

Is Ireland a sanctuary: protection of cetaceans (whales, dolphins and porpoise) in Irish waters

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Summary

Irish waters are some of the most important for cetaceans (whales, dolphins and porpoises) in Europe. Historically whales were hunted by now they are all protected under a wide range of national and EU legislation. Since 1991 there has been a significant increase in our understanding of their ecology in Irish waters. Potential threats have been quantified and important management issues identified. In this paper current knowledge and deficiencies are presented and an assessment of Ireland progress since Rio discussed.

Introduction

Irish waters are one of the most important in Europe for cetaceans (whales, dolphins and porpoises). To date 23 species have been recorded, of these 11 species are thought to breed while a further five migrate annually through Irish waters. Historically cetaceans were hunted in Ireland but in recent years they have all become protected under a range of national and international legislation. In the last 10 years there has been a huge increase in our understanding of the ecology of cetaceans in Irish waters but what are the present and potential threats to cetaceans and is Ireland compliant with its commitments under the Rio Agenda 21 agreement.

Historical interest in Irish cetaceans

Whaling in Ireland dates back at least to the 18th century when whales were hunted commercially in Co. Donegal (Fairley, 1981). From early writings (Henry, 1739) it seems fin whales *Balaenoptera physalus*, or “huge herring hogs” were found in large numbers during the summer and as early as 1736 there were reports of abundant whales each spring in Donegal Bay. Although a fishery was encouraged only a few whales were ever caught (Fairley, 1981). Many of these early whaling efforts were sustained by hunting basking sharks *Cetorhinus maximus* and were not commercially viable alone (Went and Ó Súilleabháin, 1967).

Over 130 years later two Norwegian owned whaling stations were established in Co Mayo (South Iniskea Island and Blacksod Bay on the Mullet peninsula) and operated between 1908 and 1922. During the 15 years of operation, 894 whales were killed within a 95-120km radius of the station. These were mostly fin whales (66%), but also blue *Balaenoptera musculus*, sei *Balaenoptera borealis* and sperm whales *Physeter macrocephalus* (Fairley 1981). These whales migrated along the edge of the continental shelf, an area of high productivity due to seasonal

upwellings resulting in high densities of phyto- and zooplankton. A few humpback *Megaptera novaengliae* and right whales *Eubalaena glacialis* were also killed but were already thought to be scarce in Irish waters due to historic overexploitation.

Ireland passed the Whale Fisheries Act in 1937 in response to the formation of the International Whaling Commission. This Act repealed the Act of 1908 and whaling was forbidden in Irish territorial waters. All Irish-registered vessels engaged in whaling had to be licensed and restrictions enforced such as no immature or female baleen whales were allowed to be taken and right whales were protected entirely. The few Irish-registered whaling vessels by this time were fishing in the Antarctic. Cetaceans continued to be hunted in Irish waters with reports of bottlenose whales *Hyperoodon ampullatus* being taken up to 1969 (Evans, 1991) and minke whales *Balaenoptera acutorostrata* until 1976, with at least 10 Norwegian vessels fishing annually during the 10 years prior to this date (Fairley, 1981). The Wildlife Act of 1976 reinforced the Whale Fisheries Act (1937) and made it illegal to hunt or kill any cetaceans in the territorial waters of the state.

Present status and knowledge of cetaceans in Irish waters

Information on the status and distribution of cetaceans around the Irish coast was historically based on strandings and sightings. Up to 1947 some stranded animals were reported to the Stranded Whale Scheme ran by the British Museum and since that date stranded cetaceans were occasionally reported to the Natural History Museum, Dublin. O’Riordan (1972) published the first list of whales stranded and captured on the Irish coast and since then records have been published annually in the Irish Naturalists’ Journal.

