afbi Agri-Food and Biosciences Institute ®

EUROPEAN FISHERIES FUND

NORTHERN IRELAND INSHORE FISHERIES

Prepared by
AFBI Fisheries and Aquatic Ecosystems Branch
for DARD Fisheries and Environment Division

Document version control:

Version	Issue date	Modifier	Note	Issued to
1.0	01/03/2012	AFBI_CMC	First Draft	Steering Group
1.1	08/05/2012	AFBI_CMC	Amendments	Steering Group
1.2	24/10/2012	AFBI_CMC	Amendments	Steering Group
1.3	**19/02/2013**	AFBI_CMC	Amendments	Steering Group
1.4	**13/05/2013**	AFBI_CMC	Amendments	Public availability

Further information

Agri-Food and Bioscience Institute (AFBI)

Fisheries & Aquatic Ecosystems Branch

Coastal Zone Science Group

Newforge Lane

Belfast

BT9 5PX

Tel: 028-90255472

Contents

Summary

The inshore sector has seen considerable growth in recent years, partly as a consequence of the increased pressure on the offshore fleet which has seen fishermen moving from offshore fisheries to inshore fisheries such as pot fishing and scallop dredging. With the inshore fishery being worth in excess of £4.4 million in 2010 and relatively lightly regulated, the move is attractive to offshore fishermen who are being constrained by tight regulations and reduced quotas.

Within Northern Ireland, the main species targeted by the inshore fleet are crab, lobster, scallops, queen scallops, mussels, cockles, whelks, *Palaemon* prawns and *Nephrops*. In addition to these commercial species, recreational sea angling (RSA) also contributes to the Northern Ireland economy. The inshore sector must therefore be managed in a way that balances the future development of both commercial and recreational fishing as well as maintaining a healthy marine environment with exploited stocks at a sustainable level.

The inshore sector is currently facing a number of physical, biological and environmental challenges which are common across all the fisheries within the 12nm.

- Lack of focus on inshore
- Influx of new entrants
- Lack of data available
- Marine spatial planning
- Sustainability of stocks
- Optimising economic return

The United Kingdom has recently brought more focus onto the inshore region and has overhauled its management of the sector through the creation of the Marine Management Organisation, Inshore Fisheries and Conservation Authorities, Marine Scotland and Inshore Fisheries Groups. Whilst Northern Ireland has a number of organisations operating within the inshore, these are either specific to a particular species, region or the inshore is only part of their remit. There is no dedicated inshore management group in Northern Ireland. It is important that Northern Ireland now follow in the footsteps of the UK by bringing more focus onto the inshore sector and that emphasis is put on the governance of the inshore. It is proposed that a dedicated Inshore Management Group be established and adequate resources are put in place to manage the inshore sector. In addition a number of further potential actions have been identified that may assist the sector to overcome the challenges it is currently facing (Table I).

Table 1. Possible actions for the Northern Ireland inshore sector

Recommendation / Challenge	Governance	Technology	Mapping	Enforcement	Economic sustainability	Data collection	Other opportunities
Lack of focus	✓	✓	✓	✓	✓	✓	✓
Obligations to protect environment	✓	✓	✓	✓		✓	✓
Lack of data	✓	✓	✓	✓	✓	✓	
Spatial pressures	✓	✓	✓	✓		✓	
Sustainability	✓	✓	✓	✓	✓	✓	✓

Report Background

In 2004 the Cabinet Office Strategy Unit published a report on UK fisheries entitled Net Benefits, which highlighted the need for renewed focus on inshore fisheries, describing inshore fisheries as "... *a sector of local cultural and tourism value, with the potential to provide high value fishing jobs into the future*".

In 2007 a review of inshore fisheries in Northern Ireland was carried out by a stakeholder advisory group (SAG) comprising representatives from the fishing industry, the mariculture and angling sectors, environmental NGOs, local government, scientists and other interested parties. The aim was to advise the Department of Agriculture and Rural Development (DARD) on the future management of inshore fisheries. The report highlighted a number of concerns for the inshore sector:

- As more pressure is placed on the offshore sector, the inshore sector is attracting new entrants which could lead to oversupply and reduced profit as well as over-fishing
- Lack of knowledge on status and exploitation of stocks
- The proposed network of marine protected areas under development
- Offshore renewable energy
- Limited knowledge of the socio-economics of the inshore sector
- Poor enforcement

The report, together with the departmental response set out the vision for the sustainable development of inshore fisheries which is "... *fully aware of, and compliant with, environmental responsibilities …*"

Key recommendations and areas of agreement were identified including:

- The need to develop a comprehensive strategy for inshore fisheries which will
    1. address management measures for non-quota species in the inshore sector
    2. aim at progressive implementation of an ecosystem approach to the extent permitted by scientific knowledge
    3. be developed and implemented with the full involvement of all stakeholders
- The need for local management plans to define the range of measures needed to develop each individual inshore fishery in a sustainable manner

(A complete list of the recommendations made during the review can be found in Appendix 1)

In 2010 the report of the Northern Ireland Fisheries Forum fully endorsed the SAG vision for inshore fisheries and the Departments response. These objectives must now be brought into reality via an integrated well targeted programme of scientific work, in conjunction with stakeholders, the central purpose of which is to develop a sustainable development strategy for Northern Ireland's inshore fisheries.

Objectives

In response to the SAG report DARD agreed that the development and implementation of a comprehensive strategy was needed to examine the challenges facing the inshore sector and to help ensure sustainable development of Northern Ireland inshore fisheries, with the strategy used to form the basis of future DARD inshore policy development. Sustainable development was quoted in 1983 by the World Commission on Environment and Development as development *"which meets the needs of the present without compromising the ability of future generations to meet their own needs"*.

To progress the development of a sustainable development strategy for Northern Ireland's inshore fisheries, AFBI were commissioned by DARD to:

- produce a draft strategy that:
    a) commands the support of stakeholders
    b) forms the basis for the development of policy towards a sustainable future for Northern Ireland's inshore fisheries
- identify a stakeholder role in data collection whilst setting a basis for scientists and fishers to work together to deliver a credible evidence base for management of the inshore sector
- work with stakeholders to encourage sustainable development of the inshore sector
- a GIS approach to the inshore sector which recognises the varying spatial and temporal extent of inshore fisheries and the variety of other pressures on inshore habitats and resources e.g. renewable energy, conservation areas
- establish a draft scientific work programme that meets the requirements for an improved knowledge base on the inshore fisheries sector
- put an integrated and enhanced science programme in place and working successfully with stakeholder participation

Introduction

The total number of vessels (both offshore and inshore) within the Northern Ireland fleet over the last 10 years has averaged around 340. Following a dip in 2003, the number of fishing vessels has been increasing steadily (Figure 1) with the inshore sector seeing considerable growth in recent years. This increase in the inshore sector is partly as a consequence of the increased pressure on the offshore fleet which has seen fishermen moving from offshore fisheries to inshore fisheries such as pot fishing and scallop dredging. With the Northern Ireland inshore fishery being worth in excess of £4 million in 2010, the move is attractive to fishermen who are being constrained by tight regulations and reduced quotas.

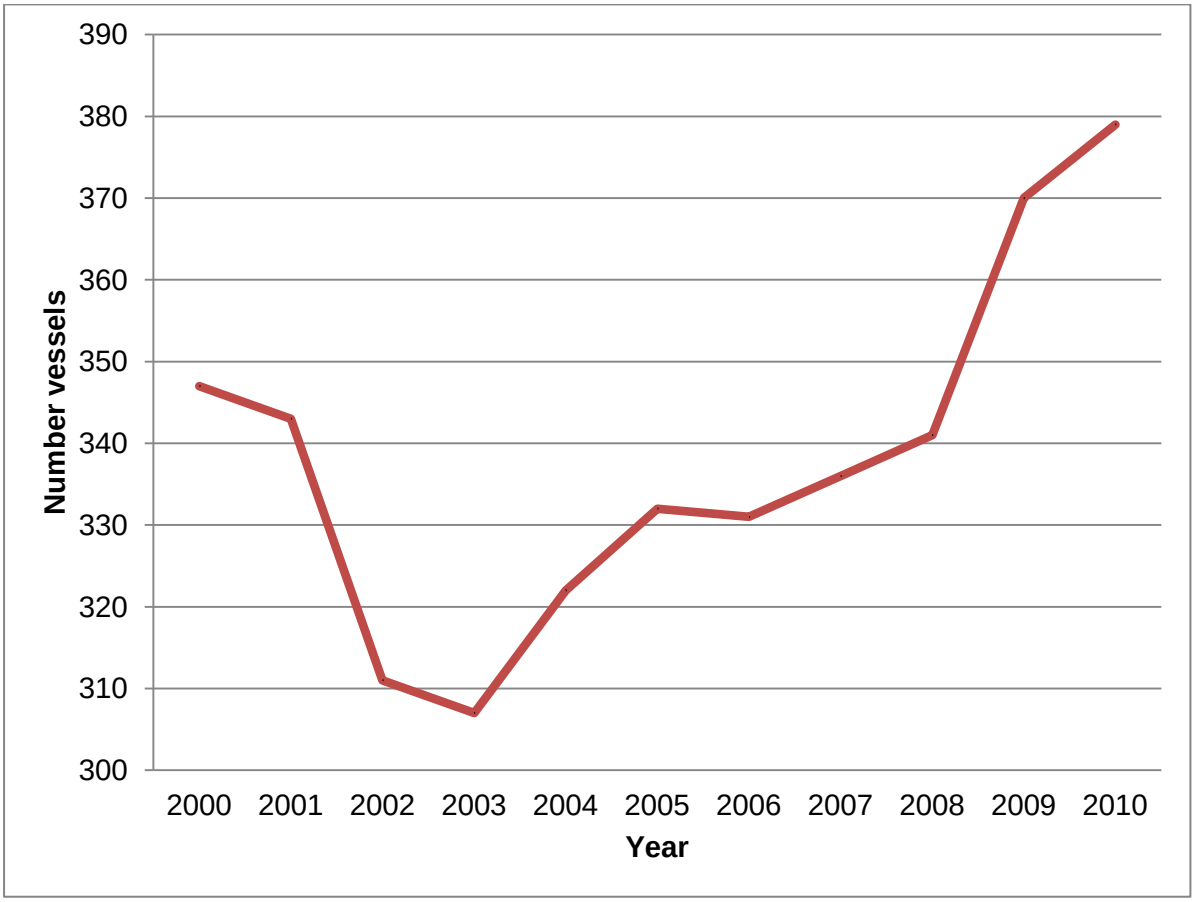


Figure 1 The number of vessels within the Northern Ireland fishing fleet between 2000 and 2010 (data from DARD and MMO)

This move towards the inshore sector is characterised by the change in the Northern Ireland fleet which has now become dominated by smaller vessels (Figure 2). Whilst in 2000 52% of the fleet were greater than 10m in length, by 2010 this had dropped to 38% meaning that three in every five Northern Ireland fishing vessels are now less than 10m in length. With this change in length there has also been a change in the structure of the ports with more fishermen fishing from smaller ports rather than the traditional 3 of Ardglass, Kilkeel and Portavogie, making inshore fisheries economically important to a wider number of communities as a source of employment.

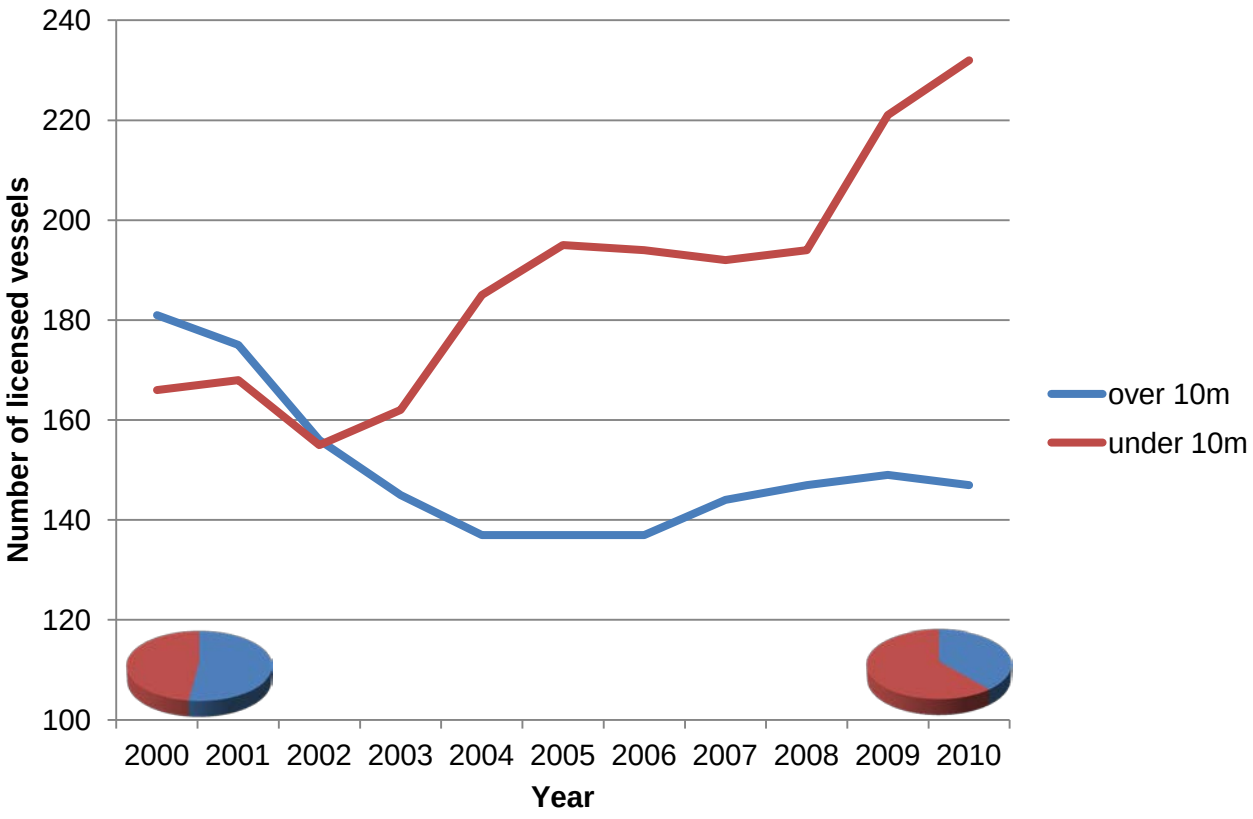


Figure 2 Number of vessels greater than 10m and under 10m in the Northern Ireland fishing fleet

Within the inshore, few fishermen specialise in a particular species, with most being able to diversify to follow market demand. In Northern Ireland, whilst there are fisheries for a wide range of species including whelks, *Palaemon* and pot caught *Nephrops*, the value of the main species targeted by the inshore fleet is shown in figure 3. In total, the value of inshore fisheries in 2011 (excluding aquaculture and intertidal harvesting) was worth an estimated

£4.8 million (Figure 3). This includes developmental fisheries such as the County Down *Palaemon* fishery. In addition to these commercial species, recreational sea angling (RSA) also contributes to the Northern Ireland economy by bringing in tourists as well as through chartering of boats, buying of equipment etc. The inshore sector must therefore be managed in a way that balances the future development of both commercial and recreational fishing as well as maintaining a healthy marine environment with exploited stocks at a sustainable level.

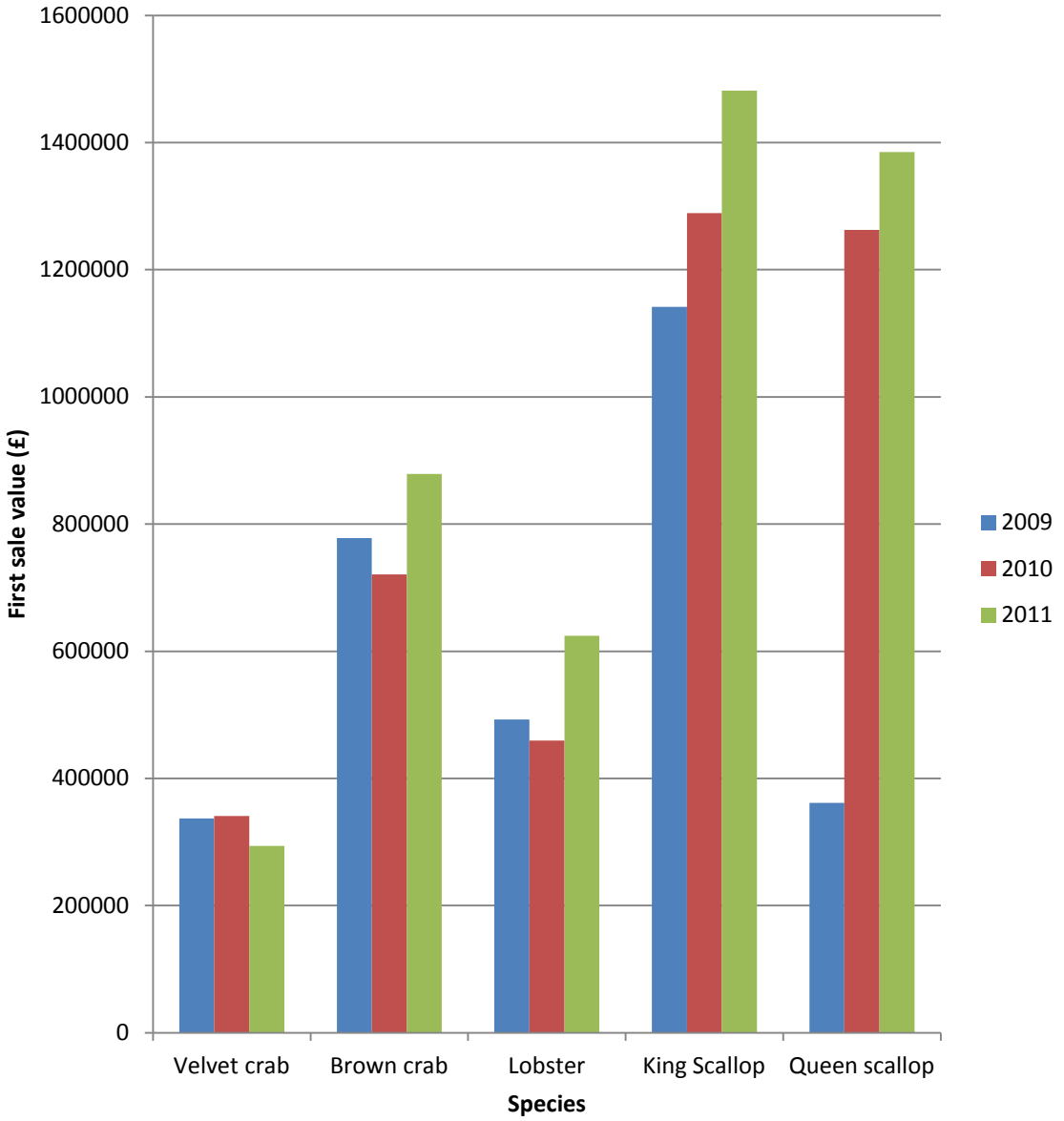


Figure 3 Value of most significant species targeted by the Northern Ireland inshore sector

Northern Ireland Inshore Fisheries

Within the Northern Ireland inshore area, as well as the shellfish species mentioned, there is also a small seasonal herring skiff fishery, but unlike the other inshore fisheries, this remains tightly regulated in comparison. Only vessels less than 40 ft (12.2m) in length can fish for herring within the designated area (Figure 4). The only method of fishing permitted is drift netting using nets with a minimum mesh size of 54mm. In Northern Ireland between 12 and 15 boats fish the Mourne herring fishery directly employing approximately 75 fishermen plus processors and factories. An annual quota is set for British registered fishing vessels. From 2008 the British quota has decreased from 58.7 tonnes to 32.1 tonnes in 2011, a quota which can be exceeded in one night if all boats fish. Ireland holds a separate quota for the Mourne herring fishery. In addition to this quota, the skiff fishery may 'bank' a percentage of unused quota to be available for the following year. Also, quota may be transferred. For example, in 2011 the Northern Ireland skiff fishery received around 100 tonnes extra quota from the Irish allocation. However, as this fishery is weather dependent and it can take several weeks to get quota transferred, the transfer may be too late to be exploited by the fishermen. Therefore, ideally the Mourne herring fishery is given an appropriate quota from the outset. A licence is required to fish within the boundary of the Mourne fishery, with licences permitting fishing between September and December. However, if either the British or Irish quotas are reached prior to the planned date of closure of the fishery, the licences will be revoked thus closing the fishery.

Also, whilst not examined in this strategy it is important to note the significant Northern Ireland aquaculture sector. In 2011 data, the value of the shellfish aquaculture industry in Northern Ireland was around £6 million, employing 49 full-time and 16 part-time employees. The industry supplies high quality shellfish throughout the UK, Ireland and Europe (mainly to Holland and France). The main species cultivated are blue mussels and trestle grown pacific oysters. There is also an important Finfish aquaculture industry in Northern Ireland which was worth £4 million pounds in 2011, employing 41 fulltime and 14 part-time employees. The main species are Atlantic salmon, Brown trout and Rainbow trout supplying both local and international markets.

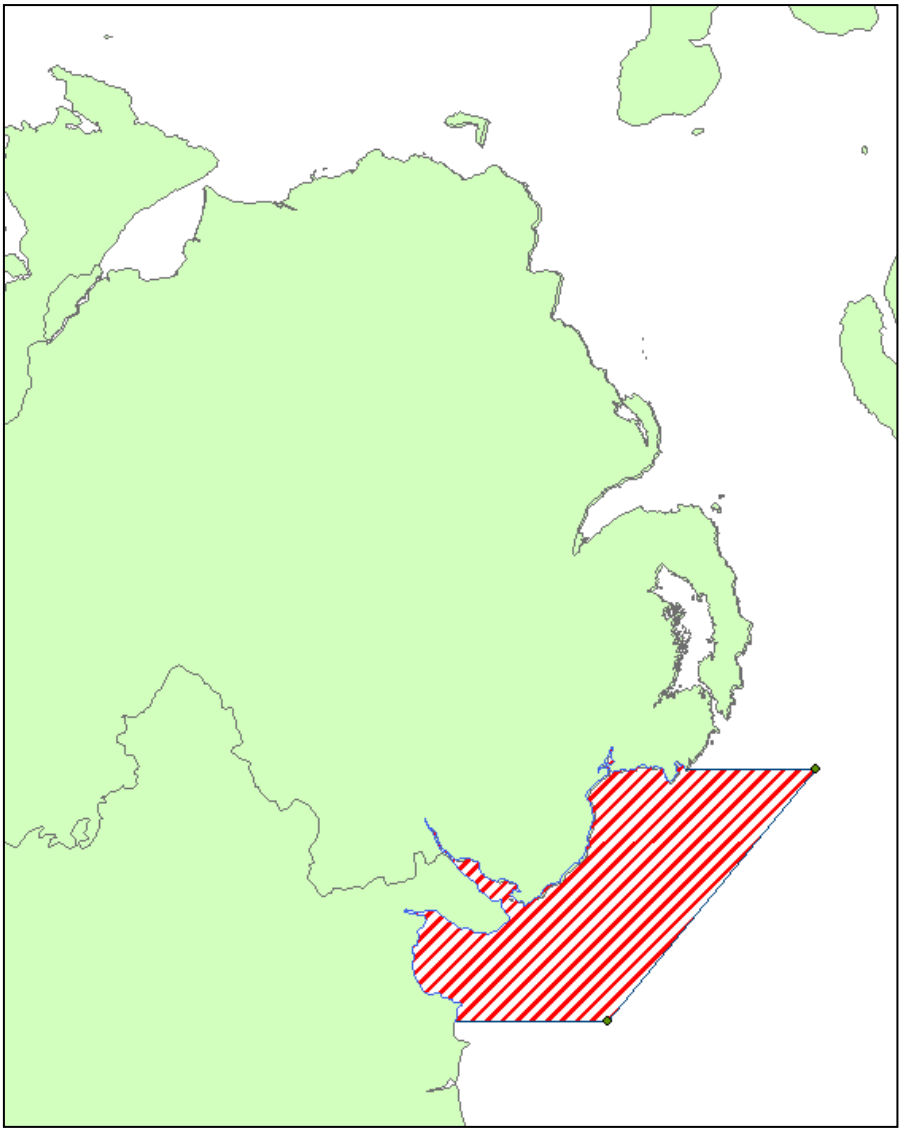


Figure 4 Location of the Mourne herring fishery (highlighted in red)

Inshore Management in Great Britain and Ireland

Great Britain has recently brought more focus onto the inshore and the devolved administrations have overhauled their management of the sector. This began in 2008 when the Welsh Assembly Government launched the Wales Fishery Strategy which aims to 'support the development of viable and sustainable fisheries in Wales as an integral part of coherent policies for safeguarding the environment'. The strategy looks at sustaining fisheries as well as communities which rely on the sector

In 2009, under the Marine and Coastal Access Act, the structure of the English inshore fisheries management was reorganised. Under the Act the Marine Management Organisation (MMO) was established. The MMO, a non-departmental public body (NDPB), has the responsibilities of:

- Implementing marine planning
- Implementing a new license regime
- Managing the UK fishing fleet
- Creating and managing a network of Marine Protected Areas (MPA's) alongside Natural England and the Joint Nature Conservation Committee (JNCC).

Alongside the establishment of the MMO, the Marine and Coastal Access Act dissolved the powers of the Sea Fisheries Committees and replaced them with ten Inshore Fisheries and Conservation Authorities (IFCA's). The IFCA's, which are arranged by district (Figure 5), are tasked with the sustainable management of the inshore sector and are funded by local councils and the Department of Environment, Food and Rural Affairs (DEFRA). The principle behind the IFCA's is to "*lead, champion and manage a sustainable marine environment and inshore fisheries by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry*".

Also in 2009, Marine Scotland was established as a directorate of the Scottish Government to bring together the responsibilities of the SG Marine Directorate, Fisheries Research Services and the Scottish Fisheries Protection Agency. The mission of Marine Scotland is "*to manage Scotland's seas for prosperity and environmental sustainability*"; this includes ensuring a "*viable and sustainable fishery*".

Scotland also created Inshore Fisheries Groups (IFGs) which include members drawn from Fishermen's Associations alongside those from Marine Scotland, Scottish Natural Heritage and other marine stakeholders Initially it was outlined that there would be 12 IFGs which would follow the boundaries of the planning regions. However, this was changed to 6 IFGs with IFG's being responsible for bigger areas. The main responsibility of these IFGs is the

management of inshore fisheries. The IFGs will develop local objectives for their region out to 6 miles, as well as setting up the management plans needed to deliver those objectives. It has been proposed that the first of the IFG's will become operational in 2013.

In 2010 the Irish Central Fisheries Board and 7 Regional Fisheries Boards amalgamated to form Inland Fisheries Ireland (IFI) under the Inland Fisheries Act 2010. The IFI covers inland waters and out to the 12 mile limit and protects freshwater species, sea bass and certain mollusc species. The IFI is also in charge of sea angling. In cross border areas the IFI work alongside the Loughs Agency which is an agency of the Foyle, Carlingford and Irish Lights Commission and was established under agreement between the UK and Irish governments. The Loughs Agency has responsibility for the development of fisheries and aquaculture, conservation and protection of inland fisheries and sustainable development of marine tourism in the two cross border Loughs. As well as working alongside the IFI, the Loughs Agency also work with DARD in Northern Ireland.

In England, the New Under Ten Fishermen's Association (NUTFA) are in discussion with Defra for the establishment of an Inshore Producers Organisation. It is believed an inshore PO will give the inshore sector the balance it needs to sit alongside larger scale fishermen in decision and policy making. The PO will also manage all quotas over the entire inshore fleet rather than through individual fixed quota allocations.

