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Biological diversity of cetaceans (whales, dolphins and porpoises) in Irish waters.

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Irish waters are some of the most important in Europe for a wide range of cetacean (whales, dolphins and porpoise) species. Historically whales were hunted in Ireland (Fairley, 1981) but now they are all protected under a wide range of national and EU legislation. However due to a lack of information on the basic ecology and habitat requirements of most species, this important element of Irelands' fauna is rarely acknowledged in nature conservation and management in Ireland.

This paper reviews the biodiversity of marine mammals in Irish waters and briefly discusses issues which may impact on this biodiversity, including actions that will improve our ability to protect the great abundance and diversity of cetaceans around the island of Ireland.

Diversity of cetaceans around Ireland

To date 24 cetacean species have been recorded in Irish waters. Twenty-one of these have been reported washed up or stranded (Berrow and Rogan, 1997) and three species have been observed (Evans, 1980). One species, the false killer whale *Pseudorca crassidens*, was only positively confirmed as occurring in Irish waters this summer (O. Kiely, pers. comm.) although bones suspected to be from this species have been reported from Counties Mayo and Kerry (Berrow and Rogan, 1997).

The biodiversity of marine mammals in Irish waters compares very favourably with terrestrial mammals. Table 1 lists the number of species occurring in each group. Of the 31 species of terrestrial mammals recorded in Ireland 8 (25%) are thought to be introduced, leaving 22 native species. This compares to 27 native species of marine mammal (24 cetacea and 3 pinnipeds). Parturition in Irish waters has been confirmed for a number of cetacean species including harbour porpoise *Phocoena phocoena*, common *Delphinus delphis*, bottlenose *Tursiops truncatus*, Risso's *Grampus griseus*, white-sided *Lagenorhynchus acutus* and white-beaked *L. albirostris* dolphins and pilot whale *Globiocephala melas* while other species such as bottlenosed *Hyperoodon ampullatus* and minke whale *Balaenoptera acutorostrata* until are also suspected of breeding. Many species are not breeding in Irish waters but migrate annually along the western seaboard, including blue *Balaenoptera musculus*, fin *B. physalus*, humpback whale *Megaptera novaegliana*, while others such as beluga *Delphinapterus leucas* are vagrants on the edge of their range in the Northeast Atlantic and only occur infrequently.

Habitat requirements

The high biodiversity of cetacean species in Ireland reflects the high diversity of marine habitats. Although the habitat requirements of nearly all species are not properly known, there is some information available on distribution.

Table 1. List of terrestrial and marine mammal species recorded in Ireland.

Order	Species	Native	Introduced	Non-breeding
Terrestrial				
Insectivora	2	2	0	0
Chiroptera	9	9	0	0
Lagomorpha	3	1	2 (Rabbit, Brown hare)	0
Rodentia	7	4	2 (Grey squirrel, bank vole)	1 (Black rat)
Carnivora	6	5	1 (mink)	0
Artiodactyla	4	1	3 (Sika deer, fallow deer, feral goat)	0
Marine				
Pinnipedia	3	2	0	1 (Walrus)
Cetacea	24	11	0	13 (Right, humpback, fin, blue, sei (?), sperm, pygmy sperm, and false killer whales, beluga, Gervais', True's beaked whales, striped dolphin)
Total terrestrial	31	22	8	1
Total marine	27	13	0	14

The harbour porpoise is the most abundant and widespread of all cetacean species and occurs all around the Irish coast. Up to recently it was thought to be mainly coastal (Evans, 1980) but recent work in Ireland has shown that it occurs throughout continental shelf waters, up to 220km from land (Rogan and Berrow, 1996). Bottlenose dolphins are also frequently encountered inshore, in bays and estuaries. The only known resident group of bottlenose or any other species of dolphin in Irish waters occurs in the Shannon estuary (Berrow et al. 1996) although undoubtedly many others exist. Rogan et al. (2000) suggested there was a marked stratification of habitat use by bottlenose dolphins in the Shannon estuary with dolphins selecting areas with steep gradients causing strong currents for foraging. Recent sighting surveys (Pollock et al. 1997, Gordon et al. 2000) have reported pilot whales and white-sided dolphins mainly on the shelf edge,

where the water depth increases rapidly from 200-300m over the continental shelf to 2000-3000m to the west. This shelf edge is an important habitat, not only for resident whales and dolphins but also for migratory species such as blue, fin and humpback whales which tend to migrate along the shelf edge, mainly on the seaward side (Brown 1976). The shelf edge is a highly productive area with nutrient upwellings leading to high densities of phyto- and zoo-plankton and thus fish species.

