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COMMISSIONED REPORT

Commissioned Report No. [SNH to complete]

Abundance and Behaviour of Cetaceans & Basking Sharks in the Pentland Firth and Orkney Waters

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COMMISSIONED REPORT

Summary

Abundance and Behaviour of Cetaceans & Basking Sharks in the Pentland Firth and Orkney Waters

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Background

In the light of proposed offshore energy developments in the Pentland Firth and Orkney Waters, a review was conducted of sightings information for cetaceans and basking sharks.

Gaps in current knowledge were identified, and recommendations made on how to interpret or use the data available in the context of providing appropriate advice to regulators on potential interactions between these marine animals and renewable devices.

Main findings

- Nineteen cetacean species have been recorded in the Pentland Firth and Orkney Waters since 1980, 17 of these as live sightings, making it one of the richest areas in the UK.
- Six cetacean species occur regularly: harbour porpoise, minke whale, white-beaked dolphin, Risso's dolphin, killer whale, and bottlenose dolphin.
- The basking shark and four cetacean species are casual visitors: short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale and sperm whale; these four species normally inhabit offshore waters.
- Harbour porpoise (common) and long-finned pilot whales (uncommon) are recorded year round. The other regular species tend to be seasonal, mainly in summer, although increased effort & better viewing conditions at this time of year may bias patterns.
- Although areas can be identified where sightings have been concentrated, the uneven distribution of effort limits clear interpretation of distribution patterns.
- Notwithstanding potential effort biases, some areas (e.g. Scapa Flow and adjacent areas in S. Orkney, Gills Bay, Dunnet Bay and Strathy Bay on the Scottish mainland) are clearly important for cetaceans.
- Some of the proposed development sites (e.g. those in the Pentland Firth) directly overlap with important areas for cetaceans, whilst a few (e.g. Armadale) are in localities that have had little observation effort.

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1. INTRODUCTION

The cetacean fauna (whales, dolphins and porpoises) of the Pentland Firth and adjacent Orkney waters is comparatively rich, both in species diversity and numbers of animals. For the region under consideration (the north Caithness coast from Cape Wrath to Duncansby Head, south to Helmsdale, extending 15 miles offshore into the North Sea, and north to include the Pentland Firth and all of Orkney), a total of 17 cetacean species have been recorded live, and a further two as strandings, since 1980. Of these, six species (22% of the 27 UK species) are either present through most of the year or are recorded annually as regular seasonal visitors to the region; four species are more casual visitors; and the remaining seven species are more or less accidental (Table 1; Evans, 1996, 1997; Sea Watch unpubl. data). Two other species, recorded as strandings only, include northern bottlenose whale *Hyperoodon ampullatus* and Sowerby's beaked whale *Mesoplodon bidens*. The species most frequently observed in near-shore waters include (in descending order of frequency of sightings): the harbour porpoise *Phocoena phocoena*, minke whale *Balaenoptera acutorostrata*, white-beaked dolphin *Lagenorhynchus albirostris*, Risso's dolphin *Grampus griseus*, killer whale *Orcinus orca*, and bottlenose dolphin *Tursiops truncatus*.

Table 1. Summary of Cetacean Sightings Records in Orkney Waters and the Pentland Firth

Species	No. records	%	No. individuals	%
Harbour Porpoise	3,332	50.4	16,822	49.2
Minke Whale	800	12.1	1,319	3.9
Killer Whale	474	7.2	2,437	7.1
White-beaked Dolphin	416	6.3	2,722	8.0
Risso's Dolphin	361	5.5	1,569	4.6
Bottlenose Dolphin	146	2.2	637	1.9
Short-beaked Common Dolphin	98	1.5	3,016	8.8
Atlantic White-sided Dolphin	138	2.1	559	1.6
Long-finned Pilot Whale	109	1.6	2,193	6.4
Sperm Whale	47	0.7	283	0.8
Humpback Whale	14	<0.1	22	<0.1
Fin Whale	5	<0.1	5	<0.1
Beluga	3	<0.1	3	<0.1
Sei Whale	2	<0.1	2	<0.1
Striped Dolphin	2	<0.1	2	<0.1
Cuvier's Beaked Whale	1	<0.1	1	<0.1
False Killer Whale	1	<0.1	125	0.4
Unidentified Dolphin Species	448	6.8	1,837	5.4
Unidentified Cetacean Species	121	1.8	335	1.0
Unidentified <i>Lagenorhynchus</i> sp.	40	0.6	158	.05
Unidentified Whale Species	30	0.5	64	0.2
Unidentified Large Whale Species	17	0.3	17	<0.1
Patterned Dolphin Species	10	0.1	49	0.1
TOTAL	6,635	100.0	34,177	100.0

The harbour porpoise and bottlenose dolphin are listed in Annex II of the EU Species & Habitats Directive (1992) as species whose conservation requires the designation of Special Areas of Conservation.

Cetacean species recorded casually in the region include killer whale or orca *Orcinus orca*, short-beaked common dolphin *Delphinus delphis*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, long-finned pilot whale *Globicephala melas*, and sperm whale *Physeter macrocephalus*. Vagrant species include humpback whale *Megaptera novaeangliae*, fin whale *Balaenoptera physalus*, sei whale *Balaenoptera borealis*, false killer whale *Pseudorca crassidens*, beluga *Delphinapterus leucas*, striped dolphin *Stenella coeruleoalba*, Cuvier's beaked whale *Ziphius cavirostris* and Sowerby's beaked whale *Mesoplodon bidens*.

Figures 1 and 2 depict the area under consideration for offshore renewable energy development in this latest round offered by the Crown Estate. Sightings plots for all cetacean species recorded alive are provided in Figures 3-12, and of basking sharks in Fig. 15, with locations of sightings for the rarer species depicted in Figures 13-14. For geographical comparisons of sightings rates for cetacean species in UK waters, see Evans *et al.* (2003) and Reid *et al.* (2003).

2. DATA SOURCES & DATA COLLECTION METHODS

The following data sources were identified:

- 1) Sea Watch database of casual sightings and systematic observations
- 2) European Seabirds at Sea (ESAS) database held by JNCC
- 3) SCANS & SCANS II surveys held by SMRU
- 4) Marine Conservation Society database of shark records for Scotland
- 5) Orkney Biodiversity Records database
- 6) North Ronaldsay Bird Observatory records
- 7) Fair Isle Bird Observatory records
- 8) EMEC land-based watches from two Orkney sites
- 9) Aquamarine Power land-based observations from two Orkney sites
- 10) John O'Groats Ferry observations across the Pentland Firth
- 11) Highland Ranger Service land-based observations from Caithness sites
- 12) Cetacean Strandings Investigation Programme (CSIP)

Other potential sources of data included Marine Mammal Observer (MMO) records from any offshore surveillance activities in relation to oil & gas; casual sightings from Orkney Ferries and Pentland Ferries; and any observations made by contractors for Renewable Energy Developers not listed above (i.e. Atlantis Power, Energy Research Institute, Green Tide Turbines, International Power plc, Marine Current Turbines, Scottish Renewables, and Scottish Power Renewables) at renewables test sites. However, these parties have not yet responded to requests for any data.

Information on cetacean status and distribution comes primarily from the national sightings database (1973-present, although records from 1980 onwards only are included here) which is maintained by the Sea Watch Foundation (SWF). Several of the data sources listed above (Orkney Biodiversity Records database, Fair Isle Bird Observatory, John O'Groats Ferries, and Highland Ranger Service) already provide sightings data to SWF. However, to ensure that no records were missing, full datasets from these organisations were obtained separately and a procedure for identifying duplicates was applied to the integrated database.

Most records in the Orkney / Pentland Firth region are opportunistic without associated effort, and therefore potentially contain biases in observer coverage both spatially and over time. Sea Watch's regional coordinator, Colin Bird, together with a network of rangers from the Highland Council, contribute the bulk of sightings records from

Caithness; the John O'Groats Ferry travels regularly across the Pentland Firth from Thurso to the islands of Orkney, particularly in summer, and routinely records sightings; whilst sightings in Orkney are collated by Sea Watch's regional coordinator for Orkney, Chris Booth, who is also Mammal Recorder for the islands, and oversees records for the Orkney Biodiversity Records database. Casual sightings are submitted by a number of observers and are either sent directly to SWF or received via Chris Booth.

Since July 2005, Jim Williams and Stuart Williams have also been conducting systematic seabird and cetacean watches from land-based sites at Billia Croo, and Mike Cockram has been doing the same on Eday, on behalf of EMEC. These observations have involved 20 hours per week of watching in six four-hour sessions (for these, only approximate positions for sightings have been provided). Nine cetacean records were also submitted by Aquamarine Power, from observations made at Marwick Head and Billia Croo. Observations at Marwick Head started in September 2009 and are ongoing. From September to March, effort was four hours per week, and from April onwards it increased to eight hours per week. Observations at Billia Croo started on 12 April 2010 for eight hours per week. Exact positions of sightings were not available.

Daily logs are kept at North Ronaldsay and Fair Isle Bird Observatories, although positions for sightings are rarely given. Most recording effort occurs during the field season, April to October. Elsewhere in Orkney, land-based watching has been conducted mainly at Hoxa Head (South Ronaldsay) and Noup Head (Westray). There have also been a number of reports from Rora Head (Hoy), Mull Head (Deerness) and from around the north end of Papa Westray. On the West Mainland Coast, most watching has been conducted from the vicinity of Marwick Head and the Brough of Birsay.

Regular watches are conducted on the east Caithness mainland coast, particularly on the south side of the Wick River Estuary near the Trinkie Pool and the southern edge of the area from Whaligoe Steps (Ulbster) and Lybster Point. Watching effort along the north coast is generally greater at prominent headlands and bays such as Strathy Point, Holburn Head, Dunnet Head, Scarfiskerry, Duncansby Head, Thurso Bay, Dunnet Bay and Gills Bay, as well as Scapa Flow in Orkney; resulting in greater coverage at these localities than elsewhere. Most observers have been watching from land although, as the maps illustrate, there has also been a significant amount of offshore coverage (including some systematic surveys during summer).

The Marine Conservation Society runs a basking shark reporting scheme and Scottish records (>90% from the west coast) held in their database have been supplied to this project. In addition, casual sightings of basking sharks (plus any obtained from systematic surveys) submitted to Sea Watch are collated in their national database. The vast majority of these records are from the west coast of Scotland.

As a collaborative effort between Aberdeen University, Sea Watch Foundation and East Grampian Coastal Partnership, NORCET ferry surveys were set up. Working aboard Northlink ferries, the NORCET surveys have been running monthly from April to September since 2005 between Aberdeen and Shetland with occasional trips to Orkney. Part of the journey is made in darkness but effort-based watches are conducted from the ship's bridge during daylight hours.

A major international collaborative programme, the Small Cetacean Abundance in the North Sea (SCANS) project, was conducted over the region in July 1994 in order to provide a baseline assessment of abundance of the major species (Hammond *et al.*, 2002). This was then repeated in July 2005 (SCANS II) (Hammond, 2008). Sightings from the first survey are included here, whilst for the most recent survey a contoured map of densities for the most common species, the harbour porpoise, is presented in Figure 17.

JNCC hosts the European Seabirds At Sea database, which includes data from at-sea surveys targeting seabirds but also recording cetaceans. These surveys have been conducted mainly over the European continental shelf using a mixture of platforms of opportunity (for example ferries) and dedicated surveys. Effort is greatest in the summer months, and varies regionally around the British Isles over time. The majority of effort off North Scotland, including Orkney, has been between 1980 and 1989.

Effort-based sightings from the SWF, ESAS and SCANS databases have all been combined to form the Joint Cetacean Database, and for the years up to 1999 were used to construct a European Cetacean Distribution Atlas (Reid *et al.*, 2003). The databases were also used to identify areas of relative high density for harbour porpoises (Evans & Wang, 2004; see Fig. 16).

Observations in the region tend to be concentrated between the months of April and October, when the weather is better and sea conditions more suited to spotting cetaceans. This means that winter months are under represented and species may occur more frequently than indicated here, although watches are conducted year-round from Lybster Point and on a more casual basis at other headland locations. Year-round observations have also started recently at Marwick Head, Billia Croo and Eday. The great majority of sightings data available derive from the years since 1990.

3. LEGISLATION

A number of national and international legislative instruments are relevant to cetacean species occurring in Orkney and Pentland waters. These are detailed below:

3.1 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

All species of cetaceans in UK waters are listed in either CITES Appendix I or II. However, in the UK, CITES is implemented via the EC Regulation of Trade in Endangered Species. All cetaceans are noted under list C1 of this regulation, which means, regardless of their CITES listing, all cetaceans in the UK must be treated as if they are on Appendix I, prohibiting commercial trade between the UK and other nations.

3.2 Convention on the Conservation of Migratory Species of Wild Animals (CMS) (Bonn Convention) 1983

Most UK cetaceans are highlighted as priority species under the Convention, being listed under Appendix I (migratory species threatened with extinction), or Appendix II (migratory species that would significantly benefit from international co-operation). CMS has helped progress regional conservation agreements for cetaceans such as in the Baltic, Northeast Atlantic, Irish and North Seas (ASCOBANS). Cetacean species in UK on Appendix I include northern right whale, blue, fin, sei and humpback whales; all other UK cetacean species are on Appendix II.

3.3 Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) 1982

The establishment of the Emerald Network (1996) of Areas of Special Conservation Interest (ASCI) (1989) to Europe supports the implementation of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979) which deal with the protection of natural habitats, in particular habitats of the wild flora and fauna species, specially those in the Appendices I and II; and endangered natural habitats.

Appendix II relating to fauna strictly protects 29 species of cetaceans. Species on Appendix III (such as minke whale) can be exploited so long as regulation keeps populations out of danger.

3.4 Agreement on the Conservation of Small Cetaceans of the Baltic, Northeast Atlantic, Irish and North Seas (ASCOBANS) 1992

The ASCOBANS agreement calls on Parties to: “*undertake to cooperate closely in order to achieve and maintain a favourable conservation status for small cetaceans.*”

Small cetaceans are defined as all toothed whales (Odontoceti, including dolphins & porpoises) with the exception of the sperm whale.

The Agreement also requires Parties to apply certain “*conservation, research and management measures*”.

These measures include working towards:

“(a) *the prevention of the release of substances which are a potential threat to the health of the animals,*”

“(b) *the development, in the light of available data indicating unacceptable interaction, of modifications of fishing gear and fishing practices in order to reduce by-catches and to prevent fishing gear from getting adrift or being discarded at sea,*”

“(c) *the effective regulation... of activities which seriously affect their food resources,*” and

“(d) *the prevention of other significant disturbance, especially of an acoustic nature.*”

The Agreement also calls for co-ordinated research on small cetacean distribution and abundance including trying to “*locate areas of special importance to their survival*” and “*identify present and potential threats*” to small cetacean species.

3.5 International Union for the Conservation of Nature and Natural Resources (IUCN)

Whilst not providing legal protection, the IUCN’s “Red List” provides criteria for the evaluation of how threatened a species is and whether it is vulnerable or endangered.

Being classified as ‘*endangered*’ means that the species has significantly decreased (50% decrease) in numbers in recent years (10 years or 3 generations), numbers less than 2,500 animals in total, occurs only in a very small area or fragmented habitat, and/or faces a high risk of extinction in the wild in the near future (20% in the next 20 years or 5 generations). Endangered species occurring in UK waters include fin, blue, sei and northern right whales.