Northern Ireland Management Structure

In Northern Ireland, the inshore sector is governed by the Department of Agriculture and Rural Development (DARD) whose Fisheries and Environment Division has the responsibility of preparing and enforcing all fisheries regulations, both for the offshore and inshore sectors. Whilst previously this did not include the foreshore, the Fisheries (Amendment) Act (Northern Ireland) 2001 gave DARD powers to regulate fisheries up to the high water mark.

The Loughs Agency is an agency of the Foyle, Carlingford and Irish Lights Commission and was established under agreement between the UK and Irish governments. The Loughs Agency has responsibility for the development of fisheries and aquaculture, conservation and protection of inland fisheries and sustainable development of marine tourism in the two cross border Loughs.

The Marine Division has been recently established as part of the Department of Environment. The Division works alongside the Environmental Protection Directorate of NIEA to implement water quality regulations including the Shellfish Water Directive

(transposed into NI legislation through the Surface Waters (Shellfish) (Classification) (Amendment) Regulations (Northern Ireland) 2009).The Marine Division has control over the designation of marine protected areas, whilst the Natural Heritage Directorate have control over the designation of land-based protected areas in Northern Ireland. Marine Division also has control over marine spatial planning under the Northern Ireland Marine Bill.

Northern Ireland fishermen have a number of groups working within the inshore

1. Northern Ireland Fish Producers Organisation
2. Anglo-North Irish Fish Producers Organisation
3. North East Lobster Cooperative
4. North Coast Lobster Fishermen's Association
5. Strangford Lough Fishermen's Association
6. Northern Ireland Scallop Association
7. Mourne Herring Association
8. Provincial Councils Irish Federation of Sea Angling

As well as the above established groups, the Northern Ireland Brown Crab Strategy (see page 48 for more details) has recommended the creation of a North Down and Outer Ards Fishermen's Association and a South Down Fishermen's Association.

There is no fully representative dedicated inshore management group in Northern Ireland.

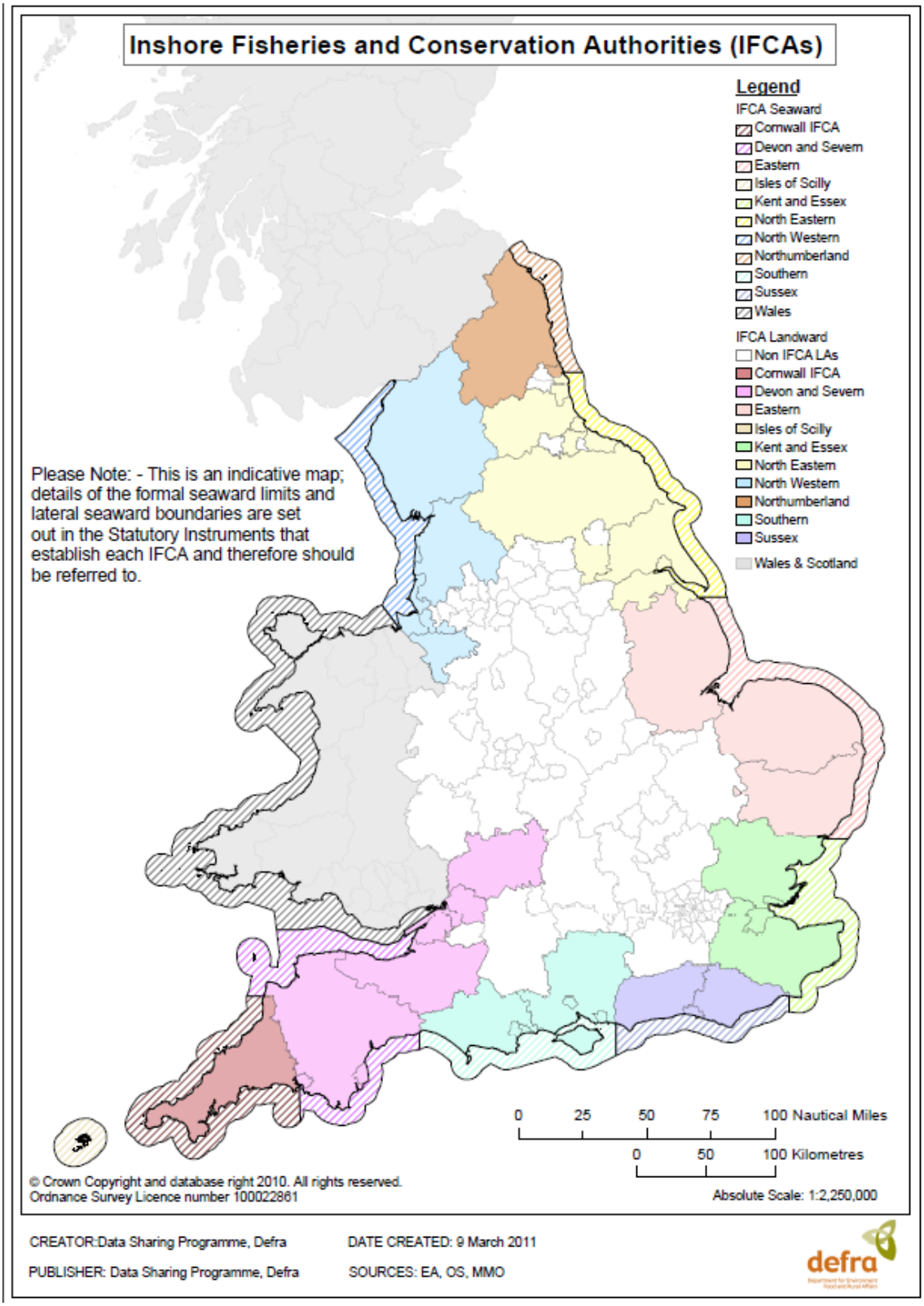


Figure 5 Map showing the boundaries of the English Inshore Fisheries and Conservation Authorities (Source: MMO)

Key Northern Ireland Inshore legislation

Under the **Fisheries Act (Northern Ireland) 1966 as amended**, DARD has full responsibility for the management, conservation, protection and improvement of inshore fisheries (out to 12nm) in Northern Ireland.

The **Sea Fish (Conservation) Act 1992** extends the powers of the 1967 Sea Fish (Conservation) Act to Northern Ireland. This includes the entitlement to introduce minimum landing sizes, the issue of penalties for offences and greater enforcement powers to DARD and sea-fishery officers.

The **Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995** gave the Department of Environment the powers to implement the Habitats Directive and thus designate areas for the protection of important species or habitats. Currently there are 6 designated/candidate Special Areas of Conservation (SACs) within the Northern Ireland inshore area:

- Murlough
- Rathlin
- Red Bay
- Strangford Lough
- The Maidens
- The Skerries and Causeway

In 2005 the **Registration of Fish Buyers and Sellers and Designation of fish auction sites regulations (Northern Ireland)** was created. Under these regulations sales notes must be submitted within 48 hours of sale by the registered seller (if fish sold at auction) or the buyer. The sales notes must include the name of the species, its geographical area of origin, price and quality of each species, the vessel landing the species and the port and date landed. Sales notes are not required if the quantity landed is less than 25kg per day and is being sold direct to the public. This has significantly increased the data available to monitor the effort and landings into Northern Ireland.

Currently in development is the **Northern Ireland Marine Bill** which will '*play a key part in ensuring that an integrated, coherent marine plan is in place for Northern Ireland*'.
The draft Marine Bill, which was introduced to the Assembly in February 2012, sets out a new management framework for Northern Ireland's seas based on: a system of marine planning that will balance conservation, energy and resource needs; improved management

for marine nature conservation and the streamlining of marine licensing for some electricity projects.

Through the Marine and Coastal Access Act 2009, the UK-wide Marine Policy Statement was prepared by all the Administrations. This document, which applies to all UK marine waters, came into effect in March 2011. It sets out the key strategic priorities for the UK's marine waters and is a tangible product against which all sustainable licensing decisions will be made until such times as marine plans are in place.

The Northern Ireland inshore is also regulated by a number of EU directives. In 2000 the **Water Framework Directive** (WFD) was adopted into EU legislation. The aim of the WFD is to integrate the way water bodies are managed throughout Europe. In 2003 this was transposed into Northern Ireland legislation through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003, which gave the Department of Environment the powers to manage and enforce the legislation which includes the protection and enhancement of coastal waters out to one mile. In addition, the **Marine Strategy Framework Directive** was introduced by Europe in 2008 and transposed into UK law in 2010. The MSFD requires an assessment of the current state of the UK seas, targets and indicators to achieve Good Environmental Status (GES) and the development of a programme which will help achieve GES (for more details see page 21).

Challenges facing the Northern Ireland Inshore sector

1. Lack of focus on inshore

Unlike in England and Wales where there are dedicated inshore authorities, in Northern Ireland there is no such structure with DARD managing the inshore alongside offshore fisheries and aquaculture. Resources are limited meaning that priority fisheries such as those for whitefish and *Nephrops* have increasing effort placed on them, removing the focus from other fisheries. In addition DARD is expected to police and enforce all legislation, meaning, that resources are generally fully utilised and, indeed, at times, stretched.

2. Obligations to protect marine environment

Northern Ireland is obligated to protect its marine environment under a number of regulations including the Habitats Directive transposed by The Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995. Under these regulations Northern Ireland is committed to identify and protect a series of habitats and species through the designation of Special Areas of Conservation (SACs), and birds of European importance through the designation of Special Protection Areas (SPAs). Northern Ireland can also designate an area as a Marine Nature Reserve (MNR) through the Nature Conservation and Amenity Lands (NI) Order 1985. However, MNRs have limited protection powers and only extend out to 3nm. Once the Northern Ireland Marine Bill becomes operational these MNRs will automatically become Marine Conservation Zones. The Northern Ireland Marine Bill will allow the designation of Marine Conservation Zones, which will be more flexible and enforceable, and can extend out to 12nm.

Most recently, the Marine Strategy Framework Directive (MSFD) has highlighted the need to protect the marine environment through "*halting biodiversity loss, ensuring the conservation and sustainable use of marine biodiversity, and on the creation of a global network of marine protected areas by 2012*". The MSFD aims to achieve Good Environmental Status (GES) by 2020. There are 11 descriptors of the MSFD

1. Biological Diversity
2. Non-indigenous species
3. Populations of commercial fish and shellfish
4. Elements of marine food webs
5. Eutrophication
6. Sea floor integrity

7. Alteration of hydrographical conditions
8. Contaminants
9. Contaminants in fish and seafood for human consumption
10. Marine litter
11. Introduction of energy including underwater noise

To achieve GES, commercial fisheries must ensure that commercial stocks are harvested sustainably (in line with descriptor 3) and that fishing impacts are sustainable with minimum impacts to the marine ecosystem (descriptors 1, 4 and 6). Whilst the reform of the Common Fisheries Policy (CFP) should support the achievement of GES, stocks outside of the CFP, shellfish, will need to be managed nationally or locally in order to secure GES.

3. Lack of data available

Prior to 2006 vessels under 10m in length were not required to submit landings data. The Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites regulations (Northern Ireland) 2005 changed this so that all fish sold (over and above 25kg per day for which sales notes are not required if being sold to the public) must be reported. Whilst this increased the data available on landings, there is still a deficit in the information available in respect of the inshore sector and the species which are exploited. If accurate data is not available on a stock, the stock cannot be sustainably managed. In addition, sustainable development of a sector cannot be managed without first knowing the status of the stock being exploited. This could lead to overfishing and a potential collapse in the stock.

In 2008, the Republic of Ireland produced an atlas of fishing which maps the areas of fishing, by gear used, within its territorial waters. Similarly, in England, “FisherMap” used stakeholder input to map fishing activities around the coast. This was then available for use for the determination of proposed Marine Conservation Zones (MCZ’s) in south-west England’s Finding Sanctuary project. In addition, information collected during “FisherMap” was also utilised by the Irish Sea Conservation Zones project (alongside data from ABP MER, ISCZ Liaison officers, landings data and VMS) to collect evidence on the location of recreational and commercial fishing in the Irish sea (including Northern Ireland inshore waters) prior to the selection of possible MCZ’s. Currently, in Wales the Countryside Council for Wales (CCW) is working alongside fishermen to map fishing activity, including the levels of fishing, around Anglesey. The aim of this “FishMap” is to identify areas which are robust to fishing and others which are more vulnerable, allowing for sustainable development of the fishery.

Whilst Northern Ireland has some information available, primarily based on evidence from vessel monitoring systems (VMS) , there is limited information on the effort of vessels under 15m in length. Whilst this is currently being addressed in the 12-15m fleet through the introduction of VMS, there is as of yet, no way of addressing the lack of knowledge on where the under 12m vessels fish.

4. Spatial Pressures

The Northern Ireland inshore area is important to a range of stakeholders for environmental, cultural or economic reasons. Due to an expansion of needs for the inshore region there is now competition for space between fishermen, conservation requirements and the production of renewable energy. This competition leads to a squeeze in the areas available to each interest.

Following on from Section 44 of the Marine and Coastal Access Act 2009, the UK Marine Policy Statement was developed in 2011 and provides the framework for preparing marine plans. Under the proposed Northern Ireland Marine Bill marine planning shall balance conservation, energy and resource needs. The Department of the Environment have the duty to produce a marine plan for the Northern Ireland inshore and offshore which shall facilitate sustainable development. Once the marine plan is produced it will provide spatial guidance, allowing policy makers to manage competing demands. In addition, all authorisation or enforcement issues will have to take in to account the marine plan once it is in place.

a) Protected Areas

Marine protected areas are a way to protect marine habitats and species. Under the MSFD member states must achieve Good Environmental Status (GES) by 2020. Marine protected areas are an important contributor to achieving this goal. There are already a number of protected areas (MPA's) in Northern Ireland, including Strangford Lough and Murlough. Whilst some fishing may be allowed to occur in some of the areas selected, in other areas fishing and other potentially harmful activities may be banned completely.

The UK is also committed to developing an ecologically coherent network of protected areas under

- The World Summit for Sustainable Development
- The UN Convention on Biological Diversity
- Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention)

b) Renewable energy

Under the Strategic Energy Framework Northern Ireland are expected to produce 40% of its electricity through renewable energy by 2020. Currently, onshore wind is the main source of Northern Ireland renewable energy production but this only equates to approximately 10% of production energy. The Department of Enterprise, Trade and Investment (DETI) have carried out a study examining the potential for offshore renewable energy around Northern Ireland and in October 2012 three companies were awarded the rights to develop offshore renewable energy at three sites around the Northern Ireland coast. First Flight Wind Limited have been leased a site along the south east coast of County Down for the potential development of a 600MW offshore wind farm. On the north east coast of County Antrim, Tidal Ventures Limited have been leased an area at Torr Head for a potential 100MW tidal opportunity and DP Marine Energy Limited have been leased a site at Fair Head for a further 100MW tidal opportunity.

The areas leased for renewable energy are also commercially important fishing grounds and fishermen have a number of concerns relating to offshore renewable energy. The potential loss of available fishing areas (either through a prohibition of fishing around the structures or through hazards to safe fishing/navigation) could lead to increased competition for space and potentially an increased travelling time to get to suitable grounds which may reduce the profitability. In addition, fishermen are also greatly concerned about the potential impacts renewable energy may have on the stocks. The most immediate impact will arise during the construction of turbines. This will influence the species found in the area by disturbance to the habitat as well as through direct removal of the animals. The noise produced during construction may also affect species such as whiting, cod and herring causing them to avoid the area during construction. In addition, the presence of electromagnetic fields produced by cabling may affect elasmobranches species, causing them to avoid the area (Shields *et* al. 2009; Centre for Marine and Coastal Studies, 2002).

c) Conflict between users

Conflicts for resources arise when different people have different needs from the marine environment. The Northern Ireland inshore is important to a range of stakeholders for environmental, cultural or economic reasons. Due to an expansion of needs for the inshore there is now competition for space between fishermen, conservation requirements and the production of renewable energy. This competition leads to a squeeze in the areas available to each interest and thus conflict between users can arise. In addition, with less area to fish

due to closed areas, comes increasing competition within the fishing sector for space, For example fishermen who use static gear believe that the users of towed gear tow their gear away as they are trying to fish in the same area.

5. Sustainability

Like other fishing sectors, the inshore sector depends on the sustainability of stocks. If stocks are not managed sustainably then they will not be there for future fisheries (commercial or recreational). As previously mentioned, there has been some movement away from the offshore and towards the inshore sector by fishermen who are attracted by the potential value of the inshore sector. In addition cuts in quotas have meant that fishermen have had no option but to diversify and move in to the inshore sector. Rising fuel costs have also seen fishermen staying closer to home to reduce outgoings.. This increased fishing effort on the inshore has the potential to threaten the sustainability of the stocks being targeted.

Whilst the most significant threat is on the sustainability of the stocks, it is also important that inshore fisheries are economically sustainable. With more people fishing for the same resources, there is the potential for the market to become saturated with the product and the price to be reduced. The 2007 inshore review stated that "*future economic success will depend on the inshore sector making the most of the opportunities which currently exist*". Whilst these opportunities may not be increasing fishing effort, the economic value of the inshore sector may still be improved by supplying a high quality, sustainably fished product. The value of the sector may also be increased by diversifying the species which are exploited provided that the resource is exploited sustainably and there is sufficient market demand for it to be economically viable.

General Objectives for the Northern Ireland Inshore Sector

Through discussions with stakeholders and other inshore management organisations around the United Kingdom and Ireland, a number of general strategic proposals have been developed in order to meet the challenges previously highlighted and to help reach the objective for sustainable development of Northern Ireland inshore fisheries (a summary of the linkages between challenges and how these can be addressed is available in Table 1).

Governance

In Northern Ireland, inshore fisheries are governed by the Department of Agriculture and Rural Development (DARD) with their Fisheries and Environment Division having the responsibility of preparing and enforcing all fisheries regulations, both for the offshore and inshore sectors. Whilst previously this did not include the foreshore, the Fisheries (Amendment) Act (Northern Ireland) 2001 gave DARD powers to regulate fisheries up to the high water mark.

The Department of Environment has recently established a new Marine Division. This division will have responsibilities for marine planning, marine conservation, the Marine Strategy Framework Directive, licensing (construction, dredging, disposal, aggregate extraction) and the Marine Bill.

DARD is fully aware of the need for greater focus on the inshore and has recently demonstrated this by allocating additional staffing resources for the management of the sector. Whilst DARD has recently increased its focus on the inshore, there is, as of yet, no dedicated inshore management group that is representative of the entire Northern Ireland inshore fishing sector and which focuses on its management and development.

In terms of which structure would best suit the management of inshore fisheries in Northern Ireland, the systems set up to date around the UK and Ireland are still relatively new and the negatives and positives are not fully apparent as yet. Taking account of the relatively short length of coastline and the spatial extent of the fisheries around the Northern Ireland coast, it is considered that the best way to manage the inshore sector is through the establishment of an Inshore Fisheries Advisory Group (IFAG), with DARD retaining legislative powers over inshore fisheries. The overall aim of the IFAG is to bring greater focus to the inshore and make its management more integrated and efficient. The IFAG would be responsible for identifying and helping to resolve inshore issues, by methods including;

- the development of management plans for sustainable development of the inshore
- the development of voluntary codes of practice
- advising on how to ensure inshore fisheries obligations are met
- advising DARD on legislative issues, including the revision of current legislation
- recommending areas for further scientific research to support management decisions and provide robust inshore data
- examining regional objectives and the use of local management plans to meet these objectives
- investigating the potential for increasing added value to the inshore species

The IFAG should reflect shared responsibility of inshore fisheries, through involvement with fishermen who fully represent the industry. This should include, if possible, involvement from all sectors within inshore fisheries. This would give the group an improved insight into the sector, and allow for a more 'bottom-up' approach, with ideas on management being industry rather than Government led.

During the process of preparing the strategy a number of possible actions were raised by each sector. These are outlined in the following sections of this document and should be examined by the IFAG upon its creation.

Currently in Northern Ireland there are a number of National and Regional fisheries groups operating within the inshore which should be represented on the IFAG. It is recommended that the group include a representative from each of the following organisations:-

1. National inshore fishing groups
2. Regional inshore fishing groups
3. Department of Environment (DOE)
4. Relevant NGO
5. Council for Nature Conservation and the Countryside (CNCC)
6. Agri-Food and Biosciences Institute (AFBI)
7. Recreational sea anglers
8. Intertidal harvesters
9. Processors/buyers who represent inshore sector
10. DARD Fisheries Policy (DARD should provide the secretariat for the group)

It is suggested that initially a stakeholder workshop be arranged to determine the full membership of the IFAG. Should new national or regional groups be established the IFAG

should consider extending its membership to the new group provided the group remains representative of the inshore sector. As well as the permanent representatives, the group should have the ability to bring in experts to provide greater in depth detail on particular aspects of the inshore. For example, if the issue of renewable energy resources was raised, DETI could be invited to provide further information/evidence to the group. This ability should lead to stronger collaboration in a range of marine management issues, not only between DARD and the industry but also between the relevant agencies who have functions within the inshore area.

As the IFAG would have representatives from all the inshore fishery interests, it would ensure that, when decisions are being made, no one interest is left out of consultation. Indeed, through the formation of an IFAG all recommendations would require to be fair, transparent and open.

Stakeholders are concerned at the length of time it takes legislation to be passed in Northern Ireland. Whilst the period from consultation to acceptance by the Executive Minister is timely, DARD have little control on the length of consultation, with the period from the drafting of the legislation until the legislation is accepted by the Executive Minister out of DARD's direct control. However, through discussion with the IFAG prior to the drafting stage, issues that may arise during the consultation process may be identified and therefore addressed in a timelier manner.

Use of technology

1) Monitoring system

Currently there is a lack of knowledge as to where small boats are fishing and where the effort is being placed. Whilst the MMO, through EU legislation, has set a requirement for vessels greater than 12m in length to have a monitoring system onboard, there is no plan as yet to bring this in to under 12m vessels. However, an inshore monitoring system could be introduced in to Northern Ireland to indicate where fishing is taking place. Unlike VMS where there is a substantial time period between reports (hourly etc), inshore monitoring allows for more frequent reporting of the vessel position and so is an effective tool in monitoring fishing around protected areas. The system can be set up with 'geofenced zones' which cause an alert to be sent to the regulatory authority if the protected area is entered.

From the fisherman's perspective there are a number of benefits of having an inshore monitoring system:

- fishermen have evidence (track record) to state their claim to an area in the face of closure either for environmental or renewable energy purposes
- it can provide evidence that fishing can coexist alongside other marine activities
- it can provide evidence during gear conflict
- an inshore monitoring system has safety benefits as fishermen can get the system to send a message to family/friends to let them know that they have left the harbour. The fisherman can also provide his log on details to friends or family so they can check where they are at all times.
- unlike VMS used on over 15m vessels which rely on satellites and can be expensive, inshore monitoring systems can use mobile phone technology to send the signal of its location making it much cheaper. In areas where there is no network available the system can retain all information and report back as soon as reception is available.
- fishing activity around closed areas can be monitored and policed in an effective way which allows fishing close to the boundaries of a protected area and indeed, have a reduction in size of the protected area as no 'buffer zone' will be required.
- Stakeholders have indicated that enforcement is an issue within the inshore sector. The use of an inshore monitoring system on all licensed fishing vessels would enable DARD to know where each vessel is fishing and provide the evidence for any cases which are brought up by fishermen.
- The system can be geofenced on moorings so that if a vessel breaks away the fisherman is alerted immediately.

2) Log sheets

Current practice sees fishermen completing a paper log sheet which is then input onto the DARD database by a DARD officer. This method of attaining information from fishermen is somewhat flawed with not all log sheets being returned, some not filled in completely or incorrectly and some entered inaccurately into the database. With the DARD databases being the sole source of information for fisheries landings, it is important that the data which they hold is accurate. The process of submitting log sheets should be reviewed by the IFAG. One potential method of increasing the accuracy is that log sheets are completed electronically by the fishermen thus eliminating any errors which can happen when

transferring a large volume of information from paper copies to an electronic version. It would also make the data available much more rapidly as the middle step would be removed.

Currently onboard electronic logbooks are operated on over 15m vessels with the aim of rolling this out to over 12m vessels. Whilst there are issues on smaller boats for storage of the electronic logbooks, there is of yet no obligation from Europe that there must be a system held onboard vessels under 12m. Therefore an alternative is that the fishermen can complete an electronic log sheet at home. Some fishermen are concerned that electronic log sheets may take longer to complete, however, programmes can be created to reduce the time it takes to submit landings as items such as Port, gear used, species captured etc can be programmed so that only the amount of landings needs to be entered each time.

In addition, the information collected via the current log sheets (Appendix 2) should be reviewed by the IFAG to ensure that they are fit for the purpose intended, collect as much useful data as possible, but are not protracted and time consuming for fishermen to complete.

Mapping of existing fisheries

The spatial extent of all existing inshore fisheries should be mapped. Whilst there is some form of fishing everywhere around Northern Ireland, the type of fishing and intensity varies considerably around the inshore. Whilst an inshore monitoring system would provide information on the spatial extent of the fisheries, a supplementary programme of additional mapping is required to collect data on spatial variations in effort, catch etc. Such data is required for local management plans which may be utilised for certain fisheries (for example pot fishing, where there are distinctive patterns in the primary catch from pots around the Northern Ireland coast). Data collected during scientific observation and an inshore monitoring system should be used to develop a suitable effort distribution map. Alongside fishing effort, such an inshore map should also include pressures on the fishing industry such as protected areas, renewable energy, aggregate extraction etc.

Improved Enforcement

The perception amongst many inshore fishermen in Northern Ireland is that there is not adequate enforcement of the inshore. Unless there is adequate enforcement there will be no protection for the sector. Whilst the introduction of an inshore monitoring system will provide knowledge of where fishing is taking place, proper policing and a greater onsite presence is

required to ensure that technical/ conservation measures are being met. DARD should examine their enforcement resources to determine if they are being used to their full potential. If this is not the case, improved enforcement should be a priority for the inshore region. As previously mentioned, the IFAG should review the current legislation available, and provide feedback to the department on possible gaps in the legislation. The IFAG should review the possible actions highlighted in this document and, if suitable, advise DARD on legislative changes/ new legislation required to meet these recommendations. In certain situations, different departments will need to collaborate for enforcement issues.

Economic sustainability

By effective marketing of a product the value may be increased, bringing increased profit into the sector without increasing the effort placed on to the fishery. At a time when fuel prices and bait are increasing in cost, it is important that the maximum profit is captured from the fishery to ensure that it is economically sustainable. Many communities around the coast of Northern Ireland are traditional fishing villages/towns, with fishing being the main source of income for many families. It is important that fishing is managed in a sustainable and profitable way that secures maximum revenue to support such communities. This may mean putting management regulations or voluntary codes on to fisheries which only allows high quality product to be landed. An example of this would be banning the landing of white crab which receives a much lower value per kg and which also suffers high mortalities. Other areas which could be considered by the IFAG to maximise profit include:

- market and transport costs
- introduction of a marketing and promotion campaign
- local providence
- Improved handling and transportation practices to reduce mortality during export

Data collection

As mentioned previously, data can be collected on where fishing effort is taking place through the use of inshore monitoring systems, and on what is being landed through the use of logbooks. However, to determine if a fishery is sustainable, fisheries managers require accurate biological data on exploited stocks. Currently, the information is not available to carry out a stock assessment of a majority of the species targeted within the inshore. Scientific studies are needed to fill in the gaps in the knowledge of the sector to allow for appropriate management measures to be implemented. Without having information such as

the state of the stocks, the biology of the stocks and the level of fishing effort placed on them, there can never be management of stocks which allows them to be exploited sustainably. However, it will take time to collect all the data required for a stock assessment and this should be accounted for in the management of the fisheries.

