

**The oceans** of the world cover approx 70% of the earth surface. As a result they play a huge part in maintaining the global ecosystem. In fact over 51% of the earth is covered by seas deeper than 3000m, meaning that most of the planet is dominated by deep sea life, about which we know relatively little (World Conservation Monitoring Centre, 1992, in Costello, 2000). More is known in fact about the surface of the moon than about the earth's deep seabed.



**Figure 1 Dahlia Anemone**

In shallow waters, light is abundant and the temperature is relatively warm giving rise to high productivity and abundant life forms. As you go deeper, the water pressure increases, the temperature drops and the light gradually fades away to total darkness, allowing for a wide spectrum of different marine habitats from the shallow waters to the deep seabed. Biodiversity doesn't necessarily drop off with the light and temperature as you might expect in deeper waters. In fact, many species have adapted to live in these harsher physical conditions such as the deep water corals recently discovered off the west coast of Ireland.

Hugely contrasting habitats can be found in high-energy marine environments compared to low energy environments. High-energy habitats are commonplace along the Atlantic coast, especially along the north-west coast where ocean currents are particularly strong. Species adapted to live in these sorts of environments are bigger and stronger than species in calmer waters, as they need to either hang on or swim against the currents to stay in one area. Often these areas are home to up welling of deeper waters, which brings nutrients from the seabed. This increases the productivity of the area, and where productivity is high biodiversity is often high too. In low energy, calmer waters, there is more sediment and sand and so you find burrowing animals and in general smaller weaker swimmers.



**Figure 2 Dead Man's Fingers**

# THREATS TO OUR MARINE BIODIVERSITY

Threats to marine biodiversity fall into three categories:

1. Increased pressures
2. Untapped resources
3. Knowledge base

## Increased pressures

Human activity now affects all parts of every ocean and as a consequence there is now widespread pollution in our seas.

*"Degradation of the marine environment can result from a wide range of sources. Land-based sources contribute 70 per cent of marine pollution, while maritime transport and dumping-at-sea activities contribute 10 per cent each. The contaminants that pose the greatest threat to the marine environment are, in variable order of importance and depending on differing national or regional situations, sewage, nutrients, synthetic organic compounds, sediments, litter and plastics, metals, radionuclides, oil/hydrocarbons and polycyclic aromatic hydrocarbons (PAHs). Many of the polluting substances originating from land-based sources are of particular concern to the marine environment since they exhibit at the same time toxicity, persistence and bioaccumulation in the food chain. There is currently no global scheme to address marine pollution from land-based sources" Agenda 21.*



**Figure 3 Dog Whelk**

Tributyltin (TBT) is a chemical that is acutely toxic to many species of marine animals. For this reason, it effectively inhibits the growth of marine organisms when used in marine paints (e.g., on boat hulls) and in other "antifoulants."

TBT is also known to effect the sexuality and reproductive ability of Dog whelks in Irish waters (Minchin et al 1995). However, because of concern about the adverse effects on marine life of TBT leaching from treated surfaces, TBT was banned in Ireland from use on all nets, structures, and vessels of <25 m in April 1987. Subsequent studies on Dog whelks in Ireland have shown a marked population recovery in areas where levels of TBT has been reduced (Minchin et al 1995).

Pollution can lead to contamination in human food supplies. Over-fishing and over harvesting are putting increased pressure on marine biodiversity and as a result of international fishing practices alien (exotic) species have been introduced to our seas and are competing strongly with our endemic species. Ships that have taken on ballast water in foreign ports can unknowingly carry with this water species local to that area. When these ships release this water in Irish ports, the marine creatures (now considered exotic or alien species) are also released into Irish waters. In many cases these creatures are unable to live in the different environment, but occasionally they do survive and go on to compete aggressively with the local wildlife. A prime example is that of the Zebra Mussel which is now a pest species in Ireland. The zebra mussel (*Dreissena polymorpha*) is an aquatic nuisance species that invaded Ireland around 1994 and is thought to have come to Ireland from Britain (Pollux 2003).