A ‘*vulnerable*’ species has decreased in numbers in recent years (20% decrease in the last 10 years or 3 generations), exists in low numbers globally (but in larger numbers than endangered species, e.g. between 2,500 and 10,000 animals) and/or faces a high risk of extinction in the wild in the medium term (i.e. 10% chance of extinction in the next 100 years). Vulnerable species in UK waters include the sperm whale and humpback whale. Despite being one of the most commonly sighted cetaceans in UK waters, the harbour porpoise is also classified as vulnerable by the IUCN.

Put simply, '*conservation dependent*' means that a species is currently subject to a conservation programme, the cessation of which would cause the species to become vulnerable or endangered within five years (in UK waters, these include striped dolphin, northern bottlenose whale and killer whale). '*Near threatened*' species are species which are not conservation dependent, but are close to qualifying for vulnerable status (e.g. minke whales). The remaining species are considered either least concern (short-finned pilot whale, short-beaked common dolphin, Atlantic white-sided dolphin and white-beaked dolphin) or data deficient (beaked whales of the family Ziphiidae, Risso's dolphin, and bottlenose dolphin).

3.6 Council Directive on the Conservation of Natural Habitats and Wild Fauna and Flora (EU Habitats Directive) 1992

The aim of this Directive is "to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the treaty applies"

Article 2 of the Directive places a duty on Member States to ensure that any measures taken under the Directive are designed to "maintain or restore, at a favourable conservation status, natural habitats and species of wild fauna of Community interest" (which include all cetaceans). The Directive requires Member States to undertake surveillance of the conservation status of these natural habitats and species.

Article 12 requires Member States to establish a system of strict protection for the animal species listed in Annex IV(a). All cetaceans are in this Annex as European Protected Species (EPS). As such member states are required to take the requisite measures to establish a system of strict protection in their natural range, prohibiting all forms of deliberate capture or killing of specimens of these species in the wild; deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration; and deterioration or destruction of breeding sites or resting places.

The Directive has two parts that are pertinent to UK cetacean conservation, one through species protection, and the second through the designation of protected areas. EU Governments are obliged to establish Special Areas of Conservation (within the Natura 2000 network of sites) for those species listed in Annex II, which includes bottlenose dolphin and harbour porpoise. Within such sites, there is a requirement that developments should not have an adverse effect on the integrity of the site or on the wildlife or habitat interests for which the site has been designated. In general, Annex II prohibits all forms of deliberate capture, killing or disturbance, especially during breeding, rearing or migration; banning the keeping, sale, or exchange of such species; requires that member states monitor the incidental capture and killing of all cetaceans, and carries out research on conservation measures to prevent such accidents).

3.7 Nature Conservation (Scotland) Act 2004

An Act of the Scottish Parliament came into force in June 2004 to "make provision in relation to the conservation of biodiversity; to make further provision in relation to the conservation and enhancement of Scotland's natural features; to amend the law relating to the protection of certain birds, animals and plants; and for connected purposes."

The Act has three main parts, the first to further the conservation of biodiversity, the second is the conservation and enhancement of natural features, the third is the protection of

wildlife, the fourth is a Scottish fossil code, and the fifth a general part containing orders and regulations.

Within the third part is the requirement for a Scottish Marine Wildlife Watching Code, with information on activities likely to disturb marine wildlife, circumstances in which marine wildlife may be approached, and the manner in which marine wildlife may best be viewed with minimum disturbance.

3.8 The Conservation (Natural Habitats, &c.) Regulations 1994 & Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007

The European Habitats Directive has been transposed into national law by the Conservation (Natural Habitats, &c.) Regulations 1994 for inshore waters of England, Wales & Scotland, and the Conservation (Natural Habitats, &c.) Regulations 1995 for Northern Ireland (together referred to as the Habitat Regulations, HR), and offshore (beyond 12nm but within territorial waters), by the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (referred to as the Offshore Marine Regulations, OMR).

The Conservation (Natural Habitats, &c.) Regulations 1994 have been amended twice. Firstly, in relation to Scotland, by the Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 (SSI 80/2007) which came into force on 15th February 2007. The Conservation (Natural Habitats, &c.) Amendment Regulations 2007 (SI 1843/2007), which came into force on 21st August 2007, made similar, but not identical, amendments in relation to England and Wales. The amendment introduced the concept of recklessness to some offences and made the disturbance of Cetacea (and basking sharks) an offence.

The revised disturbance offence under Regulation 39(1)(b) states that:

(1) It is an offence—

(a) deliberately or recklessly to capture, injure or kill a wild animal of a European protected species;

(b) deliberately or recklessly—

(i) to harass a wild animal or group of wild animals of a European protected species;

(ii) to disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;

(iii) to disturb such an animal while it is rearing or otherwise caring for its young;

(iv) to obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;

(v) to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;

(vi) disturb such an animal in a manner that is, or in circumstances which are likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; or

(vii) to disturb such an animal while it is migrating or hibernating;

(c) deliberately or recklessly to take or destroy the eggs of such an animal; or

(d) to damage or destroy a breeding site or resting place of such an animal.

(2) Subject to the provisions of this Part, it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).

Marine European Protected Species (EPS) include all species of cetaceans, all species of marine turtles and the sturgeon (*Acipenser sturio*).

3.9 Marine (Scotland) Act 2010

An Act of the Scottish Parliament came into force in March 2010, to make provision “in relation to functions and activities in the Scottish marine area, including provision about marine plans, licensing of marine activities, the protection of the area and its wildlife including seals and regulation of sea fisheries; and for connected purposes”.

The Act sets out a framework for planning, licensing and conservation in Scotland’s territorial seas. It introduces a duty to protect and enhance the marine environment and also includes measures to help boost economic investment and growth in areas such as marine renewables. Through the Act, a new marine works licence is due to be introduced in 2011 that will combine elements of the CEPA 1949 and FEPA 1985 consents currently required for marine development.

Scottish Natural Heritage has published a policy statement with respect to marine renewable energy and the natural heritage (SNH, 2004). It recognises the potential for marine renewable energy developments to contribute a substantial proportion of Scotland’s renewable electricity, and considers that if sensitively designed and sited, this should be at lower environmental cost than comparable land-based generation systems. To achieve this, SNH recommends the following:

Siting

- areas designated specifically to protect the marine natural heritage, or habitats important to protected marine species, should be avoided;
- effects on hydrology and shoreline sedimentation should always be carefully modelled;
- the wild, isolated and undisturbed qualities which characterise some parts of Scotland’s coastline should be protected;
- because of the environmental consequences of shipping collision, minimising navigational risks should be seen as an environmental as well as a safety objective;
- a coordinated approach to underwater cabling is needed, with a minimum of cabling and landfalls, in optimum locations;
- better information is needed on areas used for marine recreation.

Design and operation

- out-at-sea maintenance or the use of ultra-smooth paints should be preferred to the use of anti-fouling paints;
- attention should be paid to the outcome of current research on the effect of underwater noise on fish and cetaceans, particularly from piling operations;
- it will be important to monitor and obtain feedback on the environmental impacts of first and second generation developments, so as to guide the further development of the industry;
- further research is needed to address a range of outstanding environmental uncertainties.

Specific technologies

- wave and tidal stream devices, particularly if moored rather than bottom-founded, offer the potential for energy generation with least impact on the marine natural heritage;

- the impact of offshore wind farms on bird populations and on seascapes can be minimised by careful siting and distance from shore;
- tidal barrage schemes are likely to have major impacts on estuarine habitats and the bird populations they support. SNH is likely to oppose tidal barrage development unless a component of a structure required for other purposes.

Since this document was published, there have been a number of studies and reviews of the impacts of offshore renewables upon marine mammals, particularly during the construction phase (see, for example, Carstensen *et al.*, 2006; Evans, 2008; Tougaard *et al.*, 2009; Bailey *et al.*, 2010). Impacts from wave and tidal stream devices are still to be fully assessed, but concerns have been expressed of the risk of physical damage to marine mammals (Carter, 2008).

3.10 Wildlife and Natural Environment (Scotland) Act 2011

This Act, which is due to come into force in 2011, should include a mechanism for licensing disturbance to other animals besides European Protected Species, and thus will extend to basking sharks.

4. STATUS & ECOLOGY

The status, seasonal occurrence, behaviour and ecology of the ten main species of marine mammal recorded from the region in recent years are given below:

a) Regular Species

4.1 Harbour Porpoise (*Phocoena phocoena*)

Distribution restricted to temperate and subarctic seas of the northern hemisphere. In the eastern North Atlantic, the harbour porpoise is widely distributed on the continental shelf from the Barents Sea south to the coast of France and Spain, although between the 1960s and 1980s it became scarce in the southernmost North Sea, English Channel, and Bay of Biscay (Smeenk, 1987; Evans, 1990b, 1992; Addink & Smeenk, 1999; Evans *et al.*, 2003, 2008). Nevertheless, it is the commonest and most widely distributed cetacean recorded in British and Irish waters; most abundant along the south and west coasts of Ireland, western and northern Scotland including the Hebrides and Northern Isles, in East Scotland and North-east England, and in some coastal areas within the Irish Sea (mainly off SW Wales where some of the largest concentrations occur). Only small numbers occur off the south coast of England although in the last decade numbers in the Channel appear to have increased. There is also some evidence for a southwards shift in abundance from the northern to the central and southern North Sea (Evans, 1992; Evans *et al.*, 2003; Camphuysen & Peet, 2006; Hammond, 2008).

Orkney and the north Caithness coast are clearly important for porpoises, with the region having relatively high densities (see Figs. 16 & 17). Porpoises appear to be widely distributed throughout the region with sightings concentrated in Thurso Bay, Dunnet Bay and Gills Bay along the Caithness coast, as well as in the inner waters of Orkney such as Scapa Flow and Stronsay Firth in Orkney (Fig. 3). Although the occurrence of the species in these areas is probably exaggerated by greater observer coverage, other cetacean species do not necessarily show similar distribution patterns, and therefore, they may indeed reflect true areas of concentration. Harbour porpoises also occur commonly offshore in the northern North Sea.

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Harbour porpoises are resident throughout the year in UK waters with peak sightings frequency and near-shore numbers usually recorded in the summer months. This pattern also applies around northern Scotland where peak sightings and numbers occur between July and September, and particularly in August (Fig. 18). However, on occasions, the species can occur near-shore in large numbers at other times of the year, as has been found in Shetland during spring and late autumn (Evans, 1996a; Evans *et al.*, 1997a, b). At least a portion of the Danish porpoise population occupying the Skagerrak migrate towards the Northern Isles (mainly Shetland) for the winter months, as revealed by radio telemetry studies (Teilmann *et al.*, 2008; Sveegaard *et al.*, 2010).

The main diet of porpoises is small fish (usually less than 40 cm length) such as young herring, cod, whiting, sand-eel, sprat, saithe, pollack, blue whiting, gobies and various flatfish. Off North-east Scotland, the diet in recent years appears to be predominantly whiting and sandeel (Santos & Pierce, 2003; Santos *et al.*, 1994, 2004). In some areas (e.g. Shetland Isles) when sandeel have become scarce, so have porpoises (Evans *et al.*, 2003). Breeding takes place between April and August with about 80% of births occurring in June (Lockyer, 1995, 2003; Evans *et al.*, 2008). There is no evidence for discrete breeding grounds, but at least some porpoises are born in coastal waters of Orkney (and Shetland), possibly taking advantage of the shallow depths as nursery areas (Evans, 1996a; Evans *et al.*, 1997a, b). In fact, in Shetland, there appears to be a distinct seasonal onshore movement of adults with young during July (Evans, 1996a).

4.2 Minke Whale (*Balaenoptera acutorostrata*)

This species has a worldwide distribution in tropical, temperate and polar seas of both hemispheres. In the North Atlantic, the minke whale occurs from Baffin Bay in the west and the Greenland & Barents Seas in the east, south to the Lesser Antilles in the west and the Iberian Peninsula and Mediterranean in the east (Anderwald *et al.*, 2008).

The minke whale is widely distributed along the Atlantic seaboard of Britain and Ireland, occurring regularly in the northern and central North Sea as far south as the Yorkshire coast (Evans *et al.*, 2003; Reid *et al.*, 2003; Anderwald *et al.*, 2008). It is seen in small numbers in the Irish Sea, particularly in the Celtic Deep (Baines & Evans, 2009), but is rare in the Channel and southernmost North Sea as well as south of here in the Bay of Biscay (Evans *et al.*, 2003; Hammond, 2008; Anderwald *et al.*, 2008). There is some indication of increasing numbers since the 1980s with populations concentrated in the northern North Sea and around North and West Scotland, and sightings of individuals around Jersey and Guernsey north to the mid-Channel (Evans *et al.*, 2003; Hammond, 2008; Anderwald *et al.*, 2008).

The only published population estimate for minke whales in UK waters comes from the North Sea, English Channel and Celtic Sea; the line transect survey (SCANS) in July 1994 estimated 8,450 (95% C.I. 5,000-13,500) (Hammond *et al.*, 2002). A more extensive line transect survey (SCANS II) over the NW European continental shelf in July 2005 gave an overall estimate of 16,395 (including 10,500 in the equivalent area as 1994) (Hammond, 2008). The species is subject to whaling in Norwegian waters and to a lesser extent off Iceland and Greenland. Since 2006 the annual catch quota set by the Norwegian government has been 1,052 whales, but the numbers actually caught have been much less.

Sightings are widely distributed in Northern Scotland, both offshore in the northern North Sea and at particular locations around the coast; including West Hoy, West Mainland of Orkney, around Copinsay and adjacent East Mainland of Orkney, Gills Bay and around the

island of Stroma, Dunnet Bay, Thurso Bay, and Lybster Point (East Caithness) - although these sightings may be enhanced by greater observer effort (Fig. 4).

The species has been recorded in the region anytime between January and October with most sightings and greatest numbers in June, July and August (Fig. 19). At least small numbers remain in coastal UK waters year-round (Evans, 1980, 1992; Evans *et al.*, 1986; Northridge *et al.*, 1995; Evans *et al.*, 2003; Anderwald & Evans, 2007). In the autumn there appears to be a general offshore movement, possibly associated with breeding that occurs sometime between autumn and spring. Breeding locations are unknown. There is no information on whether any more extensive migration takes place (Anderwald *et al.*, 2008).

Although most commonly seen singly or in loose groups of up to ten, in Northern Scotland in summer, feeding aggregations numbering up to 30 individuals have been recorded, particularly around Gills Bay.

Feeding occurs often in areas of upwelling or strong currents around headlands and small islands, primarily during the summer. In late summer, feeding minke whales are commonly associated with flocks of northern gannet, kittiwake and various *Larus* gulls.

The diet of Northeast Atlantic minke whales varies with region but prey species commonly recorded include sandeel, sprat, herring, and mackerel (Olsen & Holst, 2001; Pierce *et al.*, 2004). In the Scottish Hebrides, minke whales have been shown to switch prey from sandeel during May and June to sprat in July and August (Anderwald, 2009).

About half of the observed mortality (from post mortem examinations) of minke whales in Scottish waters can be attributed to entanglement in creel lines and other ropes (Northridge *et al.*, 2010).

4.3 Killer Whale or Orca (*Orcinus orca*)

The killer whale has a worldwide distribution in tropical, temperate and polar seas in both hemispheres (with greatest abundance at higher latitudes).