In addition, fishing effort and species data should be examined alongside other forms of information such as sea bed maps and environmental parameters to provide a clearer picture for the inshore region.

Recently through funding by the European Fisheries Fund (awarded by DARD), AFBI have begun an enhanced scientific work programme within the inshore region to begin to fill the data gaps for inshore fisheries. This work programme should be developed where appropriate to provide the scientific evidence needed to support the sustainable management and development of the sector.

Other opportunities

Potential new fisheries should not be ignored. Recent fisheries which have taken place in Northern Ireland are the *Palaemon* fishery in County Down and the pilot cockle fishery in Belfast Lough. New fisheries have the potential to bring a boost to the economy as long as:

- They can be fished sustainably
- There is sufficient market demand for the product

In order to ensure the fishery is potentially viable, prior to the development of a new fishery an assessment should be carried out on the demand for the species to ensure that it will be marketable. In addition, an assessment of the stock should be required to ensure that any new fishery is developed sustainably from the start and that the fishery will cause no negative impacts to the environment.

Other areas where fishermen could become involved, include carrying out environmental schemes such as “Fishing for Litter” which sees fishermen collecting litter that is caught during their normal fishing activities. Whilst this has no direct financial incentive to fishermen, in Scotland where it is estimated that litter costs fishermen in excess of £11 million per year due to damage to nets, contaminated catch etc, over 170 vessels take part in the scheme.

Table 1 A summary of how the recommendations discussed in the strategy could help overcome the challenges currently faced by the inshore sector.

Recommendation / Challenge	Governance	Technology	Mapping	Enforcement	Economic sustainability	Data collection	Other opportunities
Lack of focus	✓	✓	✓	✓	✓	✓	✓
Obligations to protect environment	✓	✓	✓	✓		✓	✓
Lack of data		✓	✓	✓	✓	✓	
Spatial pressures	✓	✓	✓	✓		✓	
Sustainability	✓	✓	✓	✓	✓	✓	✓

Pot Fishing

Fishery

Lobsters and crabs are traditionally fished using pots or creels. In Northern Ireland, *Nephrops*, *Palaemon* and whelks are also fished using pots. Figure 6 shows examples of different types of pots used.

Inkwell pots- These are the traditional style of pots. The animal climbs in to the pot to feed on the bait through the entrance at the top. However, the animal can get back out and therefore these pots have to be checked regularly to prevent loss of catch.

Parlour Pots- Unlike inkwell pots these parlour pots have two chambers which makes it much more difficult for the animal to get back out. These pots are traditionally used in areas were weather can prevent the fishermen getting out to the pot regularly.

***Nephrops* pots –** pots used for fishing *Nephrops* are much lighter than those used for crab/lobster fishing (5-8kg as opposed to 15-30kg). In addition, whilst crab/lobster pots generally have soft eyes (though some fishermen opt for hard eyes), *Nephrops* pots have hard eyes i.e. the entrance netting has a predetermined plastic ring sewn in.

***Palaemon* pots-** cylindrical pots made of plastic. The net at either end of the pot may be of a different mesh size to the rest of the pot to allow smaller animals to escape. Pots used in the *Palaemon* fishery are much lighter in weight than those used to target crab and lobster.

Whelk pots- made from a plastic container, usually a drum. One end is partially removed and covered with netting and the rest of the pot perforated with 2-3 cm holes. The pot usually has sand at the bottom to weigh it down.

A large number of pots may be attached to a single string which is marked by a buoy at each end. The pots are baited and placed on the seabed to soak for a number of days before being hauled. Once hauled, any lobsters which are caught have their claws banded as lobster are aggressive cannibals and would fight to the death it held together. Brown crab which will not be marketed immediately have the tendon at the base of each pincer cut or ‘nicked’ to stop the crabs from damaging each other.

Whilst mobile gear such as dredges and trawls can damage the sea bed, pot fishing is seen as a relatively benign form of fishing having little impact on the environment (Kinnear *et* al. 1996; Holt *et al*. 1998; Eno *et al*. 2001; Adey *et al*. 2006; OSPAR commission, 2009).

Indeed, in areas where other forms of fishing have been prohibited, the use of static gear has been allowed to continue.

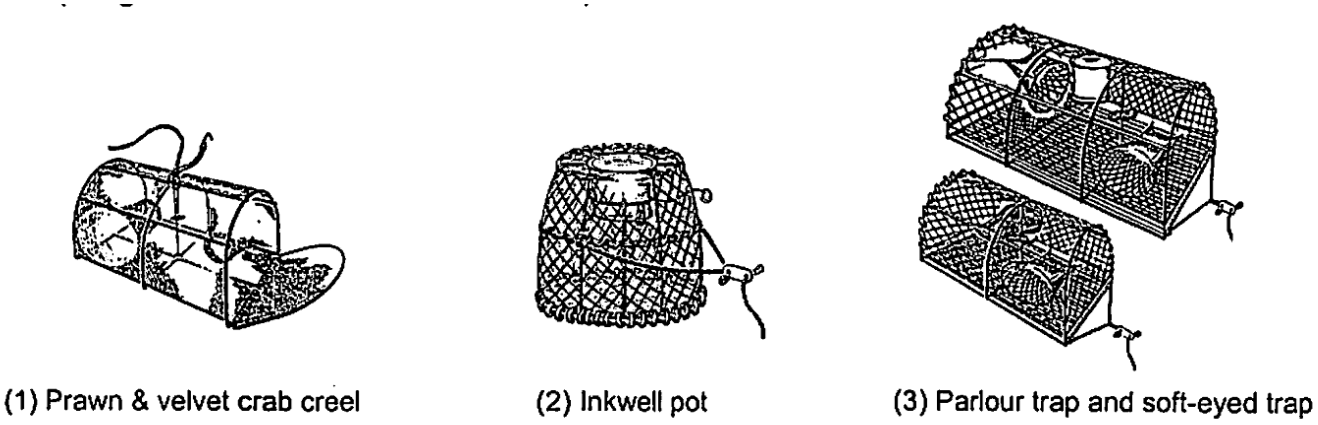
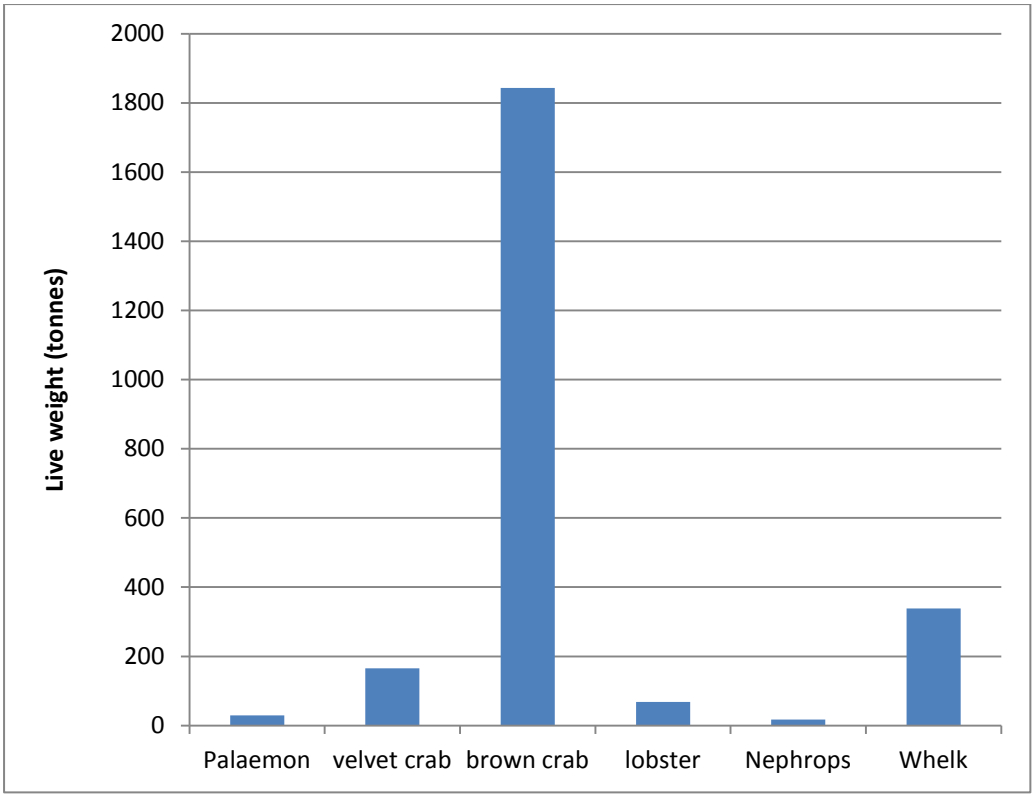


Figure 6 Diagram of the three main types of crustacean pots deployed within Britain and Ireland. Taken from Swarbrick and Arkley, (2002)

Northern Ireland Pot Fisheries

Whilst pot fishing for brown crab and lobster has a long history in Northern Ireland, the velvet crab fishery is relatively new, having only begun in the 1980's when a collapse in the Spanish fishery meant that there was an opportunity to expand the fishery for export to the European markets. The *Palaemon* fishery is the most recent pot fishery in Northern Ireland, having only really taken off commercially in 2008.

As in the rest of Western Europe, the brown crab is the most commercially important species landed by pots. Figure 7 shows how the live weight (tonnes) of brown crab landed by vessels registered in Northern Ireland far exceeds that of any of the other species landed by pot. However, in terms of monetary value, the brown crab has the lowest price per kg (based on DARD valuations). In 2010 the average value of brown crab was 91.8p/kg, the second lowest after whelks which had a DARD valuation of 60.5p/kg. The value of brown crab drops if the meat is poor quality.



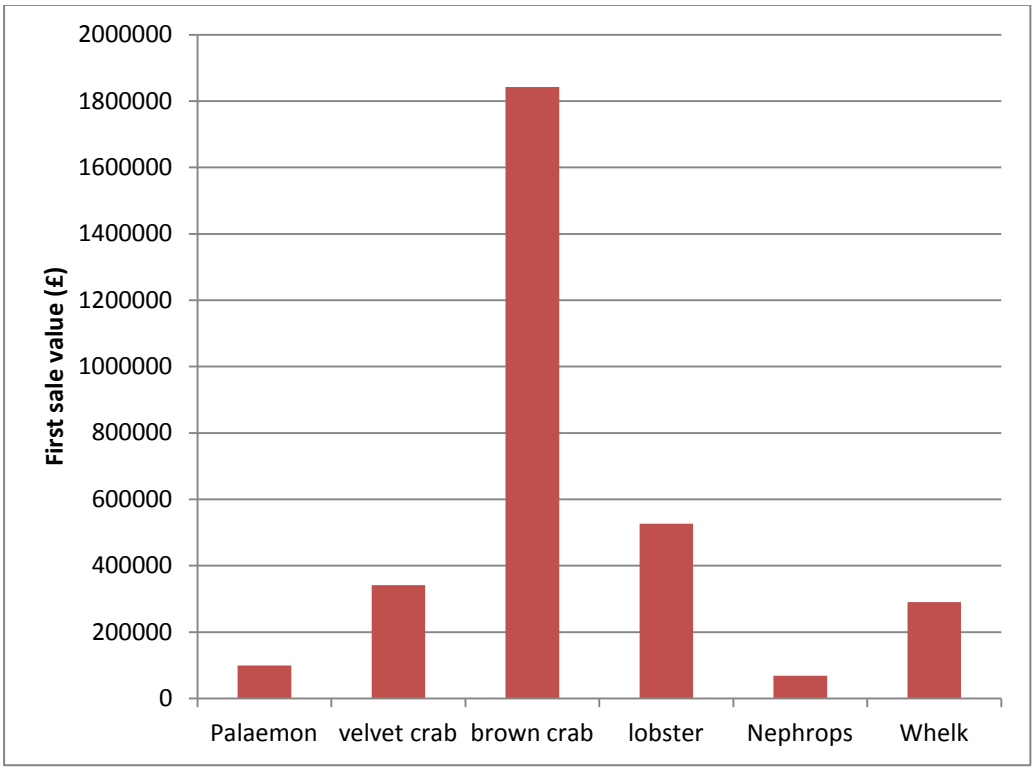


Figure 7 Total landings (tonnes and first sale value) of species landed by pots in Northern Ireland in 2010.

In 2010 a total of 129 vessels reported landings from pots in Northern Ireland waters. Only 17 of these vessels were greater than 10m in length with the largest vessel being 23m. Using DARD statistics, the number of pots worked at a time in 2010 ranged from an average of 6 to 3801, with 93% of all vessels hauling a maximum of 500 pots. Four vessels, all of which were greater than 10m in length, worked on average more than 1000 pots at a time.

In 2010 a total of 617,340 pots were hauled. The largest percentage of pots was landed in to Kilkeel (154,261 pots, representing 25% of overall effort in Northern Ireland). In 2010 the total first sale value for all landings by pots into Kilkeel was £599,909. This makes an average value per pot of £3.89. Portavogie had the greatest first sale value per pot for Northern Ireland ports. A total of 19,304 pots were landed into Portavogie with a combined first sale value of £294,246 giving an average pot value of £15.24. From 2006 Ballycastle has consistently had the lowest value per pot of, on average from 2006-2010, £2.05.

From 2006 there has been almost a 2.5 times increase in the number of pots which are fished around Northern Ireland (Figure 8). However, the total landings (tonnes) in to Northern Ireland have not followed this pattern and the first sale value of the landings has not varied much in previous years (apart from a slight increase in 2007). This leads to a reduction in the average value per pot cross Northern Ireland from £16 per pot in 2007 to £8.79 in 2010. This decrease in catch per unit effort may be indicative of a fishery that has exceeded its optimum level.

Between 2006 and 2010 the annual landings of brown crab and velvet crab have dropped by 32 tonnes and 81 tonnes respectively (this is linked to a drop in market demand). There have been no significant changes in the annual landings of lobsters and *Nephrops* (apart from a drop in *Nephrops* landings in 2009). The whelk fishery has seen the greatest increase in landings going from 151 tonnes in 2006 to 339 tonnes in 2010.

Although pot fishing is a mixed fishery with pots being unselective as to what they catch, in Northern Ireland there are distinctive patterns in the primary catch from pots (Figure 9). Along the South Down coast the main catch is brown crab. In Strangford Lough and the Ards Peninsula the main catch is velvet crab, whilst, the North coast sees the greatest abundance of lobster. The *Nephrops* pot fishery is based in Strangford Lough.

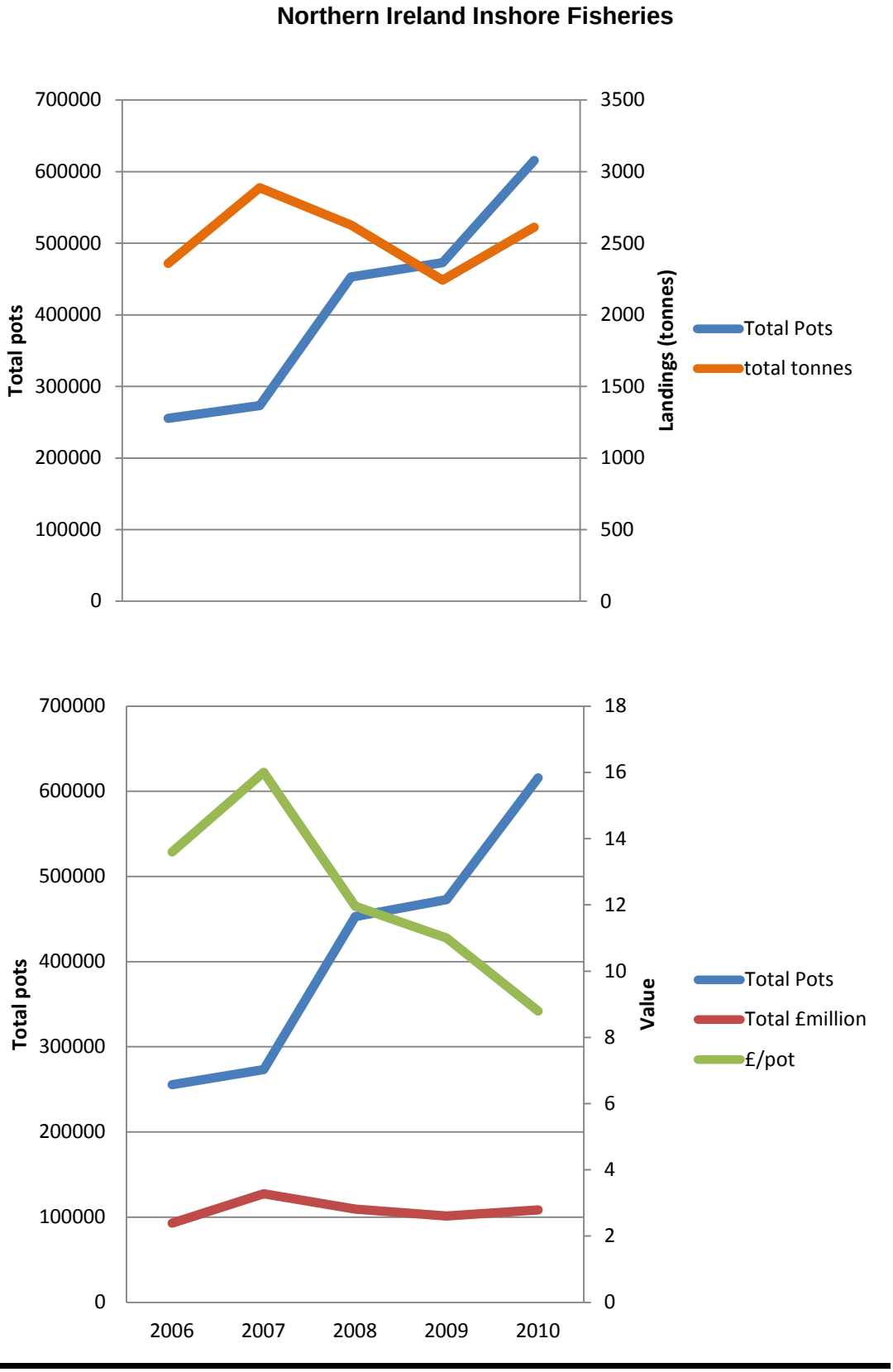


Figure 8 From 2006 there has been a steady increase in the number of pots hauled. However, this has not led to the expected increase in landings. More effort is being placed onto the fishery with very little increase in the value of pot fishing as a whole.

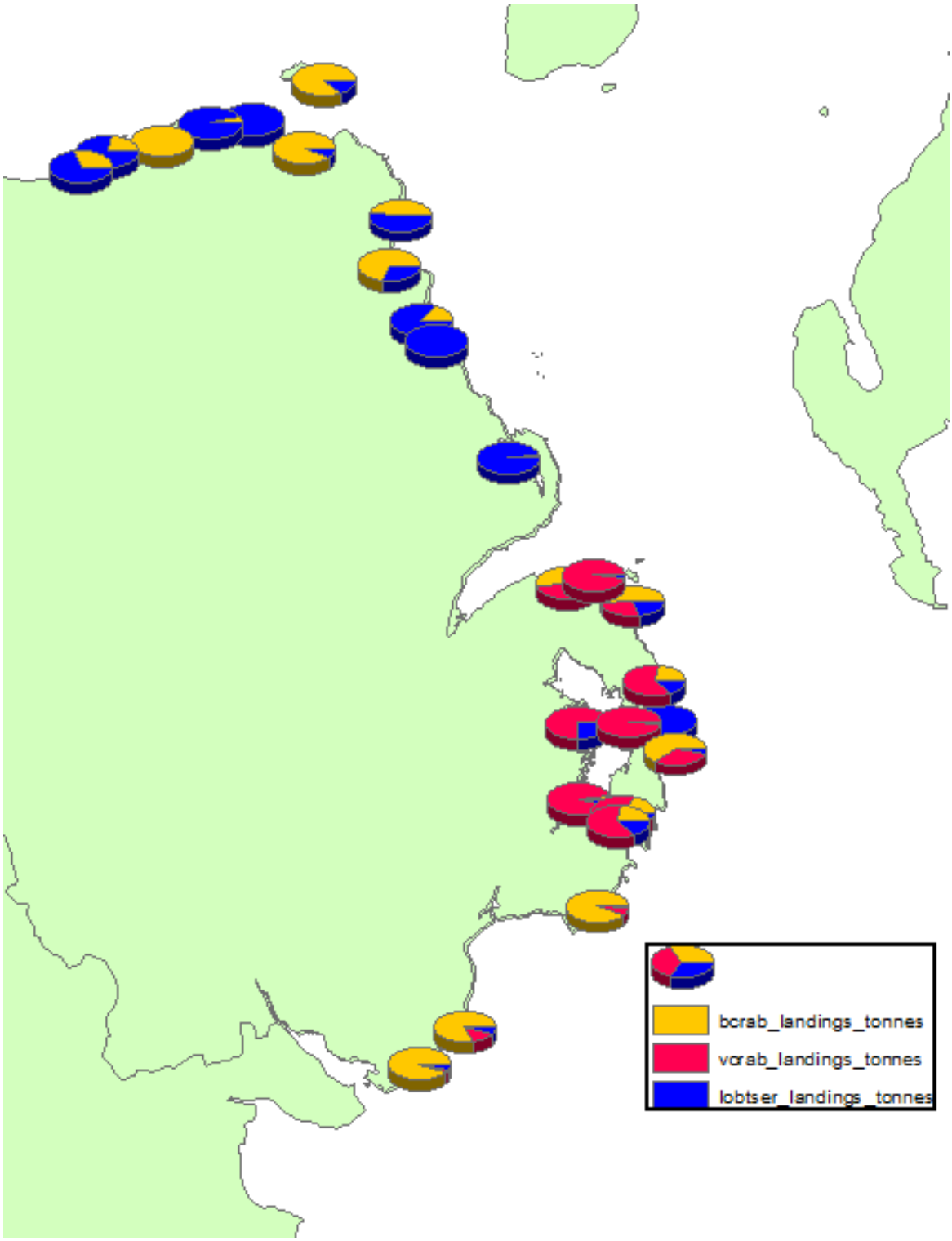


Figure 9 Proportion of landings made up of the three main species targeted by pot fishermen around Northern Ireland.

Management throughout the UK and Ireland

Anyone fishing for shellfish on a commercial scale must have a license (which registers the vessel as a fishing vessel under the Merchant Shipping Act 1995), with a shellfish entitlement. This entitlement was granted by the 2003 UK Restrictive Shellfish Licensing Scheme which was set up to cap levels of crab and lobster fishing. Through this scheme a fishermen was granted a shellfish entitlement based on track record (if they had landed or sold more than 200kg lobsters or 750kg crabs during any 12 month consecutive period between 1 January 1998 and 31 December 2002). Anyone who now wants a shellfish entitlement can only do so by transferring the license from a fisherman who is leaving the sector or by buying a vessel which has a shellfish entitlement.

Fishing for crab and lobster is not subject to European total allowable catch regulations and there are no national quotas. The primary means of managing stocks is through a minimum landing size (MLS) which is the minimum size at which it is legal to keep or land an animal. This is an effective way of managing the reproductive population. Whilst a minimum landing size may not be as effective for fish species which are usually dead when returned, for shellfish a minimum landing size is an effective tool as the shellfish usually survive when returned and can re-enter the population where they can reproduce until they have reached the MLS and can be landed.

In 1875 it was reported that Cromer fishermen imposed a voluntary size restriction of 108mm carapace length on brown crabs to try and restore stocks after heavy fishing of small crabs the previous year caused a considerable decrease in landings. This then went to Parliament as the 1876 Crab and Lobster Fisheries (Norfolk) Act. The act also prohibited the sale of berried crab and lobster. However landing sizes were only introduced at an EC level through Council Regulations (EC) 850/98 (as amended). The current MLSs are:

Brown Crab*

- 140mm north of 56^{o}N to West of Scotland and in North Sea
- 130mm in remainder of North Sea except the Eastern Sea Fisheries District
- 115mm in the Eastern Sea Fisheries District
- 140mm in the Channel and around the Southwest Peninsula
- 130mm elsewhere

**The MLS for brown crab show vary with area due to regional variations in growth rates*

Lobster

- 87mm everywhere

Whelk

- 45mm everywhere

Whilst these EC MLS apply, around the UK and Ireland national legislation and byelaws have been installed to increase the MLS. In England under a Byelaw made by the Cornwall Inshore Fisheries and Conservation Authority, it is illegal to retain a cock brown crab of less than 140mm and a hen of less than 150mm. In addition, Cornwall IFCA has also increased the MLS of lobster to 90mm for their district. In the Republic of Ireland, whilst they have retained the EC MLS for lobster, they have increased the brown crab MLS to 140mm, and under the Whelk (Conservation of stocks) Order 1994, increased the MLS of whelks to 50mm. The Whelk (Conservation of stocks) Order 2006 sets out a minimum width of whelk, prohibiting the landing of any whelk with a shell diameter less than 25mm.

The English IFCA's have set a number of additional byelaws for the management of the crab and lobster fishery (refer to Table 2). In some areas pot limits have been introduced to control the effort placed on the fisher. Pot limits also prevent large scale fishermen from blanketing an area with their pots which would subsequently prevent other fishermen from laying their pots on the productive ground. In some instances a limit has been decided directly by the IFCA. For example Sussex IFCA set a standard pot limit at 100 pots per crew, up to a maximum of 300 pots per vessel (a similar scheme was introduced in France in 1997 with an allowance of 200 pots per crew member, with a cap of 1000 pots per vessel). Other IFCA's have set a pot limit by putting it out to consultation with the fishermen and letting them decide on the maximum number of pots allowed. Whilst there will be grievance from some fishermen who currently fish over the limit, fishermen with a large number of pots tend to have larger vessels capable of going further offshore where the pot limit does not stand. Pot limits may also be varied according to the distance from the shore. In the Isle of Man the pot limit within 3nm is set at 300, whilst between 3-12nm it is set at 500. Defra have considered an alternative method to control fishing effort - rights based management - whereby fishing rights are allocated to those who have been active within the fishery during a set reference period. The fishing rights would entitle the fisherman to a percentage share of a total allowable catch based on a track record.

Another byelaw set by some the IFCA's is the banning of soft shelled crab, also known as white crab. When a crab molts its shell remains soft for a period. At this time the quality of

the meat is low and therefore the crab is worth a lower value. If a soft shelled crab is landed it may die before being sold due to damage from the other crabs. By landing soft animals fishermen are removing animals which may not survive to market and which get a lower price. An article in Fishing Focus reported mortality of brown crab of 30% during export from the UK to France, with the French market considering only buying UK crab for the cooked whole crab market during October and November to guarantee quality (Crab and Lobster Strategy Group meeting April 2008 cited in Nautilus Consultants, 2009). By returning soft shelled crab, it gives a chance for the shell to harden and the meat quality to improve which would then yield a better price at sale.

Escape gaps are used to allow undersize animals to get back out of the pots. In the Isle of Man, from September 2011 the use of escape panels is compulsory on all pots fished within the 3 mile limit. Fishermen have reported that escape panels mean fewer undersized are caught leaving more room for legal sized lobster, pots are easier to lift and there was less damage to lobster.

