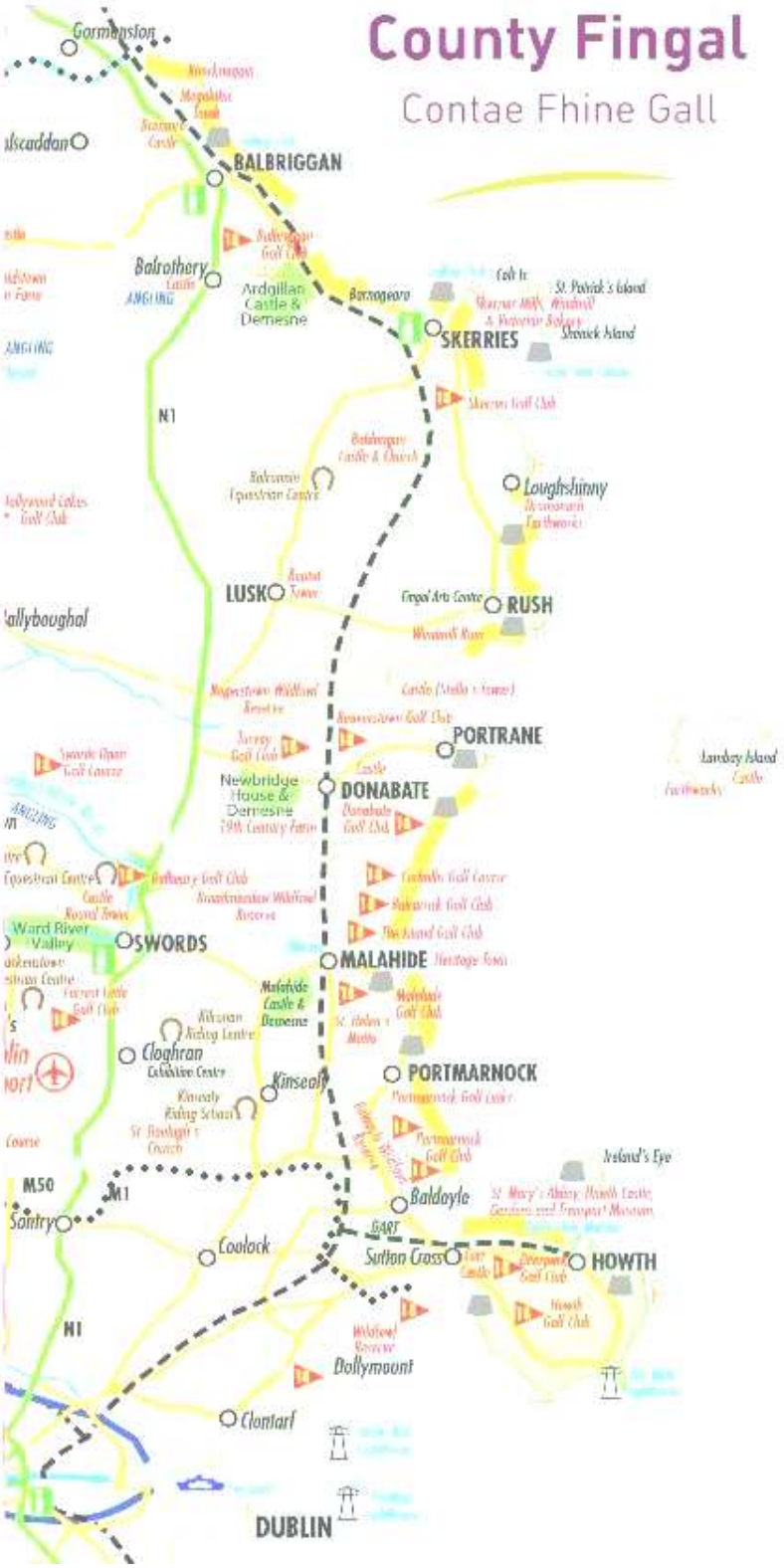

Fisheries Study of Fingal Coastal Zone

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Report prepared for:
Fingal County Council

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Fingal County Council
Comhairle Contae Fhine Gall

EcoServe

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1) Acknowledgements

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2) Introduction

The waters around Ireland contain some of the most productive fishing grounds in the EU. In 2004, an estimated 1.5 million tonnes of fish were harvested from the waters around Ireland (FSS, 2005). Fingal County Council covers an area of coastline, on the west coast of the Irish Sea, running from just north of Balbriggan to, and including part of Dublin Bay to the south. The fishing industry makes a significant contribution to the economic and social fabric of coastal communities. One of Irelands largest fishing harbours Howth is located within the Fingal area and to the north there are a number of historic fishing villages located including Balbriggan and Skerries, which still boast active fishing harbours.

Many inshore areas of the Irish Sea are regarded as notable spawning and/or nursery systems for several commercially important fish species including Cod (*Gadus morhua*), Whiting (*Merlangius merlangus*), Plaice (*Pleuronectes platessa*), Sole (*Soleidae*), Herring (*Clupea harengus*) and Mackerel (*Scomber scombrus*), with the most important areas being in the Western Irish Sea between Strangford and Dublin. As such, the Fingal coastal area is highly important in terms of fishery (both commercial and non-commercial) spawning, nursery and feeding functions.

The major fisheries in the Irish Sea are for demersal species, caught using a variety of gears. The large estuaries bounding the eastern Irish Sea support pot fisheries for velvet crab, lobster and whelk. There are also hydraulic dredge fisheries for razor fish and dredge fisheries for scallops. The main pelagic fishery in the Irish Sea is for herring, however, the number of vessels has declined to very low levels in recent years. Angling attracts people of all ages, gender and ability, who fish from beaches, harbours, piers, and from boats both close to shore and offshore over wrecks where marine life thrives. Recreational sea angling is a popular pastime/sport within the Fingal area, which has grown over the years and now supports 6 angling clubs in the region.

Marine biodiversity is in great danger, with the depletion of fisheries among biggest concerns. Fish make up the most abundant class of vertebrates, both in terms of numbers of species and individuals. They exhibit enormous diversity in size, shape, biology, and in the habitats they occupy. Because of the ecological importance of the Fingal coast for fish populations, Fingal County Council initiated a fisheries study of the Fingal coastal habitats. This study is being undertaken as part of the county council's Local Biodiversity Action Plan Program and will provide detailed and up-to-date information on: what species are present along the Fingal coast; how they use the coastal environment for example spawning; seasonal and long term trends in fish populations; locations with high fish diversity; conservation status and threats to the fish populations.

3) Study Site

Figure 1 Coastal area covered by Fingal County Council © Fingal Co. Co.

Rogerstown Estuary, Broadmeadow Estuary & Baldoyle Estuary are identified as important wildlife and leisure resources and have SAC, SPA and NHA status.

There are three active fishing harbours in the area: Howth, Balbriggan and Skerries Harbour.

Location

Fingal coastal fisheries (**Figure 1**) lie to the west of the Irish Sea, a relatively shallow sea, less than 90m deep in most places with shallow sandbanks off the Irish coasts. The Fingal coastal fisheries fall into Division VIIa, of the ICES areas, which incorporates all of the Irish Sea (**Figure 2**). The Irish Sea is one of the most ecologically-distinct and recognisable regional seas around Ireland and the UK, having a semi-enclosed geography and identifiable range of stakeholders and activities.

Habitats

The seabed of the Irish Sea contains a diverse range of habitats and species, from algae dominated rocky reefs to deep muddy areas inhabited by burrowing animals. To varying degrees all of these habitats can be utilised by mankind, through activities such as fishing, aggregate extraction and development of renewable energy resources offshore. In addition, some are priority habitats or contain listed species under EC and international legislation.

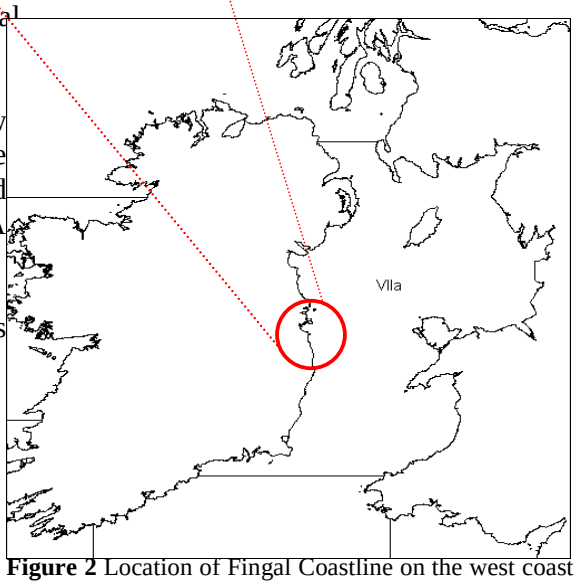

Figure 2 Location of Fingal Coastline on the west coast of Irish Sea within the ICES division VIIa © ICES

The recently completed the Irish Sea Pilot was set up in 2002 to examine the potential for an ecosystem-based approach to managing the marine environment at the regional sea level. Specifically, the pilot looked at the integration of nature conservation into key sectors, including fisheries, in relation to sustainable development. As part of its results, an over view of the Irish Sea through collated geophysical, hydrographical, nature conservation, ecological and human use data and used GIS analysis was produced. **Figures 3-6** show the bathemetry of the Irish Sea, SACs and SPAs, and marine landscapes produced during this study (JNCC, 2004).

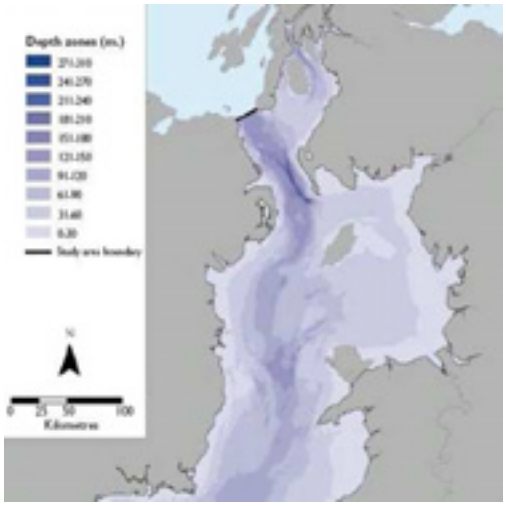

Figure 3. Irish Sea Pilot
Processed Bathemetry
Copyright: British Geological Survey© NERC / © Crown

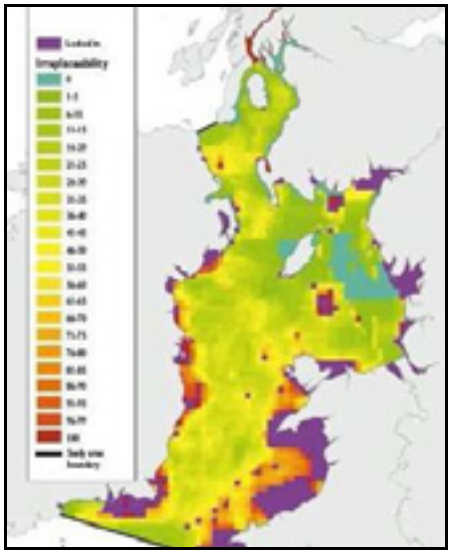

Figure 4. Irish Sea Pilot
Irreplaceability: in biodiversity, estuaries, SACs and SPAs with Naturalness © Crown.

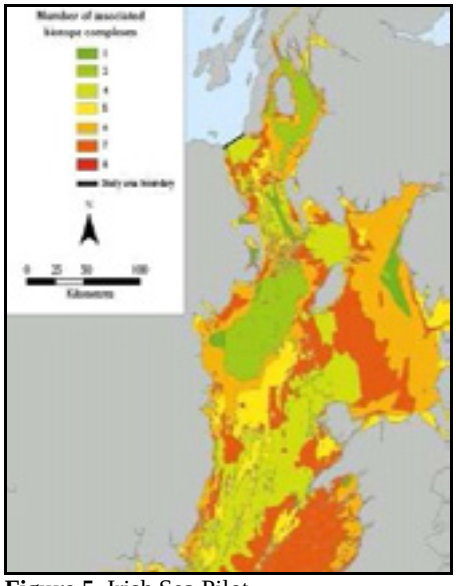

Figure 5. Irish Sea Pilot
locking Marine Landscapes biotope complexes © Crown.

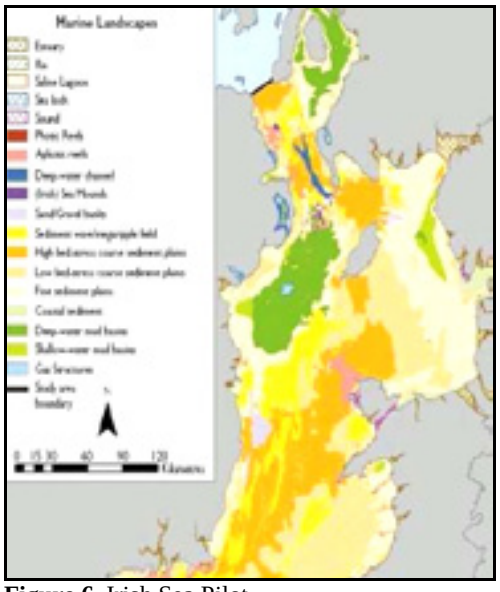

Figure 6. Irish Sea Pilot
Marine Landscapes showing number of associated © Crown.

4) Materials & Methods

Methodology

The 'Fisheries Study of Fingal Coastal Zone' project is divided into three phases:

1. Initial consultation / literature review
2. Field investigations, data collection / collation
3. Reporting

1. Data source identification (initial consultation)

This phase involves a comprehensive review of in-house data from the EcoServe marine library / database and consultation with the following state or semi state agencies and NGO's:

- Department of the Marine and Natural Resources – vessel register (identify potential contributors to any survey from various elements of the fishery sector in the Fingal area)
- Marine Institute (MI data collection programmes involve both on-board fisheries observations on commercial fishing vessels and in-house scientific surveys – often species and location specific
- Bord Iascaigh Mhara (BIM data collection programmes aim to collect data on fishing activity, catches and discards, throughout the course of fishing operations in accordance with best international practices and techniques in order to increase the amount of biological data available on Irish coast species and to provide this data in an internationally acceptable format to the International Council for the Exploration of the Sea (ICES).
- Central Fisheries Board (Peter Green, Jimmy King), Eastern Regional Fisheries Board. The CFB is involved in a long term monitoring of coastal juvenile fish species programme, while the ERF would keep fisheries records – both science and angling oriented.
- Central Statistics Office

2. Data collection / collation (Investigative methodology)

Consultation aims

The main function of the consultation was to provide a means of reviewing general fisheries information in a local (Fingal) context. Through a process of semi-structured interviewing, the four identified programme areas of interest were explored

i) the overview of species present along the Fingal coast and how they use the coastal environment;
ii) identification of seasonal and long term trends in fish populations;
iii) identification of specific locations with high fish diversity
iv) identification of threats to the fish populations.

By conducting this consultation we aimed to develop an understanding of how local Fingal fishermen understand these issues in addition to scientifically verified information and datasets from the various state and semi-state bodies responsible for fisheries in this area.

Sample selection

The project brief identifies the Fingal fisheries communities as a primary information source for local data (in addition to long-term scientific datasets held for fisheries in the area by fisheries authorities). In order to ensure a geographical and functional (sectoral) range of fisheries information in the Fingal area, the EcoServe project team identified (in conjunction with DoMNR, BIM and the client) a number of local fishermen from the major Fingal ports (Skerries, Balbriggan and Howth) that would be suitable interviewees for this project. Thus, the sample encompassed fishers and/or their representatives, anglers, regulators and administrators, biological scientists, and environmentalists.

The interview process

The consultation would be carried out using semi-structured interviews. This approach enabled the interviewer to be flexible and responsive with regard to the particular circumstances and interests of the interviewee. It also provided an environment within which stakeholders could raise the issues which were most important and relevant to them and share their knowledge and experiences with the interviewer, as well as their opinions and their reasons for holding those views. Thus, interviews were interviewee-led, rather than strictly structured by the interviewer. The specific survey design was oriented to needs of the client and was agreed before any consultation was undertaken.

Ethics

In accordance with the norms governing consultative research, strict ethical guidelines were imposed on the research team when conducting interviews.