Although killer whale numbers in the North Atlantic appear to be greatest in sub-arctic and arctic waters, the distribution of the species extends south to the Caribbean, Azores, Madeira, Canaries and occasionally the western Mediterranean (Boran *et al.*, 2008b). It is widely distributed in the North Atlantic and in coastal northern European waters, particularly around Iceland and western Norway. In the UK it is most common in northern and western Scotland, but rare in the Irish, central and southern North Seas, and the English Channel.

The species is relatively common and widely distributed in the region but sightings appear to be concentrated between Dunnet Head and Duncansby Head and in adjacent waters towards Orkney (Fig. 5). Although recorded year-round, most sightings off northern Scotland occur between May and July (Evans, 1988, 1992; Evans *et al.*, 2003; Bolt *et al.*, 2009; see Fig. 20). Photo-ID studies, supported by genetic evidence, suggest that the population visiting the Northern Isles is quite small, possibly as few as 30 individuals, and that these are linked to the community of killer whales that follow the Icelandic summer-spawning herring (Foote *et al.*, 2009, 2010).

Group sizes recorded in the region are small, mainly between 1 and 10, with a maximum of 20. Studies elsewhere indicate that groups (termed pods) have a stable membership, although pods can coalesce and individuals (particularly males) can change their association patterns. Breeding occurs between October and March, possibly mainly between October and December (Boran *et al.*, 2008b). During winter months killer whales are found

particularly offshore in the northern North Sea, associated with the mackerel and herring fisheries (Couperus, 1993, 1994; Evans *et al.*, 2003; Luque *et al.*, 2006). In summer killer whales visit the coastal waters of the Northern Isles where they have been observed taking harbour seals, as well as harbour porpoise, otter and common eider (Evans *et al.*, 2003; Bolt *et al.*, 2009).

4.4 White-beaked Dolphin (*Lagenorhynchus albirostris*)

The distribution of this species is restricted to temperate and sub-polar seas of the North Atlantic. The distribution of the white-beaked dolphin extends northwards to central west Greenland, the Greenland Sea and the southern Barents Sea, and south to Newfoundland, Cape Cod and South-west Ireland (Reeves *et al.*, 1999a). It occurs over a large part of the northern European continental shelf (mainly in waters of 50-100 m depth, and almost entirely within the 200 m isobath), its distribution extending northwards to northern Norway, Iceland, the Greenland Sea and central west Greenland (Evans & Smeenk, 2008a). It has a broadly similar distribution to the Atlantic white-sided dolphin though less pelagic and in UK waters is apparently more abundant, at least in shelf seas. Its distribution is centred mainly upon the central and northern North Sea, extending westwards to North and North-west Scotland, and southwards towards South-west Britain and Ireland (Evans, 1990a, 1992; Northridge *et al.*, 1995; Evans *et al.*, 2003; Reid *et al.*, 2003). A small, relatively isolated, population is reported to exist in the western Channel east to Dorset, and the species occasionally occurs south to the Bay of Biscay, in the Irish Sea, and southernmost parts of the North Sea (Kinze *et al.*, 1997; Evans *et al.*, 2003; Reid *et al.*, 2003; Evans & Smeenk, 2008a).

In British and Irish waters, the species is found most abundantly in the central and northern North Sea across to North-west Scotland. From line transect surveys in July 1994 (Hammond *et al.*, 2002), a population estimate of 7,856 white-beaked dolphins (95% CI 4,032-13,301) was made for the North Sea and Channel. An abundance estimate of 11,760 (95% CI 5,867-18,528) dolphins was obtained when all *Lagenorhynchus* (i.e. white-beaked and Atlantic white-sided dolphins) sightings were combined (including those whose specific identity was not known). The most recent (July 2005) population estimate (from SCANS II), covering a much wider area of European continental shelf seas from Southwest Norway south to Atlantic Portugal, gave an estimate of 16,800 (95% CI 7,451-21,459) with the majority in the North Sea and off North-west Britain (Hammond, 2008).

Sightings are very widely distributed off northern Scotland, both inshore and offshore, although small concentrations of sightings exist in Strathy Bay, Thurso Bay and around Duncansby Head. (Fig. 4). Typically, in the northern North Sea, white-beaked dolphins occur mainly offshore and in summer between May and October (particularly between July and September) (Fig. 6); these are also the peak months for sightings rates and individual rates when corrected for effort (Northridge *et al.*, 1995; Evans *et al.*, 2003; Reid *et al.*, 2003; Weir *et al.*, 2007). Although rarely reported between November and April in most coastal waters around the British Isles, there are sightings of this species off northern Scotland in every month of the year except January (Fig. 21). Peak numbers in the region are between June and October.

In recent years, the species appears to be exhibiting a shift northwards. During the SCANS II survey in July 2005, only one sighting of white-beaked dolphins was made south of 55°N. A similar reduction in sightings in northern Britain was observed in the Sea Watch database, comparing sightings during the 1980s-90s with those since 2002 (Evans, 1990a, 1992; Northridge *et al.*, 1995; Evans *et al.* 2003). A decrease in strandings in northern Britain has also occurred over the same period (Canning *et al.*, 2008). Possible causes for a range shift

include a response to changing prey distributions resulting from warming sea surface temperatures, or a more direct thermal response (MacLeod, 2009; Evans *et al.*, 2010).

The Orkney and North Caithness region is used both for feeding and breeding, with several sightings of feeding groups and groups with small young (Sea Watch, unpubl. data). White-beaked dolphins feed upon haddock, whiting, mackerel, herring, cod, poor-cod, sandeels, bib, and hake, as well as squid, octopus, and benthic crustaceans (Canning *et al.*, 2008; Evans & Smeenk, 2008a). They breed mainly between May and August, although some may occur also in September and October (Evans & Smeenk, 2008a).

4.5 Risso's Dolphin (*Grampus griseus*)

Risso's Dolphin has a worldwide distribution in tropical and temperate seas of both hemispheres. The species occurs in small numbers along the Atlantic European seaboard from the Northern Isles of Scotland south to the Iberian Peninsula and east into the Mediterranean Sea (particularly the Ligurian Sea) (Evans *et al.*, 2003; Reid *et al.*, 2003; Evans, 2008). The species also occurs around oceanic islands such as the Azores, Madeira, Canaries and Cape Verde.

The major populations in northern European waters occur in the Hebrides (Evans, 1997b, Boran *et al.*, 1999), where at least 142 individuals have been identified from a photo-ID study (Atkinson *et al.*, 1997, 1999), but the species is also regularly observed in the Northern Isles, the Irish Sea (particularly the St George's Channel, North-west Wales and the Isle of Man), and in South-west Ireland; it is rare in the North Sea and all but the western end of the English Channel (Evans *et al.*, 2003; Reid *et al.*, 2003). Elsewhere, it is present in North-west France (and the Channel Islands), the southern Bay of Biscay, around the Iberian Peninsula and in the Mediterranean Sea (Evans, 2008).

In recent years, Risso's dolphins have been observed regularly in the northern and central North Sea (Sea Watch, unpubl. data). In northern Scotland, sightings of the species are widely distributed from Strathy Point round to Lybster Point, including all of Orkney (Fig. 7). The species has been recorded year-round (except December) with peak numbers of individuals and sightings occurring between May and September, and in particular June to August (Fig. 22). A similar seasonal pattern exists in the Hebrides (Evans, 1997b; Benoldi *et al.*, 1997; Boran *et al.*, 1999). Group sizes have generally been small - less than eight individuals, with a maximum of 16 animals observed on one occasion.

The Orkney and North Caithness region is used for feeding and possibly also for breeding (since young calves have been observed within groups sighted in the region). Calves in UK waters born mainly from early spring to summer (March to July), whereas elsewhere, births occur mainly in December to February (Evans, 2008). The diet of Risso's dolphins comprises mainly cephalopods, particularly octopus, and various small squid (e.g. *Todarodes sagittatus*, *Loligo* spp., *Histioteuthis* spp. - Zonfrillo *et al.*, 1987; Santos *et al.*, 1994; Evans, 2008). Fish (e.g. cod) are also occasionally taken.

4.6 Bottlenose Dolphin (*Tursiops truncatus*)

The bottlenose dolphin has a worldwide distribution in tropical and temperate seas in both hemispheres. Along the Atlantic seaboard of Europe, the species is locally fairly common near-shore off the coasts of Spain, Portugal, North-west France, western Ireland, western and north-eastern Britain, and in the Channel. All these localities receive influence from the Gulf Stream. Essentially an inshore species on the north-west European continental shelf, in

British and Irish waters the bottlenose dolphin is most frequently sighted within 10 km of land where it may be present throughout the year - often favouring river estuaries, bays, headlands or sandbanks where there is uneven bottom relief and/or strong tidal currents (Lewis & Evans, 1993; Liret *et al.*, 1994, 2006; Wilson *et al.*, 1997; Wilson, 2008; Pesante *et al.*, 2008; Baines & Evans, 2009). Substantial populations of the species also occur offshore in the North Atlantic (often in association with long-finned pilot whales) along the shelf edge as far north as the Faroe Islands (Evans *et al.*, 2003; Reid *et al.*, 2003; Hammond, 2008).

Bottlenose dolphins are present throughout the year in various bays in the Irish Sea (particularly concentrated around Cardigan Bay in summer), North-east Scotland (particularly the Moray Firth), around the Island of Jersey and in various bays in western Ireland (particularly the Shannon Estuary). Elsewhere in Britain the species became scarce in the central and southern North Sea during the 1960s to 1980s. It returned to South-west England in the 1990s and now occurs seasonally along the south coast of England at various localities (Evans *et al.*, 2003).

From the mid 1990s onwards bottlenose dolphins have been seen regularly off the Grampian coast and as far south as the Yorkshire coast. Photo-ID matches have shown that some, if not all, of the animals are part of the Moray Firth population (Weir & Stockin, 2001; Wilson *et al.*, 2004; Canning, 2007; Thompson *et al.*, 2009).

Bottlenose dolphins are observed all around the coast of north Scotland with sightings concentrated at Lybster Point (East Caithness), Dunnet Bay and Thurso Bay - possibly enhanced by greater observer effort (Fig. 8). There are also some offshore sightings of bottlenose dolphins, however, in the northern North Sea the species rarely occurs north of Orkney.

In the region under consideration the frequency of sightings increases between May and June and group sizes peak between May and September (Fig. 23) - when they may number up to 80 individuals (though most commonly less than 20). This pattern is similar to that observed in the Moray Firth (Wilson 1995; Wilson *et al.*, 1997).

The species has an extended breeding season with births peaking between May and October (Evans 1980, 1996b, 1997; Wilson, 1995; Grellier, 2000; Evans *et al.*, 2003; Pesante *et al.*, 2008).

Bottlenose dolphins feed upon a variety of benthic (e.g. eels, flounder, dab, sole, turbot, haddock, hake, and cod) and mid-water fish (e.g. salmon, trout, bass, mullet, herring, blue whiting), as well as marine invertebrates (cephalopods and shellfish) (Santos *et al.*, 2001; Wilson, 2008).

b) Casual Species

4.7 Short-beaked Common Dolphin (*Delphinus delphis*)

This species has a worldwide distribution in tropical, subtropical and temperate seas in both hemispheres. The common dolphin is widely distributed in the eastern North Atlantic, mainly in deeper waters from the Iberian Peninsula north to West Scotland. In British and Irish coastal waters its distribution has a mainly western and southern component. It is common in the Western Approaches to the Channel and the southern Irish Sea, off the west coast of Ireland and around the Inner Hebrides and west coast of Scotland (Evans, 1992; Northridge *et al.*, 1995; Evans *et al.*, 2003; Reid *et al.*, 2003). In the last ten years the species has occurred further north and east, around Shetland and Orkney and into the northern North Sea (Evans *et al.*, 2003; Murphy *et al.*, 2008). It is generally rare in the southern North Sea

and the eastern portion of the English Channel although it is a regular visitor in the western sector.

In northern Scotland common dolphins have been recorded throughout the region, particularly between Strathy Point and Lybster Point and in and around Scapa Flow (Fig. 9). Most records have been between May and November with largest groups in June and July (Fig. 24). The majority of sightings have been of sizeable groups numbering between 10 and 50, with occasional larger groups of up to 200.

Common dolphin groups have several times been observed feeding in the area, with some groups including young calves. Breeding in British & Irish waters takes place mainly between May and September (Murphy *et al.*, 2008). The diet of common dolphins varies with region but around the British Isles is dominated by mackerel, horse mackerel, Norway pout and sardines (Santos, 1998; Murphy *et al.*, 2008).

4.8 Atlantic White-sided Dolphin (*Lagenorhynchus acutus*)

Distribution restricted to temperate and sub-polar seas of the North Atlantic. This species is relatively abundant mainly in offshore waters from central West Greenland, Iceland and the southern Barents Sea south to Cape Cod (United States) and South-west Ireland (Evans & Smeenk, 2008b). In European waters it is widely distributed, mainly offshore from Iceland and the western Barents Sea south to the Bay of Biscay. It is less common on the continental shelf than on the slope or in deeper waters and is more abundant north of 56°N than south of this latitude. In coastal waters of Britain and Ireland it is less commonly recorded than the related white-beaked dolphin, except in those areas closest to the shelf edge such as Shetland (Evans, 1998a). Consequently its distribution is concentrated around the Hebrides, the Northern Isles and in the northern North Sea (Evans *et al.*, 2003; Reid *et al.*, 2003). It also occurs regularly off western Ireland and in the South-west Approaches to the Channel and the central North Sea, but is rare in the southernmost North Sea and Irish Sea, and absent from the Channel east of Dorset (Evans *et al.*, 2003; Reid *et al.*, 2003).

Sightings in northern Scotland are widely distributed mainly offshore in the northern North Sea and in the Pentland Firth between the Caithness coast and Orkney, and on the west side of Orkney (Fig. 10). Most sightings in the region occur in July and September, corresponding with when the species occurs elsewhere in UK waters, although the species has been recorded in the region in all months between March and October (Fig. 25).

Breeding in UK waters occurs between February and September, probably mainly between May and August (Evans & Smeenk, 2008b), and groups with small calves have been seen in the vicinity of Fair Isle and Shetland to the north (P.G.H. Evans, personal observations). The diet of white-sided dolphins in European seas includes poor cod, mackerel, horse mackerel, cod, hake, and blue whiting, as well as squid and shrimp (Desportes, 1985; Reeves *et al.*, 1999b; Evans & Smeenk, 2008b).

4.9 Long-finned Pilot Whale (*Globicephala melas*)

This species has a worldwide distribution in temperate and sub-polar seas of both hemispheres (although absent from the North Pacific). The species is common and widely distributed in deep North Atlantic waters but seasonally enters coastal areas such as the Faroes, northern Scotland, western Ireland and the South-west Channel Approaches; it also occurs south to the Iberian Peninsula and is common in the Mediterranean (Boran *et al.*, 2008a).

The species usually occurs in deep temperate and sub-polar waters (mainly 200-3,000m depth) seaward and along the edges of continental shelves where bottom relief is greatest, although it may venture on occasions into coastal waters entering fjords and bays (Payne & Heinemann, 1993; Boran *et al.*, 2008a).