Strandings

Between 1901 and 1995 there were 529 published records involving 21 species (Berrow and Rogan, 1997) and the rate of reporting has increased significantly over the last 5 years. Berrow and Rogan (1997) considered stranding records were inadequate to assess the status of most cetacean species around the Irish coast but thought they were useful in identifying mass and unusual stranding events, such as that due to incidental capture or epizootics. One species that is stranding more frequently on the Irish coast is the striped dolphin *Stenella coeruleoalba*, which may be due to changes in seawater temperatures. 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 dolphins *Delphinus delphis*, it is now the third most frequently stranded cetacean species in Ireland. There is also evidence from stranding records that squid eating species such as the sperm whale and some beaked whales (Ziphiids) may have increased in abundance off Scotland and Ireland since the 1960s (Berrow et al. 1993).

Sightings

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. Some sighting records have also been published by the Irish Naturalists' Journal but the most comprehensive sighting scheme was established by the UK Mammal Societies Cetacean Group in 1973. Sightings from 1958 to 1978 were reviewed by Evans (1980) and

Table 1. Species checklist and the status and potential threats to cetaceans in Irish waters (By = Bycatch, Po = Pollution, Ha = Habitat degradation).

Species	Status	Threats	References
Harbour porpoise	?	By, Po, Ha	Tregenza et al. (1997a), Rogan and Berrow (1995), Berrow et al. (1998a), Smyth et al. (2000)
White-beaked dolphin	?	?	-
White-sided dolphin	?	By, Po	Couperus (1995), McKenzie et al. (1998)
Common dolphin	?	By	Berrow and Rogan (1998), Rogan (unpubl.)
Bottlenose dolphin	?	Po, Ha	Berrow et al. (in prep), Berrow and Holmes (1999)
Striped dolphin	Increasing	By	Berrow and Rogan (1997), Rogan (unpubl.)
Killer whale	?	?	-
Risso's dolphin	?	?	-
Pilot whale	?	?	-
Bottlenose whale	Depleted	?	Evans (1991)
Cuvier's beaked whale	Rare	?	Berrow and Rogan (1997)
Sowerby's beaked whale	Rare	?	Berrow and Rogan (1997)
Gervais beaked whale	Very Rare	?	Berrow and Rogan (1997)
True's beaked whale	Rare	?	Berrow and Rogan (1997)
Pygmy Sperm whale	Very Rare	?	Berrow and Rogan (1997)
Sperm whale	Increasing	?	Berrow et al. (1993)
Humpback whale	Depleted	?	Evans (1991)
Blue whale	Depleted	?	Evans (1991)
Fin Whale	Depleted	?	Evans (1991)
Sei whale	?	?	-
Minke whale	?	?	-

included sightings from Irish waters, though coverage was poor. More recently Evans (1991) included a review of sightings from Ireland in his descriptions of cetaceans in the British Isles. Northridge et al. (1995) reviewed effort related sightings from the Seabirds and Cetaceans at Sea database and identified possible concentrations of harbour porpoises *Phocoena phocoena* in the southern Irish Sea and of the coasts of Kerry and West Cork, however sightings effort was relatively low off the Irish coast. Pollock et al. (1997) recorded cetaceans during 37,563 km of survey effort of the Irish coast although 25% of this was during July and August. In total, 9,160 animals involving 13 species have been recorded off Ireland since 1981. Common dolphin and harbour porpoise were the most abundant species and minke whales the most frequently recorded rorqual.

There have been two published abundance estimates in Irish waters based on line-transect methodology. Leopold et al. (1992) took advantage of excellent sea conditions on a “platform of opportunity” to conduct 5 line transects from Galway Bay to West Cork in July 1989 and estimated a density of 0.77 ± 0.26 per km² giving an abundance of 19,210 with a coefficient of variation (CV) of 0.34. The Celtic Sea was surveyed as part of a transnational survey of harbour porpoises and an abundance estimate of 36,280 harbour porpoises (CV = 0.57), 1,195 (CV = 0.49) minke whales and 833 (CV = 1.02) *Lagenorhynchus* sp. were recorded (Hammond et al. 1995).