Increased exploitation of offshore and deep-sea resources also continues to put pressure on marine biodiversity.

## Untapped resources

With so little known about our seas, they are still a vastly untapped resource for biotechnology applications and aquaculture. Ireland has 220 million acres of territorial seafloor, a natural resource that is approximately ten times the size of Ireland's land area.

## Knowledge Base

Our marine environment is less studied than our terrestrial environment as a result of it being less accessible. As a result it is less well understood by the wider public. Many species are still undescribed in Irish seas and only very recently has the seabed been accurately mapped (INFOMAR/ Irish National Seabed Survey: <http://www.gsiseabed.ie/>)



## FISHING

One of the main pressures on marine biodiversity is the threat from over-fishing. Recent reports have expressed concern that 25 out of the 56 fish stocks in Irish waters that are currently fished, are over exploited and in decline.(source??)

The International Council for the Exploration of the Sea (ICES) has divided international waters into fishing sub-areas. ICES sub-areas VI and VII cover the Celtic seas; the Irish Sea, West of Ireland and western Scotland. There are two distinct types of marine ecosystem in the Celtic seas; shelf seas and deep water communities.

### Shelf seas

In the shelf areas there are important commercial fisheries for Nephrops, cod, haddock and whiting and a number of flatfish species. Hake and angler fish are also fished across the whole area. The Rockall plateau is subject to a haddock and small-scale Nephrops fishery. Commercial fisheries for, cod, plaice and sole are conducted in the Irish Sea. The whole area is also characterised as a spawning area for a number of key wide ranging, migratory species, notably mackerel, horse mackerel and blue whiting. These species are also commercially exploited within the area. Key pelagic species are herring, considered as consisting of a number of different stocks, as well as sardine, in the southern part of the area, and sprat, particularly in the Celtic Sea proper. The area also accommodates considerable stocks of argentinines (two species) along the shelf break.

The shelf slope (500-1800m) comprises a quite different species assemblage including roundnose grenadier, black scabbard fish, blue ling and orange roughy as well as deep sea squalids (sharks) and macrouridae. For the most part none of these species are subject to stock assessment, although some are likely to have been severely depleted by the deep water fisheries carried out in this area. A notable example would be orange roughy, which has probably been largely fished out. All these fish are characterised as being long lived, slow growing and having a low fecundity (reproductive capacity), making them very vulnerable to overfishing. (ICES advice 2007).

### Deep water communities

The diversity of deep-sea life history strategies is considerable, but many species of fish targeted by fisheries and their communities are particularly vulnerable to disturbance because they grow slowly, mature late in life, and form aggregations easily accessible to fisheries. Recovery rates are much slower than in shallower waters. Examples are the archetypal long-lived fish species orange roughy and grenadiers, but also vulnerable benthic species such as cold-water corals that form important habitats for many fishes.

See [www.bim.ie](http://www.bim.ie) for more information on fisheries in Ireland

### Fish stocks in danger

Over the years carious species of fish have come into the media as being in danger of over fishing. Cod (*Gadus morhua*) is one of these. The Marine Institute Fishery Sciences Service produce the Stock Book each year to provide the latest impartial scientific advice on the commercially exploited fish stocks of interest to Ireland. For 2007 they advise that Irish seas stocks of cod are in imminent danger of collapse. Failure to reduce fishing mortality to zero will result in a prolonged rebuilding phase and a high risk that the stock will not recover. In 2004 the EC implemented a recovery plan for this stock (EC Reg. No 423/2004), however this has not affected an increase in Spawning Stock Biomass (SSB) or a reduction in fishing mortality. The main reason for this is continued under-reporting of catches. The zero catch advice needs to be accompanied by strong control and enforcement.