Sightings in the region are widely distributed, both offshore and near-shore - the near-shore sightings being concentrated particularly in the Pentland Firth from Duncansby Head and Gills Bay north to southern Orkney, including Scapa Flow (Fig. 11). Sightings are scattered through the year, mainly between May and August, although group sizes tend to be larger in winter numbering up to 100-150 animals in January (Fig. 26). The majority of sightings of this species (particularly of the larger groups) in the region have occurred during the 1980s (Evans *et al.*, 2003; Sea Watch, unpubl. data).

A highly social species, long-finned pilot whales are usually found in groups of 6-40 animals although pods in offshore deep waters can comprise more than 1,000 individuals (Evans, 1980; Evans *et al.*, 2003). In the Orkney region, during recent years, pods have rarely exceeded ten individuals.

Sightings surveys in the eastern North Atlantic in the late 1980s (Buckland *et al.*, 1993) estimate the population at 778,000 (CV=0.295), but the difficulty of accurately estimating group size and distance of the centre of the group from survey vessels imposes serious limitations to the accuracy of such estimates whilst the area of coverage did not extend fully into UK waters. There were too few sightings on the European continental shelf in July 1994 or July 2005 to derive abundance estimates for the species (Hammond *et al.*, 2002; Hammond, 2008).

Although there is no distinct breeding season, births in UK waters show a slight peak in late winter to early spring (January to March) (Evans, 1980; Martin *et al.*, 1987; Evans *et al.*, 2003; Boran *et al.*, 2008). Further north, in the Faroe Islands, conceptions peak between April and July with most births between July and September (Desportes *et al.*, 1993; Martin & Rothery, 1993).

Cephalopods form the bulk of the prey in all dietary studies of this species, although a wide variety of fish have also been found (Sergeant, 1962; Desportes, 1985; Clarke, 1986; Waring *et al.*, 1990; Desportes & Mouritson, 1993; Bernard & Reilly, 1999). Examination of the stomach contents of 857 pilot whales from the Faroe Islands revealed 12 genera of cephalopods, 15 genera of fish, and three species of crustaceans (Desportes & Mouritson, 1993). The prey comprised mainly oceanic, mid-water pelagic shoaling species - most of the squid were luminous. Two species of squid, *Todarodes sagittatus* and *Gonatus* sp., were the dominant prey, the former appearing to be the preferred food. When unavailable, other prey items including fish (mainly greater argentine and blue whiting) and shrimps (mainly *Pandalus montagui*) were taken. Fish were more important in summer, especially in the diet of males (although squid continued to make up the bulk of the food), whilst in winter, prey species diversity increased. The diet varied with reproductive status (e.g. fish were of very low importance in non-lactating mature females) and between years (*Todarodes* was much more important in some years compared with others).

4.10 Sperm Whale (*Physeter macrocephalus*)

Sperm whales have a worldwide distribution in deep waters of all seas and in both hemispheres.

Females and juvenile males have a more limited range than adolescent and mature males, being confined to warmer waters of the tropics and subtropics. From the ages of 14-21 years, males move increasingly to higher latitudes (Gordon & Evans, 2008).

In the eastern North Atlantic sperm whales are widely distributed in deep waters off the continental shelf, along the Mid-Atlantic Ridge and oceanic island archipelagoes (Azores, Madeira, Canaries, and Cape Verdes), from Iceland and Norway south to the Iberian Peninsula and east into the Mediterranean (Gordon & Evans, 2008). A number of preferred feeding areas in North-west Europe have been identified. These include deeper waters along the continental slope west of Portugal and north of Spain, west and north of the British Isles, off Iceland, and the Lofoten Islands in Norway (Evans *et al.*, 2003; Reid *et al.*, 2003; Gordon & Evans, 2008).

Most sightings around the British Isles come from deep waters off the continental shelf or adjacent areas, notably the waters around Rockall, north of the Outer Hebrides, north and west of Shetland in the Faroe-Shetland Channel, the Porcupine Bight west of Ireland, and in the Bay of Biscay (Evans *et al.*, 2003; Reid *et al.*, 2003; Gordon & Evans, 2008). The species sometimes strays into the North Sea, usually resulting in strandings (Evans, 1998b).

Although there have been 47 sightings recorded in the region under consideration, these have involved seven main events (Fig. 12): six sperm whales remained in Scapa Flow for a month between late February and late March 1993; a further seven sperm whales were seen in Scapa Flow in April 1998; a pod of 13 sperm whales was sighted off Orkney between East Holm and Burra in late November 2002; eight sperm whales were observed near Rose Ness, Orkney, just east of Scapa Flow in November 2003; a pod of 15 sperm whales was seen between Latheron and Berriedale in East Caithness in mid-March 2007, with a single animal spotted off Lybster Point two weeks later at the end of the month; and one seen in the same area two months later, in May 2007. In addition to these, a pod of 11 sperm whales was seen in December 1994 just outside the area near Sanday, Orkney.

Although sightings in British and Irish waters are mainly between July and December, there is increasing evidence of small groups remaining at high latitudes into winter - as indicated by a number of the records detailed above between November and March (Gordon & Evans, 2008; Fig. 27).

North Atlantic sperm whales give birth in low latitudes mainly between June and September. Their diet is dominated by medium-sized mesopelagic squid (for example *Gonatus fabricii*, *Loligo forbesi*) and octopus, although males at high latitudes also take demersal fish, including rays, sharks, lanternfish, redfish and gadoids (Clarke & MacLeod, 1976; Martin & Clarke, 1986; Santos *et al.*, 1999, 2002; Gordon & Evans, 2008).

4.11 Other Cetacean Species

Seven other cetacean species have been recorded alive in the region, all as vagrants (see Fig. 13 & 14). A pod of between 100 and 150 false killer whales was seen about 50 km east of Orkney in July 1981; a striped dolphin was recorded off the west coast of Shapinsay, Orkney, in July 2005 and another in the Sound of Hoxa, Orkney, in November 2006; a Cuvier's beaked whale was identified in January 2007 near Stromness, Orkney; two sightings of a beluga were made near Berriedale, East Caithness, in January 2007 with an earlier one in July 2005; single fin whales have been seen in September 1981 halfway between North Ronaldsay and Fair Isle, in July 1985 just southwest of North Ronaldsay, with another sighting possibly the same individual just south of Papa Westray, in February 2007 south of Hoy, Orkney, and another in the same area in June 2009; and a sei whale was seen just south of Handa Island in July 1980, and another a few miles east of Stronsay,

Orkney in July 2008. There have been a total of fourteen sightings of humpbacks, some probably involving the same individuals. Most of these have been clustered around Orkney (Fig. 13), although a humpback whale was spotted off Duncansby Head, Northeast Caithness, in August 2008 and another off Lybster Point, East Caithness, in July 2009. They have shown no particular seasonal pattern (occurring in Feb, May, July, Aug & Nov). Most of these species have their normal ranges either in deep waters far offshore (e.g. sei whale) or to the north (e.g. beluga) or south (e.g. striped dolphin) of the British Isles.

4.12 Basking Shark (*Cetorhinus maximus*)

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The basking shark is currently listed by IUCN as “Vulnerable” globally and “Endangered” in the Northeast Atlantic and North Pacific. They were listed in Appendix II of CITES in 2002, and are on Appendix 1 and II of CMS, and Annex I of UNCLOS. They are protected from capture and disturbance in British waters (up to 12nm offshore) under the Wildlife & Countryside Act, and, under the Nature Conservation (Scotland) Act, no disturbance is allowed. Under European legislation, it is prohibited for basking sharks to be fished for, retained on board, or landed by any Community vessel.

Basking sharks are a wide-ranging species occurring from warm temperate waters of the European continental shelf as far north as the arctic (Sims, 2008). They are commonly observed in British and Irish waters along the western seaboard, including the Irish Sea, making seasonal movements north from the western English Channel in spring past the Isle of Man to west Scottish waters - where they spend the summer and early autumn before moving offshore between November and March. Recent warming of European seas has resulted in the species occurring further north than in previous decades, with occasional records now around Shetland and Orkney north to the Norwegian coast and in the northern North Sea. (Fowler, 2000; Sims, 2008).

The 345 basking shark records (comprising 385 individuals) from North Scotland and Orkney are widely scattered with no particular concentration (Fig. 15). They have occurred in most months of the year, although rarely between November and April (Fig. 28). Peak records occur between July and September (particularly August), as is found also along the west coast of Scotland (Speedie *et al.*, 2009; Sea Watch, unpubl. data).

The basking shark is exclusively a filter-feeding plankton feeder, and as a consequence is frequently associated with productive frontal zones (Sims *et al.*, 2003; Skomal *et al.*, 2004). Animals can occur singly or in loose aggregations, which in British waters can sometimes number in the low tens. Recent studies have demonstrated trans-Atlantic and trans-equatorial migrations (Gore *et al.*, 2008; Skomal *et al.*, 2009). They pair in early summer in British waters and eggs hatch in uteri.

5. Information Gaps

Most observation effort in the region involves casual watching, and although there have been effort-based observations at a few land sites, most offshore survey effort has spent rather little time in the immediate area of interest. Notwithstanding this, we believe the status and distribution patterns described here reasonably reflect their occurrence in the region.

A few of the development sites have had very little observation effort in the immediate area and that is likely to reflect in the lack of sightings (e.g. of porpoises) there (see Fig. 29). A good example of this is Armadale. We would recommend more survey effort particularly in near-shore waters around this and other proposed development sites.

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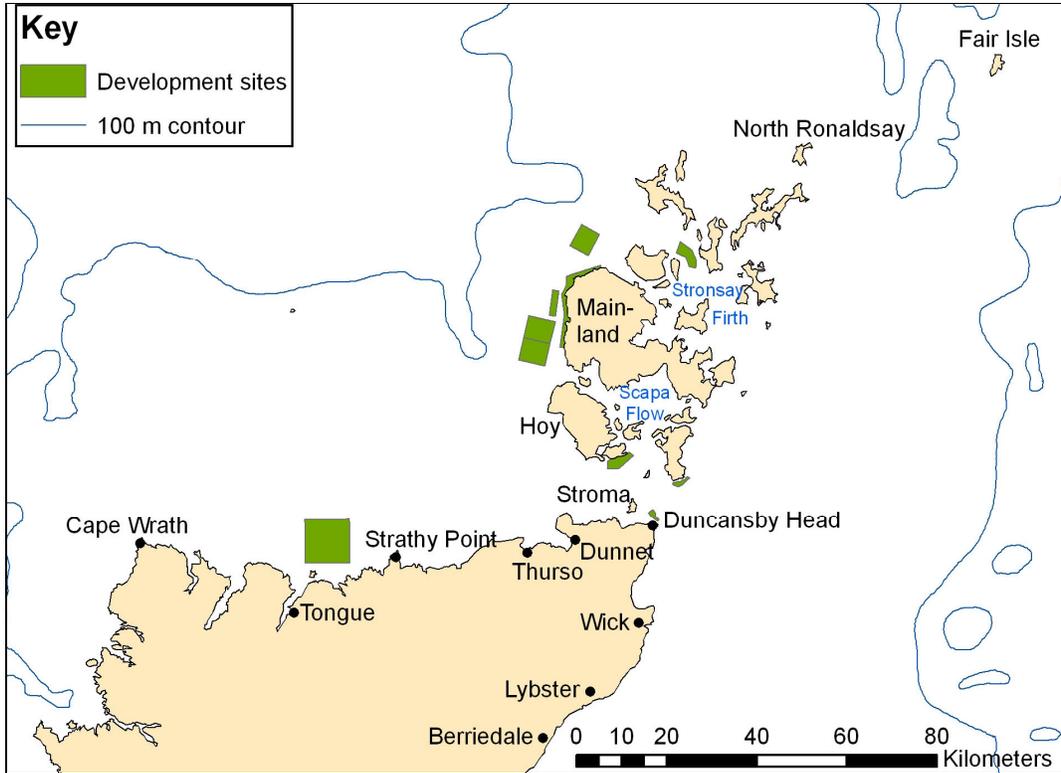


Fig. 1. Map of Overall Area for Offshore Renewable Energy Development for Pentland Firth & Orkney Waters