Survey locations

The project focused on the following potential contributing ports and harbours:

- Balbriggan
- Skerries
- Howth

The following coastal locations were also specifically investigated for fisheries importance in the area:

- Lough Shinney
- Rush
- Rodgerstown
- Malahide
- Clontarf
- Dublin Bay

5) Review of scientific data

i) Background

Fisheries management – overview

The management of inshore waters is largely under the control of the member state of the European Community from 12 nautical miles and under exclusively national control (Department of Communications, Marine and Natural Resources) from 6 nm to the shore. Certain EU technical conservation measures must be enforced within the coastal band unless the member state itself applies more stringent conservation regulations. Although inshore stocks and fisheries are within the national 12 nm limit they still come under the Common Fisheries Policy (CFP) system of regulation. The CFP is the European Union's system for the management of fisheries and aquaculture. As fish are a mobile resource and cannot be delimited to a particular country, all regulations under the CFP are adopted at Community level and implemented in all Member States. All aspects of fisheries and aquaculture are covered to some extent under the umbrella of the CFP. The main instrument of the CFP is Total Allowable Catches (TAC's) supplemented by various technical measures (e.g. effort control; mesh size etc.). The provision of timely and accurate fisheries advice on the resource base underpins the management framework of the CFP. For management purposes, fish populations are separated into "stocks", i.e. the populations occurring within the divisions allocated by the International Council for the exploration of the Seas (ICES). These fisheries are mixed with many stocks exploited together in different combinations in different fisheries.

Scientific fisheries information/advice comes from a number of sources:

Marine Institute: Fisheries Science Services (**FSS**) is one of seven service teams within the Marine Institute. Its mission is to 'research, assess and advise' on marine fisheries in order to ensure the sustainable exploitation of this vital resource.
International Council for Exploration of the Seas (ICES): Analytical assessments of commercial fish stocks are carried in June each year by the ICES Northern Shelf Demersal Working group, using estimates of the numbers of fish at each age in international landings, commercial catch rates in relation to fishing effort, and data from trawling surveys. In addition, estimates missing removals as a bias in landings, assuming that they have the same age composition as reported landings. The results are used to provide advice on the level of exploitation of each stock, and on management measures for the coming year.
Centre for Environment, Fisheries & Aquaculture Science (Cefas): Cefas is an internationally renowned scientific research and advisory centre working in fisheries management, environmental protection and aquaculture. Scientific information can also be sourced from a number of independent studies funded for example through **BIM** (Bord Iscaigh Mhara) and implemented through a number of colleges where research is carried out by Postgraduate or Postdoctoral researchers.

Fisheries interactions in the Irish Sea:

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly the critical stocks, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Four main fishery units can be described in the Fingal area of the Irish Sea: these are *Nephrops* otter trawlers, roundfish otter trawlers, semipelagic trawlers, and beam trawlers. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries.

ii) Status of commercial stocks

Cod (*Gadus morhua*)
Ecology (Cohen *et al*., 1990)
Mature cod grow to approximately 120 cm in length, weighing around 12 kg, however larger fish have been recorded. Age of maturity varies regionally but is usually between one and fifteen years. Colour is variable depending on habitat but most are spotted with white bellies. A prominent curved, white (or very pale) lateral line makes this species easy to identify. **Habitat:** The Atlantic cod is generally considered a demersal fish, although its habitat may become pelagic under certain hydrography conditions, when feeding or spawning. The presence of cod usually depends on prey distribution rather than on temperature. However, whatever the reason, larger fish are found in colder waters in most areas (0-5°C). It lives in almost every salinity from nearly fresh to full oceanic water, and in a wide range of temperatures from nearly freezing to 20C° Cod prefer cold temperate waters and are commonly found on sandy bottoms and are often mottled brown in appearance from the shoreline down to depths of 600 m.

The Irish Sea cod fishery has traditionally been carried out by otter trawlers targeting spawning cod in spring and juvenile cod in autumn and winter. Since the early 1980s the activities of these vessels have decreased and there has been a development of semi-pelagic trawling for cod and whiting. Some of these vessels switch between pelagic trawling and twin-trawl fishing for *Nephrops* (prawn), depending on fishing opportunities and market demands. Cod are caught throughout the year in mixed-species fisheries, over a wide area but especially in the north-west Irish Sea. Approximately 30% of the total cod catch is taken in the *Nephrops* fishery. Seasonal changes in the availability of cod to these fisheries can usually be associated with adult fish aggregating to spawn or the recruitment of small fish to the fishery as they grow and move away from nursery areas.

The main spawning areas for cod in the Irish Sea in the north-west off County Down and to the east off the Isle of Man (**Figure 7.**). There is also some cod spawning off the south-west tip of the Isle of Man and of the south east coast of Ireland. Spawning takes place chiefly during March, although cod eggs have been found in the plankton as late as May.

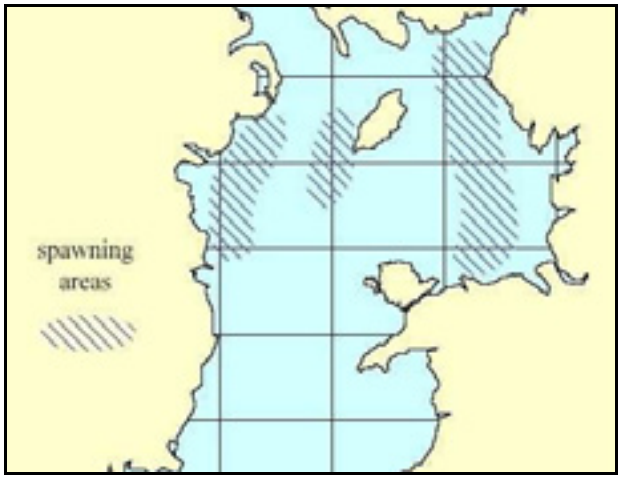

Figure 7 Cod spawning area in the Irish Sea © Cefas

Cod stocks

The Irish Sea cod stock, based on the most recent estimates (Oct 2005) of spawning stock biomass (SSB – the weight of all mature fish within a stock) and fishing mortality, ICES classifies the stock as having reduced reproductive capacity and as being harvested unsustainably, i.e. the stock is in such a poor state that it is outside safe biological limits.

Recruitment: There have been large fluctuations in recruitment of young cod to the fishery, though the abundance of all year classes since 1987, other than that of 1991, has been below the long-term average. Recruitment has been below average for the past 16 years and the three most recent year-classes are amongst the four lowest on record (FSS, 2005).

Exploitation: Assessment shows that the fishing mortalitiy of VIIa cod rose steadily in the 1970s and 1980s to a peak in 1993, when over 60% of 2-4 year old cod were caught each year. A reduction in the proportion caught in 1995 and 1996 is thought to be caused by an overall decline in trawl effort in the Irish Sea and an increased targeting of *Nephrops* and haddock. The fishing mortalities observed in the early 1990s and 1997 has caused a long-term decline in the SSB and carry a very high risk of stock collapse. The large fluctuations in recruitment of young cod have strongly influenced the adult stock. However, high fishing mortality rates from the mid-1980s resulted in the SSB falling below 10,000t from1990 onwards to an historic low in 1995. At the average rate of exploitation estimated for recent years, SSB will remain at sizes, dominated by only a few age classes, where the risk of continued below-average recruitment is high (FSS, 2005).

In 2000, an emergency spawning closure was introduced to maximize egg production (**Figure 8**). The closure has been continued in recent years, restricted to the western Irish Sea.

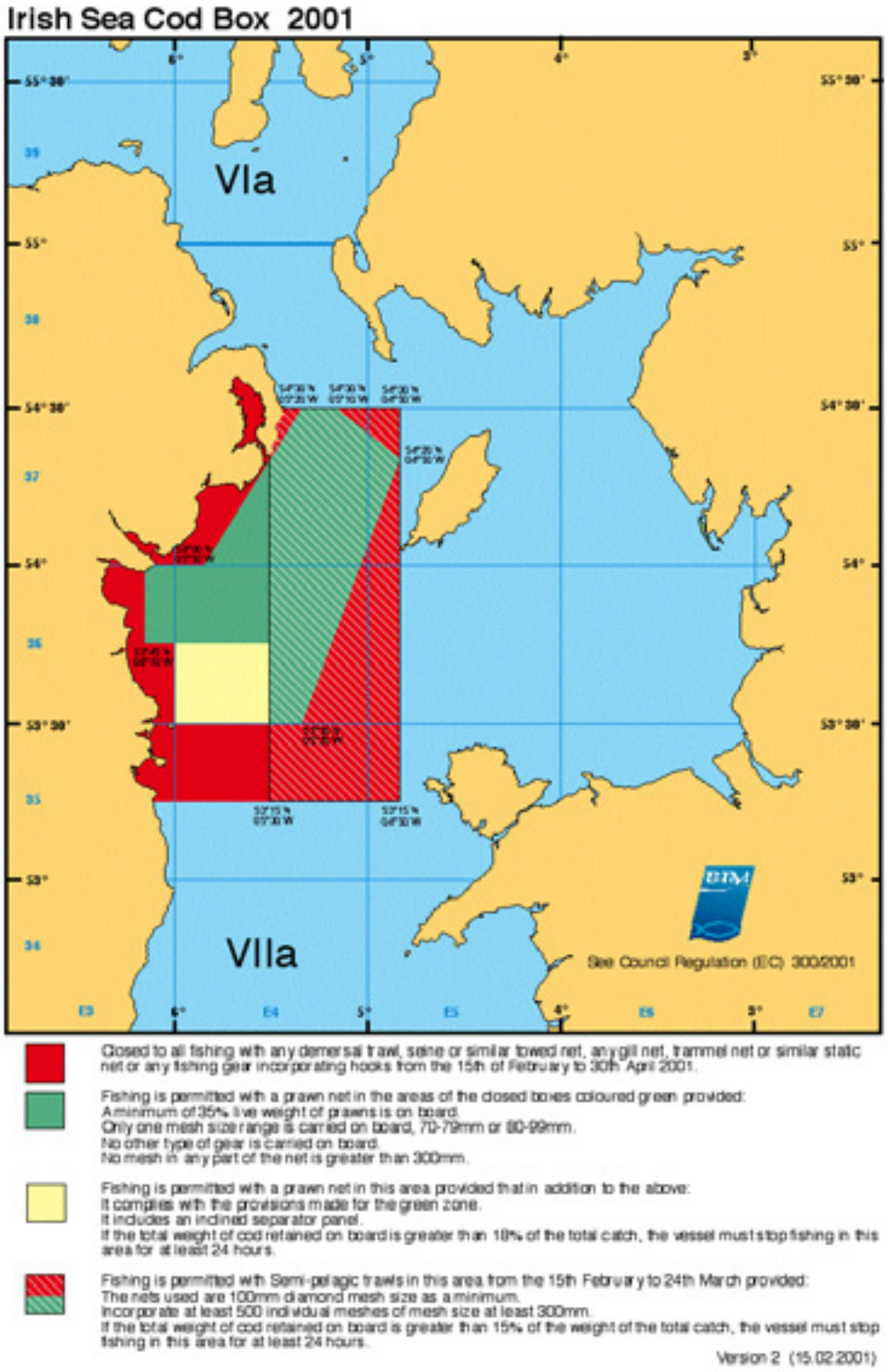

Figure 8. Irish Sea cod box © Directory of the Irish Seafood, Fisheries & Aquaculture Industries (www.irishseafood.com/ maps/codbox_gif.html).

A recovery plan has been proposed that should include zero catch rates. In February 2004, the European Union introduced regulatory measures for the recovery of cod

stocks in the Irish Sea. The aim is to increase the quantity of mature fish to more than 10,000 t over the next five to ten years. These measures included controls for the setting of total allowable catch (TAC), fishing effort limitation (number of days at sea and gear restrictions) and restrictions on landing ports, stowage and transport of cod.

Forecast: The most plausible forecast assumes a total removal in 2005 that is 25% greater than the agreed TAC. The forecast indicates that a zero catch in 2006 provides only 50% probability of rebuilding SSB to its biological limit in 2007. The simulations indicate that a 30% increase in SSB during 2006 could be achieved with a high probability, only with a reduction in fishing mortality to below 25% of the 2004 level (ICES, 2005).

ICES Management concerns regarding stocks:

- Time and area closures have not been sufficient to lead to rebuilding of this stock.
- The fishery is managed by TACs that do not restrict landings.
- Practices of misreporting may develop when TAC regulations are not efficiently implemented. If misreporting cannot be estimated accurately and included in stock assessments the result will be an increasing bias in stock assessments and forecasts resulting in even more restrictive TACs and increasing misreporting. Over time it becomes impossible to establish the real stock situation and to advice on catches which may be taken sustainably.
- It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

The continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of the regulations will not be possible until data of sufficient quality become available.

Whiting *(Merlangius merlangus)*

Ecology (Cohen *et al*., 1990)

The whiting is similar in appearance to its larger relatives the cod, the haddock, the coley and the pollack. It has three dorsal fins separated by small gaps, the third fin extending almost to the tail fin. The tail is not forked, having almost a square end. The two anal fins are very close together, nearly touching one another and, together with the anterior fin, are elongated. The pectoral fin is also long and projects beyond the base of the anal fin. The whiting's upper jaw projects slightly beyond the lower, and the lateral line is continuous along the length of the body. In colour, individual fish vary quite a lot, and there is often a small dark blotch at upper base of the pectoral fin.

Habitat: This fish is a bottom-dweller in water no deeper than 200 metres. It prefers mud and gravel beds but is also recorded on rocky bottoms. The young fry spend about a year in much shallower waters of no more than 30m depths, before migrating to the adult feeding grounds.

Whiting are taken mainly as a by-catch in otter-trawl fisheries for *Nephrops*, cod and other demersal species. Approximately 45% of the total estimated catch of whiting is discarded in the *Nephrops* fishery that operates on the main whiting nursery areas in the Irish Sea. This means that the fishing mortality on whiting cannot be effectively controlled by restrictions on landings alone, but would also require measures to reduce discards.

The main spawning areas for whiting in the Irish Sea are off the Irish coast between County Down and Dublin, to the southeast of the Isle of Man, and in the northwest into the North Channel. Spawning takes place mainly between March and May (**Figure 9**).

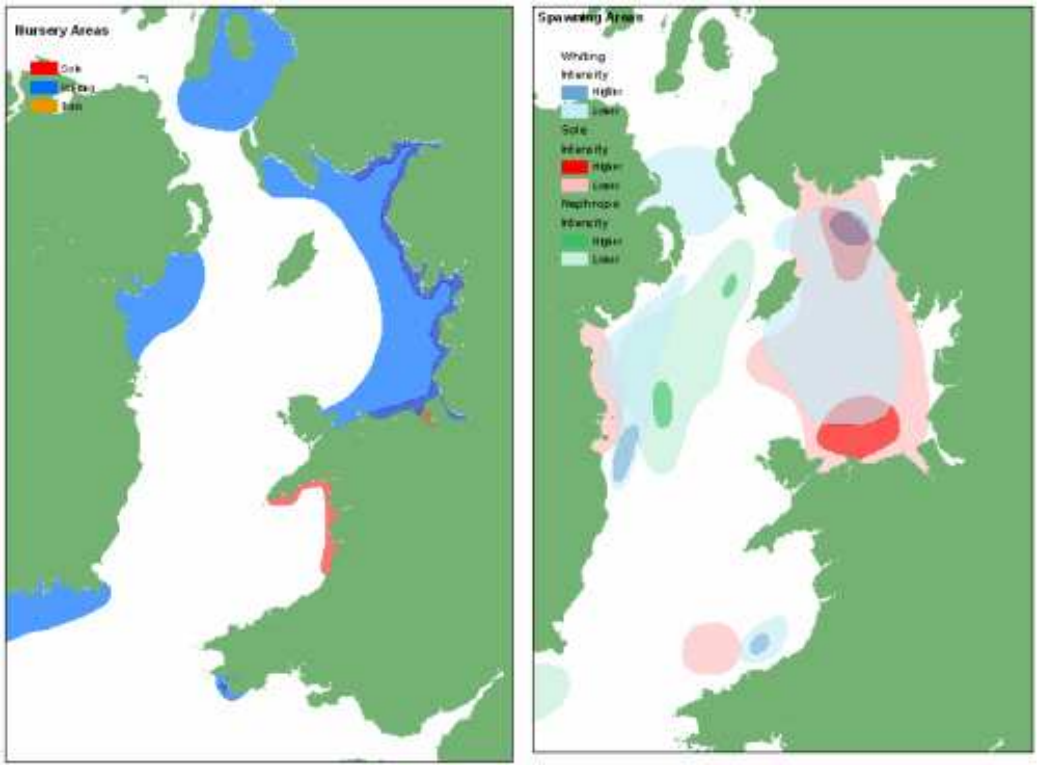

Fig 9. Nursery and spawning grounds in the Irish Sea for Whiting, Sole and Nephrops.

Whiting stocks

Long term information on the historical yield and catch composition all indicate that the whiting stock is also outside safe biological limits and a recovery plan with zero catch rate proposed. On this basis ICES advises that catches of whiting in 2006 should be the lowest possible.

Recruitment: There is a gradually decreasing trend in abundance of 0 year old whiting. High recruitment in 1991 was followed by a low recruitment for the next seven years. However, the 1999 year class is well above the series range (FSS, 2005).