In 2003 Council Regulation (EC) No 1954/2003 established a Biologically Sensitive Area (BSA) off the South West of Ireland as it was deemed to have high importance as a spawning and/or nursery area for species including mackerel, horse mackerel, hake, herring and megrim. In addition, the area also has important stocks of brown crab, spider crab and scallops. Within the BSA fishing effort is managed differently from outside the area. In 2005 S.I. No 705/2005, S.I. No. 728/2005, S.I. No. 736/2005, S.I. No. 789/2005 and S.I. No. 790/2005 (all titled Crab (Fisheries Management and Conservation) Regulations 2005), set out a number of regulations for the management of crab within and around the BSA. These included:

- Prohibiting vessels greater than 10m from fishing for, transhipping or having on board edible crab or spider crab within the BSA
- Prohibiting vessels greater than 15m from fishing for, transhipping or having on board edible crab or spider crab in ICES sub-area VII
- Allowing vessels greater than 15m to fish for edible crab and spider crab in ICES sub-area VII (excluding BSA) between 29 November 2005 and 12 December 2005
- Prohibiting vessels greater than 10m from fishing for, transhipping or having on board edible crab or spider crab within the BSA prior to 1 January 2006
- Prohibiting any vessel from fishing for, shipment or having on board edible crab or spider crab in ICES sub-areas V and VI during period 16 December 2005 and 1 January 2006

In Ireland there is a closed season for fishing *Palaemon* between 1st May and 1st August (S.I. No. 253/2006 Shrimp (Fisheries Management and Conservation) Regulations 2006). In addition there is voluntary grading at sea. In 2006 a Welsh *Palaemon* workshop recommended a closed season, extending from 1st May to 1st October and grading at sea. The workshop also recommended an introduction of a 14mm mesh size for both end cones of the prawn pots.

Table 2 Summary of the Byelaws used by the English Inshore Fisheries and Conservation Authorities to regulate pot fishing

Byelaw	North Western	Northumberland	Eastern	Southern	Devon and Severn	Kent and Essex	Cornwall	Isles of Scilly	Sussex
Effort Control									
Permit		YES	YES				YES		
Pot Limitations		800							100 pots per crew. Capped at 300
Size vessel			16m	12m within 6nm	15.24 within 3 miles	17m	15.24m		
Technical Measures									
Protection of V-Notched	YES	YES	YES		YES		YES		
Increase brown crab MLS					140mm		150mm female 160mm male		
Increase lobster MLS					90mm		90mm	90mm	
Ban on use of crab as bait		YES	YES			YES			

Marking pots	YES	YES					YES		
Quality Measures									
Ban on soft shelled crab/lobster		YES	YES		YES	YES			
Ban on berried crab		YES	YES		YES	YES			
Ban on berried lobster		YES	YES	YES	YES	YES	YES		
Ban on crab/lobster which can't be measured		YES	YES		YES	YES	YES		
Conservation									
Escape gap			YES		YES	YES	YES		

Current Management of Pot Fishing in Northern Ireland

The Unlicensed Fishing for Crabs and Lobster Regulations (Northern Ireland) 2008 was introduced by the Department of Agriculture and Rural Development to improve the management and conservation of crab and lobster and to prevent the increase in fishing by hobby fishermen who did not hold a license. Under the regulations it prevents anyone without a license from:

- Landing more than five crab and one lobster per day
- using more than 5 pots
- using a stock cage

Currently, there are no restrictions placed on pot fishing for whelks (other than the EU MLS), *Nephrops* and *Palaemon* in Northern Ireland.

V-notching

For many years, V-notching has been used as a tool in the management of lobster stocks. V-notching involves the notching of the tail of any berried female before returning it the sea. Any female which has been v-notched should not be landed. This reduces the harvest rate on reproductive females, and, as the v-notch can last several moults, it means the female is protected for a number of years. The aim of v-notching is to increase the total number of reproductive females in the population and hence increase the total egg production of the population. V-notching has now become common practise throughout the UK and Ireland.

In Northern Ireland there are two V-notching schemes running in parallel. The North Coast Lobster Fishermen's Association (NCLFA) run a scheme whereby any berried female is brought back to port where it is verified before being v-notched. The lobster is then returned to sea.

The North-East Lobster Cooperative (NELCO) run an alternative scheme whereby any lobster which is berried is V-notched at the site it was caught. In addition a small subsample of eggs are removed and placed in preservative along with the v-notch. The lobster is returned to the site it was caught and the eggs and v-notch are sent to Queen's University Belfast where they undergo DNA profiling. The profiling produces a genetic identity for the v-notched female and her eggs. From this the genetic profile of the unknown male who fertilised the eggs can be extrapolated. This scheme has led to the creation of a genetic database for lobster from the County Down coast. This can be used to determine the parentage of future lobsters which are caught. Lobsters caught in future years can then have

their genetic profile checked against the database to identify if they have come from the v-notching scheme. By identifying the percentage of lobsters which are present due to the v-notching scheme (i.e. which are the progeny of a v-notched female), this scheme can be used to prove the effectiveness of v-notching. In an independent report carried out during the Northern Ireland Brown Crab Strategy, developing measures to determine the recruiting size classes that are likely to be the progeny of v-notched animals was outlined as one of the desirable qualities, and the most challenging, of a good v-notching programme. To date, the NELCO v-notching scheme is the only scheme to meet this criterion.

Northern Ireland Brown Crab Strategy

In 2011 the Northern Ireland Brown Crab Strategy was developed (Cappell *et al.*, 2011). This report identified a number of potential management options (Table 3) which were put to industry for consultation. Through the consultation process the report identified a number of potential management recommendations (Table 4). The following measures were ruled out following industry consultation and cost benefit analysis:

- **Shellfish entitlement** - Fishermen did not want NI to alter the shellfish entitlement as it could make purchasing of vessels and licences unattractive to other UK fishermen.
- **Permit system** – When this was discussed during the Northern Ireland Brown Crab Strategy there was mixed reaction with fishermen from areas which were organised into an association showing more support to a permit system. All fishermen were concerned how a permit would affect future generations entering the fishery.
- **Pot limits** - Insufficient information available for setting pot limits as well as a high cost needed to enforce the limit.
- **Locally set TAC and Quotas** - Insufficient information available for setting TAC and quotas alongside enforcement issues.
- **Ban landing of crippled/diseased crab** - Animals not expected to return to high quality and by returning diseased animals could increase the spread of disease in the stock.
- **Closed season** - Insufficient information available on crab stocks to set closed seasons
- **Closed areas** - Insufficient information available on crab stocks to set closed areas

However, there are still a number of issues relating to the final recommendations. Fishermen are not in agreement with the banning of parlour pots. Parlour pots have two chambers which make it difficult for animals to get back out meaning that pots can be left out longer.

However during the Northern Ireland Brown Crab Strategy whilst some fishermen agreed to a ban on the use of parlour pots, others disagreed insisting that they aim to haul them daily and therefore their fishing capacity is not significantly different from other types of pots or creels. They are primarily used on the North coast where, on occasion, weather prevents the fishermen getting out on a daily basis.

Table 3 Proposed management options as raised by the Northern Ireland Brown Crab Strategy and whether they were included in the final strategy

Management Measure		Sub-options	Proposal included
Fishing capacity			
1	Shellfish entitlement	Attached to fishing license	No
		With sunset clause	No
		Crab permit for active vessels	No
		Crab permit with sunset clause for active vessels	No
2	Limit type of vessels inshore	Size of vessel	Yes
		Type of gear e.g. tank on board (vivier)	No
3	Pot Limits	Flat rate per vessel	No
		Based on track record	No
4	Gear measures	Ban on parlour pots	Yes
Outputs			
5	Introduce TACs and quotas	Flat rate per vessel	No
		Based on track record	No
6	Increase minimum landing size		Yes
7	Limit for hobby fishermen		Yes
8	Curfews		No
Quality			
9	Ban landing cripple crabs		No
10	Ban landing crab claws		Yes
11	Ban landing white/diseased crab		Yes/No
12	Ban on landing berried crab		Yes
Conservation			
13	Closed seasons for spawning		No
14	Closed areas	Complete closure for all fishing activity	No
		Closure to fishing activities with significant impacts	No
15	Escapement	Escape gap	Yes
		Biodegradable panels	Yes
Other suggestions			
16	Certification	Marine Stewardship Council	No

Table 4 Management options for the brown crab fishery as proposed by the NIFPO brown crab strategy (Cappell *et al*. 2011)

Management Measure	Change in legislation	Local Management Plan
Increase MLS to 140mm	✓	
Limit size of vessels permitted inshore	✓	
Limit of hobby fishermen (in addition to current legislation)	✓	
Ban landing of soft shelled crab	✓	
Ban landing of crab claws	✓	
Ban on landing berried crab, velvets and lobster	✓	
Control on Parlour pots		✓
Escape gap in pot		✓
Biodegradable fastening		✓

Potential Regulatory Measures for Pot Fishing

As a number of potential management measures have already been through the consultation process during the Northern Ireland Brown Crab Strategy and ruled out by industry (Table 3), these will not be examined further. In addition, this report has examined and, through direct discussions with stakeholders, ruled out:

- **Biodegradable panels/fastening:** "Ghost fishing" is the term used to describe instances whereby lost fishing gear continues to fish indiscriminately without the control of the fisherman. The main causes of pots ghost fishing are the removal of pots through collisions with towed fishing gear and pots breaking free due to bad weather conditions. The potential impacts of ghost fishing can be reduced through the use of a biodegradable panel. There are, however, a number of issues arising from fishermen with regards to biodegradable panels/fastenings. The primary concern is the cost of constantly having to replace the panels. There is also the potential that the panel breaks down whilst the pots are fishing, leading to a loss of catch. In addition, the use of a biodegradable bungee to secure pots closed comes with its own environmental issues. At the end of each bungee is a plastic hook. If the bungee was to break down whilst the pot is in the water, then the plastic hook will be lost on the sea bed with the potential to cause damage to bottom dwellers. Due to these reasons there would not be industry support for the use of biodegradable panels/fastening.
- **Increase Lobster MLS**: Whilst, for lobster, an increase in MLS has stock benefits by increasing the fecundity, it has the potential to negatively affect the market demand. Unlike for crab and other shellfish species, there is not necessarily a greater demand for larger lobsters. In fact the opposite may be true. Restaurants want to sell lobster which fit the plate and which they can make the most profit from. Therefore they don't want to be spending more money on a large lobster which, in the restaurant is going to be sold for the same price as a smaller lobster which has cost less. During the last increase in MLS, the price per kilo decreased. This increase was also a European increase and therefore everyone was impacted. However, if Northern Ireland increases the MLS of lobster there may be a decrease in demand as the market could potentially stop buying from Northern Ireland. For this reason an increase in lobster MLS will not receive stakeholder support. In addition, through the v-notching scheme, lobsters are already receiving significant protection.

In addition to the general measures proposed for all inshore fisheries, Table 5 suggests possible actions for pot fishing. Table 6 relates these actions to those proposed in the Northern Ireland Brown Crab Strategy

Table 6 Relationship between proposed actions highlighted in both this strategy and the Northern Ireland Brown Crab strategy

Challenge	Proposed Management Actions	NI Brown Crab Strategy report
Influx of new entrants	Limit vessel size	Final proposed measure
Sustainability of stocks	Limit number of pots	Ruled out
	Ban berried crab	Final proposed measure
	Palaemon mesh size regulations	Not discussed
	Increase MLS	Final proposed measure
	Ban landing crab claws	Final proposed measure
Optimising economic return	Ban soft shelled crab	Final proposed measure (brown crab)
Obligations to protect marine environment	Escape panel	Final proposed measure
Marine spatial planning	Inshore monitoring system	Not discussed
Lack of data	Review of log sheets	Not discussed
	Stock Assessment	Required

Table 5 Possible actions for the management of Northern Ireland inshore pot fishing

Challenge	Resolution	Possible Action	Reasoning
Spatial pressures	Reduce latent capacity of fleet	Limit vessel size	In 2010 94% of the 129 vessels which laid pots around Northern Ireland were less than or equal to 12m in length. Whilst larger vessels are more likely to fish further offshore there is nothing preventing them from moving to the inshore. By setting a size limit it prevents the latent capacity of larger vessels moving inshore. A clause may be installed into the legislation that if a vessel is greater than 12m but has a track record in the inshore, it is exempt to the legislation.
Sustainability	Reduce effort placed on fishery	Limit number pots	In 2010 the average number of pots for all vessels was 512 (ranging from 6 to 3801). By setting a limit to the number of pots it restricts the effort placed on the fishery and prevents 'blanketing' of grounds by fishermen with large numbers of pots.
	Protect reproductive animals	Ban landing berried crab	Banning the landing of berried crab will increase the reproductive output of the stock (berried lobsters are protected through the v-notching scheme).
		Maximum landing size for lobster	Larger lobsters tend to be more fecund than smaller lobsters and therefore are important to the sustainability of a population. Introducing a maximum landing size would retain these animals in the population. Whilst some larger animals may have remained in the population due to the success of the v-notching scheme, a maxLS would protect these animals even after the v-notch has grown out.
	Protection of undersized animals	Regulation on mesh size for the *Palaemon* Fishery	Increasing the mesh size used for *Palaemon* fishing would allow undersized animals to escape thus ensuring the sustainability of the stock. In Wales a 14mm cone in the mesh was proposed as it was shown in trials not only to reduce the volume of undersized *Palaemon* by 33% but pots with 14mm mesh size also had 35% more marketable sized *Palaemon* than standard pots thus actually increasing the economic yields.
		Increase Minimum	Following on from the brown crab report there appears to be overall acceptance amongst fishermen with increasing the MLS of brown crab to

		Landing Sizes	140mm (currently some fishermen already exceed the 130mm MLS due to market demand). An increase in MLS would also have economic benefits, with larger animals receiving a greater price.
	Protection of animals	Ban landing claws	Whilst toeing of crabs at sea is prohibited, the claws of crab may be removed at the port. Under Council Regulation EC 850/98 crab claws can account for 1% by weight of catches made by pots and creels and 75kg by any other fishing method. When removing crabs from pots or through handling of the crab, a claw may drop off. If a ban was implemented, a claw which had been naturally shed would need to be retained with the rest of the animal as confirmation that it had not been physically removed.
	Increased value for product	Ban landing soft shelled crab/Lobster	After moulting brown crab and lobster have a soft shell which not only is representative of poor meat quality due to the high water content, but which will also greatly reduce their survival rate if landed.
Obligations to protect Marine Environment	Protection of undersized and non-target species	Escape Gaps	Escape gap allow undersized animals to escape from pots and thus they don't have the stress of being hauled up and then returned to sea. This has a number of benefits for the fisherman including a reduction in sorting time on deck as well as reducing the amount of bait that is needed. A potential issue with the use of escape gaps is in relation to velvet crabs. In areas where escape gaps are currently being used, there is no velvet crab fishery. However, Northern Ireland has significant landings of velvet crab. Using certain escape gaps would allow velvets to escape, therefore it would need careful analysis before deciding on the best type of escape to use.
Lack of Data	Improved data collection	Scientific survey	A stock assessment should be carried out for all species targeted by the pot fishery so that the state of the stock can be determined and to ensure that fishing is being carried out at a sustainable level.
		Marking of pots	Currently there is no definitive way of marking pots to know which fisherman a pot belongs to. By ensuring that all pots are labelled in a consistent manner it ensures that they are easily identifiable. This can be used in terms of enforcement, gear conflict, or if a fishermen's pots are moved by

			weather etc. as a way of identifying the owner. In addition, pots may be labelled so that it is easy to establish if they are part of the commercial fishery or if they belong to a hobby fisher by, for example, using different colour markers for the different types of fishing.

Dredge Fisheries

Scallop Fishery

Due to a rapid growth rate and high market value, the scallop fishery is of high economic importance. Most of the UK and Irish scallops are exported elsewhere, mainly to France as high quality fresh, roe on scallops (Coquille St Jacques).

King scallops are fished using dredges with metal teeth set vertically along the front edge of the dredge. The teeth rake up the scallops which are caught by the mesh bag positioned behind the tooth bar. Groups of dredges are hung from a tow bar which has wheels on either end so it can move over the seabed.

In the UK queen scallops tend to be targeted during the summer months when the King scallop beds are closed. In the warmer months queen scallops have been shown to become more active (Jenkins *et* al. 2003). Fishermen can make use of this by using nets instead of dredges which have reduced impacts on the seabed. However, during colder periods queen scallops are fished using dredges.

Scallops may be hand collected by divers and although this requires much more effort, scallops are landed in pristine condition so are more valuable. However, as divers can get to areas where vessels cannot, there are concerns that unregulated dive fishing has impacts on the stock by hand collecting from areas which have been untouched by dredges and therefore have mature scallops which may be acting as a broodstock. Harvesting scallops from a potential source of spawning undermines the sustainability of a population.

In general a higher price is paid for scallops with roe. In the Isle of Man, as a general rule of thumb, a fisherman will not fish if the there is less than 30% roe. Therefore the fishery is discriminately removing some of the reproductive stock from the population. In addition fishing has secondary effects on the fecundity. Dredging for scallops' chips the scallop shells so the animal then has to put more energy into repairing the shell and therefore less energy is available for reproduction.

Whilst at a limited scale in Northern Ireland, scallop cultivation has been successful across the world. In Japan cultivation is based on collecting naturally produced larvae on spat collectors. The spat is transferred to pearl nets and then, at 5-6 months, to lantern nets both of which are hung in the water column. Once the scallops reach the age of 2 they can then be placed on the seabed for on-growing or suspended from a pole by placing a hook through

the ear of the shell. Mulroy Bay in Ireland has been designated as a Class A area, with the Bay having the largest natural scallop spat fall in Western Europe. Scallop seed has been transferred from the Bay for aquaculture purposes since the 1970's (Beaumont, 2000). In areas where collection of naturally produced spat is not possible, hatchery reared spat has been used.

Northern Ireland Scallop Fishery

Fishing for King scallops has been established in Northern Ireland since 1935 (Briggs, 1992) with Queen scallop fishing not becoming commercial until the 1970's and not becoming significant until 2009. In 2011 over 830 tonnes of King scallops was landed into Northern Ireland ports with a first sale value of £1.48 million. The landings of Queen Scallops in 2011 were just over 3300 tonnes, with a first sale value of £1.39 million. This shows the much greater price available for King Scallops. Figure 10 shows the landings of scallops into Northern Ireland between 2009 and 2011 (no queen scallops were landed into Northern Ireland in 2008 but a collapse in American stocks led to huge market demand from 2009 onwards). In the 1970's there was a queen scallop fishery in Northern Ireland, however, the short life span of queenies make the fishery much more boom and bust. In total, in 2010 43,000 tonnes of scallops (king and queen) were landed into the UK by UK vessels. Northern Ireland contributed 9% of this.

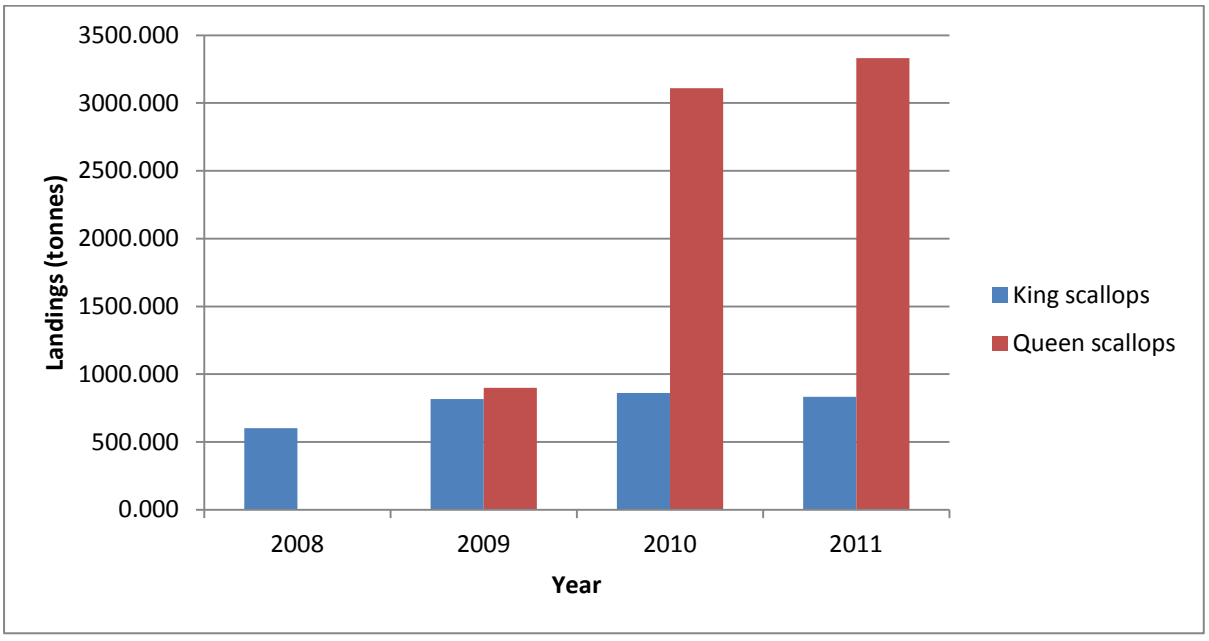


Figure 10 Landings (tonnes) of King and Queen Scallops into Northern Ireland (DARD landings data)

From 2007-2009 Portavogie had the largest landings of scallops into any port in Northern Ireland peaking in 2009 with over 282 tonnes landed with a first sale value of just under £0.4 million (Figure 11). However, in 2010 whilst there was a decrease in landings to Portavogie, landings of scallops in Kilkeel almost trebled, going from 121 tonnes in 2009 to 345 tonnes in 2011.

The peak in King Scallop fishing occurs annually in November (Figure 12). Fishing continues at moderate levels between December and May. The Irish Sea is closed to scallop fishing from the 1st June to the end of October. Landings taken during the summer months are therefore from the North coast which has no closed season.

In 2011 38 vessels reported landings of King scallops into Northern Ireland. Of these vessels 32% were less than 10m in length with the same percentage of vessels being between 10 and 15m in length (Figure 13). This is in comparison to the vessels which landed scallops into Northern Ireland in 2007 when only 15% of vessels were less than 10m and the majority (55%) were greater than 15m. This reflects changes throughout the inshore fishing fleet in Northern Ireland.

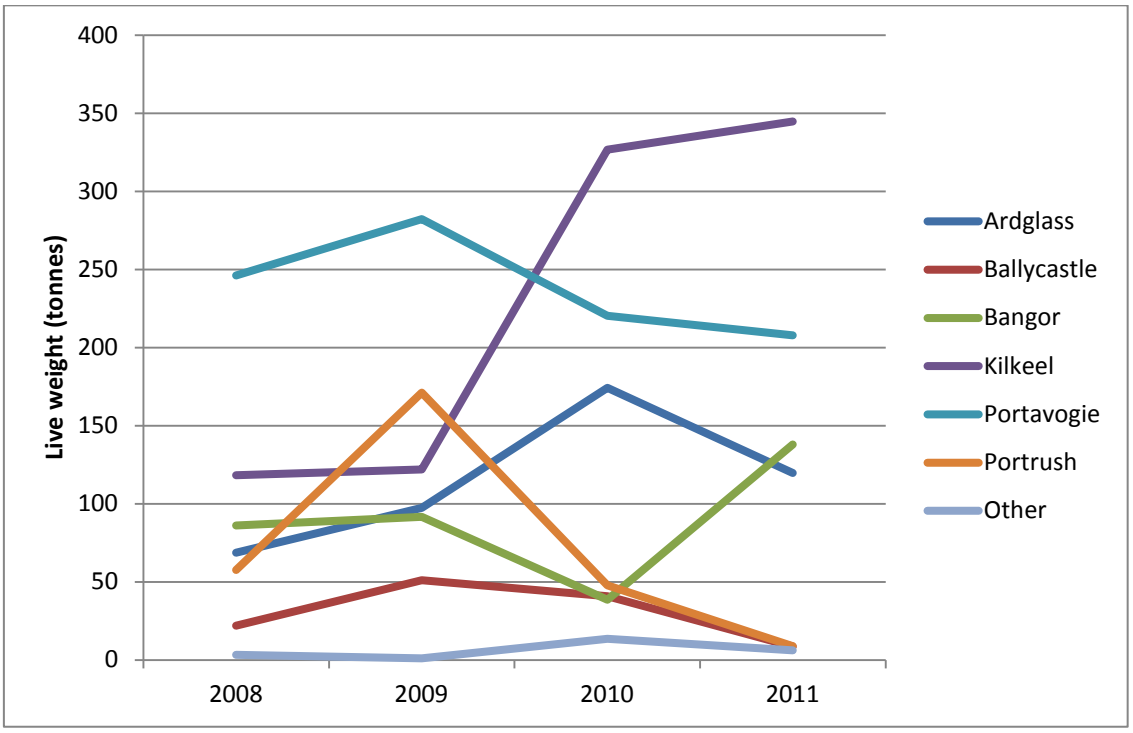


Figure 11 Landings of King scallops into all Northern Ireland ports from 2008-2011

The Northern Ireland Queen scallop fishery is located on the North coast. This is shown in terms of landings, with Ballycastle representing the largest port for Queen scallop landings (Figure 14).

In 2009 6 vessels prosecuted the Northern Ireland queen scallops grounds on the North coast. Of these vessels only 1 was less than 15m in length. In 2010 23 vessels landed Queen Scallops into Northern Ireland. Only 4 of these vessels were less than 10m with a further 4 being between 10-15m. 65% of the vessels landing queen scallops were greater than 15m in length with 2 of these vessels being larger than 20m. In 2011, of the 14 vessels which reported landings of Queen scallops into Northern Ireland, 13 were greater than 15m in length.

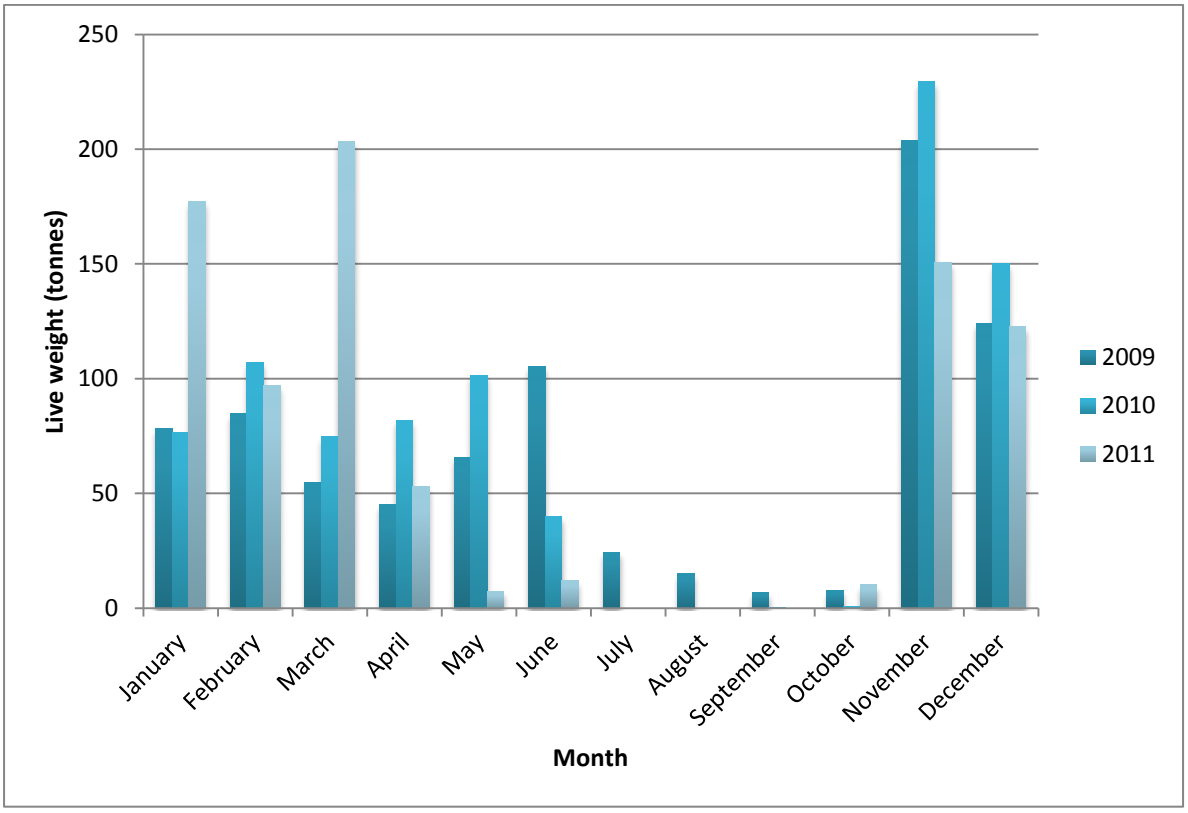


Figure 12 Landings of King scallops into Northern Ireland. From June to October the Irish Sea scallop fishery is closed and therefore all landings recorded during this period are from the North Coast.