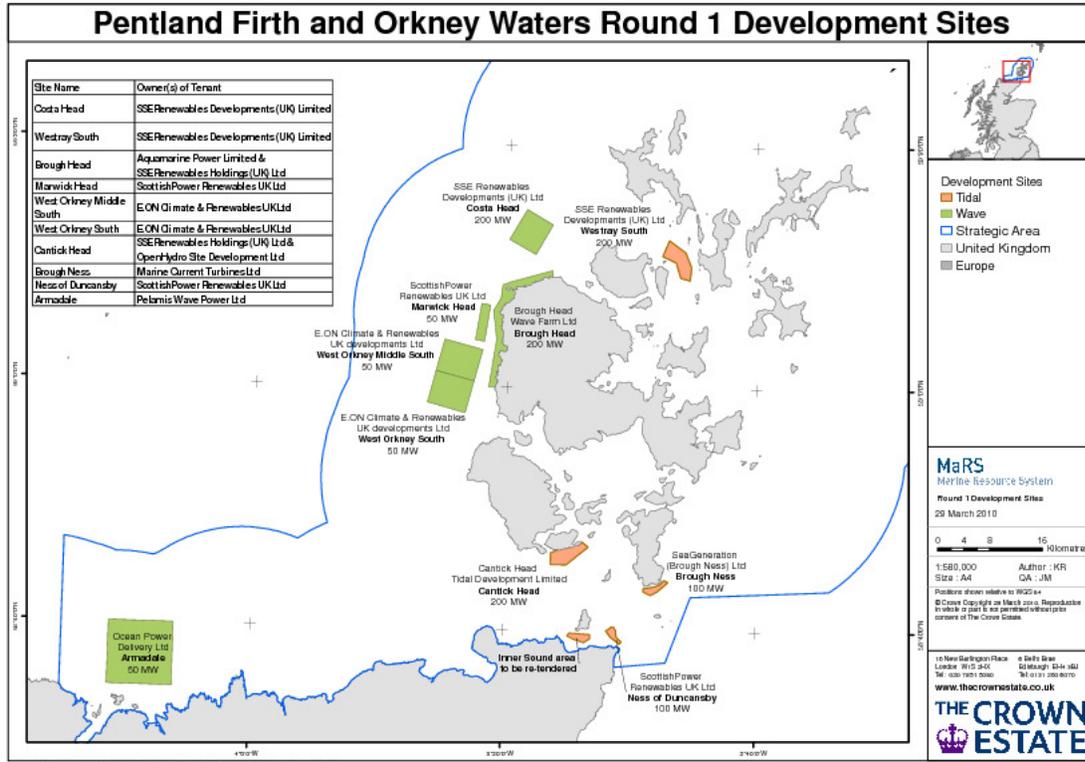


Fig. 2. Map of Round 1 Development Sites for Pentland Firth & Orkney Waters

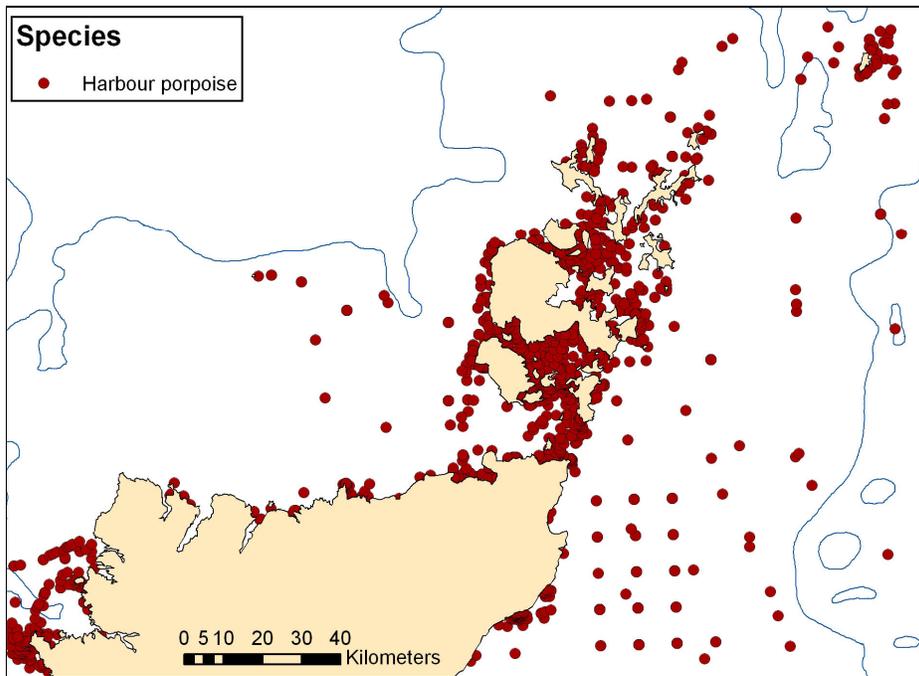


Fig. 3. Distribution of sightings of harbour porpoise, 1980-2010

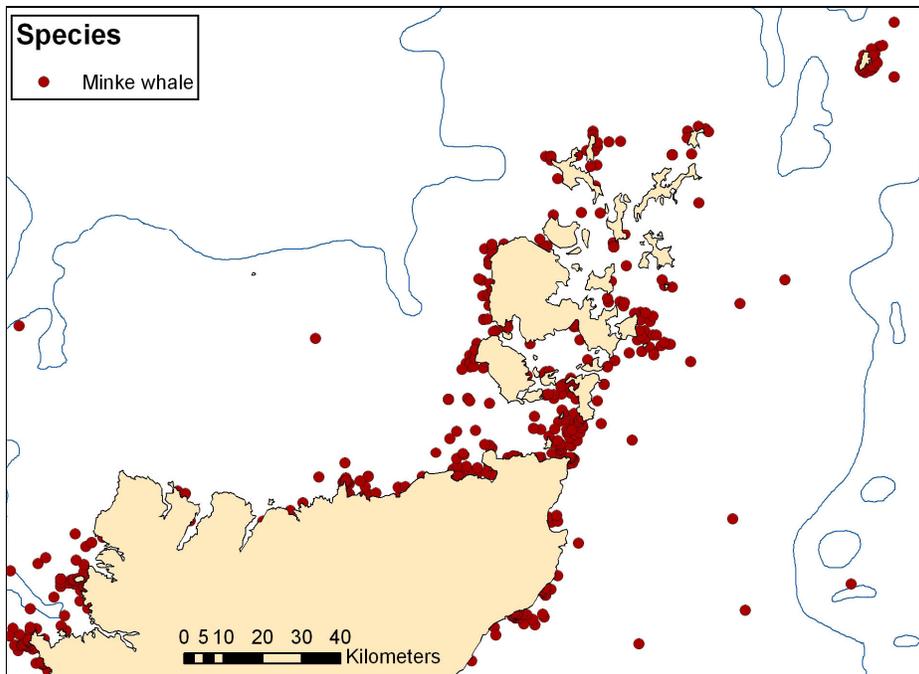


Fig. 4. Distribution of sightings of minke whale, 1980-2010

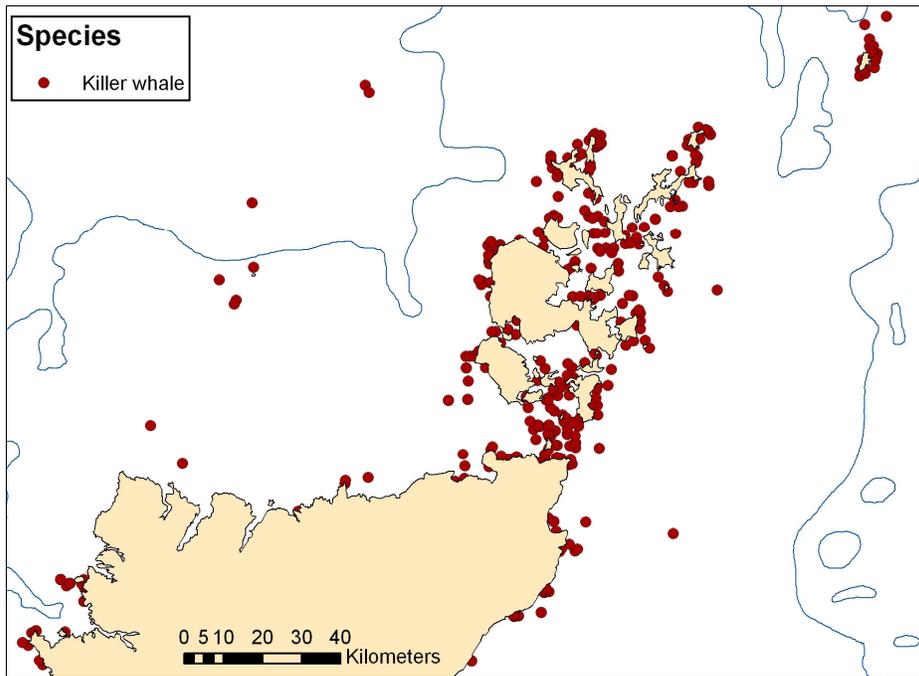


Fig. 5. Distribution of sightings of killer whale, 1980-2010

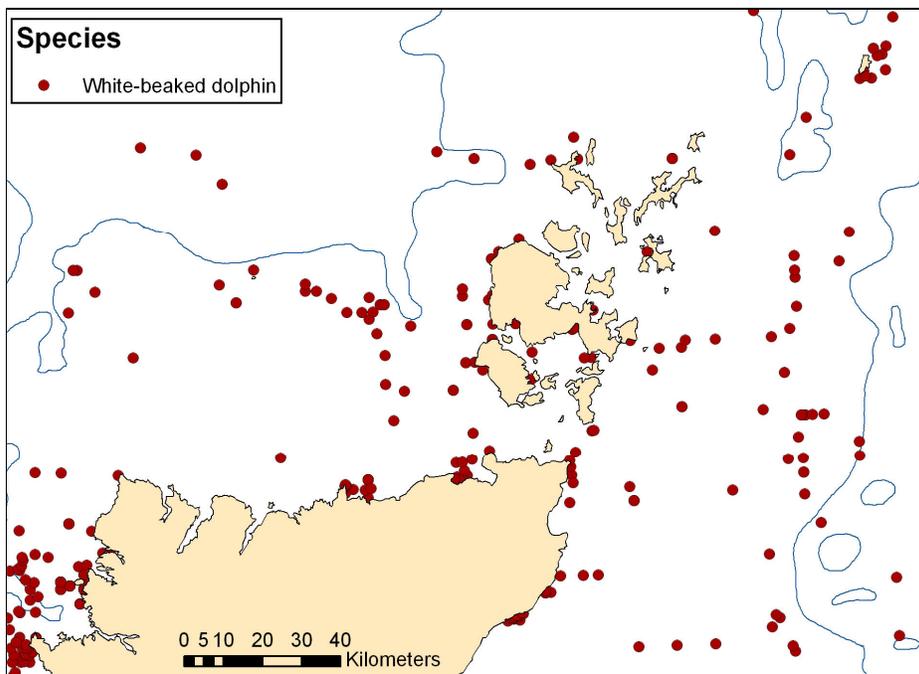


Fig. 6. Distribution of sightings of white-beaked dolphin, 1980-2010

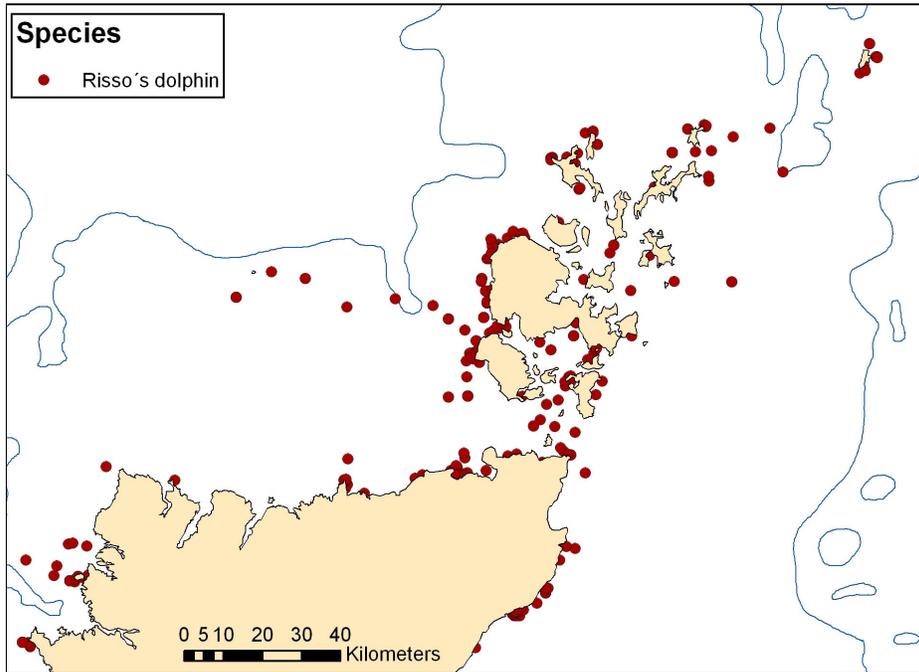


Fig. 7. Distribution of sightings of Risso's dolphin, 1980-2010

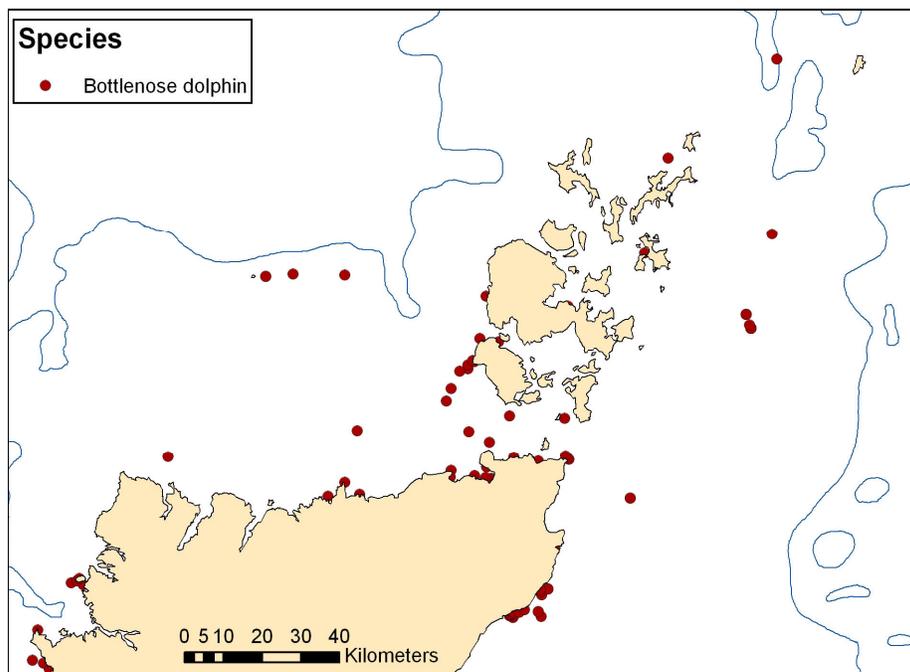


Fig. 8. Distribution of sightings of bottlenose dolphin, 1980-2010

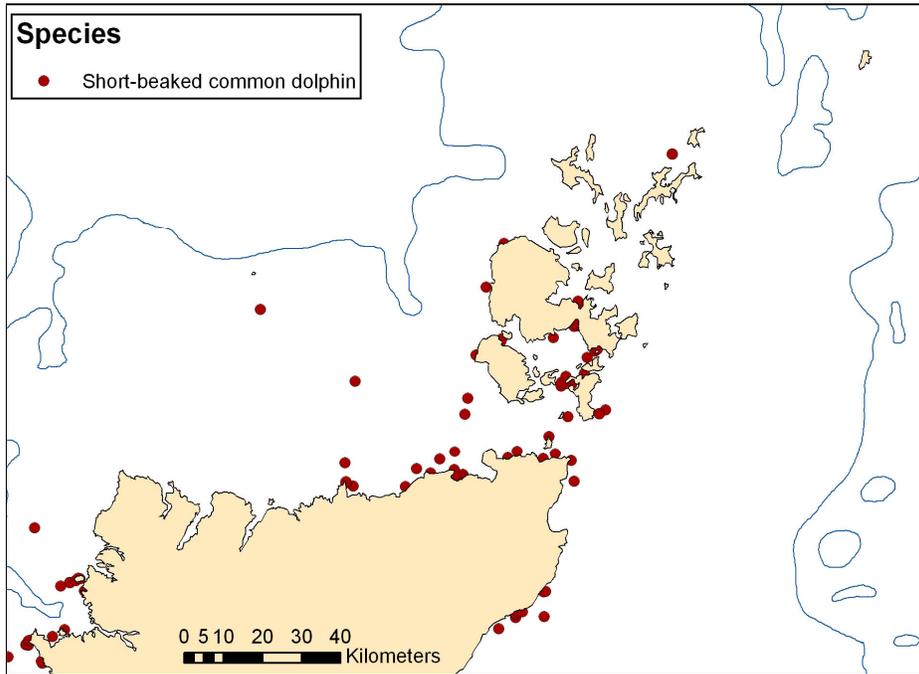


