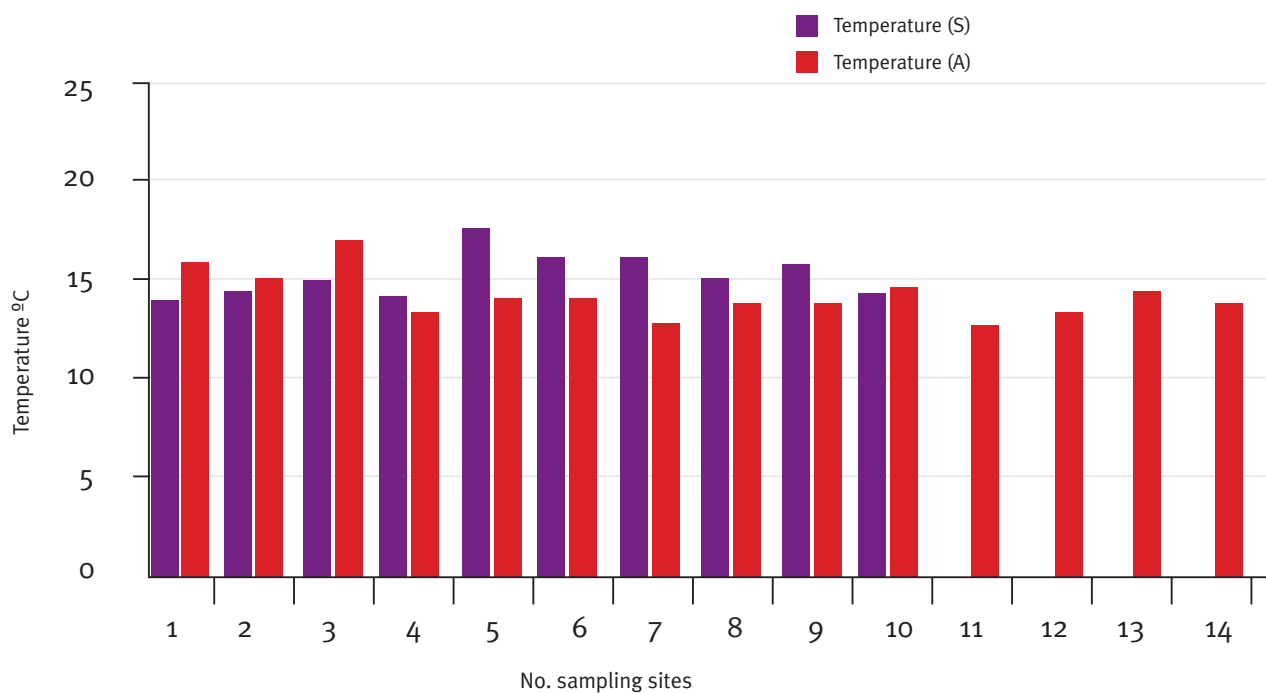
The temperature data from Rogerstown also point to a strong and consistent tidal influence and low intrusions from freshwater. Heavy rainfall events in the autumn surveys are reflected in part in the Broadmeadow data both in terms of the salinity data and also in terms of the reduced temperature data relative to those from Rogerstown, recorded one week earlier.



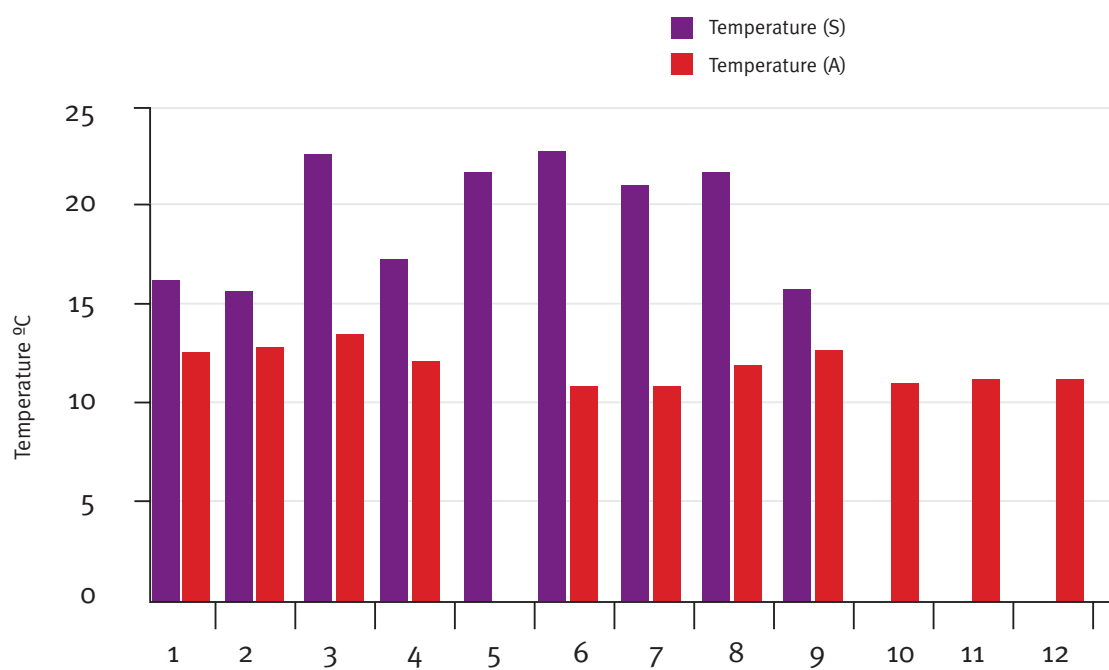
Rogerstown: Salinity Spring (S) Autumn (A) 2004