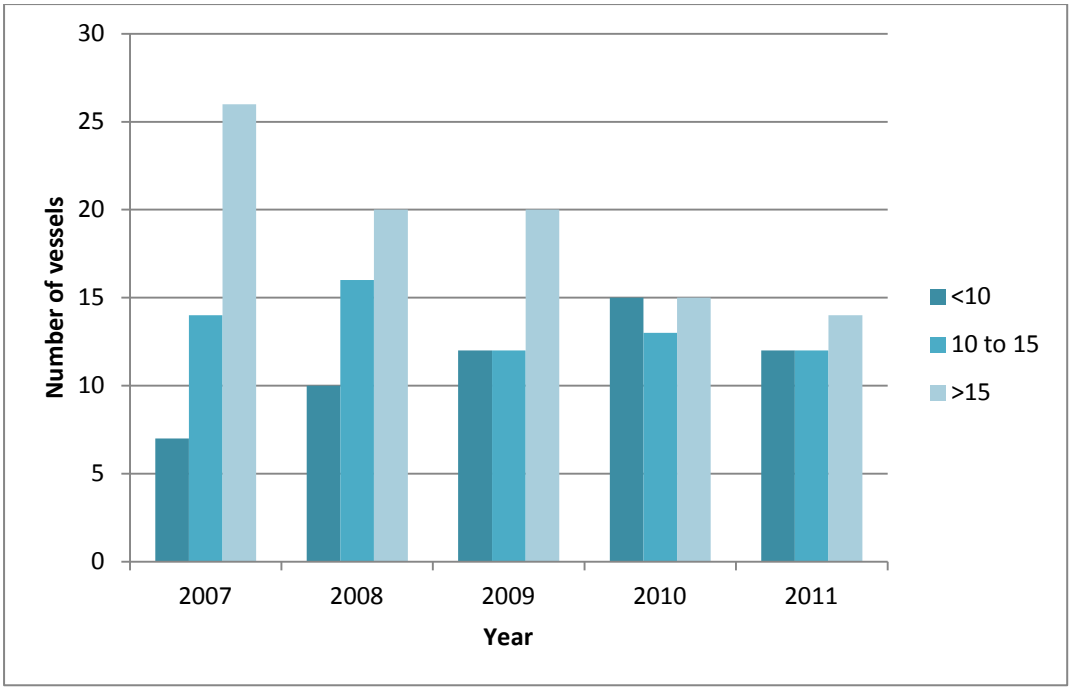


Figure 13 Number of vessels by length which reported landings of King scallops into Northern Ireland between 2007 and 2010

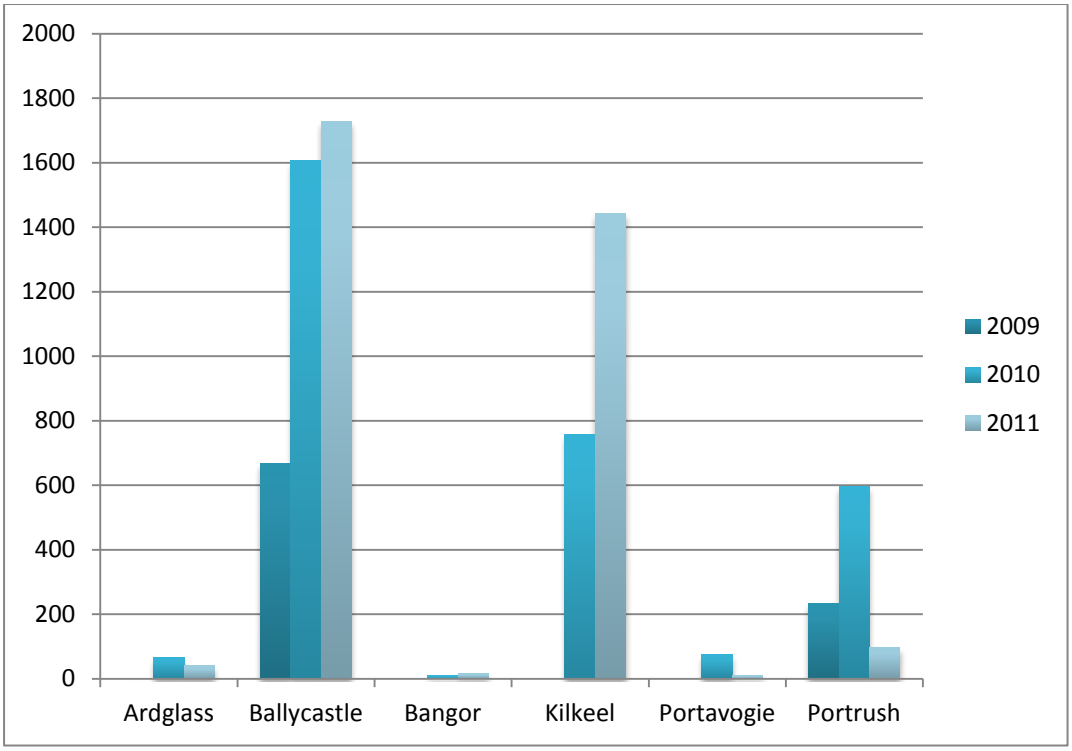


Figure 14 Landings (tonnes) of queen scallops by port

Prior to 2003 there was an important scallop fishery in Strangford Lough. However, in response to concerns over *Modiolus modiolus* beds in the Lough, The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Amendment) Regulations (Northern Ireland) 2003 prohibited the use of all mobile fishing gear within Strangford Lough put an end to all dredging and trawling. Now only diving for scallops is permitted within the Lough.

Scallop Management throughout the UK and Ireland

At a European level the UK scallop fishery is controlled by the Western Waters effort regime which was developed in 1995 to avoid an increase in fishing effort when Spain and Portugal entered the CFP. The Western Waters effort regime Council Regulation (EC) No 1415/2004 sets out the maximum levels of annual fishing based on kW days. In Area VII the United Kingdom have been allocated a total of 3,315,619 kW days whilst Ireland have been allocated 525,012 kW days, and in Area VI, the UK have been allocated 1,974,425 kW days. Effort allocation is fixed and does not change year to year. Only vessels greater than 15m in length are curtailed by the western waters regime (apart from in the Irish Biologically Sensitive Area). Effort (days at sea) may be traded between countries if a member state has exhausted theirs. An example of this occurred in 2011 when there was a possibility that the UK would exceed their limit. For this reason the fishery had to be closed (to vessels greater than 15m only) for a month until the UK could arrange a trade of quota for effort. In the UK Queen Scallops are also included in the Western Waters; however, in Ireland and France they are not included in the effort regime.

Throughout the United Kingdom there are no restrictions set on the total catch of scallop, with the fisheries being controlled primarily by the use of a minimum landing size which is set by Council Regulations (EC) 850/98 (as amended). ICES areas VIIa and VIId have a minimum landing size of 110mm. Under the European Regulations ICES area VIa has a MLS of 100mm.

Throughout the UK different gear controls have been set out. The Scallop Fishing Order 2004 states that a dredge to be used for scalloping must

- have a frame not exceeding 85cm in width,
- include a fully operational spring loaded tooth bar and belly bar,
- not contain any attachments to the dredge,
- not contain a diving plate or similar device
- have a total weight not exceeding 150kg.

In addition, if the dredge measures 80cm or more in breadth it should not have more than 8 rows of belly rings hanging from the belly bar or more than 9 teeth. If the dredge is less than 80cm in length it should have no more than 6 rows of belly rings hanging from the belly bar or more than 6 teeth on the tooth bar.

The dredges used must meet a number of specifications: internal belly ring diameter (≥ 75mm); top net mesh size (≥ 100mm); tooth spacing (≥ 75mm). A number of the English IFCAs have set a limit on the number of dredges allowed to be towed (a summary of the English Inshore Fisheries and Conservation Authorities byelaws used to manage scallop fishing is shown in Table 7). In the North West the maximum number of dredges which may be towed is 12 and all these dredges must be fitted with a spring loaded tooth bar. No more than 2 tow bars may be used at any time and the maximum length of any tow bar cannot exceed 5.18 metres including attachments

Common management measures in the UK include the use of closed seasons which are designed to protect scallops during breeding and settlement. Under The Scallops (Irish Sea) (Prohibition of Fishing) Order 1984 the Irish Sea is closed to scallop dredging between the 1st of June and the 31st October. In Sussex during the closed season it is also an offense to remove more than 200 scallops per 24 hour period by use of a trawl.

A curfew system is in operation in the North West where fishing can only take place between 0700 and 1900. In the Isle of Man fishing is prohibited within the 3-12 mile limit between 2000 hours and 0600 hours by any means, including diving. In addition, in the Isle of Man under the Sea Fisheries (Scallop Fishing) Bye-laws 2010:

- vessels with an engine power exceeding 221kw are prohibited from fishing for scallops within the whole of the Territorial Sea, unless they have been granted grandfather rights
- Satellite tracking devices are required for all vessels, regardless of length, fishing for scallops throughout the whole of the Territorial Sea
- Maximum tow bar diameter of 185mm
- Maximum of 7 dredges aside permitted within the 3-12 mile limit
- Recreational fishing for scallops is restricted to a maximum allowance of 18 scallops per day.

The Welsh Government established The Scallop Fishing (Wales) Order 2005 to restrict effort placed on the fishery. Under this Act the number of permitted dredges was restricted to 4 on each side of the vessel within 3nm of the shore and 8 on each side of the vessel beyond

3nm zone. In addition, no scallops can be taken during 1 June and 31 October, including by diving. In 2010, amendments to the order increased the closed season to 1 May to 31 October and banned all scallop dredging within 1nm of the shore. Vessel size restrictions were also introduced. No vessel can fish for scallops in Welsh waters if the boats engine has a power output exceeding 221kW. Within the 1-3nm zone no boat can exceed 10 meters in length. Also the number of dredges allowed in the 3-12nm zone was reduced to a total of 14. Six closed areas, including Cardigan Bay were set out.

In Scotland in 1999 a restricted scallop licensing scheme was introduced to limit the expansion of the sector. In 2003 additional gear restrictions were introduced including a limit of 8 dredges per side within the Scottish 6nm limit and a maximum of 10 dredges per side in UK waters out to 12nm which are adjacent to Scotland.

Other than the EU MLS of 40mm, there are much fewer regulations for the exploitation of queen scallops. Unlike, Ireland and France, the UK include queen scallops in the Western Waters effort regime. In addition, as queen scallops can be fished using a net, they are also restricted by the cod recovery plan (Council Regulation (EC) 1342/2008). Under the cod recovery plan the number of days at sea is limited.

Isle of Man Queen scallops

In 2010, the Isle of Man set up the Sea-fisheries (Queen Scallop fishing) Bye-laws 2010 and has now become a text book example of how a failing fishery can turn around and become an accredited sustainable one. Under these bye-laws no person may take queen scallops using a dredge which has a rigid mouth and teeth. No fishing for queen scallops is allowed within the 12 miles from the 1 April to 31 May. In addition, no fishing is allowed during the spawning and settlement period which is between 1 June and 31 August (thus stopping all fishing for queen scallops from 1 April to 31 August). Fishing is also limited between the hours set out for King Scallop fishing. The Isle of Man have set up “queenie conservation zones” which encompass the whole of the 3 mile area closest to shore plus 2 other no take zones which extend to the 12 mile inshore limit. They have also set a bye-law which gives them the power to implement a total allowable catch if the stock is deemed at risk.

To gain accreditation, government, fishermen, and processors worked together to get stocks back to a commercially exploitable level. Only the best quality animals were landed with the rest of the stock retained to increase the population. By 2010 the queen scallop stock had recovered to levels higher than had previously been seen (Winterbottom, 2011). In 2011 the

Isle of Man trawl caught queen scallop fishery was awarded the Marine Stewardship Council (MSC), accreditation. This classifies the fishery as a well managed, sustainable fishery.

Proposed English Scallop Order

As with the Northern Ireland inshore sector, the English inshore has seen an increase in the number of fishermen moving from the offshore to fish non-quota species in the inshore. Within the English scallop fishery there are large vessels capable of pulling 42 dredges as well as small inshore vessels whose size restricts them by area and weather. In 2011 a proposed English scallop order was put out to consultation to replace the English Scallop order 2004. The aim of the order is to provide protection for smaller vessels, safeguard scallop stocks, have better enforcement of the fishery and reduce the impact of displacement of fishing between areas.

It has listed a number of measures which could be introduced:

- extending the limit of 8 dredges per side to the 12nm limit.
- applying the larger MLS to all scallops caught in a trip which covers the two regions
- providing clarity of the term 'attachments' to a dredge to allow those solely for safety purposes

Current Scallop Management in Northern Ireland

The Conservation of Scallops Regulations (Northern Ireland) 1997 set out a number of gear restrictions for the Northern Ireland fishery. These included

- a limit of 8 dredges to be allowed on each side of the vessel;
- a maximum of 9 teeth per dredge;
- minimum tooth spacing of 75mm;
- a scallop dredge or system of scallop dredges with a width, or in the case of a system of scallop dredges, an aggregate width, not exceeding 1219cm;
- a minimum diameter of belly ring of 75mm
- a minimum mesh size of 100mm in the netting cover
- The prohibition of French dredges

Table 7 Summary of byelaws used by the English Inshore Fisheries and Conservation Authorities to manage scallop dredging

Byelaw	North Western	Northumber-land	Eastern	Southern	Devon and Severn	Kent and Essex	Cornwall	Sussex
Effort control								
Size of vessel			14m	12m within 6nm	15.24m within 3 miles	Yes	16.46m	14m
Engine power						221kW		
Dredge number		10	10	12	12		12	
Curfew				1900-0700	1900-0700		1900 - 0700	
Closed season	June-Dec		July-Sept		July-Sept			Jun-Oct
Technical Measures								
Bed may be closed			Yes		Yes	Yes	Yes	
Towing bar				≤5.18m	≤5.18m		≤5.18m	
Gear limitations		Mouth≤75cm	Spring loaded tooth bar and mouth ≤85cm	Spring loaded tooth bar and mouth ≤85cm	Spring loaded tooth bar and mouth ≤85cm		Spring loaded tooth bar and mouth ≤85cm	
Gear limitations			Rings ≥75mm		Rings ≥75mm		Rings ≥75mm	
Conservation Measures								
Closed area			Any area within 3 miles limit					

The Inshore Fishing (Daily Close Time for Scallops) Regulations (Northern Ireland) 2000 set a curfew with fishing only permitted from 0500-2100, Monday through to Friday. No fishing, including by diving, was allowed during the weekend.

In 2008 these restrictions were tightened in the Conservation of Scallops Regulations (Northern Ireland) 2008 which further reduced the number of dredges allowed to a maximum of 6 per side and increased the curfew with fishing for scallops (including that by diving) only allowed to take place from Monday to Friday and between the hours of 0600-2000. In addition, the MLS for scallops was set at 110mm, including from areas on the north coast (VIa) where under EU regulations the MLS is set at 100mm.

There are also a number of gear restrictions applicable in Northern Ireland:

It is prohibited to

- Use a scallop dredge or system of scallop dredges with a width, or in the case of a system of scallop dredges, an aggregate width, of more than 915 cm;
- Use a tow bar which exceeds 5.5m in length
- Dive for scallops between 1st June and 31st October (except in Strangford Lough)

Through the Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Amendment) Regulations (Northern Ireland) 2003 scallop dredging is prohibited in Strangford Lough in an attempt to conserve the Modiolus in the lough.

Potential Regulatory Measures for Scallop Fishing

The Northern Ireland scallop fishery is already tightly regulated. Table 8 shows the potential additional measures which could be used to sustainably manage the Northern Ireland scallop fishery. In addition to these measures a number of other management tools were examined but through discussion with stakeholders, were deemed as not necessary/unsuitable for the Northern Ireland fishery. These included:

1. **Quotas** which although would limit the effort placed on scallop fishing, they would not be well accepted across the sector
2. **An increase in the curfew system**. The curfew in place in Northern Ireland under the Conservation of Scallops Regulations (Northern Ireland) 2008 is deemed to be an acceptable curfew for the fishery and should not be extended
3. **An increase in the MLS**. *Northern* Ireland currently operates the EU MLS as does the rest of the UK and Ireland. An increase in MLS would prove tricky due to the nature of

the fishery. If the MLS in Northern Ireland was changed it would be hard to enforce as a fishermen may end up fishing in areas with different MLS.

4. **Number of dredges allowed**. Northern Ireland has one of the smallest numbers of dredges allowed throughout the UK. Currently the limit of 6 dredges per side is seen as sufficient controls over the sector.
5. **Limit to vessel size**. The limit of 6 dredges per side provides protection from larger vessels. Whilst there is nothing preventing these larger vessels to enter the Northern Ireland scallop grounds, they will be limited to 6 dredges per side and therefore their size is not an advantage.

Table 8 Possible actions for the management of the Northern Ireland inshore scallop fishery

Challenge	Resolution	Possible Action	Reasoning
Sustainability	Reduce latent capacity of fleet	Permit system	Unlike vessels over 10m which require a scallop entitlement, under 10m vessels do not require a scallop entitlement and can fish using just their licence. If expansion continues, the fishery may not be sustainable. A permit system would cap the number of vessels allowed to fish within the inshore. A permit system should also be introduced for commercial divers.
	Reduction in effort	Ban on Dredging for Queen Scallops	This is of major priority to the scallop fishermen in Northern Ireland. Queen scallops can be fished by dredge or by trawl with the trawl being the more environmentally acceptable form of fishing having a lesser impact on seabed integrity. By putting a ban on dredging for Queen Scallops it will reduce damage to the seabed. Also, as trawling is most effective during the warmer months when queen scallops are more active, it will make the fishery seasonal, putting less pressure on the bed and giving it time to recover between fishing periods.
		Limits to Recreational Diving	Currently divers are only restricted by the curfew and closed seasons, yet recreational divers can have a significant impact on stocks by accessing areas where dredges cannot, therefore potentially damaging mature brood-stocks. A daily catch limit would limit the impact of recreational diving.
	Protection of juveniles/broodstock	Nursery grounds	Resources should be put in to determining the best location for nursery grounds and for the reseeding of these areas. By keeping these areas closed to all scallop fishing, including diving, these areas have the potential to boost surrounding populations of the stock thus making fishing more sustainable. In 1999 trials carried out by the Scallop Fishermen's Co-operation and the Centre for Marine Resources and Mariculture (C-Mar) showed that survival of relaid seed varied from 0% to 100% at Strangford Lough. Growth of the scallops averaged around 2mm per month but was higher at one site averaged 4.21mm per month. This shows the importance of providing sufficient resources for the locating of reseeding sites.

		Closed season for protection of Queen scallop spawning stock	Implementing a closed season during the spawning period will protect the spawning stock and can lead to increased settlement of spat as the settlement substrate is not being damaged by fishing. Also, after dredging, the number of scavengers in an area can increase. If dredging is eliminated during times of settlement, the number of predators in the area may be reduced thus giving newly settled scallops a greater chance of survival.
	Improved fishing effort allowance	Removal of Northern Ireland from UK western waters effort regime	This is a major priority of scallop fishermen in Northern Ireland which receives 100% support. Currently Northern Ireland shares the UK's western waters effort allowance. English vessels have fewer restrictions than Northern Ireland vessels, and there are much larger vessels in the English fleet which can fish all weather conditions and therefore use up a disproportionate amount of the kW days allowance set for the UK thus negatively affecting the time smaller vessels can fish. Northern Ireland fishermen are heavily penalised under the present days at sea regime, particularly as any time they spend travelling to the fishing ground counts towards their days at sea allowance. Currently Ireland has its own effort allowance. By having a separate Northern Ireland effort then the smaller Northern Ireland fleet will get a fairer opportunity to fish under the western waters.
Lack of data	Increased fishing data	Activity reports for commercial divers	Scallop fishermen who use dredge/trawl are required to provide activity reports. This requirement should also be placed on commercial divers.
	Increased knowledge of stocks	Scientific surveys	Work should be carried out to study the scallop populations around Northern Ireland including examination of the different fisheries areas in terms of growth, spawning season and age classes of both king and queen scallops.
Obligations to Marine Environment	Protection of marine habitat	Resources put into trialling new environmentally more acceptable dredges	Due to the detrimental impacts of dredging, a lot of work has been carried out to examine the use of more environmentally friendly scallop dredges. One such eco-dredge is the N-Viro which has skids which bear the weight of the dredge. The teeth of the traditional dredge have also been replaced by spring bound tines which move individually and are less resistant meaning they will not dig up rocks etc which not only means that tow length can be increased, but also that there will be less damage done to the scallops. As it is less resistant it also

			means it is easier to tow and therefore is more fuel efficient. The N-Viro dredge has already been trialled in Northern Ireland with little success due to the nature of the seabed. Whilst there are no current alternatives, if new gear is developed resources should be provided for the trialling of this gear.

Cockle Fishery

Cockles are generally fished using a hydraulic dredge. Hydraulic dredges generate jets of water which fluidise the sediment in front of the dredge and displace the cockles. There are two types of hydraulic dredges, suction dredges which pumps the cockles onto the deck where they can be sorted and graded, or non-suction dredges which grade the catch in situ in the dredge (Clarke and Tully, 2011).

As all forms of cockle fishing remove the cockles from the substrate, those which are discarded, even if not damaged, may be lost to the fishery. Coffen-Smout and Rees (1999) found that, after physical shock brought about by fishing, cockles are slow to reburrow and can be rolled away by the tides as well as being at increased vulnerability to scavenging birds. They found that reburrowing is more successful at high tide.

Irregular recruitment is something which affects most cockle beds. For example, in 2004 in the Wash it was noted that recruitment large enough to increase the stock only occurred every 6 to 7 years, whilst other cockle fisheries have experienced similar shortages in cockle stocks.

Northern Ireland Cockle Fishery

A pilot cockle fishery was initiated by DARD in Belfast Lough in 2008 to establish the feasibility of a larger commercial fishery. The licensed fishery was situated between the main Dredged Channel within Belfast Lough and the SPA to the East of the Kinnegar outfall pipe. This fishery was operated by two small 12 meter and under vessels one of which operated a suction dredge and the other a standard cockle dredge. Between them the two boats removed 128 tonnes of cockles. In 2009 this site was closed and a second site to the West of the Kinnegar outfall pipe was proposed (Figure 15). The 2009 fishery was operated by thirteen small 12 meter and under vessels which operated either suction dredges, hydraulic dredges or dry dredges. Each boat was allocated a quota of 8 tonnes of cockles for the season and designated two specific tides between the 5th and the 23rd of October, over which this could be fished. This ensured that only two vessels were fishing at any given time. A total of 66 tonnes of cockles was landed throughout the duration of the 2009 fishing season. In 2010-2012 no cockle took place in inner Belfast Lough due to a lack of recruitment to the area.

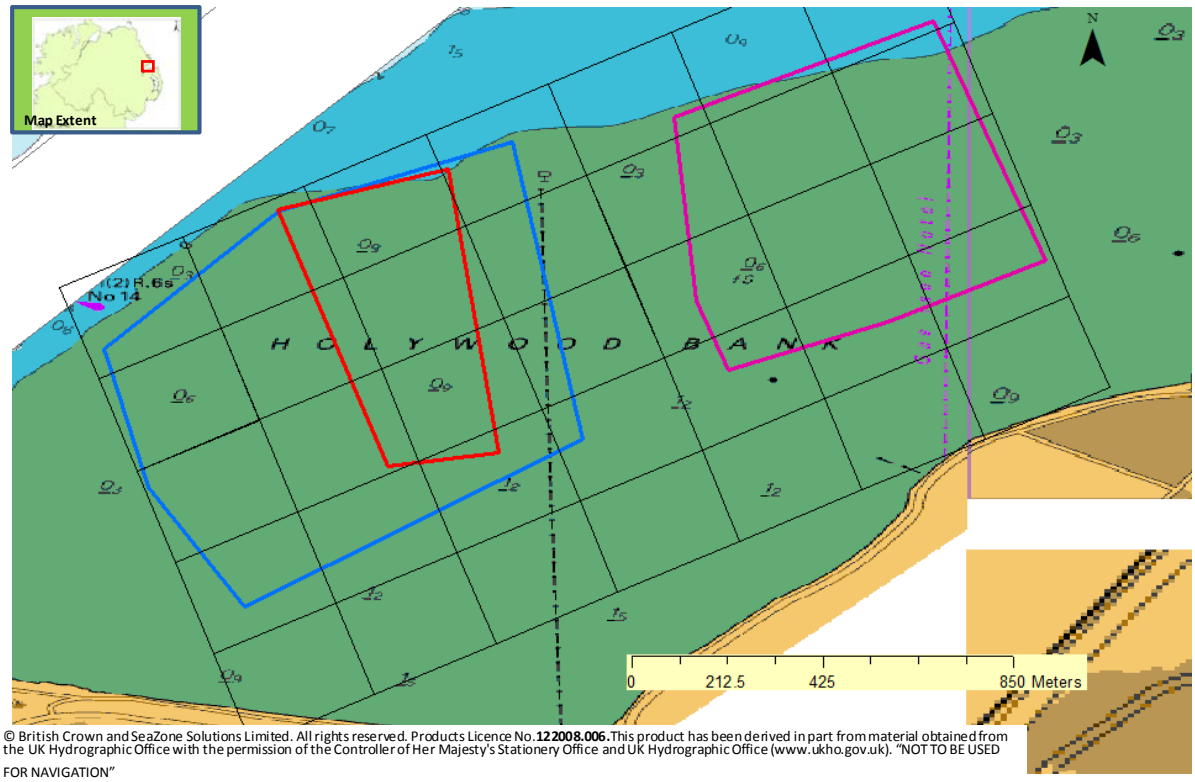


Figure 15 Holywood Bank cockle bed. The area to the East of the outfall pipe (represented by the pink box) was fished in 2008. The area to the West of the outfall pipe (represented by the red box) was fished in 2009.

Cockle Management in the UK and Ireland

There is no national legislation for cockle fishing across the UK. Management is implemented through local regulations. The two main fisheries for cockles within the UK are the Thames Estuary and The Wash. The Thames Estuary Cockle Fishery Order 1994 was established after the fishery came under heavy pressure in the early 1990's. The Order set up a license scheme whereby anyone who had fished the area for cockles a year prior to the Order would be issued a license at the cost of £1,000 per annum. The Thames fishery is also controlled by a maximum vessel size, engine power, and dredge size, MLS, maximum smash rate, seasonal closures, curfews and catch limits. A summary of the management principles used throughout the UK and Ireland cockle fisheries can be found in table 9.