Fig. 9. Distribution of sightings of short-beaked common dolphin, 1980-2010

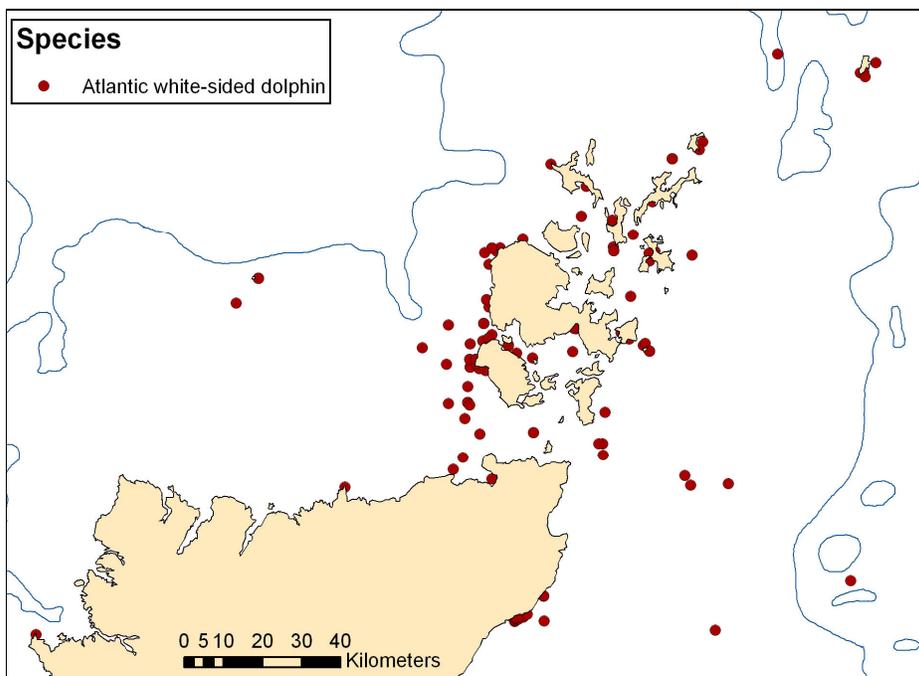


Fig. 10. Distribution of sightings of Atlantic white-sided dolphin, 1980-2010

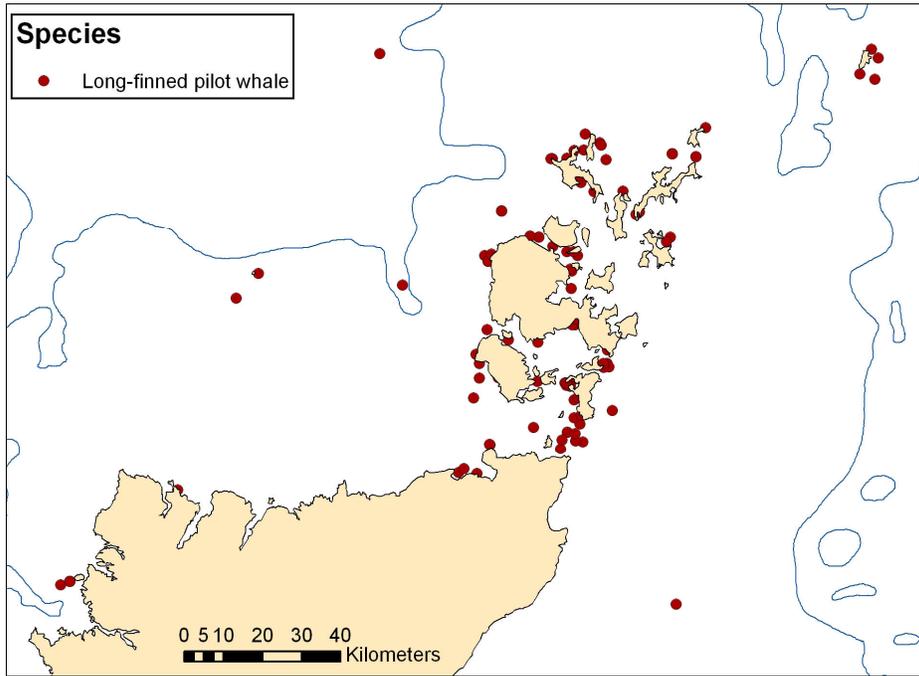


Fig. 11. Distribution of sightings of long-finned pilot whale, 1980-2010

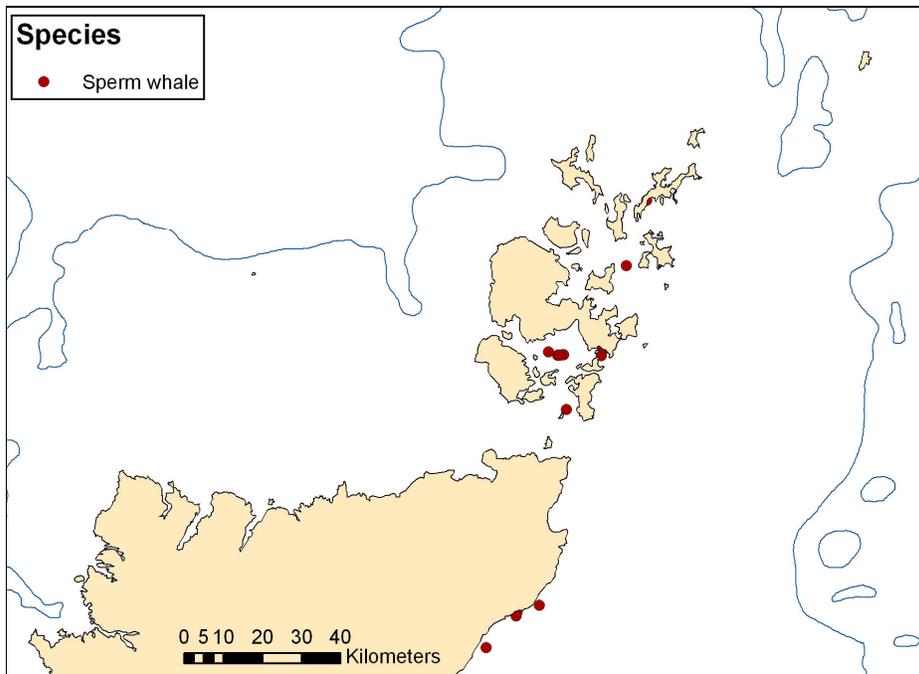


Fig. 12. Distribution of sightings of sperm whale, 1980-2010

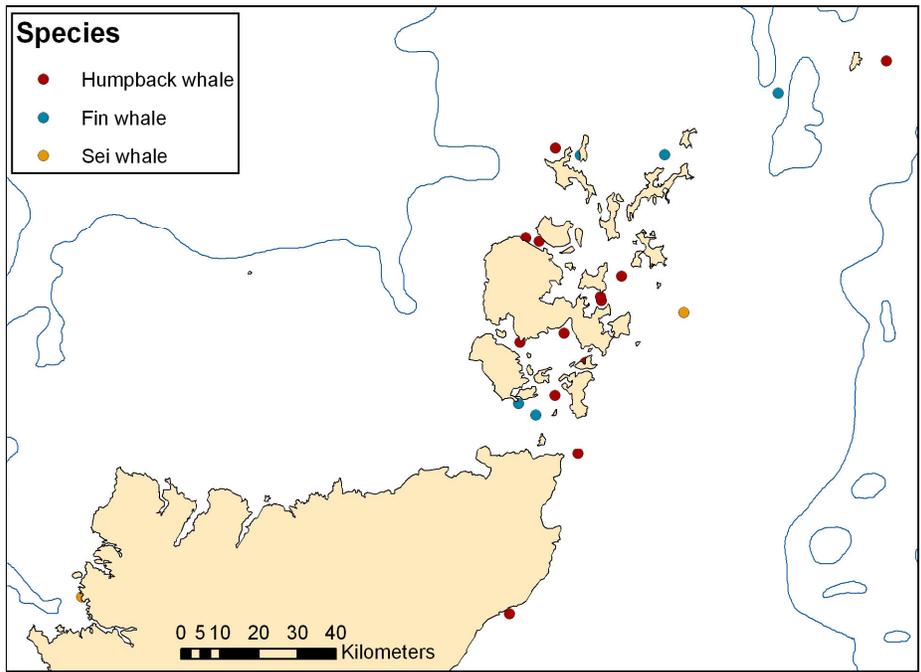


Fig. 13. Distribution of sightings of rarer baleen whale species, 1980-2010

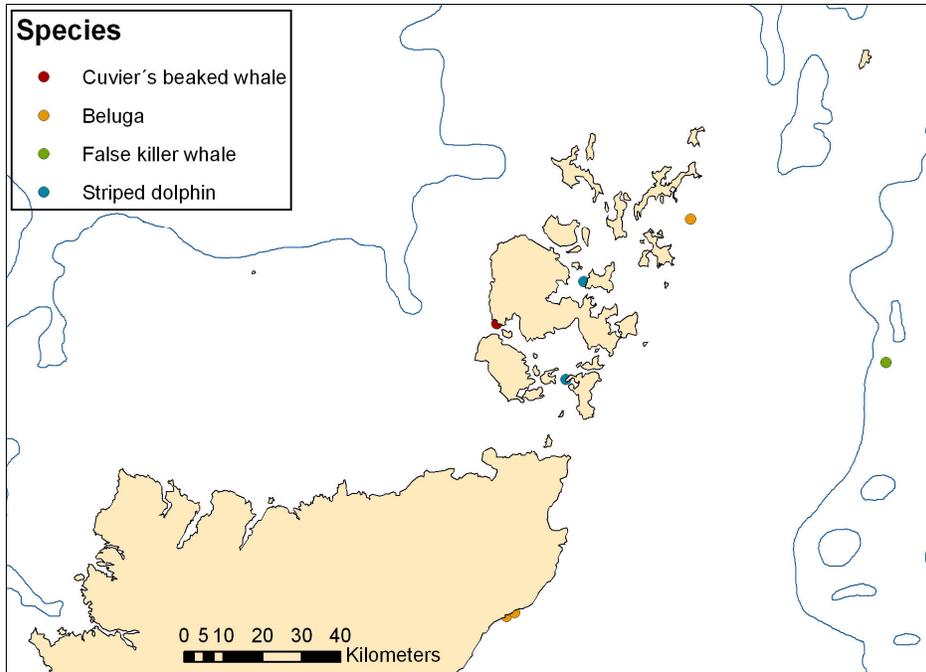


Fig. 14. Distribution of sightings of rarer odontocete species, 1980-2010

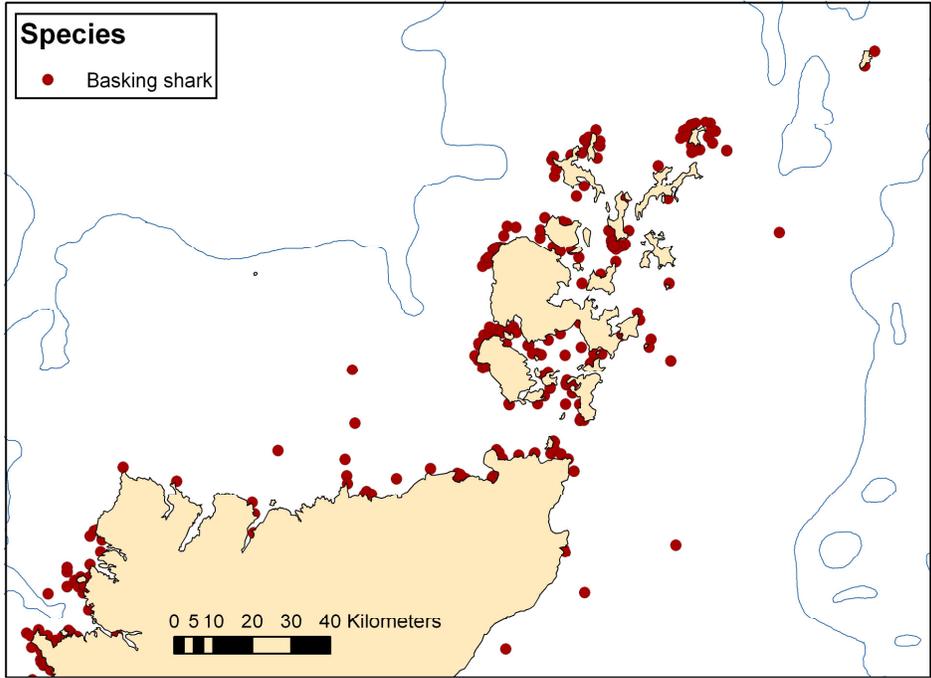


Fig. 15. Distribution of sightings of basking shark, 1980-2010

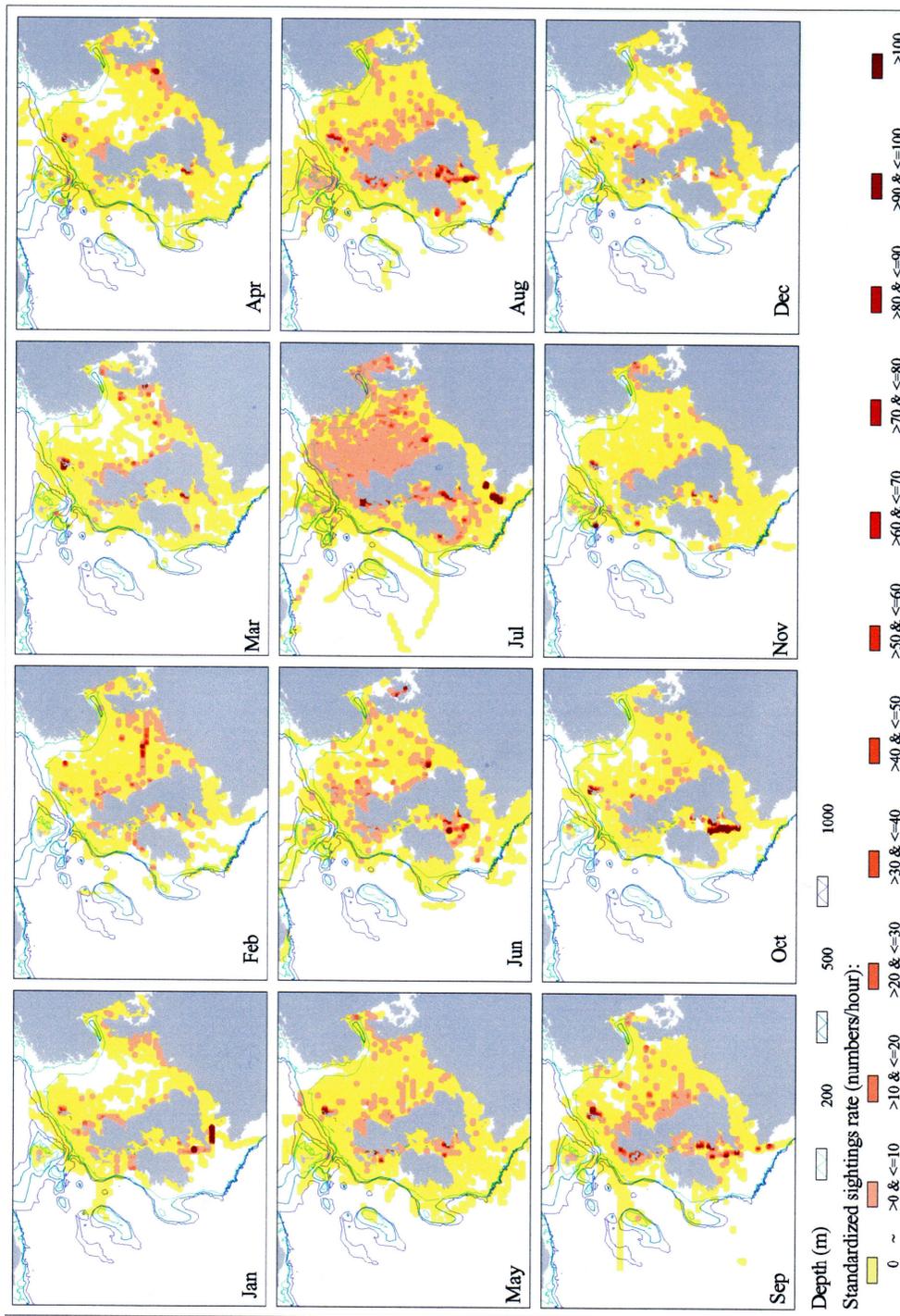
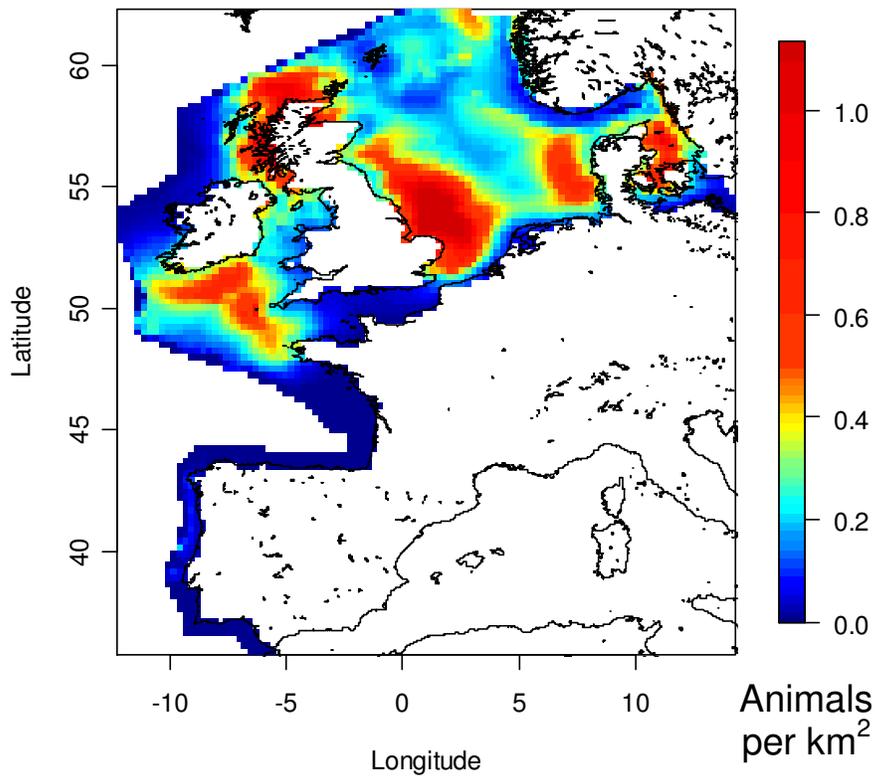