Exploitation: There was no analytical assessment carried out for this stock in 2004 and again, no analytical assessment was possible in 2005. The last assessment in 2003 indicated a decrease in SSB of a factor of 10 from 1980s to the 1990s. The very large 1991 year-class caused a temporarily rise in SSB, but survey information from the 1990s indicated low recruitment and high fish mortality resulting in the SSB to continue to decline to a very low level (FSS, 2005).

Landings of whiting by all vessels, and discards of whiting estimated for *Nephrops* fisheries, have declined substantially since the 1990s and whiting is now a relatively minor by-catch in the demersal fisheries. Due to the small catches and low value of the catch, a high proportion of whiting are discarded adding to fish mortalities. Age profiles observed on these surveys are very steep indicating either a continuing high mortality or some emigration effect.

ICES Management concerns regarding stocks:

- Fishing mortality cannot be managed by a TAC on whiting, and measures restricting landings alone will not be sufficient to allow recovery of the stock.
- The substantial drop in landings demonstrates the need for concern for this stock, but as current catches are virtually all taken as discards in the valuable *Nephrops* fishery, measures to protect whiting would require constraints on the *Nephrops* fishery. By-catch mitigation measures (square mesh panels) are in place in the *Nephrops* fishery, but the fishery is still generating substantial discards.
- There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to restrict fishing.
- The minimum landing size (MLS) for whiting is 27 cm, however, discard data shows that individuals in excess of that size are also discarded. In addition, the discard data indicates that very large numbers of whiting below this size are caught in the *Nephrops* fishery and discarded.

Sole (*Solea solea*)

Ecology (Desoutter, 1992)

Occurs at a temperature range of 8.0-24.0°C. Usually solitary. Feeds on worms, mollusks and small crustaceans at night. Waden Sea is the most important nursery area. Recruitment is very variable. During spawning migrations, frequently found pelagically. Usually solitary. Feeds on polychaete worms, small soft-shelled bivalves, small fishes and crustaceans. Reproduction: spawns January-April, with two peaks in February (Mediterranean), or December-May (Bay of Biscay), or April-June (North Sea).

Habitat: Burrows into sandy and muddy bottoms. Retreats to deeper water during winter. Benthic species on sandy and muddy bottoms,from the shore down to 300 m.

Sole are taken mainly in a beam-trawl fishery that commenced in the early 1960s and, to a lesser extent, in the longer established otter-trawl fisheries. Effort in the Belgium beam-trawl fleet increased in the late 1980s as vessels normally operating in the North Sea were attracted into the Irish Sea by better fishing opportunities. Beam-trawling by UK vessels increased substantially from 1986, reaching a peak in 1990, and decreased thereafter. In recent years, catch rates of sole have been low in the Irish Sea, and the

beam trawl fleet has spent more time fishing on sole grounds in other areas. The beam and otter-trawl fleets also take rays, brill, turbot and anglerfish.

In the coastal waters of western England and Wales, sole are found in greatest abundance in the north eastern Irish Sea and the Bristol Channel. The main sole spawning grounds are in the north-east Irish Sea and are generally in water less than 40 m deep and within extensive areas of relatively shallow and gently shelving sediments close to nursery grounds (**Figure 9**). Spawning and nursery areas are generally well defined. One and two year old sole are found exclusively in shallow (<20m depth) parts of the north-east Irish Sea, while adults (over 3 years old) are found in the same area and also in deeper water.

Sole stocks
In the eastern Irish Sea, beam trawlers target sole, with a bycatch of plaice, rays, brill, turbot, anglerfish and cod. Although Sole are considered to be outside safe biological limits the available information is inadequate with no analytical assessment was possible in 2005 to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. Commercial catch per unit effort (CPUE) indicates a stable stock situation in recent years and this is confirmed by survey information.

Recruitment: The VIIa sole stock has benefited several times since 1970 from strong year classes, and has thus sustained a level of exploitation that is considered high for a stock of this type. However, since the good recruitments in 1984-86, there were nine consecutive years below average abundance of two-year-old sole, broken only by a good year class in 1989. Recent recruitment levels have been around average (FSS, 2005).

Exploitation: The assessment shows that the fishing mortality of VIIa sole has remained steady around 30-40%, reaching and historic high in 1987, when high catch rates attracted beam trawlers into the Irish Sea. In recent years exploitation has decreased to below 30%. The sole SSB has shown a declining trend since 1970, except when above average year classes have boosted the stock. The succession of poor recruitments since 1987, combined with high fishing mortality rates, have lead to a more rapid decline resulting in an historical low level in1996. Since then there has been a slight but steady increase (FSS, 2005).

ICES Management concerns regarding stocks:

- There are indications that area misreporting of sole occurs, and there are also indications that some fleets are not limiting their uptake to their quota. Such practices have the potential of masking the true stock trends for sole.
- Sole is caught both in a targeted fishery and as a by-catch in the plaice fishery. Information on discards is very limited, but information from 2003 is indicative of discard ranges up to 5% in weight.

Nephrops
Ecology (FAO, 1991).
Nephrops norvegicus is a small lobster, pale orange in colour and one of the common names for *Nephrops* is Dublin Bay prawn. It grows to a maximum total length of 25 cm (including the tail and clawed legs), although individuals are normally between 18-20 cm. The head and thorax have a non-segmented cover (the carapace) while the

long abdomen is clearly segmented with a broad fan-like tail. The first 3 pairs of legs bear claws. The first pair of legs are very elongated with longitudinal, spiny ridges. There are 2 pairs of antennae, the second pair much longer and thinner than the first. The eyes are large, black, and moveable.

Habitat: Found sublittorally in soft sediment, commonly at depths of between 200-800 m, although considerable populations exist at depths <200 m, for example the Clyde Sea. There are many records of *Nephrops norvegicus* populations <20 m in Scottish Sea Lochs. They live in shallow burrows and are common on grounds with fine cohesive mud, which is stable enough to support their unlined burrows.

This *Nephrops* fleet is by far the largest fleet segment in the Irish Sea. Over 250 boats take part in a Nephrops fishery and these take a considerable by-catch of whiting, cod, haddock and plaice. Vessels operating out of Howth, Clogherhead and Skerries take most of the Irish landings. The western Irish Sea *Nephrops* fishery is concentrated on an area that is also a whiting nursery ground (**Figure 9**). Several vessels target *Nephrops* with otter trawls, either a single or twin rig. This fishery occurs predominantly in the muddy area west of the Isle of Man.

Bycatch from the *Nephrops* fishery includes haddock, cod and plaice. In addition, whiting is caught, but usually discarded. Discarding of juvenile whiting in the *Nephrops* fishery has contributed significantly to the reduction of the VIIa whiting stock. These trawl fisheries also have a commercially important bycatch, consisting of anglerfish, hake and sole.

***Nephrops* stock**
The *Nephrops* stock of the Irish Sea is considered to be fully exploited. CPUE data available from 1995 showed a steady increase followed by a slight drop since 1999. Despite evidence of under-reporting, the *Nephrops* fisheries in Division VIIa have been sustained for over 20 years with similar high levels of fishing effort.

ICES Management concern/advice regarding stocks:

- Concern, however, has been raised over the increasing use of twin rigs, which are known to have a greater impact on roundfish stocks (e.g. cod, haddock and whiting).
- The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch species.
- The *Nephrops* trawl fisheries take considerable by-catches of other species. The management of these fisheries should be seen in the context of mixed fisheries
- Evidence of under-reporting of landings creates problems with using commercial data for analytical assessments and in TAC recommendations.

Haddock *(Melanogrammus aeglefinus)*
Ecology (FAO, 1990)
The haddock is an omnivorous fish, feeding mainly on relatively small bottom-living organisms including crustaceans, molluscs, echinoderms, worms and fishes. Haddock undertake extensive migrations in the Barents Sea and Iceland, and more restricted

movements in the northwestern Atlantic, mostly to and 2 from the spawning grounds. First maturity is reached at 4 years for males and 5 years 4 for females, except in the North Sea stock where it is reached at 2 and 3 years respectively. Although the overall sex ratio is about 1:1, females predominate in shallow waters and males on offshore grounds.

Habitat: A demersal species found from 10 to 450 m depth, more common from 80 to 200 m, over rock, sand, gravel or shells, usually at temperatures 2 between 4° and 10°C.

Haddock are taken both directly and as a component of catches in mixed trawl fisheries. The main gears used are fish directed otter trawls, *Nephrops* directed otter trawls, seine nets and gill nets. Haddock is more widely distributed than cod with low numbers of larvae found in the Celtic Sea, north west of Ireland and on the Porcupine Bank. Little is known about the egg and larval distribution of haddock around Ireland: in the Celtic Sea haddock larvae have mainly been found in transitional waters, ie between neritic stations and the shelf edge (Horstman and Fives, 1994; Acevedo *et al.*, 2002).

Haddock stocks

Haddock had very strong 1994 and 1996 year classes, consequently there was a substantial increase in stock size. This stock is concentrated in the western Irish Sea and suffered very high rates of fishing mortality. The SSB increased since 2001 as a result of the stronger 1999 and 2001 year-classes. Although the 2003 and 2004 year-classes appear to be above average and should result in increased SSB the stock is currently harvested outside safe biological limits.

The EU Cod Recovery Plan regulation implemented in the Irish Sea from 2004 will impinge upon the management measures for 2006 for species caught in related fisheries, including haddock. The current directed fishery for haddock in the Irish Sea is likely to generate by-catches of cod in the same area.

ICES Management concerns regarding stocks:

- The misreporting levels for haddock have been highly variable in recent years, making it impossible for ICES to provide a reasonable estimate of the 2004 landings.
- Recent discard estimates available for some fleets indicate a variable, but very high discard rate of younger fish. These estimates are not used in the assessment due to the short time-series available.
- The assessment of recent stock trends is based on survey data only using the March survey data up to 2005.

Plaice (*Pleuronectes platessa*)

Ecology (Cooper & Chapleau, 1998)

Plaice are one of the best-known and most economically important flatfish in Europe. Plaice are members of the flounder family, a group that also includes dab, witch, halibut and lemon sole. They are easily identifiable by the orange spots on a brown upper surface. Feeds mainly on thin-shelled molluscs and polychaetes.

Habitat: Lives on mixed bottoms, from a few metres to about 100 m, the older the deeper the occurrence. Prefers shallow water and small plaice are usually seen on bathing beaches. Occurs at a temperature range of 2-15° C.

Plaice are taken mainly by otter trawls, as part of a mixed white-fish fishery, and as a by-catch in the beam trawl fishery for sole. Effort in the UK and Belgian beam-trawl fleets increased in the late 1980s, but has since declined. The main fishery is concentrated in the north-east Irish Sea off North Wales, Lancashire and Cumbria. Although plaice are taken throughout the year, the heavier landings are made between May and November when recruiting or early maturing fish are plentiful on the shallower grounds inshore.

The main spawning area for plaice in the Irish Sea is off the north coast of Wales, extending northwards to Cumbria (**Figure 10**). Plaice also spawn off the north-east coast of Ireland between Dublin in the south and Dundrum Bay in the north. Plaice eggs have been found in Cardigan Bay during surveys conducted before 1995, but recent work indicates that only small numbers now spawn in this area. Spawning takes place mainly during March, although plaice eggs have been found in the plankton as late as May.

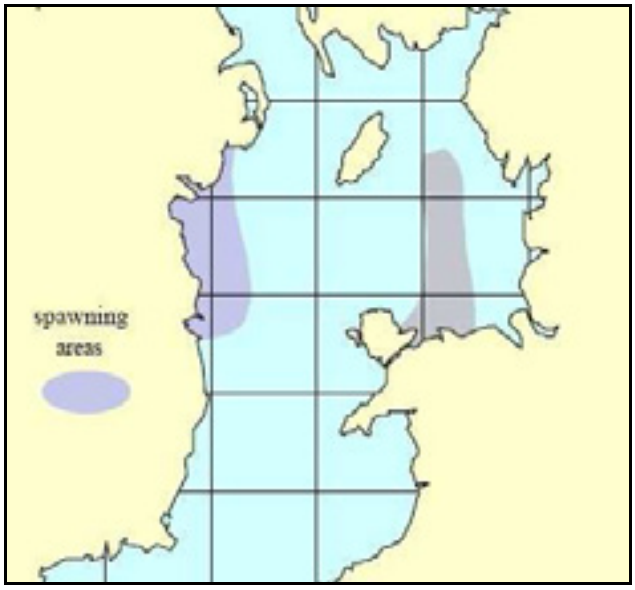

Figure 10 Plaice spawning area in the Irish Sea © Cefas

Plaice stocks

The plaice stocks are considered to be within safe biological limits, with an increasing stock size and reduced fishing mortality. ICES classify the stock as having full reproductive capacity and being harvested sustainably. Consistent with an overall decline in fishing effort on flatfish in the Irish Sea, the exploitation rate on this stock has declined in recent years.

Recruitment: From 1965 to 1981 the abundance of 1 year old plaice fluctuated but with no clear trend. However, a succession of strong year classes in the mid-1980s

was followed by recruitment levels below the average for the earlier period. Beam trawl surveys suggest a slight increase in recruitment since 1995 (FSS, 2005).

Exploitation: The assessment shows that fishing mortality of VIIa plaice rose steadily to a peak in 1976, when nearly 60% of 3 to 6 year old plaice were caught. Fishing mortality remained high during the 1980s, consistent with an increase in effort by the UK and Belgian-trawl fleets. Plaice landings have declined steadily since 1987 due to declining exploitation and a series of below average recruitment since 1987. The plaice SSB was high in the late 1960's declined to a series low in 1977 and peaked again in 1988 following a series of good recruitments. It has since declined as a result of high fishing mortality in the late 1980's although there has been a slight improvement since 1996 (FSS, 2005).

ICES Management concerns regarding stocks:

- There will be little gain to the long-term yield by increasing fishing mortalities above current levels. Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.
- Surveys indicate a substantial increase in abundance of plaice in recent years that is not apparent from commercial catch data. The assessment is strongly influenced by survey trends and the resulting estimates of rapidly increasing stock biomass should be treated with some caution until the discrepancy between these two data sources can be better explained.
- Discards are not currently incorporated into the assessment.

Herring *(Clupea harengus harengus)*
Ecology (Whitehead, 1985)
Body elongate and fairly slender, belly rather rounded, scutes without prominent keel. No median notch in upper jaw. Gill cover (operculum) without radiating bony striae. Hind border of gill opening evenly rounded. Pelvic fin insertion behind vertical from dorsal fin origin. No distinctive dark spots on body or fins. Feeds on small planktonic copepods in the first year, and thereafter mainly copepods (especially *Calanus finmarchicus* and *Temora longicornis*), but also hyperid amphipods, euphausids, mysid shrimps, small fishes, arrow-worms, ctenophores and pteropods).

Habitat: Coastal, pelagic down to 200 m, schooling, with complex feeding and spawning migrations, whose times and extent correlate with the various more or less distinct razes which can be recognized on morphological grounds (mainly numbers of vertebrae, finrays, scales and gillrakers).

Herring are fished using either purse seine or gillnet gear. Herring in the Celtic Sea and west of Scotland is considered to be an important food source for sea birds, sea mammals, and many piscivorous fish. The stock identity is complex as the juveniles mix with those of the Celtic Sea and the adults migrate from the Irish Sea after spawning. Atlantic herring consist of both winter-spring and summer-autumn spawning groups characterized in the northeast Atlantic by oceanic, shelf, and coastal populations. The shelf group includes the various locally migratory North Sea populations adjacent to Ireland and the UK. Herring typically congregate near their spawning grounds for several weeks to months prior to spawning. Temperature is one of the factors that determine when spawning occurs (Haegele & Schweigert 1985).

Herring stocks
The status of the herring stock is uncertain, although it appears to have recovered from the collapse in the 1970s. It seems likely that the stock has been relatively stable for the last 10 years, and that the fishing mortality does not appear to be increasing above the recent average.

Recovery plan: Areas closed to herring fishing around the east coast of Ireland and west coast of Britain were put in place to protect juveniles when an industrial fishery operated in the 1970s. A closed area exists to the east of the Isle of Man to protect the spawning aggregations.

Lobster (*Homarus gammarus*)
Ecology (FAO, 1991)
A large lobster that can grow up to one metre in length, but 50 cm is more common. It is blue-coloured above with coalescing spots and yellowish below. The first pair of walking legs carry massive (but slightly unequal) pincers which can be formidable and dangerous. The body lacks strong spines or ridges and is only slightly granular.

Habitat: It is found on rocky substrata, living in holes and excavated tunnels from the lower shore to about 60 m depth.

Lobsters are captured by potting where pots are deployed in groups referred to as ‘leaders’ or ‘strings’.

Lobster stocks
Recruitment: Egg per recruit is low, calculated at 7% of virgin egg production. Stocks may be vulnerable to a further reduction in egg production and recruitment in a less favourable recruitment environment (FSS, 2005).