In the Wash the maximum number of licenses has been capped at 68. Another method of reducing effort placed on the fishery is a curfew which only allows fishing for cockles from a vessel to occur four days per week. Under the Wash Fishery Order 1992 a number of gear restrictions are placed on the Wash fishery. The inside opening of any hydraulic suction dredge head must not exceed 76cm and only one dredge may be deployed per vessel. In addition a Certificate of Approval must be issued prior to fishing. This certificate is only issued once the vessel has shown a smash rate of less than 10%. Within the Wash there has also been set a maximum daily limit of 4 tonnes for the dredge fishery and 2 tonnes for the hand worked fishery. As the Wash also has a lucrative mussel fishery, 100m buffer zones have been implemented between the two fisheries.

In 2007 the Dee Estuary was closed to fishing due to a decline in cockle stocks. In 2008 The Dee Estuary Cockle Fishery Order 2008 was introduced to regulate fishing within the estuary. The order sets out a number of management tools:

- A license is needed to fish commercially within the estuary
- Licenses last for 1 year and cost £992
- A recreational limit is set at 5kg of cockles per day
- Cultch cannot be removed from the area
- The Environment Agency may set terms to a license including the area where the license is valid; the size/description of dredge used; the size/description of vessel used; when a person may fish; the size of cockles allowed to be taken from the fishery; the amount of cockles allowed to be taken from the fishery.

These measures have been successful in creating a full season of harvesting within the estuary. The area has also been put forward for MSC accreditation in 2011.

Dundalk Bay, on the East coast of Ireland supports a commercial cockle fishery which started in 2001. The Dundalk cockle fishery is within a site which has been designated as a Special Area of Conservation (SAC) and a Special Protection Area (SPA). In 2006 and early 2007 the cockle bed was closed to fishing to allow Bord Iascaigh Mhara, the Irish Sea Fisheries Board who are responsible for the cockle fishery, to set up a management plan to ensure the sustainability of the stock. The management plan included (all information gathered from Hervas *et. al.* 2008):

- A maximum dredge blade width allowed of 0.75m for suction dredges and 1.0m for non-suction dredges
- Fishing activity only allowed in areas were cockle density is, on average, greater than 4 per metre squared

- The fishery area was 35% of the area over which cockles were distributed
- Minimum landing size 17mm
- A total allowable catch (TAC) of 52% of the biomass of commercial sized cockles in the fishable area was implemented. If the daily catch averaged over all vessels fell to 250kg the bed would be closed.
- Commercial fishing can only take place Monday to Friday and between 07:00 and 19:00.
- A maximum allowable catch per vessel per day of 1 tonne.

However, a number of weaknesses were highlighted with the management plan. Firstly, whilst the MLS was set at 17mm, due to marketability, the fishermen had their graders set at 22mm which meant that even legal sized cockles were being discarded. Therefore to reach their TAC, vessels were fishing areas over and over which could lead to cumulative increases in discard mortality.

Secondly, there was no control over the number of vessels who could fish for cockles and this put pressure on the TAC but also put at risk the economic viability of the cockle bed. If more people fish the site then each vessel gets a reduced TAC and thus less income from the site. This was similar to the situation in Belfast Lough in 2009 when 14 vessels fished the site at Holywood Bank after 2 fishermen had a successful year in 2008. The TAC per vessel was reduced to 8 tonnes per vessel (in 2008 the 2 vessels lifted 128 tonnes between them). This meant that, for some fishers who had taken time out of their regular fishing to modify their vessels for cockle fishing, it was economically unviable.

In 2009 BIM looked to resolve these issues by introducing a permit based on track record. Therefore, only those who had fished for cockles in Dundalk between 2004-2007 were issued with a permit. In addition, anyone hand gathering cockles required a permit and had to submit activity reports. From this, for the period from 2011-2016 BIM have limited the number of permits available to fish cockles in Dundalk Bay to 33.

Whilst as a general rule of thumb in cockle management the TAC is set at 33% (the one third rule which allows one third for the fishery, one third for the birds and one third for the environment), BIM have set limits which will be used to determine the TAC. If the annual survey reports a biomass of less than 750 tonnes of cockles the fishery will remain closed. If 750-3000 tonnes are reported then a TAC equivalent to one third of the biomass will be set. In instances were a total abundance of >3000 tonnes of cockles is reported a TAC of 50% will be set.

Table 9 Summary of byelaws used by the English IFCA's to manage the cockle fisheries

Byelaw	North Western	Eastern	Southern	Devon and Severn	Kent and Essex	Cornwall
Effort control						
Permit required	40 permits per year	Yes			Yes	
Engine power					221kW	
Size of vessel		14m	12m within 6nm		14m	
Daily limit		500kg per day			Limit 13.6 m^3 per day	Yes
Gear Limitations						
		Head width ≤305mm with spacing ≥20mm	Dredge not exceeding 460mm		ALL parallel bars used for taking, riddling, sorting, grading must have spacing of no less than 16mm; Riddle must be minimum length of 1.75m; Certificate of approval must be issued before gear used. Need to be less than 10% smash rate; One dredge only; Dredge head aperture ≤76cm; Blade ≤76cm	
Technical Measures						
MLS	Any cockle which will pass through 20mm space cannot be landed	Any cockle which will pass through 20mm space cannot be landed	Any cockle which will pass through 23.8mm space cannot be landed	Any cockle which will pass through 19mm space cannot be landed		Any cockle which will pass through 20mm space cannot be landed
Conservation						
Closed season	May-Aug	May-Aug	Feb-April			

Cockle Management in Northern Ireland

In 2008 permits for a pilot cockle fishery were granted to two fishermen. In 2009 13 permits were granted to those fishermen who raised interest in the 2009 pilot fishery and who had a suction dredge. Conditions of these permits included:

- A MLS of 14mm
- The vessel must have a VMS on board
- Fishing only permitted Monday to Friday
- Smash rate must be less than 20%
- No more than 2 vessels allowed in designated fishing area at any one time. Each vessel was given an allotted time to fish
- Fishing will cease on 15 October 2009
- Log sheets must be completed

In 2009, each vessel was given a fixed quota of 8 tonnes of cockles. No other regulations were implemented with regards gear used, for example dredge size and riddle spacing.

Potential regulatory measures for cockle fishing in Northern Ireland

Whilst there has been no commercial cockle fishery within Northern Ireland since 2009, it is vital that if the Holywood Bank cockle bed becomes viable, or an alternative area is sourced for cockle fishing, there are regulations available for the immediate management of the fishery. Possible actions for the management of a sustainable Northern Ireland cockle fishery are outlined in Table 10.

Table 10 Possible actions for the management of the Northern Ireland cockle fishery

Challenge	Resolution	Possible Action	Reasoning
Obligations to Protect Marine Environment	Protection of sea bed	Gear restrictions	Gear restrictions could limit the impact of dredging. These could include limitations to the dredge head width and the minimum size of riddle used for sorting. In addition, the gear must be able to fish with minimum damage to the cockles. Currently the smash rate is set at 20%. This could be reduced to encouraging fishermen to purchase the correct equipment for cockle fishing and thus reduce the impact of fishing on the stock.
Lack of Data	Increased knowledge on stock	Scientific surveys	To investigate the potential for a sustainable cockle fishery studies should be carried out to determine if the adult cockles on the bed are reaching sexual maturity and releasing gametes. This can be determined through histological gametogenic investigations. If gametogenic studies indicate that adult cockles are actively releasing gametes then hydrodynamic modelling can be undertaken to identify areas of potential settlement. In order to determine if a cockle fishery should be opened a survey must be carried out beforehand to estimate the tonnage of cockles available to the fishery. The survey should examine the length/age frequency of cockles from each area and the estimated biomass of cockles. This information is then used to determine the total fishable stock and suitable fishing areas.
Sustainability	Protection of stock	Curfew	Limiting cockle fishing to certain tides has a potentially significant effect on cockle stocks. It has been shown that re-burrowing of cockles is more efficient during high tides; therefore by limiting all fishing to high tides, there will be a smaller proportion of cockles lost to the environment.
		Daily catch limits	Daily catch limits would prevent 'the race for fish' - competition amongst fishermen to see who can catch the most when a bed is opened - which can cause devastation to a bed. Also overfishing at the beginning of the season can lead to oversupply to the market and therefore more competitive i.e. lower, pricing.
		Minimum Biomass	There is no fixed value in Northern Ireland by which Government and fishermen

			alike know that if the biomass is greater than this value the bed will be opened. Such a minimum level should be determined so that fishermen do not become suspicious when a bed is not opened. From the biomass present on the bed, a total allowable catch should be set at one third of the total biomass.
		Closed area	A closed area provides protection for a proportion of the stock, most significantly for broodstock. By maintaining a closed area the surrounding area should benefit from increased recruitment. In addition, a closed area provides an undisturbed food source for feeding birds.
	Reduce latent capacity of fleet	Permit system	A permit system would cap the number of vessels allowed to fish within the inshore.
	Effective use of resources	New fisheries	Resources should be provided for locating new cockle beds. Whilst Belfast Lough provided a cockle fishery for two years, poor recruitment has seen the bed remain closed since the 2009 fishery. Through working with fishermen and using historical data other areas around Northern Ireland should be surveyed as potential sites for a commercial fishery.

Intertidal

Fishery

The main species harvested from the intertidal zone are cockles, mussels, oysters, periwinkles, whelks and razor clams. Whilst cockles and mussels may be gathered using a rake, the remaining species are gathered by hand, either for commercial or personal use. In addition to the shellfish species, intertidal harvesting may also be carried out for the purpose of bait collection for angling, generally for Polychaete worms but also for crabs. Seaweed is also collected from the intertidal for use in horticulture, food, cosmetics and seaweed baths.

Intertidal harvesting is carried out at low tide with, on some occasions, boats being used to travel to islands to collect shellfish. Because of the lack of equipment and/or knowledge required to harvest intertidal shellfish, the sector is open to anyone.

Whilst intertidal harvesting rarely involves the use of mechanical equipment, it still has a negative impact on the environment. Intertidal harvesting can affect the sustainability of stocks as it is not formally regulated meaning there are no log books etc. to monitor what is being lifted from the intertidal area and therefore there is a lack of information on the effort placed on the fishery. There is also a lack of information available on the current status of the stock. This can jeopardise the sustainability of populations.

Also, if there is no minimum landing size then, whilst large animals will be selectively harvested, once these large animals have been removed then smaller specimens can be removed leading to a collapse in the stock. In Scotland, the market demand is for winkles greater than 13mm. However, due to overfishing there is a lack of animals of this size and it has been reported that 5-20% of the catch is now undersized with these small animals being of no economic value (Cashmore and Burton, 1998). In the case of winkles, large animals tend to become infected with trematodes reducing egg production and so the smaller animals have the greatest reproductive capacity. By harvesting small animals the future reproductive potential of the population may be significantly impacted.

Harvesting may also affect the recovery of a population. Smyth *et al*. 2009 found that whilst stocks of the oyster *Ostrea edulis* in Strangford Lough increased to 1.2 million in 2003, by 2005 they had decreased by almost half. Whilst there was a reported Bonamia outbreak in the Lough around this time, there was a lack of broken shell, which would be expected to be found in the case of a natural mortality. This, in addition to the lack of medium and large

sized oysters present indicated that the stock had been depleted due to unregulated exploitation.

Intertidal harvesting has the potential to affect non-target species. Indeed, in a Defra report published in 2006 bait digging/collection was found to be of a high threat to marine biodiversity (Boyes *et al*. 2006). Numerous studies have shown that in areas of heavy footfall, marine communities are impacted (Beauchamp and Growing, 1982; Brosnan, 1993; Brosnan and Crumrine, 1994; Ghazanshahi *et al*. 1983; Liddle, 1975). Tramping affects species both directly by crushing and dislodgement and indirectly by impacting the interaction between species (Brosnan and Crumrine, 1994), for example removing predators, or competitors, allowing a species to dominate an area. Winkles are important grazers and if they are removed then the structure of the area may be affected by an increase in algae coverage, thus limiting the space available for other species.

Boulders have been shown to have a well developed zonation with the top of the boulder colonised by brown and green algae, barnacles and limpets. The underside has hydroids, anemones, polychaetes, bivalves, bryozoans, sponges, ascidians, nudibranchs, snails, echinoderms and small decapods (including peeler crabs) (Liddiard, 1989). Whilst experienced harvesters tend to collect animals from the seaweed and around the edges of the stones, inexperienced collectors, or those who move around the coast and have no desire to protect each area, move stones and leave them unturned ((McKay and Fowler, 1997). This exposes shelter seeking species to, air and wave action which can lead to desiccation and displacement as well as an increased chance of predation. In addition, the species on the top of the rock will be damaged when it is rolled over.

Digging for species, particularly worms, affects the sediment of the area. Undisturbed sediment has a well mixed surface layer on top of an anoxic layer. Contaminants can be held in this anoxic layer (Fowler, 1999). Digging brings this anoxic layer to the surface with the contaminants released into the water when the tide passes over the area.

The process of Intertidal harvesting can cause significant disturbance to benthic habitats which can affect the abundance and availability of the prey species available for birds. In addition the presence of people harvesting from the intertidal area causes disturbance to birds reducing the time they spend feeding in the area. Intertidal harvesting for commercial purposes peaks during the winter months when there is an increased market demand and thus better prices for shellfish. This peak in activity coincides with the peak in the presence of overwintering and migrating birds which need to feed continually to survive the winter (Fowler, 1999). Intertidal harvesting means that instead of feeding, birds are expending energy to move to alternative feeding grounds.

Northern Ireland Intertidal Fishery

In Northern Ireland the main species harvested intertidally is the periwinkle. In the early 1900's Strangford lough hosted a commercial fishery for winkles with 3 tonnes annually being harvested and sent to mainland UK. A survey carried out between 2004 and 2005 found that today, winkle picking still occurs at high levels around Strangford Lough, with winkle pickers accounting for 87% of all harvesters observed (Johnson *et al*., 2008).

Landings of periwinkles into Northern Ireland are extremely unreliable as there is no log book to be completed and returned to DARD stating the quantity harvested. However, using the reported landings (Figure 16) a peak in periwinkle landings occurred in 2002 when 180 tonnes were landed with a first sale value of £137,600. The peak in harvesting occurs around Christmas when market demand increases the price from approximately £1,400 to £2,200 per tonne (Cummins *et al*. 2002). In 2002, during the reported peak in periwinkle landings, 95% of the total landings were taken in December.

Unregulated harvesting in Northern Ireland is a major issue, as it is across the rest of the UK and Ireland. At Portnaboe and Port Ganny, during 2009 and 2010 at least 6 different gangs were witnessed harvesting intertidally. In some cases the shellfish are confiscated and returned, however as many of the harvesters are foreign nationals, language barriers can be an issue when explaining the legalities of intertidal harvesting. There are also concerns at the level of unregulated harvesting occurring around Strangford Lough.

Within Northern Ireland there is also a number of intertidal aquaculture sites used for the on-growing of species, most significantly, the Pacific oyster, *Crassostrea gigas,* (there is some on-growing of native oysters and clams). Currently there are several licensed sites in Northern Ireland including 3 in Larne, 1 in Killough, 1 in Dundrum Bay, 2 in Strangford Lough and 3 in Carlingford Lough. In addition to oyster aquaculture there are applications in process for the development of sites to be used for periwinkle aquaculture. There is strong market demand for periwinkles, and aquaculture gives Northern Ireland the potential to maximise growth rates and supply the market as required, thus providing significant economic input.

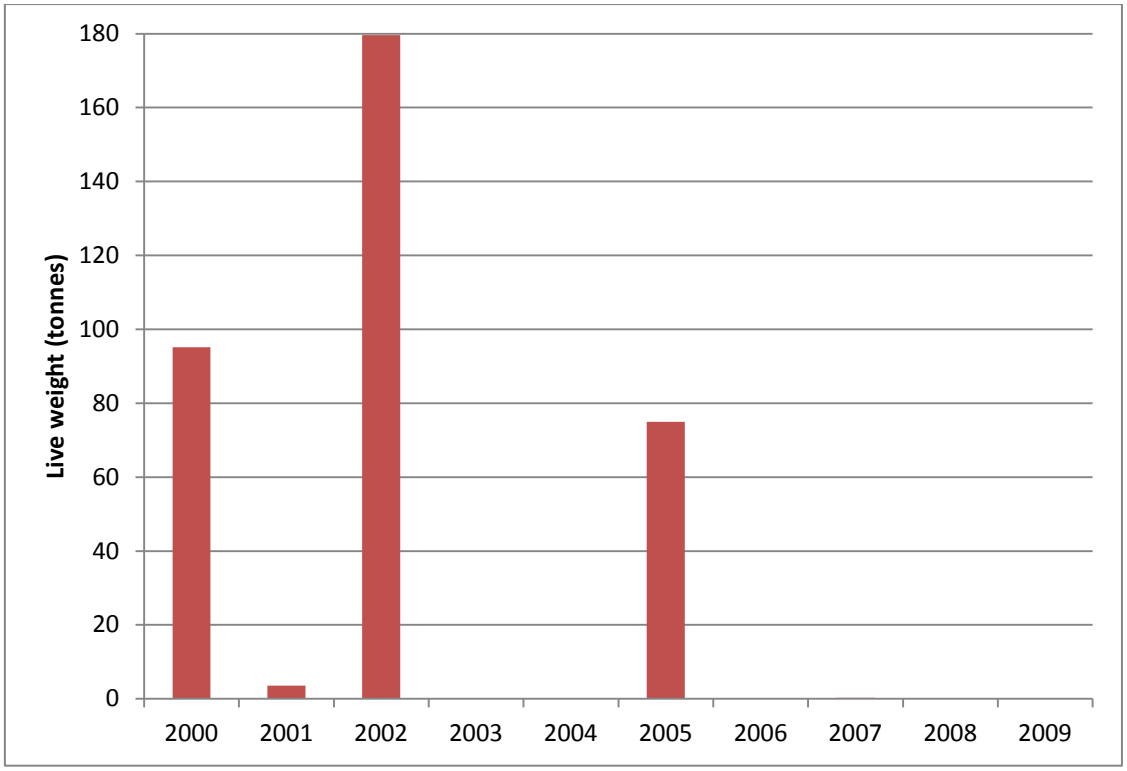


Figure 16 Reported landings of periwinkles in Northern Ireland by intertidal harvesting

UK and Ireland Management Measures

The foreshore is owned by the Crown Estate and therefore there is a common law right for everyone to have access to the intertidal zone and to gather shellfish. This was highlighted in Northern Ireland in 1998 when a plaintiff appeared in the High Court of Justice claiming his right to collect shellfish from between the low and high water marks for personal use on a section of the foreshore owned by the National Trust. Whilst under the National Trust Act (Northern Ireland) 1946 "*no unauthorised person shall on Trust property knowingly take, molest or wilfully disturb, injure or destroy any living creature or the eggs of any living creature or spread or use any net or set or use any snare or other engine, instrument, lamp, lure or other means for the taking, injury or destruction of any such living creature or its eggs whether in or above trust property*" the common law entitlement to collect shellfish was found to overrule the Act. However, Several Orders remove ('severe') the right for the public to harvest from a particular area and allocate the rights of a fishery to a single person, group or organisation. Several Orders have been previously used in Scotland. Regulatory Orders are an alternative way of limiting foreshore harvesting. A regulatory order can be implemented for an area which means that licences are required to fish in that area. The licences may contain conditions which have to be met thus regulating the fishery.

If someone is being employed to harvest shellfish commercially from the intertidal zone, then the employer must be in the possession of a Gangmasters Licence. The Gangmasters Licensing Authority (GLA) was set up under the Gangmasters (Licensing) Act 2004 to "*safeguard the welfare and interests of workers whilst ensuring labour providers operate within the law*". If a person is found to be using workers to collect shellfish from the intertidal without a Gangmasters Licence then they can face a fine or imprisonment. In Northern Ireland there is currently no-one operating a Gangmasters License.

Intertidal harvesting has little regulations, however, the water quality from where the animal has been harvested does have to meet certain standards. All shellfish waters must be designated following guidelines in The Shellfish Waters Directive 2006/113/EC (which replaced Council Directive 79/923/EEC). Under the SWD the water is monitored for pH, suspended solids, salinity, dissolved oxygen, petroleum hydrocarbons, organo-halogenated substances and metals (silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc). Two additional criteria used by the Department of Environment for the designation of shellfish waters are:

- the shellfish harvesting area is established – to be demonstrated by the receipt of a full classification (A-C) awarded by the FSA under the EU Food Hygiene Regulations for the same species in each of the last 3 years; and
- the shellfishery has been active for each of the last 3 years.

The SWD does not protect the quality of shellfish for human consumption; this is regulated by The EU Food Hygiene Regulations (Regulation (EC) No 853/2004 and Regulation (EC) No 854/2004). The former lays down the end product standards that bivalves must meet before being placed on the market for human consumption. Regulation (EC) No 854/2004 lays down the requirements for the competent authority, the Food Standards Agency, in terms of official controls on food of animal origin intended for human consumption. This includes the classification of sites for shellfish prior to harvesting for human consumption. Classification depends on the levels of microbiological contamination detected in flesh samples. There are three classes of site

- Class A – may be collected for direct human consumption
- Class B – for human consumption only after treatment in a purification centre or after relaying
- Class C – placed on the market only after relaying over a long period so as to meet the health standards

Regulation (EC) No 854/2004 also requires the FSA to monitor classified shellfish harvesting sites for a range of contaminants including e.coli, marine biotoxins, phytoplankton and chemical contaminants.

As laid down in Regulation (EC) 853/2004 and Regulation (EC) 558/2010 "*marine gastropods, should be excluded from provisions on the classification of production areas".* However, they still do need to meet the end-product requirements as set out by the EU Food Hygiene Regulations. Therefore all buyers of gastropods must be registered with Environmental Health so that the correct testing can be carried out prior to being sold to the public. The appropriate documentation is also required, stating the location of the area from which the animals were harvested.

Aside from the environmental health regulations, there is very little formal regulation of the intertidal zone. Whilst whelks and razor clams are protected by a minimum landing size as set out in Council Regulation 850/98, cockles, mussels and winkles have no EU MLS. In England, a number of the IFCA's have introduced MLS for these species as well as increasing the MLS set out by the EU for razor clams and whelks (Table11).

In addition to setting a MLS a number of the IFCA have put additional regulations on aspects of intertidal harvesting. In the jurisdiction of the Southern IFCA if raking for cockles the head width of the rake must not exceed 305mm, with spacing between the teeth of no less than 22.5mm. The Eastern IFCA has set up a similar bye-law for the Humber Estuary but with a tooth spacing of no less than 20mm. Within the Eastern IFCA and North Western IFCA boundaries, a permit is required to fish more than 5kg of cockles or mussels within a 24 hour period.

Some of the IFCA's also operate a closed season with the Southern IFCA having a closed season for periwinkle fishing between the 13th May and 15th September (inclusive) and the Eastern IFCA having a closed season for cockle harvesting in the Humber between 1st May and 31 August (inclusive).

Table 11 Minimum landing sizes as set out in Council Regulation 850/98 and those used by the English Inshore Fisheries and Conservation Authorities

Species	EU MLS (mm)	Eastern IFCA	North Western IFCA	Cornwall IFCA	Devon and Severn IFCA	Southern IFCA	Kent and Essex IFCA
Razor clam	100						
Cockles		If can pass through an opening 20mm^2 must be returned	If can pass through an opening 20mm^2 must be returned	If can pass through an opening 20mm^2 must be returned	If can pass through an opening 19mm^2 must be returned	If can pass through an opening 23.8mm^2 must be returned	
Mussels		51	45		50.8	50	50
Periwinkles				If can pass through an opening 16mm^2 must be returned	If can pass through an opening 16mm^2 must be returned		
Whelks	45						
Oyster					If can pass through an opening 57mm^2 must be returned	70	70

Current Management of Intertidal Harvesting in Northern Ireland

Prior to 2001 the Department of Agriculture and Rural Development did not have the power to regulate the intertidal area as it was not specified in the Fisheries Act 1966. The Fisheries (Amendment) Act (Northern Ireland) 2001 gave DARD powers to regulate fisheries up to the high water mark. Following this amendment the Strangford Lough (Prohibition of Fishing for Shellfish) Regulations (Northern Ireland) 2001 was created which prohibits the removal of shellfish "*from or by any means of any mechanically propelled vehicle*" within Strangford Lough. This therefore prohibits the use of tractor dredges for harvesting of cockles and the use of use of quad bikes or other mechanised transport for the removal of animals from the intertidal. Other than this, there is no fisheries legislation restricting intertidal harvesting.

The Department of the Environment have responsibility for the 'protection of the aquatic environment through the regulation of water quality, and the conservation of freshwater, marine flora, fauna, and hydrological processes. In performing this duty DOE is required to have regard to the needs of industry and agriculture, the protection of fisheries and the protection of public health'. The Marine Division monitors water quality and ensure compliance with the Shellfish Water Directive. In Northern Ireland the SWD is transposed into NI legislation through the Surface Waters (Shellfish) (Classification) (Amendment) Regulations (Northern Ireland) 2009.

Under Regulation (EC) No 854/2004 the Northern Ireland Food Standards Agency must classify sites where shellfish are harvested for human consumption. In Northern Ireland the primary indicator for classification of sites is the e-coli count (Table 12).

Under section 42 of the 1930 Belfast Corporation Act, all shellfish gathering is prohibited along shores of Belfast lough "*it shall not be lawful for any person to gather any shellfish from any part of the foreshore of that portion of Belfast Lough over the waters of which the Corporation have jurisdiction...".*

Table 12 E.Coli tolerances for the classification of shellfish waters in Northern Ireland (information from FSA)

Category	Result (Per 100g Flesh)	Action
A	<230 E.Coli/100g of flesh	May go directly for human consumption if end product standard met.
B	<4600 E.Coli/100g of flesh	Must be subject to purification, relaying in Class A area (to meet Category A requirements) or cooked by an approved method.
C	<46,000 E.Coli/100g of flesh	Must be subject to relaying for a period of at least 2 months or cooked by an approved method.
	>46,000 E.Coli/100g of flesh	Prohibited. Harvesting not permitted.

The Pacific oyster, which is a non-native species, was introduced into Strangford Lough in the 1970's when it was believed it would not be able to breed naturally due to unfavourable conditions. However, naturally settled Pacific oysters have been found around Northern Ireland, proof that the species is capable of reproducing in our waters. To prevent further spread of the Pacific oyster DARD have stipulated that all *C.* gigas used in aquaculture must be sterile. Whilst previously triploid animals were used, having the added advantage of faster growth in comparison to reproductive animals, it has been found that triploids may have the potential to become fertile and therefore their use poses a threat of further spread of the species. The impact of non-native and invasive species is also highlighted in conservation legislation such as the Habitats Directive and Wild Birds Directive as well as animal and plant health legislation.

Potential Regulatory Measures for Intertidal Harvesting

Table 13 summarises possible actions for the management of intertidal harvesting in Northern Ireland.