Fig. 16. Relative Densities of Harbour Porpoise, 1980-2003
 (Source: Evans & Wang, 2004)

2005



*Fig. 17. Porpoise Densities from SCANS II Survey
(Source: Hammond, 2008)*

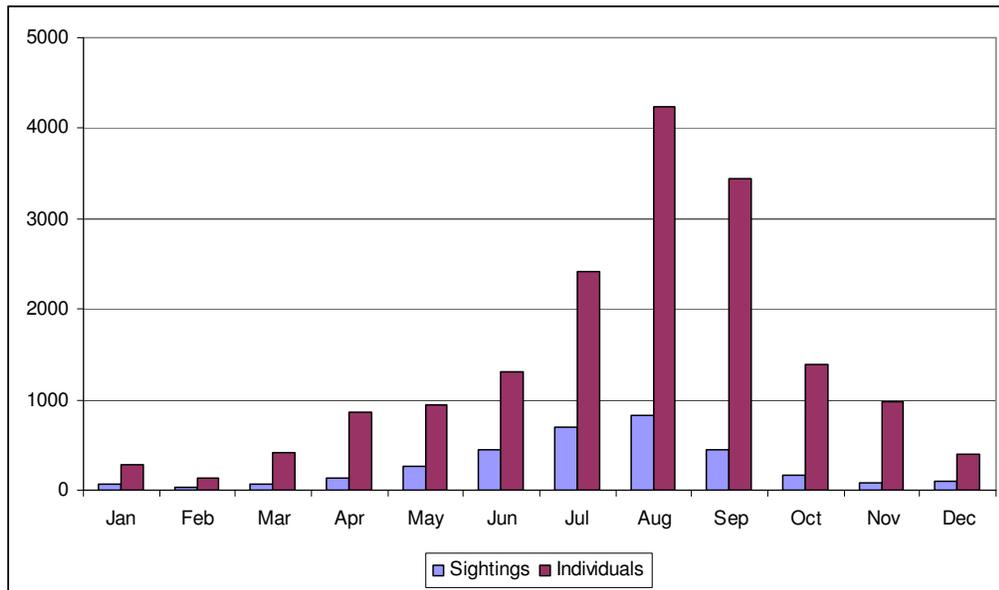


Fig. 18. Seasonal Occurrence of harbour porpoise 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

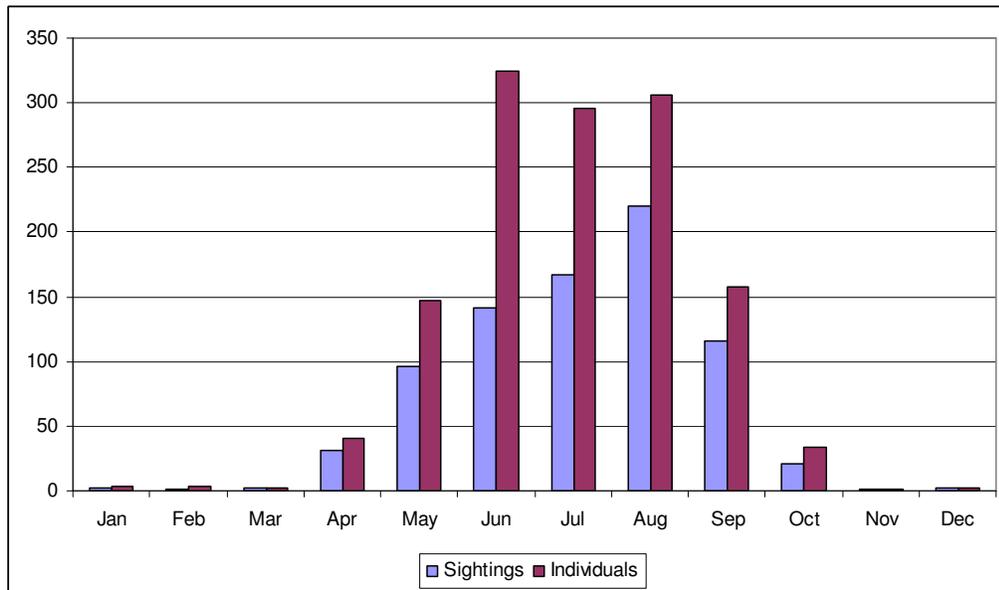


Fig. 19. Seasonal Occurrence of minke whale, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

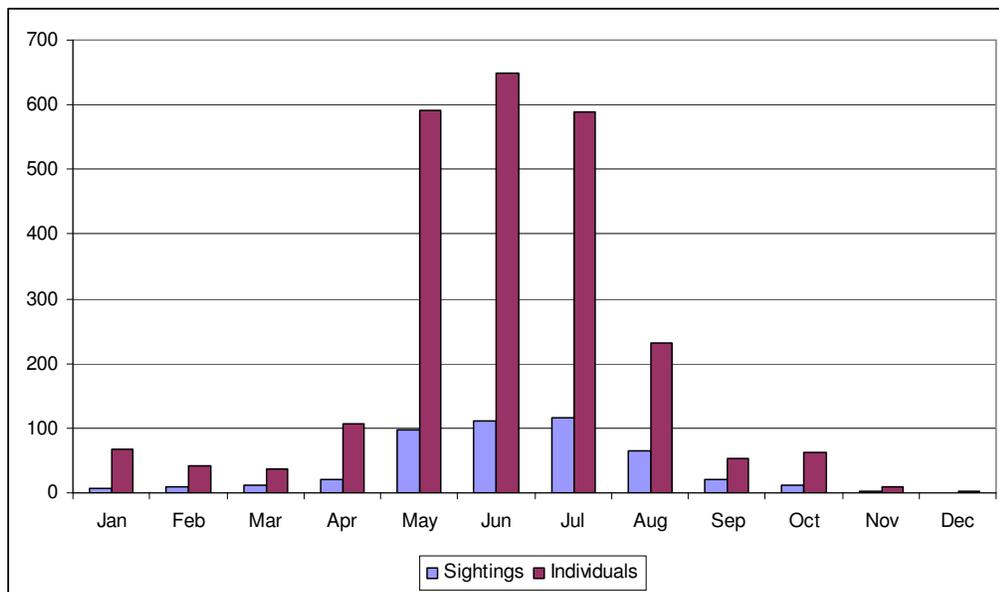


Fig. 20. Seasonal Occurrence of killer whale, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

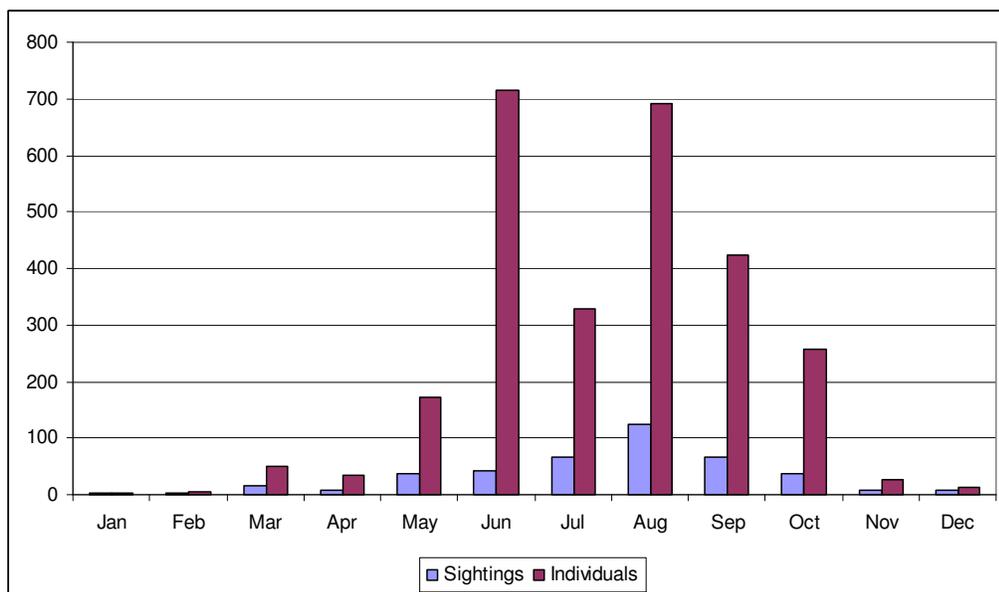


Fig. 21. Seasonal Occurrence of white-beaked dolphin, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

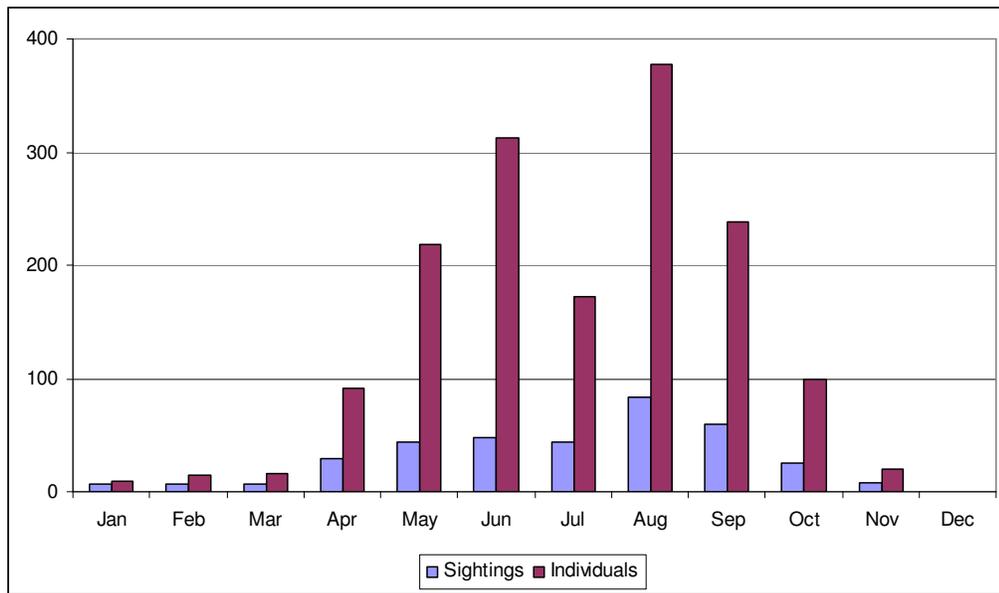


Fig. 22. Seasonal Occurrence of Risso's dolphin, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

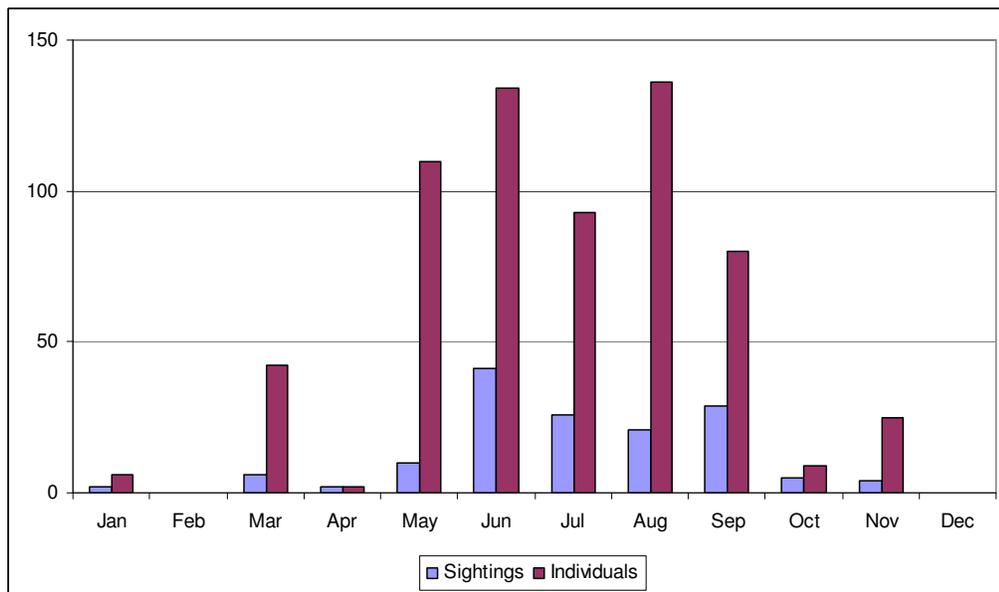


Fig. 23. Seasonal Occurrence of bottlenose dolphin, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

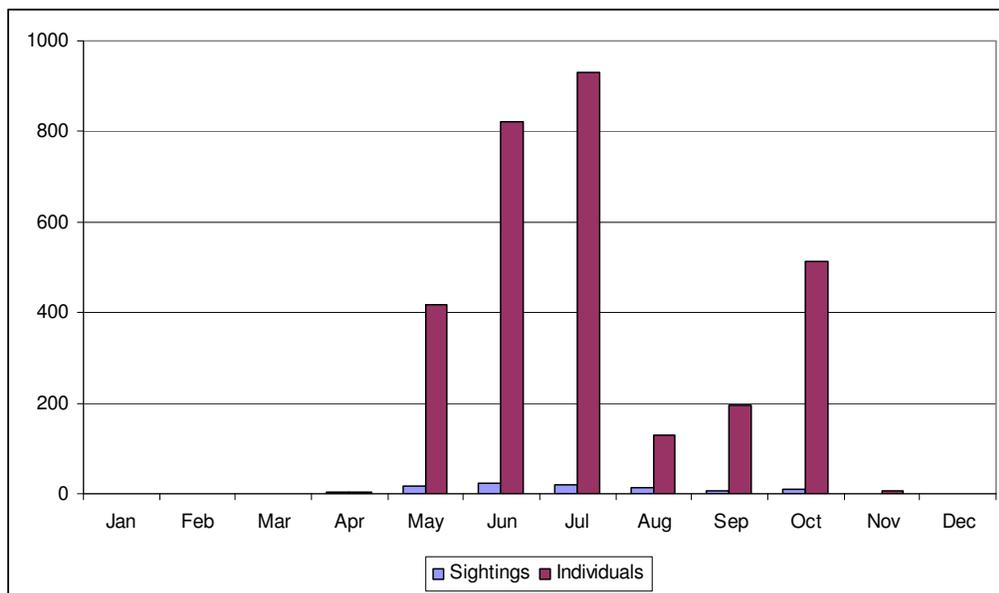


Fig. 24. Seasonal Occurrence of short-beaked common dolphin, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