Acoustics are increasingly being used in cetacean surveys. In 1993, a dedicated visual and acoustic survey off Co. Mayo (Gordon et al. 2000) recorded 6 species during 20 days at sea, mainly long-finned pilot whales *Globicephala melas* (27%), common (19%) and white-sided dolphins *Lagenorhynchus acutus* (15%) and minke whales (15%). Overall cetacean vocalisations were recorded on 29% of monitoring sessions throughout 480 hours of surveying (Gordon et al. 2000). One of the most fascinating insights into the potential abundance of whales in Irish waters comes from a two-year study using bottom-mounted hydrophone arrays off the west coast of Britain and Ireland. These hydrophones (known as SOSUS) were used to monitor the vocalisations of blue, fin and humpback whales off the edge of the continental shelf (Anon, 2000). Acoustic detections of all three species displayed distinct seasonal cycles. Fin whales were the most frequently detected, occurring in all regions in every month of the year for which data was available. Highest whale counts and highest vocal activity scores for fin whales occurred in October through January. Blue whales were also detected in all regions with peak detection rates in November and December declining through late winter and early spring to minimal levels in March through June. Humpback whales were the least frequently detected species overall occurring mainly in the north from October through April (Anon, 2000). Prior to this study we had no knowledge that large whales such as blue whales were so abundant in Irish waters.

Potential threats to cetaceans in Ireland

Little was known about the status and threats to cetaceans prior to 1991 but since then a number of studies have been carried out which have attempted to quantify some of the potential threats. Like most areas of the world, potential threats include: pollution, fisheries interactions, habitat degradation and disturbance.

Pollution

There have been few studies of persistent pollutants in mammals in Ireland (Nixon, 1991; Mason and O'Sullivan, 1992; 1993; Berrow et al. 1998a; McKenzie et al. 1998; Smyth et al. 2000). All studies have shown some level of contamination and Mason and O'Sullivan (1992; 1993) recorded concentrations in mink *Mustela vison* and otters *Lutra lutra* that could compromise some individuals.

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* (Table 6) were similar to that reported from Scotland but lower than that reported from Scandinavia (Smyth et al. 2000) 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. 1998a). McKenzie et al. (1998) suggested organochlorine contamination was ubiquitous in white-sided dolphins *Lagenorhynchus acutus* from Irish and Scottish waters, which demonstrated the difficulties when interpreting results of pollution studies.

Table 6. Concentrations of organochlorine concentrations (mg kg⁻¹ lipid weight) recorded in male dolphins from Irish waters (from Berrow et al. in prep).

Location	Shannon estuary	South and west coast	Southwest coast	North Mayo
Species	Bottlenose dolphin	Harbour porpoise	Common dolphin	White-sided dolphin
References	Berrow et al. (in prep)	Smyth et al. (2000)	Smyth et al. (2000)	McKenzie et al. (1997)
Sample size (n)	? n=6	? n=6	? n=5	? n=8
Age range (years)	?	2 – 6	1- 11	1 – 17
HCB	0.241 ± 0.168	-	-	0.310 ± 0.140
αHCH	0.292 ± 0.380	-	-	-
βHCH	0.019 ± 0.209	-	-	-
Lindane (?HCH)	0.114 ± 0.093	0.12 ± 0.17	0.045 ± 0.047	-
<i>trans</i> - nonachlor	4.21 ± 4.09	0.90 ± 0.46	1.54 ± 1.24	3.54 ± 1.94
pp'DDE	20.1 ± 15.5	1.94 ± 0.72	7.67 ± 5.27	14.8 ± 11.0
CB153	13.5 ± 10.0	2.58 ± 1.28	3.03 ± 2.76	13.1 ± 10.2
ICES 7	29.5 ± 20.9	6.15 ± 2.80	8.95 ± 5.95	-

Incidental capture

The incidental capture of cetaceans has now been quantified in some gill-net and trawl fisheries in Ireland and other by-catch records were recently reviewed by Berrow and Rogan (1998b).