The deep water to the west of the continental shelf provides suitable habitats for deep-diving species such as sperm whales *Physeter macrocephalus* and beaked whales (Ziphiids). Although female sperm whales with calves have been reported off the British Isles (Berrow et al. 1993) most sperm whales at these high latitudes are solitary males. At least four species of ziphiid have been stranded on the Irish coast, Cuvier's *Ziphius cavirostris*, Sowerby's *Mesoplodon bidens*, Gervais *M. europaeus* and True's beaked whale *M. mirus*. Cuvier's beaked whale is the most common and is quite likely to be breeding but almost nothing is known about the biology of the other three species. The distribution of many Ziphiids in the North Atlantic may be very discrete and confined to deep ocean troughs where they have specialised based on the distribution of preferred prey species (McCleod, 2000).

Conservation of cetaceans in Irish waters

The definition of Irish waters can vary considerably. In the Republic of Ireland, the Wildlife Act (1976) and in Northern Ireland the Wildlife and Countryside Act (1995) only extends to 12nmls from the coast. Ireland is signatory to a number of conventions which legislate to beyond this limit, including the Berne and Bonn Convention, OSPAR and CITES Conventions. The most important EU legislation, which all member states are party to, is the Habitats Directive (which was transmitted into Irish law under Statutory Instrument 94 of 1997). The Habitat Directive requires states to designate areas (Special Areas of Conservation) for the conservation of species listed under Annex II, which includes the harbour porpoise and bottlenose dolphin. All cetacean species are listed in Annex IV which identifies species in need of strict protection. At present Dúchas, who are responsible for implementing the Habitats Directive in the Republic of Ireland, intend only to designate marine SACs to within 3 nmls of the coast, which excludes the vast majority of the cetacean habitat in Irish waters.

In 1991 the Irish government declared all Irish waters, to the exclusive economic zone, a whale and dolphin sanctuary claiming that this was a “clear indication of Ireland’s commitment to contribute to the preservation and protection of these magnificent creatures in their natural environment, and to do everything possible to ensure they should not be put in danger of extinction but should be preserved for future generations” (Rogan and Berrow, 1995). According to the declaration, the sanctuary was empowered under the legal framework already in place, which suggests that the Irish government considers present legislation is sufficient to provide full habitat protection to cetaceans within the EEZ, which in some cases extends to over 350 nmls from the coast (Figure 1).

There are a number of potential threats to cetaceans and cetacean habitat, which could impact on marine biodiversity. These include interactions with commercial fisheries, pollution, disturbance and habitat degradation. The importance of these potential threats may depend on whether the species are resident or migratory.

Fisheries interactions

Commercial fisheries may interact with cetaceans biologically, through competition for marine resources, or operationally through incidental capture. The diet of cetaceans in Irish waters is poorly known although a range of commercially important fish species such as mackerel, herring, cod, whiting and salmon have been recorded in their diet. Six species were reported as incidentally caught in Irish waters by Berrow and Rogan (1998), most in gill-nets, however this reflects the sources of records and not necessarily the scale of interactions as pelagic trawlers are also known to have relatively high cetacean catch rates in Irish waters (Morizur et al. 1999).

The species likely to be affected by fisheries, obviously depends on the distribution of cetaceans and fishing effort. For example, bottom-set gill-net fisheries tend to catch harbour porpoise and common dolphins (Berrow and Rogan, 1998) but pelagic trawl fisheries operating along the shelf edge catch large numbers of white-sided dolphins (Couperus, 1995). Interestingly, Couperus (1995) showed that the white-sided dolphins caught in a fishery targeting horse mackerel had not been feeding on this species prior to capture which suggests susceptibility of different species to bycatch are probably related to differences in behaviour as exemplified by the considerable differences in diet.