Figure 4 Cod





Cod are distinctive by their orange spots and barbell under their chin as in this photo taken on the wreck of a mine-sweeper at Fethard-on-Sea, Co. Wexford (Justine Cavanagh 2005).

## Sustainable fishing measures

Fish stocks are managed by restricting the type of fishing nets and equipment that can be used, the areas that can be fished, the sizes and weight of fish that can be caught and the number of days that can be spent at sea fishing for each different fish. These measures help ensure that juvenile fish are not caught so they have the chance to reach sexual maturity, spawn and maintain their population size.



Commercial sea fishing is regulated by the Fisheries Acts, 1959 to 2006

With regards to work on the interactions between fisheries and other marine mammals, BIM and the industry have been actively working, since 1998, to develop new techniques to catch tuna while preventing any incidences of cetacean bycatch. From this work it was noted that by making simple adjustments to certain fishing practices, catches of dolphins in the tuna nets could be prevented. Such practices include only having vessel lights showing while towing a net; abstaining from fishing the period 1 hour either side of dusk, when cetaceans are actively feeding; avoiding towing in areas where cetaceans are seen during the day or fishing in waters of 500m depth or more. All vessels involved in

the tuna fishery are strongly urged to follow these guidelines.

To complement these practices BIM has now developed a practical underwater acoustic alarm system (pinger) to reduce cetacean by-catch further. This alarm system deters cetaceans from entering the mouth of nets, by emitting a loud sound, during periods when their capture is believed to be at highest risk. (Source: [www.bim.ie](http://www.bim.ie))

## INTERESTING SPECIES IN OUR SEAS

### Deep sea corals

Believe it or not, Ireland actually has its own coral reefs. They are not as accessible as tropical coral reefs because they are in very deep water, but they have a similar biology and richness of marine life. These coral reefs off the west coast of Ireland are formed by two coral species, *Lophelia pertusa* and *Madrepora oculata*, which occur in between tubes of the worm *Eunice norvegicus*. (Ecoserve 1998)

The same theory used to estimate the rate of extinction in tropical rain forests suggest that 1,000 of the described marine species and 60,000 including undescribed species, have gone extinct due to the destruction of 5% of the world's coral reefs (Carlton et al 1999).

### Marine mammals and sharks

A huge variety of marine mammals and sharks are frequently spotted around the Irish coast. For example the Irish Whale and Dolphin group reported 6 sightings of killer whales in 2006 alone. The animals that are actually seen and reported to be seen only constitute a fraction of the numbers that are actually swimming in our waters. Take a look at the Irish Whale and Dolphin Group webpage: [www.iwdg.ie](http://www.iwdg.ie) to see what has been spotted near you lately.

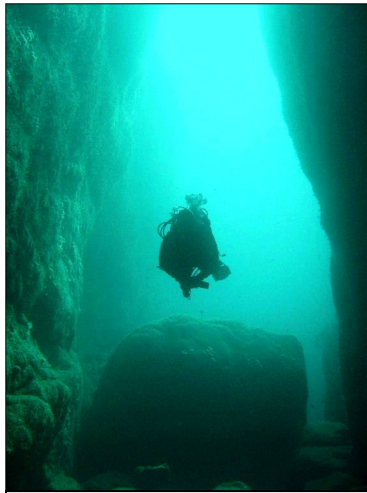
Irish waters are among Europe's richest for cetacean (dolphins and whales), with an impressive 24 species recorded to date. Fin whales and humpback whales have made their debut appearance in Irish waters off Co. Cork in recent years. In 1991 the Irish government accepted an IWDG proposal, declaring Ireland a whale and dolphin sanctuary- the first of its kind in Europe. Whalewatching is one of the fastest growing tourism industries in the world and the potential in Ireland is considered hugely under-developed.



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Whalewatching is one of the most rapidly expanding tourism products in the world and Ireland with its rich diversity and great abundance of whales and dolphins is well placed to exploit this new tourism product. Whalewatching can bring economic benefits to coastal communities and can enhance the conservation status and public awareness of whales and dolphins.