Tregenza et al. (1997a, 1997b) estimated 2,200 harbour porpoises and 230 common dolphins were killed annually by bottom-set gill-nets in the Celtic Sea. This accounted for 6.2% of the estimated number of harbour porpoises in that area and there is serious concern about the ability of the population to sustain this level of by-catch (Tregenza et al. 1997a). No cetacean by-catch was reported in the Celtic Sea Herring fishery (Berrow et al. 1998c) but five species (pilot whale, common, white-sided, white-beaked and bottlenose dolphins) were caught by Dutch mid-water trawlers off the southwest coast of Ireland (Couperus 1995). In addition Berrow and Rogan (1998b) reported a further two species (striped dolphin and minke whale) incidentally caught in Irish waters. Although the Irish Albacore tuna fishery is largely conducted outside of the Irish territorial waters, especially in the earlier part of the season an estimated 500 cetaceans, mainly common and striped dolphins but also bottlenose, Risso's *Grampus griseus* and white-sided dolphins and pilot, minke and sperm whales, were caught in 1996 (Rogan, unpubl. data).

Clearly incidental capture in fishing nets is one of the most immediate threats to cetaceans in Irish waters, however not all fisheries have significant bycatch and many more fisheries need to be monitored to determine which have the biggest impact and what mitigation measures can be developed.

Habitat loss and degradation

The habitat requirements of most cetacean species are not fully known but some important areas have been identified. The Shannon estuary on the west coast is home to the only known resident group of bottlenose dolphins in Ireland (Berrow et al. 1996) and has recently been nominated as a candidate Special Area of Conservation (SAC) under the Habitats Directive. Dúchas are obliged to designate SACs for both bottlenose dolphins and harbour porpoises but are constrained by lack of information on critical habitats and preferred sites.

The potential for whalewatching in Ireland is huge and considered under-developed (Hoyt, 2000). Although whalewatching in Ireland was estimated to be worth €1,480,000 in direct revenues and €7,973,000 in indirect revenues in 1998 (Hoyt, 2000), the majority of the 177,600 whalewatchers in Ireland visited the wild, solitary, dolphin in Dingle Harbour, Co Kerry. However whalewatching is now expanding rapidly in the Shannon estuary and a dedicated whalewatching operator has recently become established off the southwest coast. There is potential for disturbance caused by whalewatching although operators in the Shannon estuary adhere to a code of conduct and monitoring programme (Berrow and Holmes, 1999) designed to minimise impact while providing economic benefits to coastal communities. However experiences elsewhere suggest the need for licensing of whalewatching vessels, especially if operating in candidate SACs, while the industry is still relatively small.

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) and the lower the frequency

emitted the greater the area from the source that will be affected. Some species such as Ziiphids may be more susceptible to acoustic disturbance at lower intensities due to their habitat of occupying underwater canyons. Sound attenuation is thought to be less and recent mass strandings of Cuviers *Mesoplodon cavirostris* and Blainvilles beaked whale *Mesoplodon densirostris* have suggested more consideration should be given to the potential impact of acoustic disturbance on Ziiphids (Frantzis, 1998). There are suggestions that apart from animals vacating an area due to annoyance, physical damage to hearing may occur as well as interference with the ability of cetaceans to communicate or locate prey.

Welfare

In addition to this baseline research, some important welfare issues have been addressed over the last 10 years. Guidelines for the rehabilitation of live stranded cetaceans have been produced by the IWDG and a network of personnel and equipment around the coast to implement the guidelines. In the last two years there has been an increase in wild, sociable dolphins and people wanting to swim with them.

Although to be discouraged many people insist on swimming and this can lead to increased risk to the dolphin and people. Samuels et al (2000) reviewed swimming with dolphin encounters throughout the world and reported over 80% of these encounters result in injury or death to the dolphin. There are no guidelines in Ireland to minimise the impact of this interaction.

Legislation protecting cetaceans in Irish waters

There are a wide range of legislation in Ireland and the EU which can contribute to the conservation of cetaceans in Irish waters. The main legislation is the Wildlife Act (1976) and the recent amendment Act (2000). The Wildlife Act (1976) not only protects all cetacean species from hunting but protects their habitat and legislates against “wilful interference”.