Exploitation: Catch rates have been stable or increasing over the past decade despite strong increases in fishing effort, this suggesting that recruitment has been strong. This species is managed by a number of Technical conservation measures (TCMs). TCMs are effective only where fishing effort is stabilised. Catch rates in 2002 varied by region and were strongest in the southwest (25 lobsters per 100 pots hauled) and weakest in the south-east (5-10 lobsters per 100 pots hauled). Although catch rates have been strong over the past 10 years, they are 3 times lower than in the 1960s (FSS, 2005).

ICES Management advice regarding stocks:

- There is a need for restrictions on entry to this fishery and a cap on the amount of gear in use.
- The current range of conservation measures (minimum size and V-notching) should be continued and enforcement of the regulations should be intensified.
- Consideration should be given to the introduction of a maximum size limit at 120 – 125 mm carapace length, to protect previously V-notched females whose tail fins have repaired.

Razor Clam *(Ensis sp.)*

Ecology (Hill, 2000)

Razor shells have an elongate and fragile shell with valves gaping at both ends. The shell is smooth on the outside and whitish in colour with vertical and horizontal reddish-brown or purplish-brown markings separated by a diagonal line. The periostracum is olive-green. The inner surface is white with a purple tinge and the foot is pale red-brown. The presence of razor shells in sand is indicated by keyhole-shaped openings made by the short, united siphons, which extend just above the sediment surface when the animal is suspension feeding.

Habitat: Razor shells live in deep, vertical, permanent burrows in fine, sometimes muddy, sand from extreme low water to the shallow sublittoral. *Ensis arcuatus* lives in coarser sediment than either *Ensis ensis* or *Ensis siliqua*.

Razor clams are slow growing and late maturing and successful spatfalls may be erratic. The spawning period appears to be extensive although investigations have revealed there is only one spat fall per year in the case of *E. arcuatus.* Razor clams are typical K-selected species and populations of such species are characterised by relatively fewer offspring.

Harvesting them has been carried out by dredging and although techniques have improved since the first blade or harrow fluidised bed dredges were used in the late 1990s, the technique still causes considerable incidental damage and disturbance to razor clams and associated fauna. Rejection and discard rates as a result of breakage and bruising have declined from the estimated 60% that used to accompany the early dredgers but the consequences of fishing by these methods are not completely quantified. The harvestable proportion of a razor clam bed can be as high as 90% of the invertebrate biomass. Both species of razor clams harvested are long lived, longevity extending to 16 – 18 years. Growth becomes asymptotic after 10 years. As in the case of most razor clam beds, the clams themselves make up most of the biomass of the bed.

The larger east coast beds of *E. siliqua* in class A waters had been fished down to point there harvesting became uneconomic. Improving technology enabled some of them to be revisited. In the early years of this fishery (1997 –1999) it was feasible to trace all landings from the Gormanstown bed which was the only one open to exploitation; since then, other areas have been opened to harvesting some of them in waters of poorer quality from which shellfish must be cooked before export.

ICES Management advice regarding stocks:

- Controls in this fishery should include closed areas and fallowing periods.
- To monitor progress in this and other bivalve fisheries, a combined logbook/gatherer's document should be introduced and its use should be enforced.
- The market for razor clams is small and there is a case for restricting landings at times when demand is low in order to raise prices and to prevent dumping of unwanted product.

King escallop and Queen escallop *(Pecten maximus & Aequipecten opercularis)*
Ecology (Marshal & Wilson, 2005)
Shell solid, equilateral, ears equal; inequivalve, right (lower) valve convex, slightly overlapping the left (upper) valve which is flat; almost circular in outline; very large specimens measure 15,24 cm in length. Left valve red-brown, right valve white, cream or shades of light brown with pink, red or pale yellow tints; both may carry zigzag patterns and may be adorned with bands and spots of red, pink or bright yellow.

Habitat: Lives on sand and gravel bottoms but it can be found in mud as well,from the extreme low tide down to 250 m (in literature to 1846 m). The young molluscs live attached with their byssus to a hard substrate, but when they become adult the shells are free-swimming. They spend most of the time resting on the lower (right or convex) valve in self-dug depressions in the bottom, so that the upper (left or flat) valve is parallel to the sea-floor. Sand, mud, gravel or living organism cover the upper valve so that only the margin of the shell (with all tentacles and eyes) remains visible; most active during the day. When disturbed the animal retracts with a quick movement into its valves and becomes virtually undetectable.

King escallop is a typically inshore species, harvested in sheltered bays. In the 1970s escallops were fished close to the Irish coast but in the following two decades the fleet sought these shellfish progressively further afield and some of the most recently exploited stocks are closer to the coasts of Britain and France than to Ireland. The size and distribution of this fishery changed dramatically in 2005 following the curtailment of fishing in sub-area VII. This fishery lands the majority of escallops caught by the Irish fleet. Queen escallop landings have fluctuated whereas landings of king escallop have averaged 1,400 t annually since1999. The majority of queen escallops landed in 2002 were harvested from a new directed fishery off Malin Head.

The amount of gear per vessel has been increasing. The fishing power and effort are currently in excess of what the resource can sustain. Fishing mortality and fishing effort are regarded as currently too high and unsustainable. The state of the queen escallop stock is unknown.

ICES Management advice regarding stocks:

- The management priority in this fishery is reducing fishing effort. Reducing the catch in the short term as through the operation of regional, individual or fleet sector quota is another approach.
- Higher growth rates of scallop in smaller inshore grounds suggest that these might be suitable places into which translocation of juveniles for ongrowing might be attempted.
- Different minimum landing sizes for different stock(lets) and area closures might be conducive to higher yield per recruit.
- FSS recommend the collection of further data on the biology and distribution of *Aequipecten opercularis*

Velvet crab (*Necora puber*)
Ecology (Wilson, 1999)
A fast moving swimming crab, blue in colour but obscured by a brown pubescence with red prominences. The dorsal surface has a finely velvety texture and the eyes are red. It grows to about 8 cm.

Habitat: Found on stony and rock substrata intertidally and in shallow water, most abundant on moderately sheltered shores.

The state of this stock is unknown and the desirability of capping effort in this mixed crustacean pot fishery with a view to stabilizing exploitation is stressed.

Landings have remained stable at approximately 300 t (VI and VII) over the past nine years, after an abrupt decline from almost 500 t in 1995. Three phases are discernible in the landings: a growth of interest in the species in the 1990s, which culminated in a peak of exploitation in 1995, and an apparently stable period after that. Landings of this species are a component – most often a by-catch rather than a target species - of the pot fishery for larger crustaceans. The species occurs very close inshore. There are some, limited, instances of directed winter fishing for it. Landings are probably a reflection of fishing effort for large crustaceans generally, larger catches being made in the earlier part of the fishing year. When, in the later summer and autumn, fishing effort moves offshore, landings of velvet crab decline. However, velvets suffer high mortalities in storage and this may militate against their retention everywhere. This species is likely to be discarded more than any of the other large crustaceans with which it is captured (ICES, 2005).

Brown crab (*Cancer pagurus*)
Ecology (extracted from Neal & Wilson, 2005)
Crab with a heavy, oval shaped body, easily distinguished from other species by its 'piecrust' edge and massive black tipped pincers. It is reddish-brown in colour with very large individuals having a carapace width of up to 25 cm although individuals are typically up to 15 cm.

Habitat: Found on bedrock including under boulders, mixed coarse grounds, and offshore in muddy sand. Lower shore, shallow sublittoral and offshore to about 100 m.

The state of this stock is unknown but the available indicators give cause for concern. Assessment of crab stocks is complicated by the fact that they cannot be aged. It is very likely that brown crab in this area hyper-aggregate in inshore waters during summer and autumn months and the exploitation of heavily concentrated numbers of animals can give a misleading account of their abundance. There appears to be no recent change in the average size of crabs in the landings and the cumulative size distribution of landings indicates that landing of crabs does not occur until they are significantly larger that the minimum landing size (Minimum legal size: 130mm, landing size is generally (>95%) >150 mm). The fishery is conducted throughout the year, effort increasing to a maximum in the late autumn. Female crabs are in their best condition and they are therefore at their most valuable at that time. This fishery is highly productive (FSS, 2005).

FSS Management advice:

- TCMs which are currently law, should be strictly enforced. The official statistics for the fishery have, in the past, been shown to be inaccurate by a factor of 2-3 and the method by which they are estimated needs to be overhauled and standardised.
- This stock is in need of management. It is exploited along with a number of other crustacean species. A compulsory logbook system should be introduced and its use monitored, data abstracted and accurate catch trends ascertained on a regular basis. Further technical measures to discourage the harvesting of poor quality (recently moulted) crab for use as whelk bait should be considered.
- A cap on gear is believed to be essential and that question has been under review for several years by virtue of its relevance to the management of the associated lobster fishery.

Whelk (*Buccinum undatum*)
Ecology (Ager, 2003)
A large whelk up to 10 cm high and 6 cm wide. The shell has 7-8 whorls with spiral ridges. The shell is yellowish brown with irregular light and dark spiral areas. The aperture is broadly oval tapering to a point with a short wide siphonal canal leading from the base of aperture.

Habitat: Occasionally intertidal but mainly subtidal down to 1200 m. Found on muddy sand, gravel and also rock. Sometimes present in brackish waters. The main beds stretch from the Kish bank (east of Dublin Bay) and down the east coast.

Following the highest landings in fifteen years catches in 2004 halved from the previous year. The fishery has been intensively monitored for ten years and landings may have returned to the pattern of 1997 – 2000, in the aftermath of exceptional recruitments in 2001 – 2003. SSB has fallen below the ten-year average for the first time since 2000 while fishing mortality remains high. FSS are concerned about the large landing of undersized whelk in this fishery. In spite of a temporary reduction in the landings of undersized whelk early in 2005, preliminary figures indicate an increase in the landings from the south west Irish Sea.

A large proportion of the S.W. Irish Sea fishery is made up of spawning and nursery ground. The fishery is a relatively inexpensive one to become involved in and boats have entered and left it in response to the state of the market and, particularly at the southern periphery of the fishery, the local depletion of stock.

Management advice regarding stocks:

- National and EU conservation regulations for this species should be enforced, particularly the provision that undersized whelk are segregated and immediately returned to the water.
- This is an inshore fishery and entry to it should be confined to smaller vessels, this emphasizing the need for a limited entry.

- In view of the marketing problems affecting whelk, it is most desirable that the fishery maintains a sustainable output because disruption of harvest is likely to result in customer loss.

In summary ICES have identified a number of critical stocks including cod and whiting. For these stocks the SSB is lower than biological limit. Another stock for which reduction in exploitation is required is haddock. Also, spurdog is assessed to be in a critical state. These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- for cod the advice is for zero catch;
- for spurdog the advice is for zero catch;
- for whiting the advice is to reduce catch to the lowest possible levels.

The present stock estimates are relatively uncertain due to a lack of access to port sampling in 2003 and only limited access in 2004.

iii) Other Species of commercial value

Monkfish (*Lophius piscatorius*)
Ecology (Reeve, 2005)
Anglerfish has a massive head, a large crescent shaped mouth with numerous sharp inward-pointing teeth and a narrow muscular tail. Two species of Anglerfish or Monkfish, as they are known in the fishing trade, occur in the waters around Ireland. The white-bellied anglerfish (*Lophius piscatorius*) is the larger and more common of the two but the smaller black bellied cousin (*L. budegassa*) often occurs in commercial landings and is more abundant on certain fishing grounds. Anglerfish are ferocious ambush predators. Anglerfish excavate a shallow depression in the seabed and their mottled skin provides excellent camouflage making them almost invisible to their prey. They twitch their modified dorsal fin, or illicium, to attract prey. When in range the anglerfish pounces on its unsuspecting prey. A wide range of fish species have fallen foul to the jaws of anglerfish including spur dogs, rays, sand eels, cod, whiting, pouting, haddock and flatfish in general. Anglerfish are also known to eat sea snails, lobsters, crabs and squid.

Habitat: Occurs on sandy and muddy bottoms from the coast (below 20 m) down to depths of 1,000 m. May also be found on rocky bottoms.

Monkfish stocks
The data relating to monkfish is so poor that it is “impossible” to produce accurate advice on the status of the stock, they stated. They estimate stock of 266,000 tons in 2005 as a result of the large fish spawn in 1999. Scientists, however, warn that since the 1999 year class, subsequent year classes have been below average so unless there is another big year class it is likely that catch levels will decline in future.

Blue whiting (*Micromesistius poutassou*)
Ecology (Cohen *et al*., 1990)
Blue whiting is blue-grey on the back, paler on the sides, shading to white on the belly. Sometimes a small dark blotch at base of pectoral fin. Feeds mostly on small crustaceans, but large individuals also prey on small fish and cephalopods. Migrates

in summer, after spawning, to the North (Faeroes, E. Iceland and Norway) and back to the spawning areas in January-February. Also makes daily vertical migrations: surface waters at night and near the bottom during the day. Females are usually larger than males. Maximum age is 20 years (45 cm).

Habitat: Oceanic and benthopelagic over the continental slope and shelf from 150 to more than 1000 m, but more common at 300-400 m

Blue whiting stock
The blue whiting stock - a member of the cod family - is also plentiful at the moment, because of some successful year classes. The stock reached a record high of over five million tons in 2003, but has since declined slightly.

Grey Mullet (*Mugil cephalus*)
Ecology (Collins, 1985).
Grey mullet are elongate with a series of dark stripes that run the length of the body. The dorsal, or upper part of the fish's body, is a bluish-gray color, the underside is white, and there is a purplish blotch on the upper base of the pectoral fins. The feeding habits of striped mullet vary with age. Young mullet feed primarily on small crustaceans and other zooplankton, whereas adults ingest plant matter. They feed by sucking in bottom sediments that contain decaying plant material, algae, and inorganic particles. They may also extract algae and microorganisms from scum that accumulates on the water surface or from the surface of submerged vegetation or other substrates. Swarming marine worms (polychaetes) have also been reported as part of their diet.

Habitat: This species of mullet is found in temperate and tropical waters throughout the world. Adult mullet aggregate in large schools and migrate from shallow estuarine areas and freshwater rivers to offshore spawning grounds in the autumn and winter. In the autumn, young mullet either move to deeper waters or remain in estuaries to spend the winter. Once they become adults, mullet are found in various habitats including freshwater rivers, saltmarshes, estuaries, and the open sea. Inshore, gillnets and tangle nets are used to catch cod, bass, grey mullet, sole and plaice.

Bass *(Dicentrarchus labrax)*
Ecology (Figis, 2006)
Body rather elongate. Colour silvery grey to bluish on the back, silvery on the sides, belly sometimes tinged with yellow. Young with some dark spots on upper part of body but adults never spotted. A diffuse spot on the edge of opercle. There is only one breeding season per year, which takes place in winter in the Mediterranean population (December to March), and up to June in Atlantic populations. Seabass spawn small (1.02-1.39 mm) pelagic eggs in water with salinities lower than 35‰, near to river mouths and estuaries or in littoral areas where the salinity is high (≥30‰). Being not particularly sensitive to low temperature some fish may over-winter in coastal lagoons instead of returning to the open sea. Seabass are predators and their feeding range includes small fish, prawns, crabs and cuttlefish.

Habitat: The European seabass are eurythermic (5-28°C) and euryhaline (3‰ to full strength sea water); thus they are able to frequent coastal inshore waters, and occur in

estuaries and brackish water lagoons. Sometimes they venture upstream into freshwater.

The presence of juvenile bass in Rogerstown estuary 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. Bass establish strong affinities with summer feeding areas to which they return in successive years. The distribution of bass has a southern emphasis. However, global warming has encouraged its northward extension and the removal of top predators like cod has provided a niche into which bass have been able to expand. The capture of bass by fishermen in Northern Ireland is becoming more frequent.

Bass stock
Stocks of bass is seen to be greatly depleted since the 1960's and 1970's and 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. Irish bass landings are dominated by occasional large recruitments. Fish of 1989 and 1990 are still plentiful but the 1995year class, which is robust among UK fish, is not strongly represented in Irish waters. The Fisheries Science Services (FSS) recommend that bass should continue to be managed as an angler's rather than a commercial species. There is a need for more data collection on bass in Irish waters but collection is difficult in the absence of a commercial fishery.

Recruitment: Strong pre-recruit year classes frequently carry through into the exploited year classes. The only clear signal for good year classes since juvenile surveys were undertaken by the Marine Institute (in association with the Central and Regional Fisheries Boards) between 1996 and 2005 inclusive was 2002 and 2004. Age at full recruitment in bass is approximately 7+. When they occur strong year classes tend to extend across the species' geographical range although there have been some differences between Ireland and the UK (FSS, 2005).