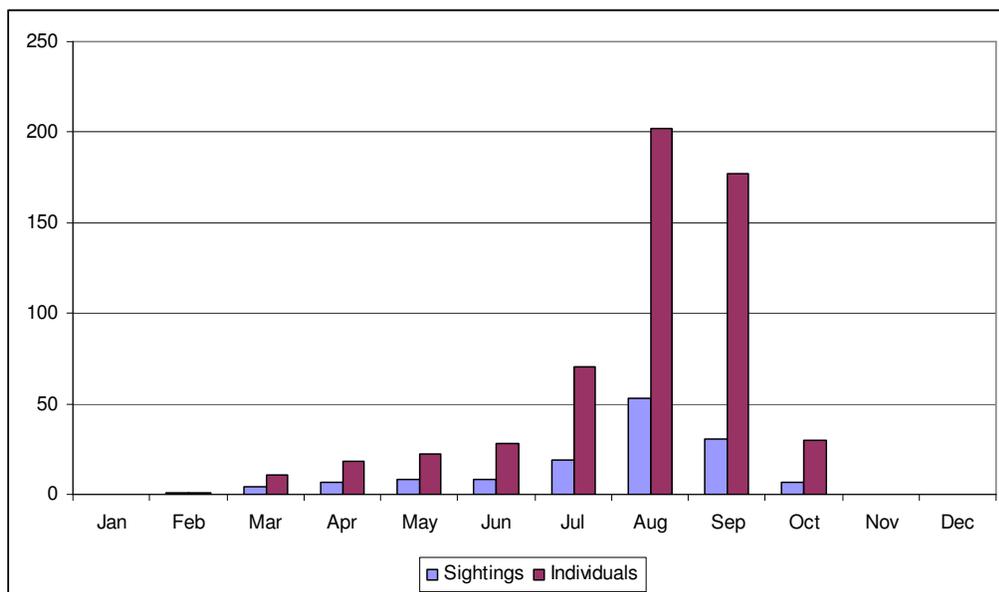


Fig. 25. Seasonal Occurrence of Atlantic white-sided dolphin, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

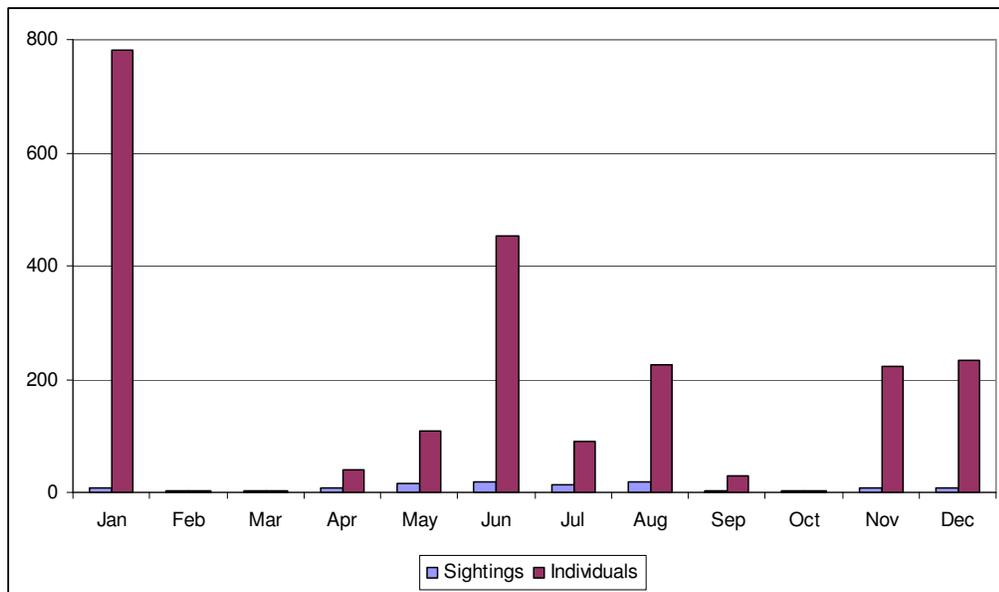


Fig. 26. Seasonal Occurrence of long-finned pilot whale, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

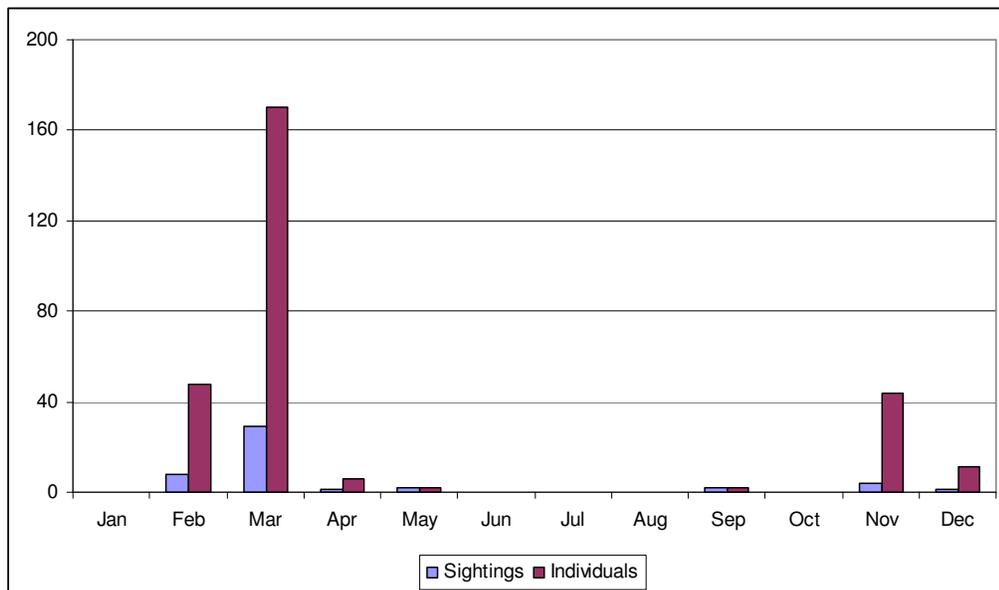


Fig. 27. Seasonal Occurrence of sperm whale, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month

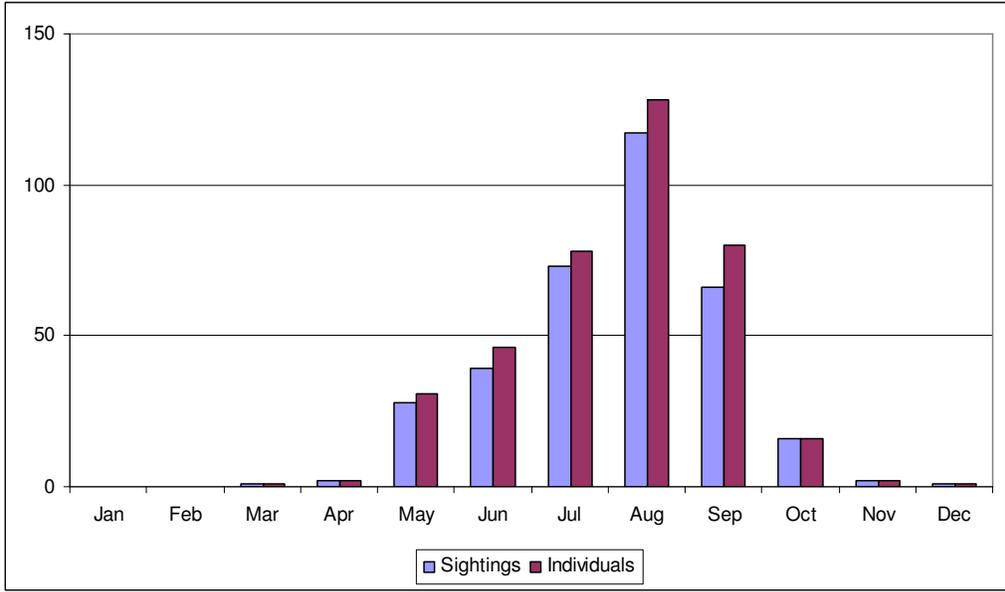
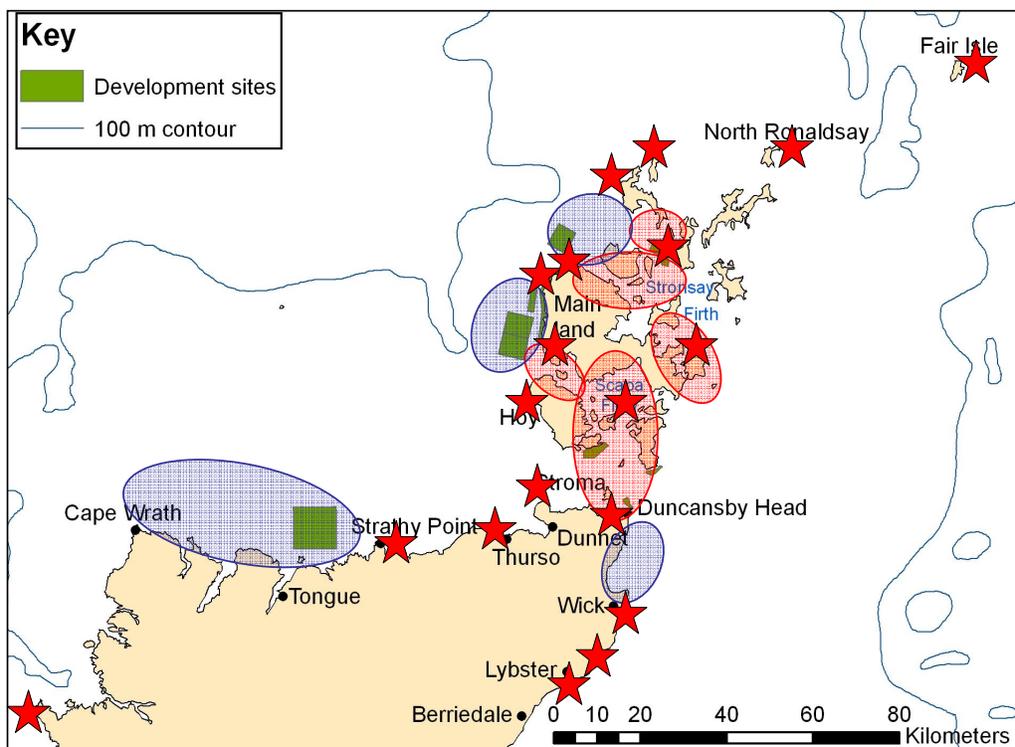


Fig. 28. *Seasonal Occurrence of basking shark, 1980-2010:
Total Number of sightings / month & Total Number of individuals / month*



- ★ = Main Land watch points
- = Main Sea Areas covered
- = Main Gaps in coverage

Fig. 29. Map showing Survey coverage in relation to proposed Development Sites

APPENDIX 1. CETACEAN AND BASKING SHARK DATA ENQUIRIES/SOURCES

Database Enquiries

Aberdeen University – Dr Andy Foote – *Papers and sightings regarding regional aspects of Orca. Northern North Sea Cetacean Ferry Surveys (NORCET)*

Cetacean Strandings Investigation Programme – Bob Reid, Rob Deaville (Institute of Zoology) - *Strandings Records (including basking sharks)*

HIE – Eilidh Gunn, Pentland Firth Tidal Energy Project – Data collection study (Aquaterra)

Highland Biodiversity Records Group - Murdo Macdonald HBRG Database Manager – *NBN Gateway Database*

Hebridean Whale and Dolphin Trust – *local sightings*

JNCC – Andy Webb, Tim Dunn - *ESAS raw data for Pentland/Orkney area*, and Karen Hall – *MMO records for Pentland/Orkney area*

Marine Conservation Society – Jen Luc Solandt - *UK Basking Shark Database*

Shark Trust – Ali Hood – *additional material enquiry*

Orkney Contacts

Aquaterra, Environmental Consultants – Jude Hamilton, Gareth Davies.

EMEC – Jenny Norris, Matthew Finn – *Data/Observations from Billia Croo and Eday test sites.*

Billia Croo - Jim Williams/ Stuart Williams

Eday - Mike Cockram.

Fluke Jewellery – Roger and Jo Philby

Westray, Nick Crocker,

Orkney Biodiversity Records Database – Chris Booth, Sidney Gauld - *collated sightings from most Orkney sources.*

Orkney Field Club – Dick Manson - *member's observations/ field letter*

Orkney Islands Council – Shona Gray, Michael Harvey, Eileen Summers, Gavin Barr.

Orkney Marine Services – Jenni Kakkonen, Alex Simpson – *T Pod data (not used).*

Orcadian Wildlife – Steve and Sarah Sarkey

North Ronaldsay Bird Observatory – Alison Duncan – *Cetacean Sightings from N. Ronaldsay*

Rod Thorne - Ranger, Sanday. - *stranding record*

RSPB Orkney – Eric Meek

SNH Orkney – Ruth de Silva, Kate Thompson,

Xodus, Environmental Consultants, Stromness – Liz Foubister, Suzanne Coey.

Scottish Mainland Contacts

Caithness Field Club – Geoff Leet

Caithness Renewables – Louise Smith

Caithness Seawatch - Colin Bird – Seawatch Coordinator E. Coast – *Seawatch data*, Kas Munro – Seawatch Coordinator N. Coast Caithness.

Colin Speedie (ex Shark Trust)

Energy Hunt Ltd – Richard Hunt

Highland Ranger Service – Lindsay Duncan (Wick), Donald Mitchell (North Coast), Paul Castle (Dunnet & N.Coast), Dieter Tuerlink (Wick)

Ferries

John O Groats Ferries – Capt. David Thomas – *personal database*

Northlink Ferries – NORCET database

Orkney Ferries – David Sawkins

Pentland Ferries

Renewable Energy Developers

Aquamarine Power - Helen Ansell, Martin Maynell –. *Observation data from renewables test site*

Atlantis Power – Mike Smith, Ed Rollins, - *Observation data from renewables test site*

Crown Estate – Tom Mallows, Duncan Mackay

Energy Research Institute, Thurso - Dr David Woolf, Priyanka Sharma

Green Tide Turbines – Michael Evans - *Observation data from renewables test site*

International Power plc – James Minto - *Observation data from renewables test site*

Marine Current Turbines – P Coppock

Scottish Renewables – Joanna Yates (Policy Manager)

Scottish Power Renewables – Alan Mortimer, *Observation data from renewables test site*