Broadmeadow: Salinity Spring (S) Autumn (A) 2004



Rogerstown: Temperature Spring (S) Autumn (A) 2004



Broadmeadow: Temperature Spring (S) Autumn (A) 2004

5. The Survey Findings in Context

5.1 Species Diversity

Since 2000, the Central Fisheries Board has carried out studies on the fish populations of a number of Irish estuaries. These have included large open water bodies such as Waterford and Cork Harbours and the Shannon Estuary as well as the long, parallel-sided extensions of the Slaney, Barrow, Suir and Munster Blackwater. The current study has provided an opportunity to collect data in two relatively small estuaries on the east coast. A comparison of fish species diversity compiled in the course of CFB's autumn sampling programme (Table 4) provides a context for biodiversity considerations in the two Fingal estuaries studied here. The data presented relates to fish capture in beach seines only.

Within the eight estuaries examined, the species inventory ranged from 11, in Rogerstown, to 29 in Cork Harbour. Broadmeadow yielded a higher species total than Rogerstown and its total was similar to those from Dingle Harbour, Waterford and the Slaney estuary. It is of note that the intensity of sampling effort did not always lead to increased species diversity. Thus Cork Harbour had a higher species total than the Shannon Estuary with little over half of the sampling effort. Similarly, Dingle Harbour produced 17 species for a single day's sampling effort. One reason for the disparities between different waters lies in the extent of microhabitats available. Very uniform water bodies tend to have a uniform ecology and limited physical diversity. This is not conducive to creating niche habitats that may suit some species with specific requirements. In physical character, the Broadmeadow and Rogerstown estuaries are most similar to Castlemaine Harbour, in Co. Kerry, surveyed in 2003. All three are broad, shallow basins that strip out at low tide to reveal extensive

areas of sand and sand-mud. Castlemaine is substantially larger and has larger tributaries, the R. Laune and R. Maine, discharging into it. Castlemaine and the Fingal estuaries had populations of the most common Estuarine Residents – goby and flounder. In addition, all three had populations of plaice, sandeel and 3-spined stickleback.

The graphic above compares findings from CFB's recent studies on Broadmeadow, Castlemaine and Cork Harbour for the seven most common species from the Broadmeadow listing. Sprat/herring was recorded in few sites in Castlemaine relative to the two other waters while 3-spined stickleback was not recorded at sites in Cork Harbour, in spite of the large number of sampling locations.

Table 4. Species diversity in autumn beach seine samplings from selected estuaries