Sea Trout (*Salmo trutta trutta*)
Ecology (Froese & Pauly, 2006).
Trout are pelagic, anadromous freshwater, brackish and marine. Brown trout are primarily a freshwater species, but can spend time in the sea: spends 1 to 5 years in fresh water and 6 months to 5 years in salt water. Matures in 3-4 years. Feeds on aquatic and terrestial insects, molluscs, crustaceans and small fish.

Habitat: they hide in shallow water weed beds and rocky, boulder-strewn areas, and prefer a water temperature of 18-23 degrees C, depth range - 10 m. Brown trout prefer cold, well-oxygenated upland waters although their tolerance limits are lower than those of rainbow trout.

Information compiled by local staff of the Eastern Regional Fisheries Board indicates that small numbers of sea trout can be found in the Rogerstown and Broadmeadow 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 (King & Green, 2003).

Atlantic Salmon (*Salmo salar*)
Ecology (Heard, 2004)
Salmo salar can grow up to 150 cm in length and weights of 39 kg or more. The colour is dependant on habitat and age. When at sea, the dorsal area is silvery and blue-green, the sides silvery, the belly white and there are dark spots along the lateral line. In freshwater, the silvery colour is lost and the fish becomes a more mottled brown, the spots darken, become larger and are ringed by a paler colour. The number and size of spots and the depth of colour also varies with age and sexual maturity. Atlantic salmon have two dorsal fins, the second is situated near the tail and is small and fleshy with no fin rays. The tail fin is slightly forked.

Habitat: The adult Atlantic salmon spends its a life at sea, returning to freshwater to spawn. The juveniles inhabit freshwater areas, before migrating to the sea. Juveniles undergo smolting; morphological and physiological changes which allow them to adapt to life in sea-water.

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 Broadmeadow 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.

Periwinkle (*Littorina littorea*)
Ecology (Jackson, 2005)
This is a large periwinkle, with the shell reaching a maximum height of 52 mm. The shell is sharply conical with a pointed apex and surface sculpturing. The spiral ridges which are marked in young animals tend to become obscured in older individuals, giving the shell a smooth appearance. The shell colour ranges from grey-black-brown-red but is generally black or dark grey-brown, often lighter towards the apex, and is usually patterned with spiral darker lines. The columella or central axis of the shell is typically white and the animal is recognizable in its juvenile stages by the transverse black barring of the tentacles which are rather flat and broad.

Habitat: *Littorina littorea* is widely distributed on rocky coasts, in all except the most exposed areas, from the upper shore into the sublittoral. In sheltered conditions they can also be found in sandy or muddy habitats such as estuaries and mud-flats. The species is fairly tolerant of brackish water.

Periwinkle populations should be regarded as stocklets rather than belonging to a single stock unit. There is no assessment of any of these hence; the state of the entire stock is unknown. This is an open access fishery and periwinkles are gathered on virtually all Irish coasts.

A frequent complaint about the quality of landings in recent years suggests that too many juveniles are gathered. Although landings have been declining, they are still high and would appear to be sustainable. That said there is considerable volatility in the production of different areas of coastline, which might indicate over-exploitation of certain stocklets. An added complication to evaluating this species is the ageing

population of gatherers, which harvest these gastropods so that decreased local harvests might simply indicate a lack of interest.

FSS Management advice regarding stocks:

- A size limit should be established and enforced in a way which ensures undersized animals are not removed from the sea shore.
- Consideration should be given to establishing a close season in the months of June and July or from May to August when high temperatures cause mortalities.

Consideration might also be given to a close season between January and April when spawning is taking place.

Squid (*Loligo vulgaris*)
Ecology (Wilson, 2005)
Very similar to *Loligo forbesii* but distinguished immediately by the tentacle club, the median suckers of which are especially large, up to four times diameter of marginal suckers. A small shield-like part of the body projects slightly over the head. The internal shell is horny and pen-like. The colour varies and is often pink to white with purple brown mottling dorsally.

Habitat: Has no preference for a particular bottom type, the only requirement seems to be the presence of substrata for the attachment of egg strings during the spawning period.

A potential emerging sector in the waters around Ireland is for squid.

Dab (*Limanda limanda*)
Ecology (Picton & Morrow, 2005)
The dab is similar in shape to the plaice and flounder and also has both eyes on the right-hand side of the body. The upper surface is usually pale brown in colour with scattered darker blotches and speckles, however the pectoral fins may be orange. The most distinctive characteristic of the dab is the lateral line, which has a strong semi-circular curve above the pectoral fin. This species rarely grows to over 40cm long and most individuals are less than 30cm.

Habitat: The dab lives mainly on sandy seabeds and is usually encountered at depths between 20-40m. It feeds on brittlestars, small sea-urchins, hermit-crabs, amphipods, worms, molluscs and sand-eels. Common all around the coasts of Britain and Ireland, particularly in the North Sea.

Dab is a common species not commercially fished. The spawning season occurs from April to June

Lemon Sole (*Microstomus kitt*)
Ecology (Cooper & Chapleau, 1998)
Feeds on a variety of small invertebrates, but worms seem to dominate. Apparently they do not feed in wintertime. It spawns in spring and summer in depths of 100 m.

It becomes sexually mature at 3-4 years (males), 4-6 years (females), and may live for 17 years.

Habitat: Benthic, lives on a wide range of bottoms from mud (exceptionally), and sand, gravel, even rocky grounds, in depths of 20-200 m, particularly on offshore banks.

It is a moderately important food-fish, caught mainly in trawls. The most common fishing techniques are "demersal bottom trawling" and "small flatfish (flounders, soles) bottom trawling".

Ling (*Molva molva*)
Ecology (Cohen *et al*., 1990)
First maturity is reached at 5 years for males (80 cm) and 5-6 years for females (90-100 cm). Spawning occurs from March to July and eggs are pelagic. Major spawning grounds are located at 200 m depth from the Bay of Biscay to the Gulf of Norway at 100 to 300 m off southern Iceland, and at 50 to 300 m in the Mediterranean Sea. Growth is rapid (8-10 cm/year): at 1 year, 20 cm; 2 years, 31-35 cm; 3 years, 31-35 cm; 4 years, 73-83 cm. Females grow faster than males. The maxi-mum age is 10 years for males and 14 for females (ca. 200 cm total length). Feeds mostly on fish (cod, herring, flatfish) but also on crustaceans (lobsters), cephalopods and echinoderms (starfishes).

Habitat: Demersal on rocky bottoms at depths of 15 to 600 m or more, commonly from 100 to 400 m. Young up to 1-2 years of age are coastal (15-20 m depth) and pelagic; fish of 3 years migrate to greater depths.

Locally abundant. Fished with bottom trawls, longlines, gillnets and handlines.

Pollack (*Pollachius pollachius*)
Ecology (Cohen *et al*., 1990)
Young are pelagic and live near the coast up to 3 years, then migrate to the open sea where they are found mostly between 40 and 100 m depth. Spawns in March in the Bay of Biscay, in February in Spain, and in May in Norway, at ca. 150 m depth. Growth is rapid but slower in the north. At 5 years, the fish attain lengths of 63 cm in the Bay of Biscay, 65 cm off Spain, 59 cm in the Celtic Sea and 52 cm off W. Maximum age and size are 8 years and 75 cm. Feeds mostly on fish and incidentally on cephalopods and crustaceans (shrimps and crabs).

Habitat: Pelagic to benthopelagic, mostly close to shore but up to 200 m depth over hard bottoms.

Not particularly important commercial fish. Caught with bottom trawl or pelagic trawl, longlines and gillnets.

Thornback Ray (*Raja clavata*)
Ecology (McEachran & Dunn, 1998)
Feed on all kinds of bottom animals, preferably crustaceans. Oviparous. Distinct pairing with embrace. Young may tend to follow large objects, such as their mother.

Habitat: Ray are demersal and marine and their depth ranges between 20 – 300 m Inhabit shelf and upper slope waters from the coastal line to about 300 m. Found on sand and sand-rock bottoms.

Blonde Ray (*Raja brachyura*)
Ecology (McEachran & Dunn, 1998)
It is of minor commercial importance although it is caught as a gamefish. Feed on all kinds of benthic animal. Oviparous. Distinct pairing with embrace. Young may tend to follow large objects, such as their mother. Eggs are oblong capsules with stiff pointed horns at the corners deposited in sandy or muddy flats. About 40-90 eggs are laid per individual every year.

Habitat: Ray are demersal and marine and their depth ranges between 10 – 380 m. Found on sand and sand-rock bottoms.

Species, other than commercial species, that frequent the Fingal coastal area include Tope (*Galeorhinus galeus*), Skate (White Skate (*Raja alba*); Long Nose Skate (Raja oxyrinchus) and the Common Skate (*Raja batis*), Conger Eel (*Conger conger*), Flounder (*Platicthys flesus*), Wrasse (Labrus spp), Shark Mako (*Isurus oxyrinchus*), Thresher (*Alopias vulpinus*), Six gilled (*Hexanchus griseus*), Porbeagle (*Lamna nasus*) and the Blue (*Prionace glauca*), Cuckoo Ray (*Raja naevus*), Electric Ray (*Torpedo nobiliana*), Homelyn Ray (*Raja montagui*), Undulate Ray (*Raja undulata*); Painted Ray (*Raja icroocellata*) and Sting Ray (*Dasyatis pastinaca*).

iv) Angling

Angling attracts people of all ages, gender and ability, who fish from beaches, harbours, piers, and from boats both close to shore and offshore over wrecks where marine life thrives. Where angling is active on a coastline such as along the Fingal coastline then information on both areas where fish biodiversity is high and areas where you can target particular species is widely known. The Eastern Regional Fisheries Board provides a detailed website on angling in the Dublin area (ERFB, 2006).

Balbriggan, Skerries, Loughshinny and Rush are all boat angling venues where small boats can be launched to fish around Lambay Island (3 miles to the south east) and over Rockabill grounds. Species caught include spurdog, ray, conger, dogfish, dab, codling, whiting, pollack, coalfish, wrasse and an occasional ling and tope. Balbriggan, Skerries and Loughshinny are also good shore angling locations and have recorded catches of mullet, mackerel (in season) and flatfish. Small boats can be launched at Balbriggan to fish the Cardy Rocks area and the grounds out to and around the Rockabill Lighthouse. Codling, dogfish, dab, spurdog, whiting, pollack and wrasse are the most common species. On the north beach Rush there is good fishing for bass following an easterly blow.

In Howth Harbour at the East and West Pier whiting, Pollack, coalfish and codling can be caught during summer and autumn. Small boats can be launched for general ground fishing around Ireland's Eye and on the Kish Bank. Species to be expected are coalfish, pollack, whiting, dogfish, mackerel and flatfish. To the East of the harbour is Balscadden Rocks where rock fishing takes place for mackerel (in season), plaice, dabs, dogfish, pouting, whiting and codling. At the Baily mackerel (in season), coalfish, plaice, dab, dogfish, wrasse and whiting have been recorded. At Red Rock in Sutton bass and flatfish have been recorded.

Fishing here takes place in Dublin Bay at Dollymount Strand Beach for bass, flatfish, and occasional codling. The evening tides in autumn are most productive and the hotspot is at the northern end of the beach where the channel runs into Sutton Creek. At North Bull Wall pier fishing is carried out from the bridge and the lighthouse where small pollack, codling, whiting and bass can be sought. The best season for catching these is in the autumn. The Poolbeg Lighthouse at South Bull Wall is a popular area for catching mackerel in season, conger and small pollack. Mullet and bass can also be taken in the hot water outlet of the power station.

The Velvet Strand in Portmarnock is a shore angling venue. Around the Martello Tower occasional bass and flounder can be fished for from the rocks. Along the strand itself distance casting will also produce dogfish and occasional codling and whiting in Autumn.

v) Estuaries

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. Fingal's coastline includes a number of estuaries:

To the south of Rush is the mouth of Rogerstown Estuary where there is shore fishing for bass and flatfish. The main channel is fished for sandeel, bass and seatrout. Further south again is the Broadmeadow estuary, where Malahide is located.

A total of 24 species or taxa were recorded, from two estuaries, **Rogerstown** and **Broadmeadow** (King & Green 2003).

Species	**Common Name**	**Functional Group**
Patichthys flesus	Flounder	ER
Gobio spp.	Goby species	ER
Spinachia spinachia	15-spined stickleback	ER
Myxocephalus scorpius	Short-spined sea scorpion	ER
Syngnathus sp.	Pipefish	ER
Pholis gunnellus	Butterfish	ER
Agonus cataphractus	Hooknose or Pogge	ER
Pleuronectes platessa	**Plaice**	**MJ**
Atherina presbyter	Atherine	MJ
Dicentrarchus labrax	Bass	MJ
Pollachius pollachius	Pollack	MJ
Gadus morhua	**Cod (codling)**	**MJ**
Spondyliosoma cantharus	Black Sea Bream	MJ
	Sprat / Herring	MS
Crenimugil labrosus	Thick-lipped grey mullet	MS
Liza auratus	Golden mullet	MS
Ciliata mustela	5-bearded rockling	MS
Labrus bergylta	Ballan wrasse	MA
Blenius gattoruginae	Tompot Blenny	MA
Scyliorhinus caniculus	Leser-spotted dogfish	MA
Ammodytes tobianus	Sandeel	ER/MA
Liza ramada	Thin-lipped grey mullet	CA
Gasterosteus aculeatus	3-spined stickleback	CA
Anguilla anguilla	Eel	CA

Estuarine Residents (**ER**) are those species considered to spend all, or the majority of, their life cycle in an estuary. 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. Marine Seasonal species move into estuaries on a

seasonal basis and may not be present all year round, unlike the Marine Juveniles (**MS**). The Marine Adventitious (**MA**) functional group reflects an opportunistic or haphazard movement from the marine area into coastal or estuarine waters. 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.

Flounder and goby, estuarine residents, emerged in this study as dominant members in each of the estuaries examined. Mullet, identified as a marine seasonal species, was another species prominent in the Fingal estuaries. The movement of juvenile sprat /herring was very apparent in the estuaries. This influx of juvenile sprat / herring can lead to other fish species moving in to feed on them. In the Fingal waters, there was a clear difference in age groups in the two seasons of Mullet recorded. In both estuaries there was an autumn year-class of young-of-the-year fish. 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, pollack, atherine, plaice and bass (King & Green 2003).

Malahide Estuary is a shore angling venue located below the railway viaduct. Here a large pool has formed where mullet, flounder and eels can be caught and occasionally bass and sea trout. Boat fishing offshore is for cod, ray, whiting, tope, spurdog, pollack, mackerel, coalfish, dabs and plaice (ERFB, 2006).

vi) Environmental concerns - fish biodiversity

Marine biodiversity has both direct and indirect importance to mankind. It provides food in the form of fisheries and aquaculture, and a recreational environment for tourism. Many species of marine life, which are not directly harvested for food, are themselves food for fish and shellfish and thus key elements in the marine food chain. Pollution reduction will improve food quality, for example of sewage contamination of shellfish, and organochlorines in the food chain.

The increasing spread and urbanisation of the human population is placing greater value on natural areas for recreation. Marine biodiversity is of growing importance in Ireland: directly for angling, nature watching, scuba diving, and photography; and indirectly by providing a pleasurable and clean environment for activities such as water sports and boating. A number of reports highlighted particular environmental problems in the Irish Sea (Costello, 2000; Department of Arts, H., Gaeltacht and the Islands, 2002; JNCC, 2006).

I. Effective extinction of common skate, long-nosed skate and angel shark. These large long-lived species of elasmobranch with a low reproductive rate have all but disappeared from the Irish Sea.

II. Scallop dredgers have been demonstrated to have serious detrimental impacts resulting in long term changes in the benthic community and a loss of benthic biodiversity. Mobile, robust and scavenging taxa are more abundant while slow-moving or sessile, fragile taxa are less abundant. In addition, as the seabed is ploughed to a single homogeneous environment, there is a loss of habitat variability and complexity, which leads to a loss of biodiversity.

III. *Nephrops* trawls have also been shown to have a negative impact on the benthic community, although probably over a shorter time frame. The number of species and the abundance of individual species were found to decrease as a response to nephrops trawling. Of particular concern was the loss of the burrowing urchin *Brissopsis lyrifera* at some sites and impacts on deep burrowers such as the mudshrimp *Jaxea nocturna* and *Callianassa subterranea*. These burrowing megafaunal species have an important role in maintaining the structure and oxygenation of muddy sediments.

IV. Disgarding of small, juvenile fish such as cod and haddock in the *Nephrops*, roundfish and flatfish fisheries are very high. The proportion of the total catch discarded has been gradually increasing. For example in the *Nephrops* fishery, over 60% of the whiting bycatch is discarded. Recent EU legislation to increase mesh sizes in the roundfish fishery to 100 mm, should help alleviate this problem. However, the *Nephrops* fishery still uses 70 and 80mm meshes. Although obligatory square mesh panels were introduced in 1994, the proportion of small whiting caught and discarded has continued to increase. Additional measures are needed which could include increases the mesh size of the cod end and square mesh panels, and the introduction of separator grids or fixed grids in the trawl to enable undersized fish to escape.