Table 13 Possible actions for the management of intertidal harvesting in Northern Ireland

Challenge	Resolution	Possible Action	Reasoning
Obligations to protect Marine Environment	Regulation of harvesting	A daily catch limit to distinguish between commercial as opposed to personal use	Currently there is no definition as to what is classified for personal use as opposed to what is for commercial use. Without this limit being established it will be almost impossible to police for illegal fishing as harvesters can state that it is for personal use. Whilst the common right to collect shellfish from the foreshore cannot be removed completely, it is important that commercial fishing, which has the potential to significantly affect an area, is regulated effectively.
Lack of data available	Information on scale of harvesting needed	Activity reports	Activity reports should be required from commercial harvesters so that there is a form of monitoring over the sector, providing DARD with information about the number of fishermen who harvest from the intertidal and where this takes place.
		Scale of harvesting examined	Currently no information is available on the effort placed on intertidal harvesting or the stocks which are exploited. A study should be carried out to estimate the levels of harvesting around Northern Ireland.
Sustainability of stocks	Protection of stock	Minimum landing size for periwinkles	Currently periwinkles, which are the most commonly harvested species from the intertidal zone, are not protected by a MLS in Northern Ireland. Whilst market demands directly affect the periwinkles lifted, some buyers may still buy undersized animals. Any undersized which are not bought are returned to the shore, or, on occasions, discarded. Setting a legal MLS would prevent buyers from being able to hold undersized specimens, which, in return, would stop harvesters collecting undersized animals. The animals can then be left on the shore to reproduce. Indeed in periwinkles, due to the trematode infection usually incurred by larger animals, it is the smaller animals which are the most fecund and so require protection.
Lack of focus on Inshore	Improved dissemination of information	Public education	The public should be educated on any new regulations and the impacts that intertidal harvesting can have on the environment. Such education may be in the form of a Code of Conduct which includes information on the impacts of harvesting, safety aspects of intertidal harvesting and knowledge of the GLA.

Sea Angling

Recreational sea angling (RSA) encompasses fishing from both the shore and boat using rod, line and hook. As highlighted by the Scottish Sea Angling Conservation Network, there are 5 main types of RSA's.

1. The competition angler who wants to catch plenty of fish
2. The pleasure angler who wants to catch fish but enjoys the other social benefits of angling
3. The species hunter who wants to record as many species as possible
4. The specimen hunter who wants to target specimen sized fish
5. The specialist who targets a particular species

Northern Ireland waters are extremely diverse, offering a wide range of fishing opportunities and in addition to species such as pollack, mackerel and wrasse they contain a large number of elasmobranchs species (sharks, skates and rays). The Sea Angling Ireland website (www.sea-angling-ireland.org) has highlighted a number of angling areas around the coast of Northern Ireland and the species that are expected to be caught in these areas (Table 14). However RSA are concerned that there is a decline in the number and species of fish available for them in comparison to historical catches. Indeed, in recent years the practice of angling from a boat has changed in response to decreases in the amount of fish being caught. Whilst previously when fishing from a boat, anglers tended to drift, they are now anchoring their boat and putting rubby dubby bait on the anchor, to increase the chances of catching a fish.

RSA's are principally of the mind of catch and release and therefore feel that they have minimal effects on fish stocks. Anglers believe that commercial fisheries are the biggest threat to fish stocks and the environment and that whilst fish are a shared resource, the needs of RSA remain somewhat forgotten during decision making.

Table 14 Areas highlighted by Sea Angling Ireland and the species expected to be caught

Area	Catch
Portrush Harbour	Small codling, coalfish
Blue Pool, Portrush	Coalfish, Pollock, wrasse
Skerries Rocks	Big Pollack, Ballan wrasse, codling
Dunseverick	Ballan wrasse, mackerel, large Pollock, big coalfish, conger eels
White Park Bay	Flounder, turbot
Ballintoy	Plaice, dabs, turbot, Ballan wrasse, mackerel, Pollack, coalfish, cod
Ballycastle	Pollack, Ballan wrasse, flounder, bass, small turbot, dabs, plaice, dogfish, whiting, codling, sea trout, coalfish
Torr Head	Tope, Pollack, coalfish, Ballan wrasse, mackerel
Layd Church	Cod, conger eel, dogfish, wrasse
Salmon Rock, Cushendun	Codling, flounder, whiting, plaice
Limerick Point	Codling
Glenarm	Plaice, coalfish, codling, dogfish, conger eels
Blackarch	Pollack, coalfish, conger eels, rock cod, Ballan wrasse, mackerel
Ballylumford Harbour	Wrasse, cod, whiting, haddock, dogfish, coalfish, Pollack, conger eel
Portmuck and Browns Bay	Pollack, wrasse, small coalfish, dogfish
Gobbins Cliffs	Wrasse, Pollack, mackerel
Blackhead Lighthouse	Ballan wrasse, dogfish, conger eel
Whitehead Promenade	Wrasse, cod, whiting, flounder, plaice, haddock, dogfish, Pollack, conger eel
Carrickfergus Harbour	Cod, whiting, flounder, haddock, dogfish, coalfish, conger eel, mullet
Bangor Pier	Large conger eel, wrasse, coalfish
Orlock Head	Mackerel, Pollack, coalfish, wrasse
Donaghadee Pier	Pollack, coalfish, wrasse, mackerel, whiting, coaly, dab, codling, rockling
Ballyhalbert Pier	Pollock, coalfish, whiting, rockling
Portavogie	Pollock, codling, rockling, coalfish
Portaferry	Dogfish, codling, mackerel, Pollock, coalfish, flatfish, tope
Ramore Head	Pollock, mackerel
Magilligan	Flounder, bass, dogfish
Roe Estuary	Flounder, silver eel

Elasmobranches

Northern Ireland waters host approximately 30 species of sharks, skates and rays which are highly valued by RSA (AFBI, 2009). Due to the late maturity, slow growth rate and slow recovery rate, elasmobranches are particularly vulnerable to overfishing. Whilst most elasmobranch species do not have a directed commercial fishery but are caught as bycatch, in Area VIIa there is a commercially important ray fishery prosecuted by vessels from Belgium, Ireland and the UK.

A report by the International Council for the Exploration of the Seas (ICES) in 2008 highlighted that there has been a general decline in the landings of skates and rays from the Celtic Sea with species such as the common skate (*Dipturus batis*) which had been widely distributed in the Irish Sea now being rarely found.

From the 2008 report ICES recommended a number of management plans which should be implemented for elasmobranches. For those species which do not have a targeted species but are primarily caught as by-catch and whose numbers is severely reduced (white skate and angel shark), they should not be landed but returned to sea as they have a high survival rate. For species which are still present but whose numbers are depleting, such as the common skate and undulate ray (both these species have been removed from the Irish Specimen List for conservation purposes), target fisheries for these species should not be permitted unless they are otherwise proved as being sustainable.

Whilst some elasmobranchs are in decline there has been an apparent increase in the number of certain species such as the dogfish. An examination of the number of specimen fish landed into Northern Ireland indicates a general increase in the numbers of Blackmouthed dogfish, Greater spotted dogfish, Lesser spotted dogfish and Spur dogfish (Table 15). For species which have been shown to be stable or increasing in number, whilst no management measures are necessary at this time, it is important that the distribution is monitored appropriately to prevent depletion of the stocks through over fishing.

In 1970 the Inland Fisheries Trust launched a marine sport fish tagging programme in Ireland. This was in response to a decline in a number of important elasmobranches species and it was believed that such a programme would put an end to the killing of fish by anglers and would instead encourage the practice of catch and release. Inshore Fisheries Ireland (previously The Central Fisheries Board) now runs the programme which is the second largest in the world (second to the USA). To encourage the tagging programme a Marine Sportsfish Tagging Programme Conservation Award is presented to the person who has tagged the most fish each year. To date approximately 43,000 fish have been tagged

with about 50 charter skippers and the same number of anglers taking part in the tagging programme in 2010. The blue shark represents 44% of the total number of fish tagged followed by the thornback ray (23%) and tope (15%) (Inland Fisheries Ireland, 2011).

Table 15 Irish Specimen fish caught in Northern Ireland

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ballan wrasse	1									4	0
Bass			2	0	1	2		1			
Blackmouthed Dogfish								3	16	14	28
Blonde Ray					1		6	3		3	1
Cod		1									
Conger eel									9	5	7
Cuckoo ray				2							
Cuckoo Wrasse	4	2	2	1	2	6	4	8	4	28	34
Dab	1						1				
Gilthead Bream										1	
Greater spotted Dogfish					1	1	1	9	13	10	7
Grey Gurnard						1					
Herring									3		
Homelyn Ray					1						
Lesser spotted Dogfish			1	4	4	3	5	7	5	4	19
Ling				1							
Plaice	2		1								
Pollack	2	1	4		2	4	11	5	2	1	2
Spur dogfish	5	26	13	15	28	16	34	55	86	59	83
Thick lipped Mullet							3	5	3	7	5
Three bearded rockling		1				2	4	2	1		
Tope	7	23			2	1	1	18	10	10	8
Trigger fish							1				
Turbot			1	1							

In Scotland the Scottish Sea Angling Conservation Network (SSACN) run a similar Shark Tagging Programme which in 2011 tagged almost 2,500 fish with almost 80% of this number being made up of tope, common skate and spurdog. The rate of recapture has given them an insight into the movements of species. For example the rate of recapture of common skate is 50.4% indicating that the common skate remains in the same area with little migration. However, tope tagged in the programme have been recaptured as far away as Portugal and Iceland (SSACN, 2011).

Socio-economics of recreational sea angling

Little is known about the value of RSA to the UK economy. A number of surveys have been carried out to estimate the economic value of RSA in England and Wales, however there is much disagreement in the figures presented. In 2000 a report prepared for the Welsh Assembly estimated that, in Wales, there was 12,000 local anglers and 28,000 visiting anglers (visitors are not necessarily people from outside of Wales, but may be people visiting the coastal area). The estimated expenditure was £28 million, £21.8 million of which came from visiting anglers.

In 2004 the Drew report estimated total expenditure of sea anglers in England and Wales to be worth £538 million annually with angling expenditure supporting over 18,500 jobs and providing £71 million in income to suppliers. It was also estimated that 1.1 million adults participated in RSA with an average spend per angling household of £489. In 2006 Nautilus Consultants estimated the annual expenditure per angling household at £1028. In 2005 Simpson and Mawle assessed the levels of participation in RSA and estimated that 3 million people over the age of 12 were active sea anglers.

Whilst there is a lot of variation in the figures estimated, what is clear is the significant economic value that RSA has to the UK economy and the support it provides to coastal areas and local businesses. In Northern Ireland it was estimated that in 2005, whilst game angling was the most popular form of angling, there were over 5,000 RSA with 2,923 anglers fishing from the sea and 2,138 fishing from shore. It was estimated that the spending of local sea anglers on expenses such as food, boat hire, travel costs etc was £1,459 per angler per year giving an estimated total expenditure of £7.4 million by local anglers. The report also estimated that in 2005 Northern Ireland hosted 450 visiting anglers for the sole reason of engaging in sea/shore angling (Pricewaterhousecoopers, 2007). Anglers believe that these numbers would increase significantly if fish stocks in Northern Ireland were returned to productive levels, encouraging visitors to come to the country.

Anglers believe that the value of fish changes depending on whether it is being targeted by RSA's or commercially with its value as a sports fish being much greater than its value as a commercial catch. For example, whilst sea bass is not commercially targeted in Northern Ireland, in terms of angling, sea bass is seen as one of the most prized fish. So whilst commercially it is worth only the value of the fish (between 2005 and 2009 this totalled at £2,141) recreationally it is worth a lot more in terms of tourism and the value anglers bring to local businesses, transport costs, bait purchase etc. In the USA, striped bass which is one of the most prized fish recreationally is believed to be up to 26 times more valuable as a sport fish than as a commercial catch (Southwick Associates Inc, 2005).

Alongside the economic benefits of angling are a number of other benefits both for the individual angler and the community as a whole. The ranges of health benefits from angling, in its role in reducing stress and as a form of relaxation are well reported. During the 2007 Pricewaterhousecoopers survey of Northern Ireland anglers the survey results showed that whilst for 51.8% of anglers the greatest thing about fishing was catching a fish, 21% undertook angling to relax, 7.3% undertook it as a healthy outdoor activity whilst 6% viewed it as a means of releasing stress. It is also a sport accessible to those with disabilities and has been shown to provide wide environmental, educational and social benefits.

Management throughout the UK and Ireland

As for commercial fishing, RSA's are regulated by EU minimum landing sizes (MLS) as set out in Council Regulation 850/98. In addition Bye-laws have been created by some of the English IFCA's to increase the MLS or place MLS on species not covered by the EU (Table 16).

In England, The Tope (Prohibition of Fishing) Order 2008, whilst only permitting fishing of tope by rod and line, prohibits the landing in England of tope caught by anglers thus enforcing a catch and release scheme. The Tope (Prohibition of Fishing) (Wales) Order 2008 sets out the same regulations for Wales.

In Scotland in 2012 the Scottish Government intends to introduce an Order which will protect 26 of Scotland's most vulnerable elasmobranches species. RSA will still be permitted to catch these species but only on the basis of catch and release.

In Ireland, sea bass are highly protected. The Bass Fishing Conservation S.I. No. 826 of 2007 sets a bag limit on anglers of 2 bass in any 24 hour period. The Bye-law also prohibits angling during 15th May and 15th June when the bass will be spawning. The Bass

(Restriction on Sale) Order S.I. No. 367 of 2007 prohibits any bass being sold or offered for sale. The Bass (Conservation of Stocks) Regulations S.I. No. 230 of 2006 prohibits any Irish sea-fishing vessel from fishing for. Landing, transhipping or having on board any sea bass. The regulations also set out a minimum landing size of 40cm.

In the EU a number of regulations have been established to improve the knowledge of both recreational and commercial fishing efforts. Under Council Regulation (EC) No 199/2008 the UK have an obligation to set up a programme to collect data on the biological, technical, environmental and socio-economics of all fishing, including recreational fishing.

Council Regulation (EC) No 1224/2009 states that "Member states shall ensure that recreational fisheries on their territory and in Community waters are conducted in a manner compatible with the objectives and rules of the common fisheries policy". The regulation also prohibits the marketing of catches from recreational fishing.

In order to meet the requirements set out by the EU, in England the MMO has set up Sea Angling 2012, based on the method used by the Marine Recreational Information Programme in America, to increase the scientific knowledge of fish stocks and to ensure that RSA are fully represented in future decision making. The MMO will use the Office for National Statistics (ONS) to carry out face to face interviews to estimate how many people are participating in RSA and how often. In addition, the MMO will survey charter boat owners to estimate the number of fishing trips as well as the catches being taken. The Centre for Environment, Fisheries and Aquaculture Science (Cefas) will work alongside the IFCA's to interview anglers on the shore and from private boats with emphasis on what they have caught (kept and released) and the size of the fish. Cefas will also carry out an online survey for anglers as well as examining the socio-economics of RSA. Speaking about Sea Angling 2012 the UK Fisheries Minister Richard Benyon said "*I want sea angling to have a bright future, but to achieve this we must understand what sea anglers are catching, what is being returned alive, and the economic and social benefits the sport provides. This is a chance for sea anglers to make sure their interests are taken into account when policies to improve and conserve fish stocks around our coast are developed*".

Table 16 EU and IFCA MLS

	EU MLS	Southern	North Western	North Eastern	Eastern	Kent and Essex	Sussex	Cornwall
Bass	36		36	36	36	36	36	**37.5**
Black sea bream			**23**					23
Blue ling	70		70		70			
Brill		**30**	**30**					**30**
cod	35		35	35	35	35	35	
Conger eel		**58**	**58**					**58**
Dab		**23**	**15**					**15**
Flounder		**27**	**25**					**25**
Grey Mullet		**30**	**20**			**30**		**20**
haddock	30		30	30	30	30		
Hake	27			27	27		27	**30**
herring	20		20	20	20	20	20	
Lemon sole		**25**	**25**					**25**
Ling	63		63	63	63		63	
Mackerel	20 (30 in North Sea)		20	30	30	20 (30 in North Sea)	20	
Megrim	20		20	20	20		20	**25**
Plaice	27		27	27	27	27	27	
Pollack	30		30	30	30		30	
Red mullet		**15**						**15**
Red sea bream			**25**					**25**
Saithe	35		35	35	35		35	
Shad		**30**						
Skates/rays		**40**						
Sole	24		24		24	24		
Turbot		**30**	**30**					**30**
Whiting	27		27	27	27	27	27	
Witch flounder		**28**	**28**					**28**

Management in Northern Ireland

Under the Fisheries Act (Northern Ireland) 1966 DARD were given the powers to promote sea angling and to '*take such other steps as appear to it appropriate to secure the furtherance and development of angling'*.

The Loughs Agency manages RSA within Carlingford Lough and Lough Foyle. The Loughs Agency is an agency of the Foyle, Carlingford and Irish Lights Commission which was established under agreement between the UK and Irish governments.

In Northern Ireland no license is required for sea angling unless fishing for salmon or sea trout when a game license is required by law for each rod used.

Following questions raised in the Inshore Fisheries Review, the Department of Agriculture and Rural Development issued a consultation on the proposed introduction of regulations for the protection and conservation of Sea Bass in 2010. Whilst Sea Bass is an important species commercially in England and Wales there is no commercial fishery for bass in Northern Ireland with total landings of bass between 2005 and 2009 only amounting to 403 kg with a value of £2,141. In addition, there is a considerable lack of information available on landings as there is no requirement for landings to be submitted to the extent of other fisheries.

Issues consulted on included

- A maximum of 2 bass retained per 24 hours
- A closed RSA period from 15 May to 15 June (inclusive) to protect spawning fish
- Prohibition on first sale of bass to prevent recreational and commercial fisheries developing a trade in Bass leading to increased landings
- A minimum landing size of 40cm
- Banning on fishing for bass by any means other than rod and line
- Ban on the retention of bass on board any UK sea fishing vessel within the Northern Ireland zone

Table 17 lists the general responses to the sea bass consultation.

Table 17 General responses received during the sea bass consultation

Proposal	Response	
	RSA	**Commercial**
Daily catch limit	Support	Either agreed or no comment made
Closed season	Few objections. Anglers felt a catch and release period more suitable. One suggestion was to add bass to the current inland angling license as game species which would create source of information of catches.	No views expressed
Prohibition on first sale	Anglers supported measure. Argued that sea bass is of much higher value as RSA fish.	Opposed as would increase discards and create an unnecessary new criminal offence.
MLS	Whilst most anglers supported this some felt the size should be further increased to 45-50cm.	Opposed
Ban on fishing other than by rod and line	Most agreed.	Commercial fishermen opposed this as should be allowance for by-catch
Ban on bass on board fishing vessel	Angler support.	Commercial fishermen opposed this as should be allowance for by-catch

Potential Regulatory measures for RSA

Table 18 summarises possible actions for the management of RSA in Northern Ireland.

Table 18 Potential actions for the management of RSA in Northern Ireland

Challenge	Resolution	Possible Action	Reasoning
Obligations to protect marine environment	Protection of marine environment	Development of a RSA Code of Conduct	A code of conduct could be developed to include environmental, safety, and sustainability measures such as bait collection, sustainable angling techniques and disposal of litter. The code should also include knowledge of commercial and recreational regulations including the MLS of fish as set out by the EU and the location of any protected sites or closed areas.
Lack of data available/ Spatial pressures	Improved knowledge of RSA	Interaction between RSA's, government and scientists	Little is actually known about RSA in Northern Ireland and the stocks which it exploits. The 2007 Inshore Fisheries review stated that "*the social and economic contribution of sea angling to Northern Ireland is not known and as a result, there is a lack of government support and investment in this sector. There is also a scarcity of data on sea angling in Northern Ireland".* Under EU regulations, DARD must provide data on RSA. Data needs to be collected on the species exploited and where they are fished. RSA's are keen for areas to be protected for the sole use of RSA. However, without any knowledge of RSA such an idea cannot be realised. It is important that RSA's work with Government and scientists to provide the information required to gain a better understanding. Without this information balanced management decisions cannot be made.
		Socio-economics studied	It is important that the value of RSA is known so that it can be managed accordingly. RSA in Northern Ireland is thought to be of already significant economic value with the possibility of further expansions brought about through appropriate management of stocks, input of resources and increased promotion, all of which would encourage new entrants to the sport, as well as increasing the number of tourists who come to Northern Ireland to participate in angling. RSA has the potential to significantly contribute to the Northern Ireland economy and this must not be ignored.
Sustainability	Protection of stocks	Sea Bass Regulations	Sea bass are seen as a prized fish amongst anglers and protection of the stock could lead to development of angling in Northern Ireland which would have

			economic benefits. Whilst proposed sea bass regulations were put out to consultation in 2010, as yet nothing has come from the proposed measures with RSA's wanting regulations based on the Irish system whereby no by-catch of bass is allowed, commercial fisherman are however opposed to this. There were areas where there was general agreement such as a bag limit of 2 bass per 24 hours and these could now be regulated on. In addition, increasing the MLS of bass, whilst opposed by commercial fishing, would provide increased protection to the stocks. Female bass mature at around 42cm (Pawson and Pickett, 1996), therefore the current MLS provides no protection for females to reach maturity and spawn and contribute to the stock.
		Artificial reefs	*"An artificial reef is a submerged structure deliberately constructed or placed on the seabed to emulate some functions of a natural reef such as protecting, regenerating, concentrating, and/or enhancing populations of living marine resources" (*London Convention and Protocol/UNEP (2009). Artificial reefs have the potential to improve stocks of fish in the area by providing protection from the environment and predators. In addition, the presence of artificial reefs prevents the use of certain types of commercial fishing gear, such as dredges, which may also help the sustainability of fish stocks.
	Improved knowledge of stocks	Elasombranchs tagging scheme	Tagging schemes in Ireland and Scotland have been successful in increasing the knowledge we have on fish stocks. Some Northern Ireland anglers already participate in this scheme. By running a similar scheme in Northern Ireland, it would provide data on the stocks around Northern Ireland. Providing the resources for the scheme would also show that RSA in Northern Ireland is not being ignored.
Lack of focus in inshore	Increased responsibility	Willingness to manage and promote Northern Ireland sea angling	Whilst the Loughs Agency have responsibility for the activities within Carlingford Lough and Lough Foyle, RSA's believe that DARD are not upholding their responsibility to protect and develop RSA around the rest of the Northern Ireland coast. Responsibility must be taken for sea angling in the areas outside of the Loughs Agency remit.

References

Adey, J.M., Atkinson, R.J.A., Smith, I.P., Tuck, I.D. Taylor, A.C. (2006) "The environmental impact of the Nephrops creel fishery". Final report to Scottish Natural Heritage 168pp.

AFBI (2009) "Position statement on sharks, skates and rays in Northern Ireland waters". Environment and Heritage Service Report BDU 2/66.

Ansell, A.D., Dao, J.C. and Mason, J. (1991) "Three European scallops: *Pecten maximus, Chlamys (Aequipecten) opercularis* and *C. (Chlamys) variai"*. In Shumway, S.E (1991) "Scallops: Biology, Ecology and Aquaculture". Developments in Aquaculture and Fisheries Science. Amsterdam, Elsevier 21: 715-738.

Beauchamp, K.A., and Growing, M.M. (1982) "A quantitative assessment of human trampling effects on a rocky intertidal community". *Marine Environmental Research*, 7, 279-283.

Beaumont, A. (2000). "Genetic considerations in transfers and introductions of scallops." *Aquaculture International,* 8, 493-512.

Boyes, S., Burdon, D. And Elliott, M. (2006) "Unlicensed Activities: a review to consider the threats to marine biodiversity. Building the evidence base for the Marine Bill". Department for Environment Food and Rural Affairs.

Briggs, R.P. (1984) "Description of the Northern Ireland scallop population from work carried out by DANI Fisheries Research Laboratory, Coleraine and elsewhere 1963-83". DANI Internal Report pp 35.

Briggs, R.P. (1992) "A study of the Northern Ireland fishery for *Pecten maximus* (L.) In Scallop Biology and culture". Selected papers from the 7th International Pectinid Workshop Shumway, S.E. and Sandifer, P.A. The World Aquaculture Society: 249-255.

Briggs, R.P. (1997) "The Dublin Bay Prawn". *Biologist*, 44(1), 246-248.

Briggs, R.P. (2000) "The great scallop: an endangered species". *Biologist*, 47(5), 260-264

Brosnan, D.M. (1993) "The effect of human trampling on biodiversity of rocky shores: monitoring and management strategies". Recent Advances in Marine Science and Technology 1992 pp333-341.

Brosnan, D.M and Crumrine, L.L. (1994) “Effects of human trampling on marine rocky shore communities”. *Journal of Experimental Marine Biology and Ecology*, 177, 79-97.

Cashmore, D. and Burton, C.A. (1998) “Feasibility study on the ongrowing potential for periwinkles (*Littorina littorea*)”. Seafish Report SR 483. 28 pages.

Centre for Marine and Coastal Studies (2002) “Burbo offshore wind farm: environmental impact assessment – technical report, marine ecology”. Report Produced for seascape Energy Limited 2694, 82pp.

Coffen-Smout, S.S. and Rees, E.I.S (1999) “Burrowing behaviour and dispersion of cockles *Cerastoderma edule* L. following simulated fishing disturbance”. *Fisheries Research*, 40, 65-72.

Cappell, R., Bannister, C. and Nimmo F. (2011) “Northern Ireland Brown Crab strategy”. Poseidon Aquatic Resource Management Ltd. Report 731-GBR/R/01/A.

Clarke, S and Tully, O. (2011) “BACI monitoring for the effects of hydraulic dredging for cockles on the intertidal benthic habitats of Dundalk Bay”.

Edwards, E (1979) “The edible crab and its fishery in British waters”. Fishing News Books Ltd.

Eno, N.C., MacDonald, D.S., Kinnear, J.A.M, Amos, C.S., Chapman, C.J., Clark, R.A., Bunker, F.St P.D., and Munro, C. (2001) “Effects of crustacean traps on benthic fauna”. *ICES Journal of Marine Science*, 58, 11-20.

Fowler, S.L. (1999) “Guidelines for managing the collection of bait and other shoreline animals within UK European marine sites”. English Nature (UK Marine SACs Project). 132 pages.

Franklin, A., Pickett, G.D. Holme, N.A. and Barrett, R.L. (1980) “Surveying stocks of scallops (*Pecten maximus*) and queens (*Chlamys opercularis*) with underwater television”. *Journal of the Marine Biological Association of the United Kingdom*, 60, 181-191.

Ghazanshahi, J., Huchel, T.D. and Devinney, J.S. (1983) “Alteration of Southern California rocky shore eco-systems by public and recreational use”. *Journal of Environmental Management*, 16, 379-394.

Gibson, R., Hextall, B. and Rogers, A. (2001) “Photographic guide to sea and shore life of Britain and North-west Europe”. Oxford University Press.

Hervas, A., Tully, O., Hickey, J., O'Keeffe, E and Kelly, E. (2008) "Assessment, monitoring and Management of the Dundalk Bay and Waterford Estuary Cockle (*Cerastoderma edule*) Fisheries in 2007". Fisheries Resource Series, No. 7 (2008), 38pp.

Holt, T.J., Rees, E.I., Hawkins, S.J., and Seed, R. (1998) "Biogenic Reefs (volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs". Scottish Association for Marine Science (UK Marine SACs Project) 170pp.

Inland Fisheries Ireland (2011) "Inaugural report 1st July 2010 to 31st December 2010". 108pp.

Jenkins, S.R., Lart, W., Vause, B.J. and Brand, A.R. (2003) "Seasonal swimming behaviour in the queen scallop (*Aequipecten opercularis*) and its effect on dredge fisheries". *Journal of Experimental Marine Biology and Ecology*, 289, 163-179.

Johnson, M.P., Portig, A., Smyth, D. And Roberts, D. (2008) "Unregulated harvesting of intertidal shellfish in Strangford Lough". Northern Ireland Environment Agency Research and Development Series No. 09/05.