The most important international legislation is the Habitats Directive, which obliges Ireland to designate Special Areas of Conservation (SACs) for species in Annex II. This includes harbour porpoise and bottlenose dolphin and all cetacean species are listed under Annex IV, identifying them for protective measures. However the Habitats Directive in Ireland is only being applied to within 3 nmls of the coast. A recent high court case in the Britain established that this Directive applies to all territorial waters and should also be applied thus in Ireland.

Ireland has also ratified the Bonn and Berne Conventions and the EC Directive on the Conservation of Natural Habitats and migratory species and the Wildlife Amendment (2000) also ratifies CITES. Ireland joined the International Whaling Commission on 2 January 1985 and Chaired the IWC between 1999 and 2000.

How are Irish waters being monitored ?

Although stranding records in Ireland are inadequate at present to assess the status of most species in Irish waters they can still be used for monitoring purposes, especially unusual stranding events and epizootics (Berrow and Rogan, 1997).

Sighting schemes can be more effective at monitoring and the Irish Navy and Air Corps patrol have been contributing to the IWDG sighting scheme for many years. The number of “ships of opportunity” has increased through the Irish Observer scheme on visiting research ships and increased Irish fishery research. Dúchas have recently expanded the Ranger network, which also provides excellent opportunities to expand land-based monitoring programmes.

Irelands’ whale and dolphin sanctuary declaration

In recognition of the importance of Irish waters for cetaceans, all Irish territorial waters were declared a sanctuary for whales and dolphins on 7 June 1991. The declaration came in the form of an announcement from the Government stating “... *the Government have declared all our seas a Whale and Dolphin Sanctuary*”. No new legislation was implemented as the Government stated that “*Ireland already has a comprehensive legal framework in place ... which empowers the Government to provide this sanctuary. Under this legislation, the hunting of all whale species, including dolphins and porpoises, has already been totally banned within the exclusive fishery limits of the State i.e. out to 200 miles from the coast*”. However the Government also stated in the declaration that Ireland would “...*contribute to the preservation and protection of these magnificent creatures in their natural environment, and do everything possible to ensure that they should not be put in danger of extinction but should be preserved for future generations*” (Rogan and Berrow 1995).

Are cetaceans protected in Ireland ?

Prior to recent research little was known about the ecological requirements of, or potential threats to, cetaceans in Irish waters. Recent work, largely conducted since the Rio declaration has quantified some threats and identified other potential threats. Priorities for research and action that should be considered if Ireland is to try and provide sanctuary to cetaceans in its waters include:

- i) more fisheries need to be monitored for cetacean bycatch to determine catch rates, especially large pelagic trawlers. Bycatch monitoring could be integrated into work of Marine Institute staff currently reporting discards,
- ii) methods of mitigating against bycatch in some bottom-set gill net fisheries need to be explored including no-take zones and closed seasons as well as gear modifications,

- iii) abundance estimates of cetaceans in the Irish Sea and off the western seaboard need to be carried out,
- iv) extensive, long-term monitoring schemes involving strandings and sightings need to be expanded and developed,
- v) more SAC for bottlenose dolphin and harbour porpoise need to be identified, designated and managed,
- vi) an EIS on the impact of seismic surveys on cetaceans needs to be carried out,
- vii) continued research on the health status and biological parameters of cetaceans from strandings should be supported,
- viii) legislative considerations including the commitments already signed up to in the EIA Directive OSPAR Convention
- ix) The Habitats Directive should be applied to all Irish territorial waters

Public awareness of cetaceans in Ireland has grown considerably, thus enabling governments to act to ensure the “... *preservation and protection of these magnificent creatures in their natural environment*” which, after all, is the spirit behind the Rio Convention.