V. Discarding of species that have no commercial value may be important in terms of the marine ecosystem. Non- commercial discards, or trash fish, such as Norway pout, poor cod, etc., may be important prey species for commercial fish and the discarding of such non commercial species at sea may well have an effect on the abundance of the important commercial fish species targeted by Irish fleets.

VI. Discards from angling: With dwindling stocks in freshwater and saltwater, anglers have become more and more aware of the need to return all unwanted fish to the water. With population declines among all species there is now an emphasis on the need to conserve trout, salmon and eels but the principles and practice are equally valid for all species.

VII. One of the most obvious threats to estuaries comes from contamination of the waters, either coastal or fresh, through pollution or excess nutrient enrichment. 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.

VIII. 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.

vii) Water Quality in the Irish Sea

An INTERREG study on Water Quality and Circulation in the Southern Irish Sea. concluded that: 1)There has been no deterioration water quality, as measured by sediment load/water clarity, over the period 1987 - 1997. Indeed the data suggests that there has been some improvement. 2) The main changes in mean annual water clarity appear to be primarily related to changes in wind stress.

The Blue Flag is an international environmental award made to beaches and marinas throughout the world that demonstrates good environmental standards and good sanitary and safety facilities. The award is made by the Foundation for Environmental Education (FEE), an independent non-profit organization. Seventy-eight beaches and four marinas in Ireland (Fig.11) currently (June 2006) have this award. This is the highest number of Blue Flags achieved by Ireland so far and represents an increase of 5 flags on 2005. A Blue Flag award is awarded to beach or marina is for one season (July to August) only. The award of a European Blue Flag beach depends on compliance with 27 criteria, including water quality. The number of blue flags along the Fingal coast is an indication of the water quality in this area.

Irish beaches must: Adhere to the relevant standards, such as the EU Bathing Water Directive; Make sure that no industrial or sewage-related discharges can affect the beach area; Have local and/or regional emergency plans to deal with pollution accidents. These four criteria must be adhered to in order to gain a Blue Flag. In addition, Irish beaches must comply with requirements for sewage treatment and effluent quality such as are contained in the EU Urban Waste Water Directive and ensure that no algal or other vegetation can accumulate and be left to decay on the

beach, except in areas designated for a specific use and as long as this does not constitute a nuisance (these two conditions are merely guidelines).
Both the water and land belonging to the marina must be visually clean (no sewage, oil, litter, etc.) - exceptions are made for freak weather conditions. No untreated sewage from boats and/or land should enter the marina or its coastal vicinities.

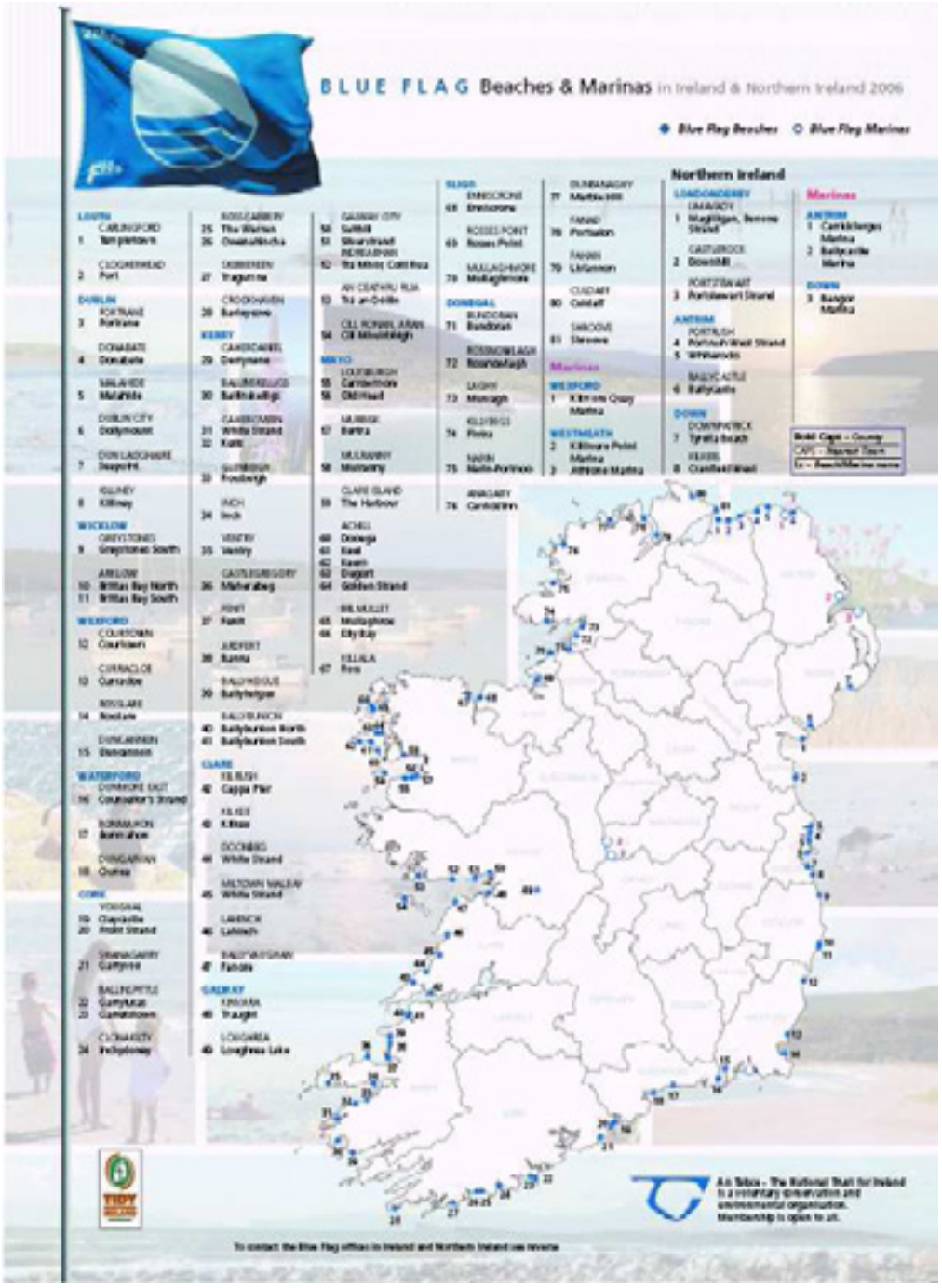

Fig 11. Seventy-eight beaches and four marinas in Ireland with Blue Flags (2006).

6) Community based information

i) Background

The Fingal fishing community has a long history of fishing the seas around Ireland with a large number of the local fishermen having spent their lives at sea. As with any other employment these fishermen have become exceptionally familiar with their area of expertise and in this case it pertains to the patterns of fish relative to other species, bottom types, temperature, fishing seasons and so on. Community based data collection and management strategies involve the incorporation of the experiential knowledge of fishermen into the body of knowledge developed by fisheries managers and are increasingly being used internationally as a preferred means of in-depth local fishery examination and ground-truthing. This is a resource that has not been tapped into prior to this study in Ireland.

The main function of this consultation is to provide a means of reviewing general fisheries information in a local (Fingal) context. Through a process of semi-structured interviewing with a number of local stakeholders all residing within the Fingal area. Stakeholders involved in different types of fishing activities were chosen in order to include as wide a range of fishing backgrounds as was possible. Interviews were arranged with a harbour master, a retired fisherman, part-time and full time potters, demersel and shellfish fishermen and a number of local anglers. Any views or opinions presented are solely those of the stockholders, and do not necessarily represent those of EcoServe.

ii) Importance of fishing to the Fingal locality

With three active fishing harbours located within the Fingal area and Howth being the largest harbour on the east coast it wasn't surprising that each of the stakeholders considered fishing to be, not only, of direct importance but also of indirect value having a knock on effect to the local community with the local service industries in the area all benefiting. However, as a number of the towns and villages along the coast are historically linked to fishing over the years the stakeholders were concerned for the future as they considered this link to be of vital importance to the identity of these towns and should be maintained where at all possible into future years. Currently only small number of locals are directly involved in the fishing industry in Fingal with a lot of the crews employed coming from outside of Ireland.

Angling within the Fingal area is growing all the time with 6 clubs currently active. One of the main attractions of coming to Ireland for recreational angling tourists is the 'unspoiled conditions that we advertise' along with 'our rich stocks of game fish'. 'Angling tourism is a big industry today for Ireland' and so is beneficial both for the 'tourist economy of Fingal' and also as 'a recreational/sporting outlet for the local residents' to enjoy.

iii) Status of commercial fish stocks

None of the stakeholders interviewed were in denial about the status of commercial fish stock with 100% in agreement with the scientific fish stock assessments with regard to declining stocks of commercial species particularly cod and whiting. Cod was often said to be 'very scarce' and the size of whiting being caught having dramatically reduced to the point where one stakeholder said you would sometimes 'need a magnifying glass' to see them.

'You only have to go down to the harbour and see for yourself' said one stakeholder with the state of fishing in the area reflected in the 'amounts of fish being brought into the harbours'. 'A dramatic reduction has been observed' over the years, where before you would see 'prawn mountains' now you often see a large fishing vessel coming in with only '2 boxes of mixed fish'.

A number of stakeholders have attributed the majority of the damage to fishing in earlier years when it was 'legal to have nets of smaller mesh sizes than are allowed nowadays'. These nets obviously caught smaller fish with 'the majority of these discarded, even those of acceptable market size' and this in turn has contributed to the status of some of the commercial fisheries where it is now reflected in the both the quantity and size of fish being captured.

Evidence of the reduction in the size of stock present in the waters is also witnessed by anglers who target commercial stocks such as cod and whiting for 'angling competitions'. Anglers have had to reduce the size of the allowable catch to be considered for the 'point system' on which their competitions are based, for example the acceptable length of cod for weigh in has been reduced by 8 inches from 18 inches originally to 10 inches today. 'Up to 400 whiting could be caught with none of them reaching the minimum size for competition' said one stakeholder.

iv) Changes in fishing technology

Stakeholders have seen 'technological developments' which have heavily 'influenced the design of fishing vessels, particularly between 1950 – 1980', resulting in increased productivity, profitability and competition to the extent that many stocks became fully or overexploited through 'more efficient exploitation'.

Some such significant technical developments include fishing gear and methods, such as hydraulic dredges have replaced old style dredges, which considerably reduce the fisherman's labour and in turn have led to 'more efficient exploitation' of razor clam beds. Crab/lobster and prawn pots have all seen advancement from the original wooden bottom pots to steel framed pots, in fact advances in gear technology is being witnessed throughout the fishing industry. 'Advancement in technology has also seen the introduction of large factory fishing vessels'. This advance in fishing technology is not only being blamed in some cases as a major 'cause of the current over-exploitation of fish stocks' but also for the 'large decline in the local fishermen fishing the seas with smaller boats'. Many local fishermen have retired from the business or are only operating part-time as they are 'unable to compete/match these larger boats'. Stakeholders are aware of new technology coming onto the market all

the time which is ‘more ecologically friendly to the sea bed’ but think it is ‘too little too late’ as the damage has already been done and all that is left is ‘to give the sea time to recover’. Not only are we seeing technological improvements to gear for fishing at sea but also angling equipment/gear sees yearly improvements with new advances from lines to rods etc.

v) Seasonal and long-term trends in fish stocks

‘Seasonal fishing is now a thing of the past’ said one stakeholder. New export markets have allowed for fish to be sold all year round, unlike when there were only ‘the local markets to sell your produce’. The only restriction to fishing now is closures like the cod box and even then fishermen simply change gear and target different species outside of the protected areas.

Seabed changes were mentioned by a number of stakeholders particularly inshore areas which they attributed the damage to dredging. At this point in the interview all stakeholders brought up their concern for the number of boats they personally witnessed off Portmarnock, which appear to have no licences, and were dredging very close to shore both day and night.

Although all stakeholders were familiar with and mentioned global warming in the interview process none were attributing any particular shifts in populations as a result of this. However, one stakeholder told of how the ‘location of fish populations were changing’, in particular cod, and having talked to a number of Scottish fishermen who were also finding fish in areas where they had never occurred before, he has concluded that global warming is one of the main attributes. How he has come to this conclusion is that having fished for over 30 years his experience of a ‘good cod season’ coincided with ‘a very cold winter where you would have ice on the nets and very hard ground frost and snow on land’. He hasn’t witnessed a winter like this in quite a number of years and neither has he come across similar numbers of cod captured! He is also aware that ‘changes in sea temperature have seen cold-water plankton move northward followed by the fish stocks’. Another attribute of global warming that he has witnessed is the landing of a number of fish, which he cannot identify and he has put them down to ‘warm water species’ and he has also noticed ‘the tuna stock coming closer to our fishing waters’.

A fisherman whose main target is shellfish has in recent years caught a number of crabs with soft shells outside of the ‘official moulting season’ (June-September) where they would discard their shells and grow a new one. He believes that crabs are now moulting all year round changing their shells a number of times and that this may in fact be due to the warmer water temperatures due to global warming and that moulting may in fact be triggered by temperature.

vi) Location of local areas of high fish biodiversity

All stakeholders were in agreement that the hotspot for fish biodiversity in the western Irish Sea was the area contained within the ‘cod box’, see Figure 8, but unfortunately this is only temporary as once the box is reopened there is ‘a flood of

vessels ready to pounce'. An element of wariness was apparent with the fishermen when they were asked to divulge areas of 'hotspots for fish biodiversity' mainly due to the number of non-Irish fishing vessels in the Irish Sea and the advantage they have over these fishermen is their in-depth knowledge of the fishing grounds and the fish that use these waters. A number of stakeholders voiced their concern that fish factories were too readily telling other boats how much they had caught and the next day these boats would be fishing alongside the named Irish boats and the majority of the time these boats would be larger and have double the fishing capacity of the smaller Irish boats. They did however mention that there are a number of areas within the Fingal area, which are known for large numbers of commercial and other species at particular times of the year but none of the stakeholders were willing to be restricted to pinpointing areas on a map, as these areas change and are dependent on a number of attributing factors including weather. It is extensive knowledge of all of these factors and how they interact helps the local fishermen 'keep an edge over foreign vessels'.

Those fishermen targeting shellfish caught using pots mentioned that the best fishing ground to be around the islands and depending on weather they generally drop their pots on the more sheltered side.

All stakeholders involved in angling mentioned all the sites both on-shore and offshore in the literature review namely: Lambay Island; the Cardy Rocks area; the grounds out to and around the Rockabill; the north beach at Rush; in Howth Harbour at the East and West Pier; Ireland's Eye; the Kish Bank; Balscadden Rocks; the Baily; Red Rock in Sutton; Dollymount Strand Beach; the bridge at North Bull Wall and the lighthouse; Poolbeg Lighthouse and the outlet of the power station. While all of these areas were mentioned as good angling spots a number of these were weather and tide dependant. One stakeholder noted that the Kish Bank can be very good but generally only in good weather and Rockabill, which is usually good, was very disappointing last year with regard to both the number and variety of species caught.

vii) Sustainability

Only one of the stakeholders could see a good future for fishing in the area. He told of how 'times were bad in the 60's for fishing' and how after a few years it 'turned favourable afterwards' and he can see this happening again. '10 years down the line after the government has removed a lot of tonnage leaving only half of the current boats fishing' and of course 'if these are strictly monitored' then the 'bad times will improve again'. The majority of stakeholders can see no future for the fishing industry in Ireland particularly for the smaller fishing boats. 'It has now become a rich mans game' one stakeholder commented with 'very little future, bleak if any! **'**The Government's 25% decommissioning plan will make no difference to the state of fishing as the fishing fleet is said to increase by 25% this year' another remarked.
All were in favourable of the cod box closure but would like to see it closed for a longer period. 'Where it is good for the short term but once opened it is free for all and all boats head there!' 'The area isn't given sufficient time to recover'.

Anglers now operate a 'weigh and release policy' with only the rare cod being taken for consumption if it measures a decent size. The local anglers are now looking into

what is involved, regulations etc., to building a man made reef with tyres etc., which it is hoped would 'attract fish providing a safe haven for them'. However they are 'wary of attracting potters to this area'.

viii) Environmental concerns/threats fishing industry

Obviously all stakeholders are concerned about overfishing but even more so with the 'rogue fishermen' that are operating in the Irish Sea. Each is aware of 'illegal landings' and entries into the cod box when it is closed. Here again each of the stakeholders voiced their concerns over 'the unlicensed razor boats off Portmarnock' and 'rumours of illegal landings by the Spanish hitting on Irish waters'. All are in agreement that regulations are not currently enforced and that when/if they are implemented then we will see a massive difference to the fishing industry for example boats need to be strictly monitored in order to check their gear, (mesh sizes), 'smaller meshes are killing off the little fish'. No one is 'recording the discards'. One stakeholder is of the opinion that 'discards should be recognised and used against their quotas, this might make them think twice!' Another remarks that 'scientists are aware of all the above but their surveys etc. go on the fisherman's logbook and do not take into account the discards when sometimes more goes back than what was taken in!'