Pollution

Recent studies of cetaceans suggest levels of organochlorine pesticide contamination are among the lowest recorded in the Northeast Atlantic (McKenzie et al. 1998, Smyth et al. 2000), however all animals analysed have some level of contamination. Contaminant levels in by-caught harbour porpoise and common dolphins *Delphinus delphis* were similar to that reported from Scotland but lower than that reported from Scandinavia while concentrations of PCBs in bottlenose dolphins in the Shannon estuary although 3-4 times higher are not thought to pose a risk to health (Berrow et al. in prep). Elevated levels of radionuclides (Cs-137) have been reported in harbour porpoises in the Irish Sea (Berrow et al. 1998).

The long term impact of elevated persistent pollutants are not known but once in the marine environment they are almost impossible to removed thus any measures to reduce input and contamination of the food chain should be adopted.

Habitat modification and degradation

Habitat modification may occur as a direct result of human activities such as acoustic disturbance or indirectly through for example depletion of fish stocks or climate change.

There is strong evidence from stranding records that the striped dolphin *Stenella coeruleoalba* may be occurring more frequently off the Irish coast. This species is abundant at lower latitudes and was first reported stranded in Ireland in 1985 (Bruton 1985). Although a re-examination of skulls in the Natural History museums in Belfast and Dublin (O'Riordan and Bruton, 1986) showed it had stranded prior to this but had been mis-identified as common dolphin. Between 1901 and 1995 there were 36 records of this species stranded on the Irish coast but the frequency of strandings has increased considerably through the 1990s and it is now the third most frequently reported stranded species. This trend matches similar increases in the occurrence of fish species which are more abundant at lower latitudes and now occurring

with increasing frequency in Ireland, including sunfish *Mola mola* and trigger fish *Balistes carolinensis* (Quigley et al. 1991).

During 1997 and 1998 nearly 47,000 km of seismic surveys were carried out off the west coast of Ireland in search of oil and gas deposits. Seismic surveys utilise airgun arrays to produce sounds of up to 140db at 20-200 Hz frequencies to map the seabed. The impact of this technique on cetaceans is still unclear but common dolphins have been shown to react to seismic activity at least 8km from the vessel (Goold, 1999). Ziphids are thought to be more susceptible to acoustic disturbance at lower intensities due to their habitat of occupying underwater canyons where sound attenuation is thought to be less (Frantzis, 1998).

Monitoring

To ensure the maintenance and management of Ireland's cetacean biodiversity an effective monitoring scheme must be put in place. Monitoring of cetaceans is difficult and can be very expensive, however stranding and sighting schemes have been used effectively in other countries and provide a low cost-long term opportunity.

Berrow and Rogan (1997) suggested stranding records were inadequate to assess the status of most cetacean species around the Irish coast but were useful in identifying mass and unusual stranding events, such as that due to incidental capture or epizootics. Recording sightings of cetaceans are potentially more useful in determining the seasonal distribution and relative abundance of cetaceans around the Irish coast and identifying critical habitats. The number of "ships of opportunity" has increased through the activities of the Marine Institute, Irish Navy and Air Corps and Irish Observer scheme which provides opportunities to join visiting research ships in Irish waters. Dúchas have recently expanded the Ranger network, which also provides excellent opportunities to expand land-based monitoring programmes.

A systematic method of data collection and management and the production of indices to determine seasonal, geographical and long-term changes could be developed using these opportunities to fulfil Ireland's commitment to ensure the maintenance of cetacean biodiversity in Irish waters.

Summary

Irish waters have a very high diversity of cetaceans but this biodiversity is not given high enough acknowledgement during discussions on nature conservation in Ireland. Although constrained by lack of knowledge on the basic ecology and habitat requirements for most species there are a number of practical measures that could be adopted to increase protection and maintenance of Ireland's cetacean biodiversity. These include:

1. Cetacean conservation measures should apply to the EEZ of the state,
2. A Red Data book for cetaceans summarizing present knowledge should be published,
3. Long term monitoring of cetaceans in Irish waters is possible through all Ireland strandings and sighting schemes. These should be expanded and developed and indices of change determined.

Irish waters are more like a chowder than a consommé, with high species diversity as well as abundance, however it remains to be seen if Ireland yet has all the ingredients to ensure this biodiversity is maintained for future generations.

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