## THE SEA AS A SOURCE OF RECREATION



**Figure 5 Diver swimming between jewel anemone**

Diving in Ireland is becoming an increasingly popular sport. In fact most Irish divers will agree that cold water diving can be significantly more rewarding and exhilarating than warm water diving abroad. This is due to the sheer abundance of life forms to be seen underwater here. Ireland's coast have so much to offer, from stunning anemone encrusted sheer walls off Tory island, Co. Donegal<sup>1</sup> to WWII U-boat submarines of the coast of Cork and everything in between. Diving is the perfect way to get to know our underwater heritage first hand and to really appreciate what an incredible resource we have. Jewel anemones<sup>2</sup>, nudibranchs, sponges and multi coloured wrasse<sup>3</sup> are among the many interesting creatures that make up our marine biodiversity.



**Figure 6 Cuckoo wrasse**

## RESEARCH

The Marine Institute is at the forefront of marine research in Ireland and carries out a wide range of surveys, from fisheries surveys which play a key role in the management and understanding of fish stocks, to the Irish National Seabed Survey project (in conjunction with the Geological Survey of Ireland), mapping the Irish seafloor to better understand the marine resource. See [www.marine.ie](http://www.marine.ie) for more information.

Infomar (a successor to the Irish national Sea bed Survey) is a multimillion European initiative supported by the Irish government involving the Marine Institute, the GSI and the Irish national Seabed Survey. The survey aims to map Ireland's 220 million acres of territorial seafloor, a natural resource that is approximately ten times the size of Ireland's land area.

As part of this project, the marine Institute are producing comprehensive charts and three-dimensional images using multi-beam sonar technology. Under the direction of the GSI, by end 2005, Marine Institute research vessels had surveyed a total of 38,659km<sup>2</sup>. Total mapping coverage of the Irish National Seabed Survey to date is 468,500km<sup>2</sup>, accounting for 87% of the total Irish territorial seafloor.

The Marine Institute operates two purpose built research vessels, the *RV Celtic Explorer* and the *RV Celtic Voyager*. Both vessels are fully equipped with state-of-the-art scientific instrumentation, laboratories and IT equipment and are used for a variety of applications including fisheries research, environmental monitoring, seabed mapping, oceanology, seismic surveys, student training and meteorological investigations.

<sup>1</sup> Diver swimming between jewel anemone encrusted walls on Tory Island, Co. Donegal. Kieran Boyce 2004

<sup>2</sup> Jewel anemones. Co. Donegal. Justine Cavanagh 2004

<sup>3</sup> Cuckoo wrasse. Kieran Boyce 2004



## LEGISLATION

### International

#### Agenda 21

Agenda 21 is a comprehensive global plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.

Chapter 17 deals with the protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources.



**Figure 7 Lobster**

#### United Nations Convention on the Law of the Sea

This piece of legislation provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources. This requires new approaches to marine and coastal area management and development, at the national, sub-regional, regional and global levels, approaches that are integrated in content and are precautionary and anticipatory in ambit, as reflected in several programme areas including Marine environmental protection.

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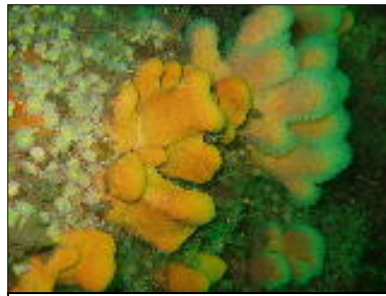


## LINKS

[www.marine.ie](http://www.marine.ie)

[www.bim.ie](http://www.bim.ie)

[www.iwdg.ie](http://www.iwdg.ie)



**Figure 9 Dead Man's Fingers**



**Figure 8 Crayfish**

## SOME RECOMMENDED READING

### Cetaceans

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