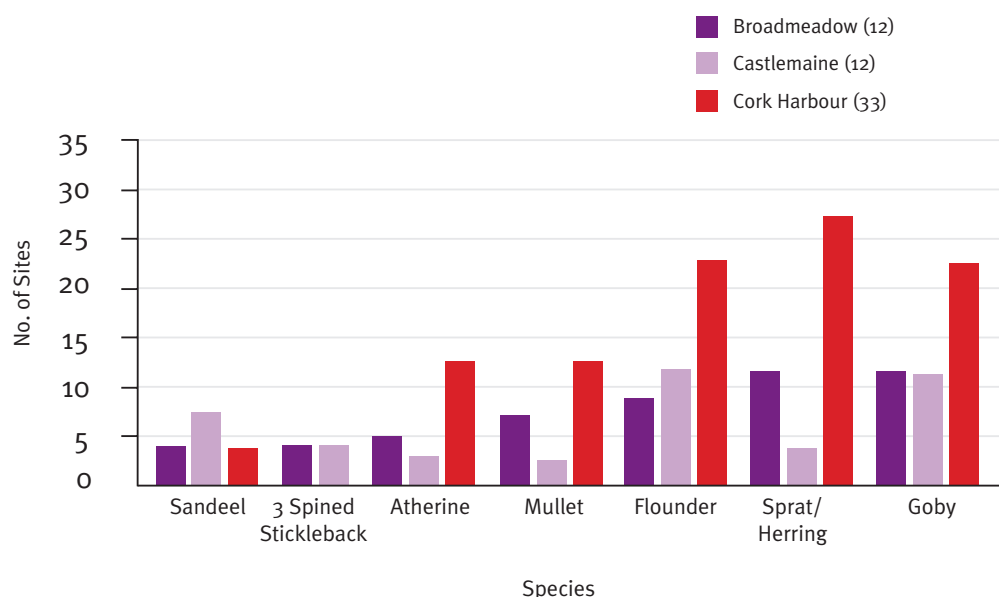
Location	Year	No. samplings	No. species
Waterford Harbour	2000	20	16
Cork Harbour	2001	33	29
Shannon Estuary	2002	56	23
Slaney Estuary	2003	14	14
Castlemaine	2003	12	20
Dingle Harbour	2003	3	17
Broadmeadow	2004	12	16
Rogerstown	2004	16	11

5.2 Characteristic Species in Irish estuaries

Each estuary has its own suite of species and while many are common to many waters the proportional representation may differ from estuary to estuary. This may reflect differences in ecology or habitat types between different waters. However, a first requirement is to carry out investigations and establish baselines on the current status and composition of the fish species. This has now been completed for the Rogerstown and Broadmeadow estuaries. A comparison of the Fingal autumn data sets with those from other Irish estuaries studies by CFB indicates many common features. The data for beach seine sampling (Table 5) lists the species most frequently recorded, up to a maximum of 10, in six CFB surveys. Flounder and goby (generic) emerge as dominant members in each estuary examined. Both are Estuarine Residents and both feature prominently in all of the estuary lists. In addition, sprat/herring, in its role as a Marine Seasonal species, featured as a significant member of the fish fauna in the majority of waters examined. Mullet, identified as a Marine Seasonal species, was another species prominent in both Fingal and in several of the other estuaries examined. Atherine was a prominent species in both of the Fingal estuaries but was only prominent in Cork Harbour, of the other waters examined. Bass, a Marine Juvenile, was recorded in Rogerstown as well as Waterford Harbour and in the lower

Slaney but was not a prominent element in Broadmeadow. Ballan Wrasse was not listed among the 'top 10' species in any water apart from Rogerstown. A unique feature of the Waterford fish fauna was the prominence of smelt, a Catadromous/Freshwater species.

There are spawning populations of this species in Waterford Harbour. Smelt is often considered indicative of good water quality. However, its absence from many of the Irish estuaries examined may have more to do with its biogeographical distribution than with estuary quality. From examination of the Irish literature on the subject it would appear that the smelt is expanding its range and it may feature in the Fingal fish fauna in future years if water quality conditions permit.



Frequency of species in Autumn beach seines in three estuaries (Sample No. in parentheses)

Table 5. The most-commonly recorded species (max of 10 taxa) from selected estuaries Irish estuaries

Species	Functional	Waterford group	Cork Harbour Harbour	Slaney	Castlemaine	Broadmeadow	Rogerstown
Year		2000	2001	2003	2003	2003	2003
No. sites		20	33	14	12	12	16
Ballan Wrasse	MA						2
3-spined stickleback	CA	3		7	5	5	2
Trout	CA	4		4	4		
Eel	CA	4		5			
Scad	MA	4	3				
15-spined stickleback	ER		14		4		2
Bass	MJ	5		3			3
Plaice	MJ		5		6	2	
Pipefish	ER				7		
Sandeel	ER/MA		4		7	4	5
Minnow	FW			5			
Sea scorpion	ER		6				
Mullet	MS	7	13	3		7	6
Smelt	CA/FW	12					
Atherine	MJ		13			6	8
Sprat/herring	MS	16	27	3	4	12	15
Goby	ER	17	23	8	12	12	13
Flounder	ER	17	23	10	12	9	14

5.3 Estuaries as dynamic ecosystems

The findings from the present study give an overview of the species present in each season and how species composition changes with the seasons. As such it is the first occasion in which such seasonal data has been collected by CFB. To date, CFB has confined itself to autumn surveys. This choice was made following best-practise in the UK's Environment Agency. The seasonal changes have been referred to earlier in relation to specific species (see Section 4). The changes reflect movement of species into and out of, the estuaries. In the case of the Estuarine Residents, such as flounder and goby, changes reflect seasonal growth patterns. In the case of other functional groups, the changes reflect influx or egress.