A number of the smaller fishermen commented 'larger boats are allowed to come as close to shore as they physically can and are destroying everything in their path'. 'There should be a limit to how close larger boats are allowed inshore'. Not only did the fishermen using smaller boats say that 'the larger boats are not environmentally friendly and are using twice as much fuel' but that they are no longer able to compete with these boats.

One stakeholder voiced his concerns on the state of fishing in Ireland as a whole saying that 'a number of sections specifically related to fisheries have now been moved from the Department of the Marine into a number of different departments making it very hard to regulate fisheries issues e.g. licensing of boats is separate to applying for quotas etc.'. 'There is no long term fishing policy or plan' everything is in the short term we need to have a 'coring structure' that will provide the 'infrastructure to help plan for fishing into the future'.

There is concern among some stakeholders with how the Department of the Marine (Government) 'interpret the rules from Brussels'. There is a discrepancy with enforcing the law here 'the government is harsher on the Irish boats in comparison to the foreign vessels'. Currently in Ireland we have introduced a law with 'the potential for Irish fishermen to get a criminal record while foreign fishermen get a fine and a slap on the wrists'. 'The amount of new regulations and associated administration work, particularly introduced in the last 10 years' is posing as difficult to keep track of, indeed one stakeholder said 'you would need a computer on board to keep track of everything' and a number of regulations are 'easy to misinterpret'.

One stakeholder noted that 'watching the boats fish for herring in the Irish Sea is terrible'. Once the herring season opens in the Irish Sea between July and August, where there is a quota of 1200 t, the 'boats from all round flock to the Irish coast' and

‘vacuum the seas!’ until the quota is filled over ‘a 2 week period’ and then they ‘head back west’.

Another stakeholder commented on the potential of Howth harbour, although it is only half completed, ‘Howth is an ideal spot for decommissioning of boats, but unfortunately it has no license to build or decommission’. Britain's Ellen MacArthur who completed her single-handed round-the-world voyage in record-breaking time had ‘her boat designed by an Irish man, but they had to go to France to build it!’.

Currently ‘Irish boats have to travel to Denmark etc., at their own expense, to decommission their boats’. ‘There is no incentive to decommission your boat if you have an older boat, i.e. >20 years as you only receive 10% and it is taxed.’ ‘Younger boats are more likely to be encouraged to decommission.’

There is concern by some stakeholders over a number of boats docked at harbours with no ‘tonnage’. Currently there are 4 such vessels docked in Howth. ‘After 4 days docked their owners will receive charges of €400 a week, which they are unable to pay due to not fishing’. ‘These owners are in the unfortunate position of potentially leaving their boats to eventually sink, unable to afford either the harbour fees or the cost to decommission their vessels’. In turn this now causes ‘concern over pollution from these boats sinking in the harbour.’ ‘Should a license ever be granted to Howth to decommission boats perhaps in the future it might be possible to sink decommissioned boats as reefs off Howth, to encourage more fish into this safe haven and provide a wreck for divers’.

One stakeholder has noticed that ‘seaweed is scarce in areas’ and that perhaps this is as a ‘result of pollution and may in turn affect the shellfish.’

Another issue that was raised by a stakeholder whose son had become involved in the fishing industry was the ‘conditions that fishermen have to work on the larger vessels’. These vessels go out on ‘10 day trips where the crew get very little sleep and are constantly doing hard labour on board’. He recommended that they ‘introduce a standard wage’.

7) Discussion

Biodiversity

The majority of information available on the status of different species, not surprisingly, is information on commercial stocks in the Irish Sea. Fisheries research has been focusing on trying to establish the current status and trends of stocks worldwide to provide advise for the levels of TAC set by the Common Fisheries Policy, all regulations under the CFP are adopted at Community level and implemented in all Member States to effectively and sustainably manage their fisheries. A number of research studies have and are being carried out on the Irish Sea examining different aspects of the marine biodiversity and the effects of different attributes (Dulvy et al. 2000; Norse & Watling, 1999; Brander, 2005). There is worldwide concern that the coastal biodiversity is being lowered, with fishing a major culprit. One project the Irish Sea pilot project (JNCC, 2004) was established to test the potential for an ecosystem approach to managing the marine environment at a

regional sea scale using the Irish Sea as an example. However, community based knowledge is not being taken into consideration in any of the research currently carried out on the Irish Sea. This study provides a novel insight into how community based knowledge may be taken on board in the future.

This fisheries study has examined the status of fourteen commercial species which are captured in the Irish Sea, namely cod, whiting, haddock, plaice, sole, *Nephrops*, herring lobster, razor clam, king and queen escallop, velvet crab, brown crab, and whelk. Also considered were fourteen species that are not directly targeted by commercial fisheries but which attribute in part to bycatches or discards. Apart from some warm water species (not identified), which were encountered by fishermen the total number of fish species, which are known to commonly frequent the Fingal coastal waters is 47, which includes 14 commercial stocks (Cod (Gadus morhua), Whiting (Merlangius merlangus), Sole (Solea solea), Nephrops, Haddock (Melanogrammus aeglefinus), Plaice (Pleuronectes platessa), Herring (Clupea harengus harengus), Lobster (Homarus gammarus), Razor Clam (Ensis sp.), King escallop and Queen escallop (Pecten maximus & Aequipecten opercularis), Velvet crab (Necora puber), Brown crab (Cancer pagurus), Whelk (Buccinum undatum)), 14 species with commercial value (Monkfish (Lophius piscatorius), Blue whiting (Micromesistius poutassou), Grey Mullet (Mugil cephalus), Bass (Dicentrarchus labrax), Sea Trout (Salmo trutta trutta), Atlantic Salmon (Salmo salar), Periwinkle (Littorina littorea), Squid (Loligo vulgaris), Dab (Limanda limanda), Lemon Sole (Microstomus kitt), Ling (Molva molva), Pollack (Pollachius pollachius), Thornback Ray (Raja clavata), Blonde Ray (Raja brachyura)), and 19 species which have no commercial value and include Tope, White Skate, Long Nose Skate, Common Skate, Conger Eel, Flounder, Wrasse, Mako shark, Thresher shark, Six gilled shark, Basking shark, Porbeagle shark, Blue shark, Cuckoo Ray, Electric Ray, Homelyn Ray, Undulate Ray, Painted Ray, Sting Ray. All stakeholders were familiar with and were able to identify each of these species. The local fishing/stakeholder community have extensive knowledge on local fish species and their patterns within the Irish Sea. This knowledge can benefit fisheries and scientists both by having the ability to recognise and record introduced, casual or infrequent visitors/species in some cases catching if possible for identification when unknown. This in effect would establish an early detection system for unwanted visitors into the Irish Sea. Fisheries boards and scientists simply do not have the resource to monitor the waters twelve months of the year to detect/record such events.

Locations of high biodiversity

Within the Fingal region there are a number of different marine ecosystems, rocky subtidal (kelp beds), intertidal (muddy, sandy, rocky, seagrass beds), open ocean and estuaries are a few examples. Some of these ecosystems support areas of high biodiversity for example around the islands and seasonally during the different fish spawning seasons i.e. when the cod box is closed to fishing, Fig. 8. These areas are high in biodiversity due to a number of different factors including: high levels of productivity reflecting the availability of nutrients and light to produce food and energy (water quality) and the provision of food and shelter from predators (including humans). Natural areas of high biodiversity reflect areas free from fishing, coastal development, pollution, and the introduction of exotic species.

As Fig. 16 (below) illustrates the Fingal coast is vital as both a spawning and nursery ground for commercial fish species in the Irish Sea. The continuance of this area for fish spawning depends on continuing good water conditions, the maintenance of good habitat conditions for spawning and as nursery areas, and the maintenance of plankton productivity and of a complex trophic structure.

High biodiversity can be defined as a large number and a wide range of species, which in fact are not the perfect conditions for the commercial fisherman, as it results in a catch where there will be a high percentage of discards. In a commercial fisherman's 'ideal world' commercial species would swim in isolation and catches would result in minimal discards! However this is not the case in 1999 and 2000 Cefas carried out a survey of the Irish Sea examining the species composition of catch by number of the coast (Cefas working group, 2001). **Figures 12** to **15** show sites sampled along the Fingal coast. In some cases up to 94% of the species were considered 'other's with no commercial value in other words up to 94% of the catch would be discarded.

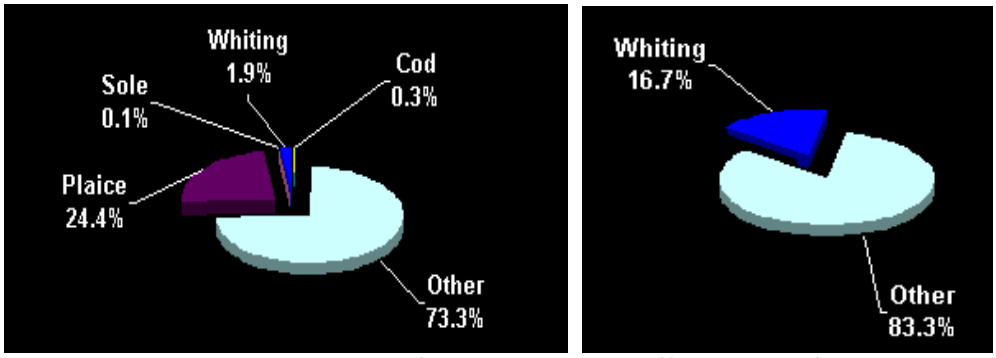

Figure 13. Species composition of catch by number off the coast of Balbriggan and further into the Irish Sea (2000) © Cefas

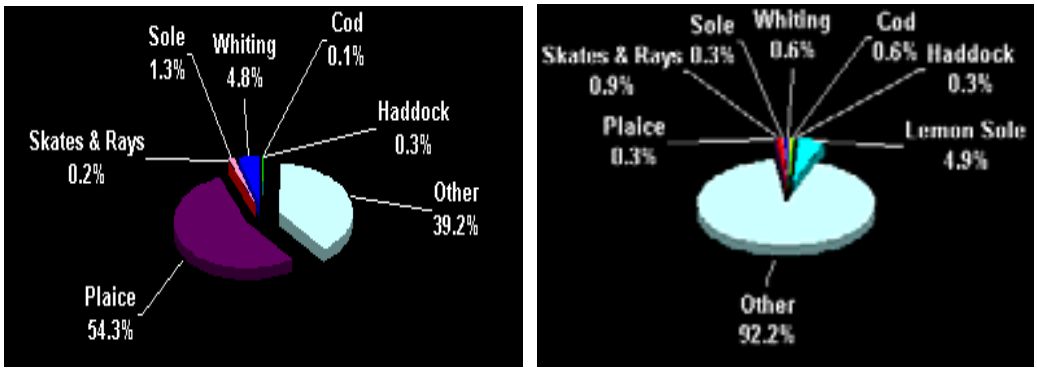

Figure 14. Species composition of catch by number off the coast of Rush and further into the Irish Sea (2000) © Cefas

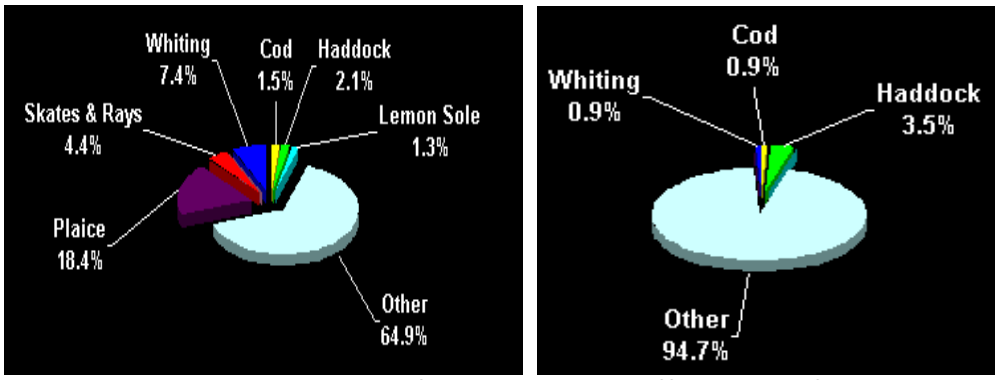

Figure 15. Species composition of catch by number off the coast of Howth and further into the Irish Sea (1999) © Cefas

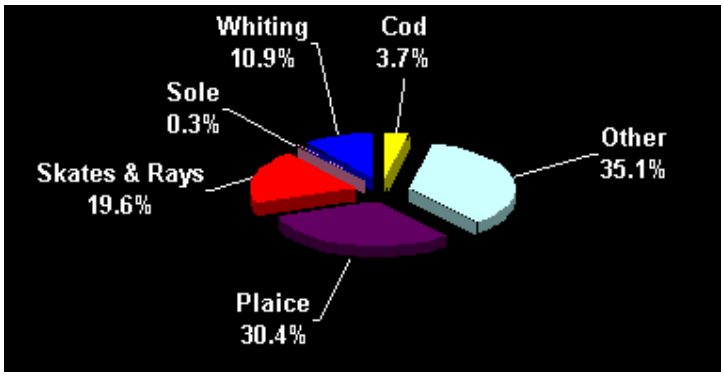

Figure 16. Species composition of catch by number off the coast of Dublin (2000). © Cefas

While these figures may indicate that potentially in areas there may be a high diversity of species, represented as 'other' in the figures, such as in the pie charts recorded from further offshore. Unfortunately 'other' may be a represented by a single species, such as dab, which is known to occur in high numbers in the Irish Sea. However, these species names were never recorded so a further study is required to examine this. Recording of discards by fishermen would provide very useful information and help to assess the biodiversity all year round within the Irish Sea. Currently there are Fisheries Assessment Technicians (FAT) employed to examine the amount and type of discards but were this to be employed on all boats a clearer more informative picture would result.

Long term and seasonal trends

Results from an Irish Sea/English Channel Cefas survey 1990-2000 show trends where Cod, Haddock and Whiting have all reduced dramatically in the amount caught over the 10 year period whereas Dab has shown an increase in numbers caught for the same fishing effort. Plaice and Ray appeared to be holding their own with no major changes in trends. Dover Sole and Monkfish showed an increase in the mid 90's but both have since declined in numbers to that similar to 1990. Interestingly one of the stakeholders was very informative with regards to trends in fishing from the 1960's and was very 'in tune' with the potential effects that climate change was having with regard to the movement of stocks particularly cod that he could very well have contributed to Brander's talk at the Biodiversity, Science and Governance conference

in Paris 2005, entitled “Is climate change moving the goalpost for fisheries management?”

Threats

So, at what intensity is fishing carried out in the Irish Sea and more particularly off the Fingal coast? Looking at **Figure 17** you would get the impression that very little trawling, beam-trawling or scallop dredging is occurring off the coast. Au contraire, information gathered from the local community tells a different story with a number of reports of ‘rogue fishermen’ operating ‘illegally’ out of both Irish and foreign boats intensively dredging quite close to shore over a prolonged period. Sometimes one study no matter how intensive it may not uncover the whole ‘story’.

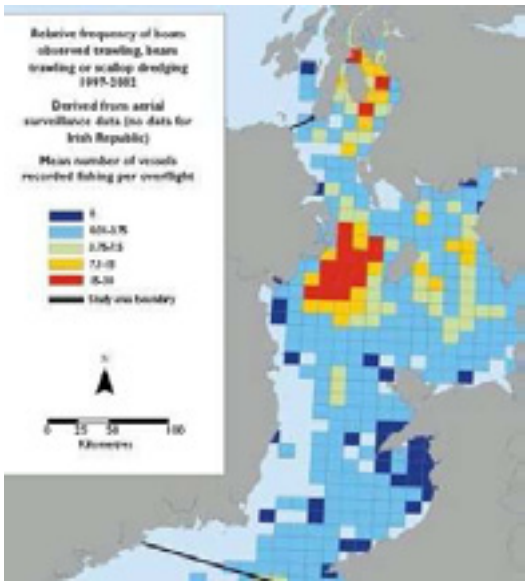

Figure 17. Irish Sea Pilot, 2004
Relative frequency of bottom-towed fishing gear use

With a number of stocks currently living dangerously close to or below their biological limit for survival there is huge pressure to conserve these stocks and to give then time to recuperate, this has seen reductions in fishing tonnage and the introduction of areas closed to fishing to increase the chances of a high recruitment the next year. However increasing pressures from stakeholders, whose livelihoods depend on fishing, on their government representatives have resulted in us never having witnessing the introduction of a complete ban even though stocks have reached or are below their biological limit e.g. cod. This may however soon become the case if the ICES advice is not followed. ICES advice on fisheries management in the Irish Sea: Fisheries in 2006 should be managed according to the following rules, which should be applied simultaneously: They should fish: without bycatch or discards of cod and spurdog, and with minimal catch of whiting; without jeopardizing the recommended reduction in fishing mortality of haddock; within the biological exploitation limits for all other stocks. Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted. Some of the stakeholders may be correct in seeing no future in the fishing industry in the Irish Sea.