References

- Anon (2000) *Acoustic monitoring of large whales off north and west Britain and Ireland: a two year study, October 1996 – September 1998*. JNCC Report 313.
- Berrow, S.D., Evans, P.G.H. and Sheldrick, M.C. (1993) An analysis of Sperm whale *Physeter macrocephalus* (L.) stranding and sighting data from Britain and Ireland. *Journal of Zoology (London)*, 230, pp. 333-337.
- Berrow, S.D., Holmes, B. and Kiely, O. (1996) Distribution and abundance of Bottle-nosed dolphins *Tursiops truncatus* (Montagu) in the Shannon estuary, Ireland. *Biology and Environment. Proceedings of the Royal Irish Academy* 96B (1), pp. 1-9.
- Berrow, S.D. and Rogan, E. (1997) Cetaceans stranded on the Irish coast, 1901-1995. *Mammal Review* 27(1), pp. 51-76.
- Berrow, S.D., Long, S.C., McGarry, A.J., Pollard, D., Rogan, E. and Lockyer, C. (1998a) Radionuclides (Cs-137 and K-40) in Harbour porpoises *Phocoena phocoena* L. from British and Irish waters. *Marine Pollution Bulletin* 36(8), pp. 569-576.
- Berrow, S.D. and Rogan, E. (1998b) Incidental capture of cetaceans in Irish waters. *Irish Naturalists' Journal*, 26 (1/2), pp. 22-31.

- Berrow, S.D., O'Neill, M. and Brogan, D. (1998c) Discarding practices and marine mammal bycatch and in the Celtic Sea Herring Fishery. *Biology and Environment. Proceedings of the Royal Irish Academy* (1), pp. 1-8.
- Berrow, S.D. and Holmes, B. (1999) Tour boats and dolphins: A note on quantifying the activities of whalewatching boats in the Shannon estuary, Ireland. *Journal of Cetacean Research and Management*. 1(2), pp. 199-204.
- Berrow, S.D., McHugh, B., Glynn, D., McGovern, E., Parsons, K. Hooker, S.K. and Baird, R.W. (in prep) Organochlorine concentrations in resident bottlenose dolphins *Tursiops truncatus* sampled by biopsy darts in the Shannon estuary, Ireland.
- Bruton, T. (1985) Euprosyne dolphin *Stenella coeruleolaba* (Meyen). *Irish Naturalists' Journal* 21(12), 538-540.
- Couperus, A.S. (1995) Interactions between Dutch midwater trawl and Atlantic white-sided dolphins (*Lagenorhynchus acutus*) Southwest of Ireland. *Journal of Northwest Atlantic Fishery Science*, 22, pp. 209-218.
- Evans, P.G.H. (1980) Cetaceans in British waters. *Mammal Review*, 10, pp. 1-52.
- Evans, P.G.H. (1991) *Whales, Dolphins and Porpoise: Order Cetacea*. In *The Handbook of British Mammals* 3rd Edition. Eds. Corbett, G.C and Harris, S. pp. 299-350.
- Fairley, J.S. (1981) *Irish Whales and Whaling*. Blackstaff Press, Belfast.
- Frantzis, A. (1998) Does acoustic testing strand whales ? *Nature* 392, 29.
- Goold, J.C. (1999) Acoustic assessment of populations of common dolphin, *Delphinus delphis*, off the West Wales Coast, with perspectives from satellite infra-red imagery. *Journal of the Marine Biological Association (UK.)* 76, pp. 811-820.
- Gordon, J., Berrow, S.D., Rogan, E and Fennelly, S. (2000) Acoustic and visual survey of cetaceans off the Mullet Peninsula, Co Mayo. *Irish Naturalists' Journal*. 26 (7/8), pp. 251-259.
- Hammond, P.S., Benke, H., Berggren, P., Borchers, D.L., Buckland, S.T., Collet, A., Heide-Jørgensen, M.P., Heimlich-Boran, S., Hiby, A.R., Leopold, M.F. and Øien, N. (1995) *Distribution and abundance of the Harbour porpoise and other small cetaceans in the North sea and adjacent waters*. LIFE 92-2/UK/027.
- Henry, W. (1739) *Hints towards a Natural and Typographical History of the Counties Sligoe, Donegal, Fermanagh and Lough Erne*. Public Record Office, Dublin. Ms M2533, cited from Fairley (1981).
- Hoyt, E. (2000) *Whale Watching 2000, Worldwide tourism numbers, expenditures and expanding socioeconomic benefits*. Whale and Dolphin Conservation Society, Bath, UK. 36 pp.
- Leopold, M.F., Wolf, P.A. and Van de Meer, J. (1992) The elusive harbour porpoise exposed: strip transect counts off southwestern Ireland. *Netherlands Journal of Sea Research* 29, pp. 395-402.
- Mason, C.F. and O'Sullivan, W.M. (1992) Organochlorine pesticide residues, PCBs and heavy metals in Irish mink and pine martin. *Irish Naturalists' Journal* 24, pp. 153-155.
- Mason, C.F. and O'Sullivan, W.M. (1993) Further observations on PCB and organochlorine pesticide residues in Irish Otters *Lutra lutra*. *Biology and Environment* 3, pp. 187-188
- Nixon, E. (1991) PCBs in marine mammals from Irish coastal waters. *Irish Chemical News* 7, pp. 311-38.