The movement of juvenile sprat /herring was very apparent in both Rogerstown and Broadmeadow. These forms were also a major element of the fish fauna in the majority of other autumn estuarine surveys conducted by CFB (Table 5). This influx of juvenile sprat / herring can lead to other fish species moving in to feed on them. Mullet are also regarded as Marine Seasonal users of estuaries. In the Fingal waters, there was a clear difference in age groups in the two seasons. In both estuaries there was an autumn year-class of young-of-the-year fish. This pattern was also reflected in other estuaries where mullet was a prominent element of the beach seine fauna, such as Waterford Harbour and Cork Harbour.

Marine Juveniles use the estuaries in the young life stage, moving to other waters as adults. Several Marine Juveniles use the Fingal estuaries including both cod and pollack. While neither featured on the 'top 10' listing of most-common species in beach seines, a number of other Marine Juveniles did, including atherine, plaice and bass. The atherine was a prominent feature of the Cork Harbour survey (Table 5) but was not significant in other CFB surveys. Plaice, while being closely related to flounder, is more commonly found in more saline waters. The high salinities recorded throughout both Fingal estuaries were conducive to penetration by plaice. This was similar to the pattern in Castlemaine (Table 5) where the water strips out at low tide revealing large areas of exposed sands and where plaice penetrated far into the main waterbody. Bass is a highly-prized angling species and is currently protected nationally by a bye-law. This was introduced as a conservation measure to address a severe decline in bass stocks. Bass was recorded in Rogerstown, only, of the Fingal estuaries and had a similar level of occurrence to those found in the Slaney and in Waterford harbour. The presence of juvenile bass in Rogerstown is very important insofar as the estuary acts as nursery ground for the young life stages. The bass is a very

slow-growing species and the physical protection and feeding conditions available in estuaries are important for its development.

5.4 Other Sources of Information on fish presence

Other sources of information are also pertinent when looking at the fish species in a water body. Information compiled by local staff of the Eastern Regional Fisheries Board indicates that small numbers of sea trout can be found in both estuaries. These fish would have been born or spawned in the tributary rivers or channels of the estuaries and would descend into the estuaries proper in their second or third year of life. Sea trout drop down into tidal waters, estuarine or coastal, due to pressures for space and or food in their native channels. They can feed freely in the rich saline waters and put on weight rapidly. Sea trout make a fine angling quarry. In recent years occasional evidence points to a very limited degree of spawning in the Ward and Broadmeadow rivers by Atlantic salmon. These adults would have returned to their native waters, travelling up through the estuaries en route. As smolts, or juvenile migratory salmon, they would have descended from their natal area and passed through the estuary on their way to sea.

A limited degree of commercial fishing has taken place in Broadmeadow and its adjoining coastal waters. Good quantities of adult mullet have been taken commercially on occasions.

Discussion with licensed commercial netmen who operate in Fingal's inshore waters indicated that seals present a nuisance to commercial netting. Seals were observed in Broadmeadow during the present survey, to the seaward side of the railway viaduct. However, they are reported to move up into the landward side of the viaduct with rising tide. All of these sources provide valid information that contributes to an enhanced biodiversity register for these waters.

5.5 Threats to the Fingal estuaries

The dynamic of the Fingal estuaries comes from the interaction of the physical environment with all of the biological components, including the fish. One of the most obvious threats comes from contamination of the waters, either coastal or fresh, through pollution or excess nutrient enrichment. Investigations by the Environmental Protection Agency have indicated that the inner Broadmeadow estuary has been found to be exceeding its quantitative eutrophication criteria in regard to high levels of Dissolved Inorganic Nitrogen