Rare and threatened fish species
Out of the 40,169 species currently evaluated for the 2006 IUCN (The International Union for the Conservation of Nature and Natural Resources) Red List of Threatened Species, 1,372 species use the marine environment. Of these 1,372 species, 16 are Extinct, and 369 are threatened (listed as Critically Endangered, Endangered or Vulnerable).

212 marine fishes are listed in one of the threatened categories; nearly half of these (102 species) are sharks, rays or chimaeras. The angel shark Squatina squatina and common skate (Dipturus batis) have both been uplisted this year: the angel shark moves from Vulnerable to Critically Endangered; and the common skate moves from Endangered to Critically Endangered. Historically, the common skate was one of the most abundant skates in the North-east Atlantic. By the 1970's common skate was considered extirpated from the Irish Sea, and they have also mostly disappeared from the English Channel and the southern and central North Sea.

Status of commercial stock: According to ICES very few, if any of the marine fish species exploited commercially by Irish fishermen are in immediate danger of biological extinction as they are found across wide geographic areas. For example, the mackerel and hake are found from Morocco in the south to Norway in the north while the cod spans the North Atlantic from the North Sea to the Grand Banks of North America and the Arctic. Within these wide distributions, however, there are local stocks of fish subject to excessive exploitation and risk of collapse even though the species itself may not be in immediate danger. Such a collapse would represent a reduction in the natural range of the species. For these reasons, this action plan is aimed at particular stocks rather than the species as a whole.

Although none of the commercial species apart from the common skate are listed on the Red List there are now serious concerns about the state of a number of key fish stocks in EU waters. Stocks of Irish Sea cod, West of Scotland cod, Irish Sea whiting, Rockall haddock and northern hake are in a very poor state. In the past number of years the 'recovery plan' and 'emergency measures' have become a feature in the management of EU fish stocks. 'Emergency measures' have now been established from the north coast of Spain, to Norway as part of the recovery plan process. With Ireland at the geographical centre of this recovery plan area and given the mixed fisheries nature of the stocks involved, this plans will have a considerable impact on our coastal fishing communities and our fishing fleet.

What protection is there for marine biodiversity in Fingal?
The Department of Communications, Marine and Natural resources is responsible for the protection and monitoring of offshore areas and fisheries (see Fisheries Management overview). However, off shore protected habitats are needed to fully protect marine biodiversity. Although the Irish Sea has restricted/protected areas for fisheries, where spawning and nursery areas occur e.g. cod box, these are only closed at certain times of the year and they still allow restricted entry. These however according to stakeholders are not monitored effectively and they are aware of a number of 'rogue fishermen' entering this area at times of closure. Also a number of the smaller fishermen would like to see this area closed for longer periods, which would provide a haven for a number of fish species. This area would be considered high in terms of marine biodiversity during this period. Fig. 16 gives an overview of

the importance of the coast off Fingal for nursery and spawning grounds for commercial species.

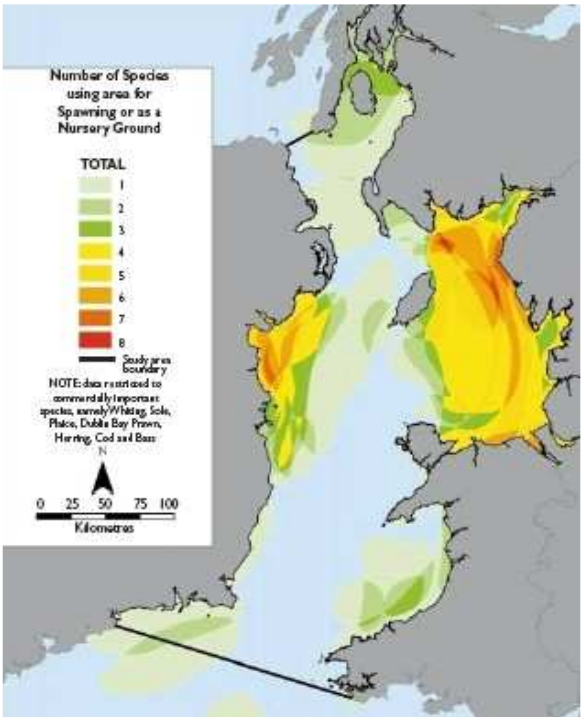

Figure 16. Irish Sea Pilot, 2004
Nursery and Spawning Grounds for Commercially Important Fish

Conclusion

This study has revealed that there is a magnitude of community knowledge available on fisheries and related issues, including patterns of fish relative to other species, bottom types, temperature, fishing seasons and so on. A vast quantity of this knowledge is experiential gained over years of fishing at sea through both knowledge passed down the generations and knowledge that can only be gained from years at sea, both are extremely hard to put down on paper. This information can be very intricate involving a number of different factors attributing to the end result, catch, that as one stakeholder put it 'you would have to be there at that particular moment and then I could tell you why and where'. To find a way to tap into a resource such as this would at minimal compliment the fisheries research being carried out, but may also reveal answers to questions that may not have been asked yet. Unfortunately it was beyond the scope of this study to spend time at sea but this may lead to an interesting study in the future.

8) Recommendations

Educate the public

- **Marine Biodiversity:** Set up a series of talks on the marine biodiversity in the Fingal area focusing on the fish species and the importance of the coast for spawning and as a nursery ground. Illustrate the effects of pollution and the importance of maintaining high water quality. To actively endorse the local angling clubs in their 'weigh and release policy'.

- **Alternative fish species:** Highlight the different fish stocks that are under pressure in the Irish Sea and encourage the locals to buy alternate fish species that are equally tasty. Highlight the positive outcomes from this including the reduced pressure on these stocks allowing for recovery of these stocks.

Protection of inshore habitats

- Use the County Council powers to enforce that the regulations for **onshore planning permission** are strictly adhered to allowing for protection of inshore fisheries.

- Continue to enforce strict fines for **pollution** on beaches etc. and to publicise these fines to discourage others from repeating the offence.

- To continue the **'beach cleaning programme'** and, if possible, to extend this programme to include less popular beaches.

- To explore the possibility of designating part of the Fingal inshore area as a **marine protected area**.

Get the public active

- Involve the public by advertising the many opportunities to see and enjoy marine biodiversity in their local area. There are also opportunities to become actively involved in recording schemes and to participate in research projects e.g. Coastwatch Europe. Organise marine biodiversity guided tours of the seashore.

Encourage & promote Blue Flag beaches

- As a local authority it is up to Fingal County Council to continue to apply to an Taisce for Blue Flags for their beaches and marinas. In the process it is important to keep the locals aware of what is involved in obtaining a Blue Flag and its importance to the local community. For those beaches that have not successfully attained a Blue Fag to continue to aspire towards this.

Ensure our Government plays its part in protecting our biodiversity

- The Department of Communications, Marine and Natural Resources has a wide range of roles and functions in the areas of public safety, environmental protection and coastal zone management. It is important for local authorities and communities to put pressure on this department to carry

through with their initiatives (management and development of the marine coastal zone, management and development of the inland fisheries sector and environmental assessment etc.). Although the first step towards a more efficient inshore fisheries management is currently underway with the licensing of unregistered boats the department must continue to:

- Develop an appropriate and effective management framework for the inshore fisheries including the continual enforcement of quotas and fishing restrictions in the long term rather than the short term.
- Take on board the advice that is given to them by the scientists

One area that needs to be addressed is the development of a long-term strategic plan for Inshore fisheries.

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Appendix – Cetaceans

Whales and dolphins off the Fingal coast

In 1991, the Irish Government designated all Irish territorial waters a whale and dolphin (cetacean) sanctuary in recognition of the importance of Irish waters to these marine mammals (Berrow, 2001). A total of 23 species of cetacean have been recorded in Irish waters. Of these, six have been recorded in the waters off the Fingal coast: harbour porpoise (*Phocoena phocoena*), common dolphin (*Delphinus delphis*), striped dolphin *(Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*), minke whale (*Balaenoptera acutorostrata*) and fin whale (*Balaenoptera physalus*) (IWDG, 2006).

Whale-watching is becoming increasing popular in Ireland, as it is recognised that there are numerous opportunities to view cetaceans in Irish waters, both from land and at sea. Islands and headlands provide the best place to partake in whale-watching, as, with the use of binoculars or a telescope, a large expanse of water can be surveyed from one location. There has been an increase in the number of whale-watching boat trips being run around the west and southwest coasts, as cetaceans are more commonly seen in these areas. For example, there is a population of bottlenose dolphins resident in the Shannon Estuary, providing local boat operators with excellent potential for sightings.

All whale and dolphin species are protected under the Wildlife Act 1976 (amended 2000), and the European Communities (Natural Habitats) Regulations (S.I. 94/1997) (which transposed the European Unions Habitats Directive (92/43/EEC) into Irish law) making it illegal to hunt them or interfere with their habitats. The Department of Communications, Marine and Natural Resources published Marine Notice No. 15 of 2005, entitled Guidelines For Correct Procedures When Encountering Whales and Dolphins in Irish Coastal Waters. This is particularly important in light of the increased number of vessels operating whale-watching trips. In addition to these statutory measures, Ireland has signed up to a number of conventions protecting cetaceans, such as the Bern Convention and the Bonn Convention.

Cetacean species across the world face threats from a number of sources including continued whaling by a number of countries (principally Japan, Norway and Iceland), incidental by-catch in fishing gear (especially gillnets), pollution, effects of low frequency sonar used by some navies, and depleted food supplies owing to over-exploitation by the global fishing industry. Different species face a different combination of these threats owing to their different biology, ecology and distribution.

Below is a short discussion on each of the cetacean species recorded in the waters off the Fingal coast, including description, identification at sea, feeding and threats faced by the species.

Harbour porpoise (*Phocoena phocoena*)
The harbour porpoise is the smallest cetacean to be recorded in Irish waters, with a typical body length of 1.6m, and the most commonly sighted species in the Fingal area (IWDG, 2006). It has a short round head with no beak, a small, triangular dorsal

fin. Its coloration is black/grey on the dorsal surface with a pale belly. Identification at sea is possible by means of their characteristic low, rolling surfacing behaviour, where the head and flukes are very rarely seen.

Harbour porpoises are found in shallow coastal waters (<200m), and feed mainly on small, shoaling pelagic fish species, such as herring, mackerel, sprat, etc.

Harbour porpoises are listed under Annex II of the European Union Habitats Directive as a species requiring the designation of Special Areas of Conservation for their conservation.

The main threats faced by harbour porpoises include pollution and accidental entanglement in fishing gear, especially gill nets. Their small size means that any encounter with a gill net or other fishing gear is likely to be fatal. The threat posed by pollution is due to the accumulation of chemicals in the tissues of the porpoise, which in turn affects its body functioning, e.g. immune system. Chemicals enter the body mainly as a result of being present in the fish on which the harbour porpoise feeds.

Common dolphin (*Delphinus delphis*)
The common dolphin is one of the most abundant species in the north eastern Atlantic, though is less common in the Irish Sea, with only one sighting event recorded in the Fingal area (IWDG, 2006). Male common dolphins grow up to a length of 2.4m. They can be recognised by their slender form, distinct beak and characteristic coloration. Common dolphins have a black back, white belly, patches of yellow and grey on the flanks forming an hourglass pattern.

Common dolphins are found both in coastal and offshore waters. The greatest concentration of this species tends to occur at the edge of the continental shelf, at approximately the 200m isobath off the Atlantic coast of Ireland.

Common dolphins have a varied diet, and are regarded as having an opportunistic foraging strategy, focusing on locally abundant species. In general, shoaling fish species such as mackerel, herring, blue whiting, as well as squid species, form the basis of the common dolphin diet in coastal waters, while offshore feeding focuses on the small shoaling fish of the deep scattering layer, such as myctophids (lanternfish) and also squid.
The main threat to common dolphins is accidental entanglement in fishing gear. Gill nets are notable for their incidental capture of cetaceans such as common dolphins, though trawls are also known to take this species. In the case of trawls it appears that dolphins may be feeding on the target species around the mouth of the trawl, and that they are entangled mainly when the trawler changes direction or starts hauling in the gear.

Striped dolphin *(Stenella coeruleoalba*)
The striped dolphin is a small, sleek dolphin, and gets its name from the dark stripe that runs from the beak, across the eye and down the pale flank. They have a distinct beak and a tall, curved dorsal fin. The dorsal surface of the dolphin is dark grey, with

a pale underside. The striped dolphin grows to a length of 2m or more, with a maximum recorded length of 2.6m.

Striped dolphins are generally found in warm, pelagic waters, and are only occasionally observed in Irish waters, mainly off the southwest coast. Only a single sighting of this species has been recorded in the waters off the Fingal coast, at Lambay Island.

In the eastern North Atlantic, the striped dolphin feeds on mesopelagic and benthic fish, such as sprat, blue whiting, poor cod, Norway pout, and other small fish species, as well as crustaceans and squid.

As a small cetacean, the main threat to striped dolphins is entanglement and drowning in fishing gear. At an international level, the striped dolphin is still hunted in Japan, where schools are driven ashore and butchered. Thousands of striped dolphins meet this fate every year.

Bottlenose dolphin (*Tursiops truncatus*)

Bottlenose dolphins are the largest of the beaked dolphins, with males growing up to approximately 4m in length. They are seen as the quintessential dolphin owing to their roles in television programmes and aquaria performances. They have a robust body form with a medium grey dorsal surface and paler underside. In the field they can be identified by their tall dorsal fin, their robust frame and their strongly arched back as they dive.

Bottlenose dolphins are generally found in inshore areas, including bays and estuaries, and are rarely seen in open water. They feed on a number of fish and crustacean species. Fish species taken include shoaling species, as well as individual demersal fish.

Bottlenose dolphins are listed under Annex II of the European Union Habitats Directive as a species requiring the designation of Special Areas of Conservation for their conservation.

Major threats to bottlenose dolphins include depletion of fish stocks on which they feed, pollution and live capture for the entertainment industry.

Minke whale (*Balaenoptera acutorostrata*)

Minke whales are the smallest of the rorquals (whales that feed by filtering prey from seawater by means of baleen plates), reaching an average length of 7m, and weighing in at 10 tonnes. Minke whales have a black to grey dorsal surface and a white underside, with pale grey chevron markings occasionally behind the head and white bands on the pectoral fins. In common with the other baleen whales, the minke whale has a ventral grooves or pleats on its throat, which expands during feeding. In the field, they can be identified by their surfacing behaviour. The minke whale's snout breaks the water first, and the blow and dorsal fin are seen simultaneously.

Minke whales are more common off the south and southwest coast of Ireland, however they do occur in the Irish Sea and there have been eleven recorded sightings of minke whales off the Fingal coast since 2003, extending from Howth Head to Balbriggan (IWDG, 2006).

In the Northern Hemisphere the minke whales feeds on small fish such as capelin, sand eel, herring and cod. Their feeding strategy often involves herding fish into a tight shoal before swallowing them.

While minke whales can occasionally be entangled in fishing gear, pollution poses a greater threat to the population. Internationally, this species is still the focus of whaling by Japan, Iceland and Norway. Japan and Iceland carry out the hunting of this species under the guise of "scientific research", while Norway placed an objection with the International Whaling Commission against the moratorium on whaling and resumed commercial whaling in 1993.

Fin whale (*Balaenoptera physalus*)

The fin whale is the second largest animal in the world, with only its relation, the blue whale (*Balaenoptera musculus*), being larger. The fin whale can grow to more than 19m in length, with specimens of up to 27m recorded. Fin whales are grey to brownish black, with a white underside and light coloured chevrons across the dorsal surface. A characteristic feature of the colouration of the fin whale is the asymmetric colouring on the jaw, with the right side whitish, and the left side dark.

One sighting of a fin whale has been recorded off the Fingal coast, east of Rockabill Island in 2005.

Identification in the field is based on their surfacing behaviour. A fin whale blow can reach heights of 6m, distinguishing it from the minke whale whose blow is rarely visible, and occurs before the dorsal fin breaks the surface, unlike the sei whale (*Balaenoptera borealis*) whose blow and dorsal fin are visible simultaneously.

Threats to fin whales include overexploitation of fish stocks on which they feed, and the possibility of a return to commercial whaling, which devastated the population during the 20th century, when the fin whale replaced the blue whale as the main target species of the whaling industry owing to the reduction in the population of blue whales caused by overexploitation.

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