- Northridge, S., Tasker, M.L., Webb, A. and Williams, J.M. (1995) Distribution and relative abundance of harbour porpoises (*Phocoena phocoena* L.), white-beaked dolphins (*Lagenorhynchus albirostris* Gray), and minke whale (*Balaenoptera acutorostrata* Lacepède) around the British Isles. *ICES Journal of Marine Science* 52, pp. 55-66.
- O’Riordan, C.E. (1972) Provisional list of cetacea and turtles stranded or captured on the Irish coast. *Proceedings of the Royal Irish Academy*, 72 (15), pp. 253-274.
- O’Riordan, C.E. and Bruton, T. (1986) Notes on the crania of the euprosyne dolphin *Stenella coeruleoalba* (Meyen) in the collections of the Natural history Museum of Ireland. *Irish Naturalists’ Journal*, 22, pp. 162-163.
- McKenzie, C., Rogan, E., Reid, R.J. and Wells, D.E. (1998) Concentrations and patterns of organic contaminants in Atlantic white-sided dolphins (*Lagenorhynchus acutus*) from Irish and Scottish coastal waters. *Environmental Pollution* 98, pp. 15-27.
- Pollock, C., Reid, J.B., Webb, A. and Tasker, M.L. (1997) *The distribution of seabirds and cetaceans in the waters around Ireland*. JNCC Report, No. 267.
- Rogan, E. and Berrow, S.D. (1995) The management of Irish waters as a whales and dolphin sanctuary. In *Developments in Marine Biology, 4. Whales, seals, fish and man*, Eds Blix, A.S., Walloe, L. and Ulltang, O. Proceedings of the International Symposium on the Biology of Marine Mammals in the North East Atlantic. Trömsø, Norway, 29 November - 1 December 1994. Elsevier, Amsterdam, Netherlands.
- Samuels, A., Bjeder, L. and Heinrich, S. (2000) *A Review of literature pertaining to swimming with wild dolphins*. Marine Mammal Commission, Maryland, USA.
- Smyth, M., Berrow, S.D., Nixon, E. and Rogan, E. (2000) Polychlorinated Biphenyls and Organochlorines in by-caught harbour porpoises *Phocoena phocoena* and common dolphins *Delphinus delphis* from Irish coastal waters. *Biology and Environment*. 2, pp. 85-96.
- Tregenza, N.J.C., Berrow, S.D., Leaper, R. and Hammond, P.S. (1997a) Harbour porpoise *Phocoena phocoena* L., bycatch in set gill nets in the Celtic Sea. *ICES Journal of Marine Science*. 54, pp. 896-904.
- Tregenza, N.J.C., Berrow, S.D., Leaper, R. and Hammond, P.S. (1997b) Common dolphin, *Delphinus delphis* L., Bycatch in Bottom Set Gillnets in the Celtic Sea. I. 47, pp. 835-839.
- Went, A.E.J. and Ó Súilleabháin, S. (1967) Fishing for sun-fish or basking sharks in Irish waters. *Proceedings of the Royal Irish Academy* 65C, pp. 91-115.