(DIN) and high levels of Phosphate (as MRP). In addition, oxygen supersaturation has been recorded here. These conditions are, it is assumed, related to nutrient inputs via the Ward and Broadmeadow rivers and may be exacerbated by the incomplete flushing of the inner estuary by tidal exchange. Urban development, agriculture and industrial development in the catchments of both rivers may create problems for the rivers themselves and for the estuaries. Fish kills have been recorded in both rivers. One consequence of such kills, should they occur at a critical time, would be to damage stocks of migratory (anadromous or catadromous species) moving between the estuary and the rivers. The rivers have the physical habitat to support such migratory species as Atlantic salmon, trout and eel. In addition, the habitat is also suitable for spawning grounds for sea and river lamprey. Apart, from eel, none of these diadromous species was recorded in the present survey. Information from ERFB does indicate that salmon and sea trout are found but it would appear that their status is tenuous. River lamprey have been taken in other estuaries at the time-of-year of the autumn surveys and further survey work in the river systems would be required to elucidate the status of lampreys in the Ward and Broadmeadow rivers.

Another threat to estuaries comes from the landward side, through encroachment of urban development and land reclamation. One of the first habitats to suffer is that at the terrestrial – aquatic interface. Frequently, this is a salt marsh/flooded grassland habitat with *Spartina* grass. This constitutes a very important feeding area for juvenile bass when it floods over at high tide. Such habitats are extremely limited in Broadmeadow – being confined to small areas in the north-west and north-east corners of the outer basin and a small zone to the west of Malahide Sailing Club in the inner estuary. There are more extensive areas of flooded grass margins in Rogerstown. This is the dominant marginal habitat along the entire south shore in the main basin and this habitat is also dominant in the Turvey channel and margins on the west side of the railway viaduct.

It is imperative that such habitats are protected in any county management plans. They must be permitted to function ecologically in the same manner as at present. They must not be exposed to landfilling with material of any kind and they must not be subjected to drainage works of any type. These areas constitute feeding areas for wildfowl and are essential for juvenile bass. It may be fair to say that bass and its survival may be a yardstick for the ecological health of the Fingal estuaries.

Threats to fish stocks may also come from predation by man. Both Fingal estuaries constitute an important leisure-angling amenity, particularly for flounder, mullet and dogfish. Mullet to specimen size are taken in Broadmeadow and this venue, particularly in the R. Broadmeadow channel, is a popular location for specimen angling. The majority of leisure anglers are of a conservation orientation, returning all fish alive to the water. The Bass bye-law was enacted to provide a conservation measure for this prized angling species and the bye-law operates in favour of the angler. Only two fish per day per angler can be retained in a 24-hour period and all fish retained must be over 40 cm in length. There is a closed season for bass, running from 15th May to 15th June each year. However, large-scale exploitation by rod-and-line methods is not sustainable. Equally, large-scale commercial fishing is not viable. Limited commercial netting can provide a watchdog-on-the-water as well as providing a valuable source of information for Fisheries Board and other conservation interests. Commercial fishing for bass is prohibited.

5. 6 Conclusion

The current survey provides a baseline platform against which impacts of future changes may be recorded. The value of the two seasonal data sets is substantial. Not only does it provide an important data set for comparison with those in the UK, pertinent to Ireland in terms of Water Framework Directive, but it also gives an indication of the use of the estuary in different seasons by different fish groups and hence flags the role of the estuaries in terms of facilitating fish biodiversity. This biodiversity is achieved through the estuaries' multiple functions as spawning, nursery, feeding, shelter areas for a range of fish species using the waters as residents, as seasonal or juvenile visitors or simply passing between the truly marine and the freshwater habitats. The estuaries and their catchments have been shown to carry a range of resident species as well as highly prized Marine Juveniles (cod, pollack, bass) and Catadromous (sea trout, Atlantic salmon, eel) forms. By way of setting reasonable targets that would reflect the habitat and water quality potential of the estuaries and their catchments it would be reasonable to foresee expansion of use by juvenile bass in both estuaries and up-and down-stream migration by salmon and sea trout through the estuaries.

6. Rogerstown and Broadmeadow Estuaries

The Angling Perspective

6.1 Rogerstown

The inner reaches of Rogerstown Estuary see very little angling pressure. Despite this, these waters offer a variety of species such as flounder, mullet and sea trout. Some bass and freshwater eels are also encountered. A specimen bass was recorded in the estuary in 2004. The best known angling hotspot is known locally as the Blue Pool and is situated on the southern side of the inlet, where anglers can fish from a firm comfortable stoney beach into comparatively deep water. Flounder, bass and sea trout are caught here. Peeler crab is the best bait for flounder while spinning with a variety of artificial lures and occasional fly fishing are the more usual methods for sea trout. Mullet have to be brought onto the feed with small pieces of bread soaked in fish oil in an area not affected by the inshore currents.