Kelly, E., Tully, O., Lehane, B. And Breathnach, S. (2008) "The Shrimp (Palaemon serratus P.) Fishery: Analysis of the resource in 2003-2007". *Fisheries Resource Series*, Vol. 8, 48pp.

Kinnear, J.A.M., Barkel, P.J., Mojsiewicz, W.R., Chapman, C.J., Holbrow, A.J., Barnes, C., and Greathead, C.F.F. (1996) "Effects of Nephrops creels on the Environment". SOAEFD Marine Laboratory, Aberdeen.

Liddiard, M., Gladwin, D.J., Wege, D.C. and Nelson-Smith, A. (1989) "Impact of boulder turning on sheltered sea-shores". Report for the Nature Conservancy Council No 919. 17pp.

Liddle, M.J. (1975) "A selective review of the ecological effects of human trampling on natural ecosystems". *Biological Conservation*, 7, 17-36.

London Convention and Protocol/UNEP (2009). *London Convention and Protocol/UNEP Guidelines for the Placement of Artificial Reefs*. London, UK, 100 pp.

Marine Stewardship Council (2009) "Net Benefits: the first ten years of MSC certified sustainable fisheries". 37pp

Martel, A., Larrivée, D.H. and Himmelman, J.H. (1985) “Behaviour and timing of copulation and egg-laying in the neogastropod *Buccinum undatum* L.”. *Journal of Experimental Marine Biology and Ecology*, 96(1), 27-42

McKay, D.W. and Fowler, S.L. (1997) “Review of winkle, Littorina littorea, harvesting in Scotland”. Scottish Natural Heritage Review

McQuaid, N, Briggs, R.P. and Roberts, D. (2006) “Estimation of the size of onset of sexual maturity in *Nephrops norvegicus* (L).” *Fisheries Research*, 81, 26-36

OSPAR Commission (2009) “Background Document for Modiolus modiolus beds”. Biodiversity series. 28pp.

Pawson, M.G., Pickett, G.D. (1996) “The annual pattern of condition and maturity in bass (*Dicentrarchus labrax* L.) in waters around England and Wales”. *Journal of the Marine Biological Association of the United Kingdom*, 76, 107–125.

Pricewaterhousecoopers (2007) “The social and economic impact to Northern Ireland, and areas within the Loughs Agency, of recreational fisheries, angling and angling resources.” Department of Culture, Arts and Leisure, The Loughs Agency of the Foyle, Carlingford and Irish Lights Commission and the Northern Ireland Tourist Board.

Scottish Sea Angling Conservation Network (2011) “Scottish shark tagging programme.” Christmas Newsletter 2011.

Shields, M.A., Dillon, L.J., Woolf, D.K. and Ford, A.T. (2009) “Strategic priorities for assessing ecological impacts of marine renewable energy devices in the Pentland Firth (Scotland, UK)”. *Marine Policy*, 33, 635-642.

Simpson, D and Mawle, G.S. (2005) Public attitudes to angling 2005 Environmental Agency Report.

Smyth, D., Roberts, D. And Browne, L. (2009) “Impacts of unregulated harvesting on a recovering stock of native oysters (*Ostrea edulis*)”. *Marine Pollution Bulletin*, 58, 916-922.

Southwick Associates Inc. (2005) “The economics of recreational and commercial striped bass fishing”. 64pp.

Swarbrick, J. and Arkley, K. (2002) “The evaluation of ghost fishing preventers for shellfish traps, DEFRA commission MF0724 under the programme Impact of Fishing” Seafish report no. SR549, Sea Fish Industry Authority, Hull. 42pp G.B.

Taylor, H (1975) “The Lobster: its life cycle”. Sterling Publishing Co.

Winterbottom, P. (2011) “Towards a sustainable Queenie scallop fishery”. *Fish Skeet*, 18, 7-8.

Appendix 1. Recommendations from the 2005-2007 Review of Inshore Fisheries

Securing a sustainable inshore fishery

1. Government should urgently produce a strategy for inshore fisheries which would adopt an ecosystem-based approach. This should be developed and implemented with the fullest involvement of all stakeholders.
2. Any future inshore strategy must pro-actively promote and market the seafood produce of NI inshore waters, with the objective of improving quality, adding value to, and improving the profitability and sustainability of the sector.
3. Government should ensure that adequate resources are made available to implement the strategy effectively. This will include use of its own resources and finance obtained under the EU's European Fisheries Fund (EFF).
4. There should be an audit of data and research to identify gaps in our knowledge of inshore fisheries. DARD, together with marine scientists, should develop and implement a programme designed to address gaps in the knowledge base. Stakeholders should be involved as part of the data collection process.
5. This data stream should inform future management activities which may include stock enhancement and provide for sustainable harvesting plans.
6. There should be an audit of inshore fisheries legislation and a review of management practices should be undertaken in relation to compliance and the level of regulation and enforcement.
7. Full involvement of stakeholders in the development of local management plans (rolling over a 3-5 year cycle) to implement a strategy for inshore fisheries in Northern Ireland which should include clear and quantifiable objectives for development and sustainability.

Bivalve Molluscs

1. Sustainability and profitability
    - Sustainable growth should be encouraged and appropriate stock enhancement schemes should be introduced to increase shellfish stock and create new fishing opportunities. The sector should work closely with the competent authorities to agree suitable fishing areas and the management measures required to develop these opportunities to their full potential.

- The potential for new fisheries should be investigated and assistance should be provided through available fisheries funding mechanisms to carry out surveys, environmental assessments and pilot fishery projects.
- Fisheries policy makers should take account of the effects of wider fisheries policy in encouraging displacement of fishing activity into the shellfish mollusc sector and causing market distortion and over exploitation. Wider fisheries policy should not result, directly or indirectly, in unsustainable development in the inshore bivalve sector.
- Assistance should be made available, through appropriate funding mechanisms, to effectively market Northern Ireland produce in high value, premium markets.

2. Enforcement
   - The DARD fisheries inspectorate should work with local industry to develop intelligence that will enable action against illegal fishing activity to be targeted more effectively. The enforcement presence should be more active and visible in order to deter offenders and reassure local industry that action is being taken.
   - Whilst acknowledging progress towards a UK-wide system of administrative penalties, compliance with shellfish regulations should be improved through direct stakeholder involvement in inshore fisheries management and governance.
3. Water quality
   - All competent authorities must ensure that standards of water quality are maintained. Improvement of water quality should be a high priority.
4. Human health and fish health
   - The procedure for communicating toxin test results to the fishing industry should be reviewed to ensure that information is quickly distributed to the supply chain. Toxin test results must be made available in sufficient time to prevent shellfish being sold to consumers.
5. Government consultation
   - Consultation procedures for involving shellfish producers must be reviewed by government departments (especially the DOE and DARD) in order to ensure that producers are consulted at a sufficiently early stage in the process for their concerns to be adequately addressed.
   - FEPA regulations for disposal of shellfish waste should be reviewed to explore the possibility of a simpler regime that is proportionate to the size of the business involved.

Intertidal Fisheries

1. Data
    - Data should be collected to ascertain the extent of the existing fisheries.
    - Research should be carried out to improve understanding of the sustainability of individual fisheries.
    - An evaluation of the individual fisheries in terms of possible impacts on designations should take place.
2. Regulation and Rights
    - Develop a clear, shared understanding of existing rights.
    - Regulate all fisheries for the benefit of sustainability.
    - Introduce appropriate regulations in proportion to the extent of each fishery.
    - Any coastal authority formed under, for example ICZM, should address the needs of intertidal fisheries.
    - Evaluate the environmental impact of the key intertidal fisheries.
3. Licensing
    - Develop a licensing system to regulate intertidal fisheries.

Mariculture

1. Sustainability, profitability and development
    - The Strategy for Aquaculture in Northern Ireland should be completed to underpin future development and provide a framework for investment from public, private and EU sources.
    - Support should be given to assist the sector to maximise returns and add value through quality initiatives and traceability schemes and to target high value markets and products.
    - There should be promotion of developments in technology and diversification into new species, in particular development of the range of species and natural resources the coast has to offer e.g. seaweed, shellfish (e.g. urchins, periwinkles etc), on-shore hatcheries and off-shore aquaculture operations.
    - The efficiency and productivity of the finite mussel seed resource should be maximised through appropriate fishing, seed transportation and ongrowing practices.

2. Representation
   - Government should actively encourage and facilitate the sector to participate in a representative group, so that the views of the mariculture sector can better influence government policy.
   - There should be effective promotion of the mariculture industry and products to government and the public, ensuring recognition of the value of the sector in producing high quality, safe and wholesome seafood products.
   3. Fish health, human health and water quality
   - Enforcement of fish health regulations must continue to be given high priority and measures regularly reviewed.
   - The risks and consequences of disease, and regulations to protect against spread of disease, should be well publicised to those in the sector.

Pot Fisheries

1. Sustainability
   - Government should include support for ongoing funding for the v-notching scheme within the new European Fisheries Fund.
   - There should be government-funded research and monitoring schemes on crab and lobster fisheries to provide information and knowledge to assist with appropriate development of the sector (e.g. plotting of information on GIS to include areas fished, gear used and spawning grounds).
   - A voluntary code should be developed to define potting areas and improve communications with trawlers and scallop boats.
   - The Inshore Development and Management Group proposed in this report should consider the adoption of a relevant Code of Practice with certain other marine users to deal with issues which affect fish stocks (e.g. proposals for windfarms).
2. Legislation
   - There should be faster processing of relevant legislation, including finalisation of the 'Unlicensed Fishing for Crabs and Lobsters Regulations (NI) 2007' and new legislation in respect of v-notching to protect both male and female lobsters and ensure sustainability of stocks.
   - There is a need for more stringent enforcement to ensure quality and sustainability of stocks are maintained. New enforcement powers may be required.
   - Improved consultation with the potting sector is needed on environmental issues and other issues which affect fish stocks.

Sea Angling

1. Recognition of the value of sea angling
    - A study should be commissioned to investigate the value of sea angling to the Northern Ireland economy.
    - Government and private sector support should be encouraged to ensure suitable investment and promotion of sea angling that reflects its value to the NI economy.
    - Effective representation of sea angling in the development of government and local authority marine and coastal policies is recommended.
    - Government and private sector investment is needed to provide good access and infrastructure along the coast and at ports and harbours for shore, sea-based and disabled sea angling.
2. Stocks
    - Consideration must be given to the interests of sea angling in coastal and marine developments, to improve access and create an angling infrastructure.
    - There should be protection and management of specific areas for angling activity and nursery grounds, to improve the abundance and diversity of fish stocks.
    - Responsible angling practices should be encouraged through the promotion of a suitable Code of Practice which would provide guidance on stock conservation and the safeguarding of the environment.
    - Sea angling opportunities should be considered when developing multipurpose Marine Protected Areas (MPAs).

Northern Ireland Inshore Fisheries

Appendix 2 Monthly shellfish activity return

Serial Number

Port of landing

Month

Year

Name of vessel

PLN

1	2		3		4				5	6	7	8	9
Day	**Area (Rectangle) Sub Rectangle)**		**Gear pots (no)/nets (m)**		**Edible Crabs (kgs)**				**Lobster (Kgs)**	**Other (kgs)**	**S'ford Lough Y/N**	**Larne Lough Y/N**	**Rathlin Y/N (see notes)**
	Rect.	Sub Rect.	Total set	Total Hauled	Green	Brown	Velvet	Claws					
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
Monthly Total													

Submitted by: Name in BLOCK LETTERS

I have read the DATA Protection statement contained in the Notes for Guidance

Signed

Appendix 3 Species Biology

Homarus gammarus

Also known as the common lobster or European lobster, *Homarus gammarus* is a shelter seeking animal locally common around all coasts of Britain and to depths of about 50m (although they can be found deeper). Their distribution ranges from the Lofoten Islands to western Baltic, North Sea, English Channel, Atlantic and Mediterranean coasts of Europe, south to North-West Africa and east to the Black Sea (Gibson *et al*. 2001). Due to their aggressive and solitary behaviour lobster are rarely abundant. *H. gammarus* are variable in length with larger specimens reaching 500mm. The carapace of these animals is generally granular but lacking spines or ridges. The dorsal is dark blue-black often with paler yellow or orange spots ventrally. The claws on the first pair of legs are large and powerful, with the right claw being larger than the left and used for crushing whilst the left claw is much sharper and used for slicing. The sex of a lobster is determined by its first pair of swimmers (Figure A3.1). In males these are hard and grooved to pass sperm cells into the body whilst those of a female are soft and feathery (Taylor, 1975). Lobsters mature around 5-7 years with females being around 75-80mm in length and males slightly smaller.

Lobsters grow by moulting their shell in summer or early autumn. As they moult water is absorbed by the body tissues and this causes the lobster to swell and rupture its exoskeleton which allows further swelling to occur and the new exoskeleton to begin to harden. The lobster eats its old exoskeleton which provides some of the calcium needed for the new shell. During each moult the lobster can increase by 10-15% in length, however, the rate of moulting decreases with age. It is during moulting that the soft bodied female mates with a hard bodied male. The female can retain the male sperm for up to a year, until needed to fertilise the eggs. The eggs are extruded from the base of the second pair of walking legs along with a sticky substance which cements the eggs in place under her tail. At this stage the female is referred to as being ‘berried’ (figure A3.2). A female lobster may produce 10-15 thousand eggs. The eggs are carried by the female for 9-12 months during which they go through different phases. Initially, the eggs are dark green then black. As they ripen they will turn reddy-brown before turning paler with an ‘eyed’ appearance. Once the eggs are matured the female will release them in bursts each night. The larvae remain planktonic for 5-10 weeks and go through three moults before moving to the sea bed to begin their life as bottom dwellers.

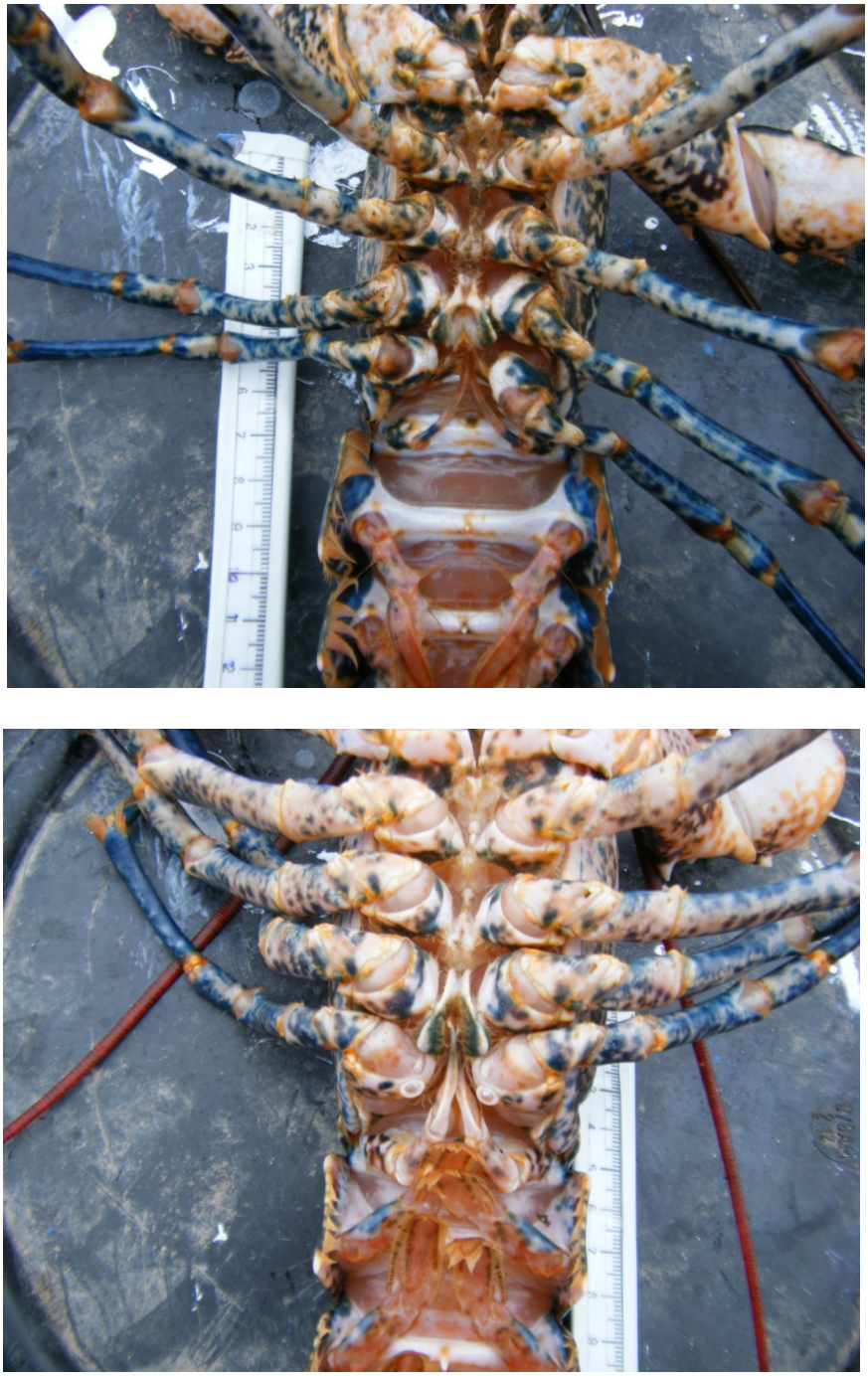


Figure A3.1 Female (top) and Male (bottom) lobster

Figure A3.2 Berried female lobster

Cancer pagurus

Cancer pagurus, commonly known as the brown crab or edible crab, has a heavy oval reddish-brown carapace. The margin of the carapace is distinctively crimped and is sometimes referred to as a 'piecrust'. The large claws are black tipped. Typically brown crabs are around 90mm in length and 150mm in width however they can grow up to 250mm. The sex of a brown crab is determined by the shape of the abdomen with males having a narrow pointed abdomen whilst females have a broad and bee-hived shaped abdomen for carrying eggs (figure A3.3). Males (or cocks) are generally larger than females (or hens). Males tend to mature around 110mm (5 years old) whilst females mature at 127mm in carapace width (Edwards, 1979). Growth is brought about by moulting. A study investigating the increase in size after moulting found that, in females moulting increased the

carapace width by 15-25% whilst in males the increase was between 9-23% (Edwards, 1979).

Brown crab are found throughout Western Europe from Norway southwards, in the Mediterranean and south to West Africa (Gibson *et al*. 2001). Adults can live at depths of 6-200m, typically on rock but also on mixed coarse ground and sand. The brown crab is thought to undergo extensive seasonal migrations associated with reproduction, with large males moving the greatest distances.

In late spring females move inshore in order to moult. Shortly afterwards copulation occurs. In late summer the females move offshore again, storing the sperm until winter when the eggs are fertilised. Eggs are carried under the abdomen. Whilst berried, females remain in pits or under rocks and do not feed so are less likely to be caught by pots. Six to nine months after copulation (late spring/early summer) larvae are released into the water column were they remain in the plankton for 2 months. Juveniles then settle in the intertidal zone in late summer/early autumn where they remain for up to 3 years before migrating to subtidal areas at approximately 60-70mm.

(a)

(b)

Figure A3.3 Examples of a male (a) and female (b) brown crab. Males have a narrow pointed abdomen whilst females have a broad and bee-hived shaped abdomen

Necora puber

Commonly known as the velvet crab, this crab has quite a flat carapace and is much smaller than *Cancer pagurus* with an average length of 50-65mm and width of 60-70mm. Females tend to be smaller presumably due to the energy used for egg production instead of growth. At either side of its distinctive red eyes are 5 anterior pointing teeth and between the eyes are up to 10 unequal teeth. The dorsal surface of the crab is blue but is masked by a brown velvety texture with red prominences. The hind legs have sections which are flattened, fringed with hairs and oval in shape for swimming. This species is fast moving and can also be quite aggressive explaining the alternative name of "Devil crab".

Velvet crabs can be found on rocky shores but are most abundant sublittoraly to depths of 80m where they feed on both animal and plant material. Their distribution extends from west Norway to North Sea, English Channel, Atlantic, Mediterranean and Black Sea coats of Europe south to West Africa (Gibson *et al*. 2001). As with *Cancer pagurus* the sex of the animal can be determined by the shape of the abdomen. Velvet crabs reach maturity at around 40mm carapace width (around 1-2 years of age). Growth is by moulting with males moulting in April-July, whilst females tend to moult from May-August. Unlike brown crab, velvet crabs are thought to remain in the same area, not undergoing migrations.

Palaemon serratus

Palaemon prawns are commonly referred to as shrimp due to their small size. Under the Food labelling Regulations 1996 any species of Palaemonidae which, when cooked, has a count less than 1,323 per kg can be described as prawn or shrimp.

Palaemon serratus is found all around the British Isles and Ireland from the intertidal to depths of 40m. *P. serratus* has a cylindrical body of which the head and thorax are protected by a thin carapace which is drawn in to an upturned rostrum between the eyes. The rostrum has 6 or 7 teeth along its dorsal surface and 4 or 5 on its ventral surface. This species is translucent with reddish lines on the carapace and abdomen. *P. serratus* can reach up to 100mm in length although they are generally less than this. *P. serratus* has a short life span of approximately 2 years.

P. serratus have separate sexes with males being smaller than females. Reproduction occurs between October and December when the female releases eggs. Fertilisation occurs as the eggs leave the female. The female then carries the eggs attached to hairs on her pleopods for around 4 months before hatching in April. After hatching the larvae are carried

in the currents before settling in July or August. These young shrimp have a rapid growth rate and by October of their first year they have reached a length of approximately 5cm (Kelly *et al*. 2008). By this stage they are of a size which will be landed in the fishery.

Buccinum undatum

Also known as a Buckies or the common whelk, Buccinum undatum is common around Britain and Ireland. Buckies have a large (up to 10 cm), sturdy shell with coarse undulating ribs crossed by spiral ridges. The shell consists of 7-8 whorls with the body whorl the largest, making up most of the shell length. The aperture of the shell is oval with flared edges and a short siphonal canal.

Buckies are found on muddy sand, gravel or sometimes rock from the low water to depths of greater than 1000m. Whelks are active predators feeding on worms or bivalve molluscs.

Whelks live to 10-15 years, reaching sexual maturity at around 7 years old. Females attract males by releasing pheromones into the water. The timing of this differs between areas. Males deposit spermatozoa into the female's bursa and this is transferred to the seminal receptacle where it may be stored for up to 8 weeks (Martel *et al.* 1985). Due to this storage of sperm, the eggs may be fertilised by different males. Eggs are laid on hard substrata with juveniles emerging after 3-5 months.

Nephrops norvegicus

Commonly referred to as the Dublin Bay Prawn in Ireland and Langoustine in the Mediterranean, the term *Nephrops* can be translated as 'kidney eye'. *N. norvegicus* is pale orange in colour and may grow up to 240mm long. The rostrum at the front of the carapace is long whilst at the rear of the abdomen, the uropods and telson form a broad flattened tail fan, the posterior margins of which are covered with dense short bristles.

N. norvegicus is distributed from the Mediterranean and Morocco northwards to Atlantic, English Channel, and North Sea coasts of Europe, Norway and Iceland (Gibson *et al*. 2001). They are entirely sublittoral living in soft sediments such as fine and silty mud, at depths of 14-800m (Briggs, 1997) and inhabit burrows, only emerging to feed or mate, usually at dawn and dusk.

Mating and molting generally occur in Spring, with females reaching maturity at around 21mm carapace length and males being around 15mm carapace length (McQuaid *et al.* 2006). Eggs are usually extruded in summer hatching in late winter/early spring.

Pecten maximus/Aequipecten opercularis

The King scallop (*Pecten maximus*) is a large, long lived bivalve which can commonly grow to 150mm or more (Ansell *et al.,* 1991). The shell is unequivalve with the right valve being convex whilst the left is flat. Both shells are externally ridged with up to 17 thick rounded ribs. The umbones on the midline are flanked on either side by similar sized large and flat ears. The King scallop is entirely sublittoral living on fine sand and gravel. If disturbed the King scallop can jump or swim, but these movements are localised with no great distance being travelled. This lack of significant movement is apparent by looking at the shell of the scallop which generally matches the colour of the environment it is living. Scallops recess into the substrate with the upper flat valve level with the seabed. This can prove a catchability issue within the fishery. In some cases a ground may appear barren in one month yet prove good fishing the next month. This is not due to movement of scallops from one area to another, but rather due to the recessing of the scallops deeper into the substrate. Through underwater video footage it is estimated that the normal density of King scallops is $0.2/m^2$ (Franklin *et al.* 1980).

The Queen scallop (*Aequipecten opercularis*) is smaller than the King Scallop, growing up to 90mm in length. It also has a much shorter life span. Both shells of the Queen scallop are convex, although the left valve is more curved. The colour of the shell varies, but tends to be shades of yellow, orange or red which are sometimes mottled. Both shells are marked with about 20 radiating ridges and corrugated concentric groves which leave the margins of the shell crenulated. The shell hinge has ears with the anterior ear more pronounced than the posterior ear. The Queen scallop occurs on substrates similar to that of the King scallop but as it does not recess into the seabed it can also live on harder substrates. Queen scallops can swim much more actively than King scallops. Both species of scallop can live to depths of 180m but are more abundant in depths of 18-46m.

Whilst King scallops become sexually mature at 2-3 years of age, Queen scallops mature earlier at around 1-2 years. Scallops display partial spawning in April/May with further spawning in late August. When one individual spawns, some of the eggs which are released are filter fed out by its neighbour. The pheromones contained in the eggs then cause the neighbour to release its eggs and so on. Therefore in low density populations it is possible

that there is a spawning stock but no reproduction due to a phenomenon known as the Allee effect i.e. there are too few individuals around to come in to contact for fertilisation. Scallops are hermaphrodite having both female (orange or red part) and male (creamy white part) which together form the roe. As they are hermaphrodite they have the potential to self-fertilise. However, if this occurs the progeny may be less viable than if the eggs had been fertilised by a different scallop. Fertilisation produces veliger larvae which live in the plankton. It is estimated that the survival rate of scallops during the larval stage is only 0.1%. After 3-4 weeks the larvae settle onto other sessile organisms such as bryozoans using byssus threads before developing in to a small scallop. After a while the byssus threads break down and the scallop can join the adult scallop population (Briggs, 2000). In colder years, the growth of the larvae is much slower and so they remain in the plankton for longer. The longer the larvae remain in the plankton the further they are carried away from the broodstock and suitable attachment substrates. This may mean that after colder periods recruitment is reduced as the larvae are lost out of the system.

Cerastoderma edule

Cerastoderma edule also known as the common cockle is a bivalve with a thick oval equivalve shell reaching lengths of up to 5cm. The shell, which is off-white, yellow or brown, has 22-28 radiating ribs crossed by concentric ridges. Also, due to reduced growth throughout the winter, prominent growth lines on the shell can be used for aging. The inner shell is dull white with a brown or purple stain about the posterior adductor muscle scar. This species is abundant around the British and Irish coasts and lives in clean sand, muddy sand, mud or muddy gravel from the middle intertidal to lower intertidal and sometimes subtidal. Although they burrow into the substrate (to about 5cm) cockles are easily dislodged by storms and can be washed away during gales thus leading to high winter mortalities.

Cockles display rapid growth during the first 2 years, with both males and females reaching maturity at around 18 months, when they are 15-20mm. Gametogenesis is initiated in the winter and increases rapidly throughout the spring. From March-August cockles spawn in a short peak (some may have more protracted spawning) leading to a peak in spatfall from May to September. Recruitment is extremely sporadic, however, it is much higher after a severe winter when the adult population has declined and there is a lesser chance of being inhaled by the adults as well as less competition for food and space.