Just outside the main estuary channel on the northern side and staying a comfortable distance from the main channel is a shallow, sandy beach. This is a popular venue for shore anglers and the two main target species are bass and flounder. The best time to fish is the flooding tide in moderate surf conditions. Irish specimen bass have been recorded here - that is fish exceeding 10 lbs in weight. Best baits are sandeel, peeler crab, ragworm and lugworm. Sea trout have been taken from the main jetty and slipway at high water.

A standard beachcaster using a multiplier on fixed spooled reel is the usual practice. Line class should be 15 lbs with a 30 lbs shock leader. Hook sizes vary from 2 to 2.0 and the terminal tackle can be a paternoster or ledger 3 hook rig with the usual variations of one up and two down. A robust spinning rod and fixed spool reel will be required for mullet and sea trout.

Access to the northern shoreline is via the Ballealy road from the R27 or the pipe road from the R125. The area known as the Blue Pool is accessible via the coast road near Portrane known locally as the Borough Road.

Bait can be collected nearby and the northern shore provides some digging for ragworm and lugworm. Crab can be collected under the weed near or on the channel banks while sandeel can be dug over the sand bars at the entrance on low spring tides.

6.2 Broadmeadow

Broadmeadow Estuary is divided into two distinctive areas. The upper section is a shallow, saltwater lagoon which runs some 3 miles inland. This artificial lagoon is brought about by a man-made railway viaduct and weir which maintains a constant level of water even at low water. This land-locked area is very shallow (less than two metres) and is used by the small craft from the local sailing club. It also provides access to shore and small boat angling. The main species taken on rod and line are flounder, freshwater eels, mullet, bass, sea trout, three bearded rockling and some codling. There are launching facilities on the southern shore while access on the northern side is excellent and the high water mark offers reasonable driving on the entire northern shoreline.

Small boat anglers will find the main hotspot 100 metres above the arches on the viaduct where the main channel offers some relatively deeper water and in addition to the species mentioned above, some dogfish and whiting have also been captured.

The upper reaches of the lagoon are fed by the Ward and Broadmeadow Rivers. Several pools and channels above and below Balheary Bridge offer mullet and sea trout to specimen size.

On the southern side of the outer section below the railway viaduct, the main channel runs out in front of the Grand Hotel and offers some productive angling for bass, flounder and some dogfish. The flooding tide during the hours of darkness provides the best results. Best baits are sandeel, ragworm and crab. On neap tides, this area can be fished throughout the tide but on springs, it is necessary to move back to the beach below the Lambay Court bungalows. Specimen bass to 11 lbs have been recorded here.

Tackle can vary from a standard beachcaster with multiplier or a fixed spooled reel to a spinning rod. Hook sizes range from size 2 to 3/0 and a two or three hook paternoster rig is the most popular.

To the northern end of the lower estuary in front of the Island Golf Club, the sandbanks offer some excellent lugworm beds. Ragworm, mussel and clam can also be collected here. Access is from the R126 on the Island Golf Club road.

Angling Species



Bass



Flounder



Mullet



Lesser Spotted Dogfish

7. School's Out - Gone Fishin' with the Dublin Angling Initiative

In carrying out the fisheries investigations described here, Fingal Co. Council was anxious to forge linkages between the estuaries and those living adjacent to them. The approach taken was to link with local Primary schools and bring class groups out to the water while the survey was going on. This gave pupils and teachers and Fisheries Board staff a chance to meet, to talk about the fish, the estuary and how the fish were being caught. A series of structured visits enabled pupils to view, handle and get familiar with some of the fish found in the study. Pupils also had a chance to view the beach seining operation and collect and sort out the catch! Crabs proved very popular, particularly when introducing them to fellow-students!. Staff of ERFB and CFB were also on hand to give some basic instruction to the pupils on fishing and had fishing rods tackled up and ready for casting.

The groundwork for the site visits was laid by a series of visits to the designated class groups prior to the visit. Students were introduced to the estuaries, the fish species and factors having an adverse effect on the fish. The school visits also provided an opportunity to introduce the teachers to the information available from the Fisheries Boards through their web sites and through the Fisheries Boards' educational initiative 'Something Fishy'.



What's this... Des Chew (ERFB and Dublin Angling Initiative) with students from St. Andrew's National School, Malahide.



Anglers of the future.....

Pupils of St. Andrew's National School, Malahide
learning to fish on their visit to the survey team.



Anglers of the future.....

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