CETACEANS OF THE

EAST GRAMPIAN REGION

Compiled by

Pia Anderwald & Peter G.H. Evans

with support from
Sarah Canning, Kevin Hepworth, Mike Innes,
Peter Macdonald, Ian Sim,
Karen Stockin, and Caroline Weir
of the Sea Watch Grampian Regional Groups

August 2010

1. INTRODUCTION

The East Grampian coast of Scotland and adjacent areas of the northern North Sea are relatively rich areas for cetaceans compared with other parts of the United Kingdom, with a high diversity of species recorded. Fifteen cetacean species have been recorded since 1990 in near-shore waters (within 60 km of the coast), and all have been sighted alive at least once (Evans, 1995, Evans *et al*. 2003, Sea Watch, unpublished data). Nine species (one-third of a UK total of 27 species) occur regularly, either being present year-round or as seasonal visitors to the region. The most frequently observed species in near-shore waters are the harbour porpoise *Phocoena phocoena* and the bottlenose dolphin *Tursiops truncatus*, but white-beaked dolphins *Lagenorhynchus albirostris* and minke whales *Balaenoptera acutorostrata* also occur every summer. Atlantic white-sided dolphin *Lagenorhynchus acutus*, short-beaked common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus*, killer whale *Orcinus orca* and long-finned pilot whale *Globicephala melas*, are uncommon, but nevertheless are recorded in the northern North Sea more or less annually. The harbour porpoise and bottlenose dolphin are listed in Annex II of the Habitats Directive as species whose conservation requires the designation of Special Areas of Conservation.

Other cetacean species recorded in the region since 1990 include striped dolphin *Stenella coeruleoalba*, northern bottlenose whale *Hyperoodon ampullattus*, Sowerby's beaked whale *Mesoplodon bidens* (stranding only), sperm whale, *Physeter macrocephalus*, humpback whale *Megaptera novaeangliae*, and fin whale *Balaenoptera physalus*.

2. DATA SOURCES

This review of cetacean status and distribution represents an analysis of the national sightings database (1973-present) that is maintained by the Sea Watch Foundation (SWF). Effort-based input comes largely from the long-term observations of Mike Innes, who has conducted regular watches from Peterhead since the early 1970s, and members of the South Grampian Regional Group, which was established in the late 1990s.

Systematic effort-based land watches have been carried out at several locations along the East Grampian coast, and this is reflected in the distribution of sightings. The sites most often watched (in descending order) are Peterhead, Aberdeen Harbour (Torry Battery), Girdleness, Cove (Souter Head), Collieston and Stonehaven. Other sites watched (<1,000 minutes of observation) include Aberdeen Beach, Balmedie, Nigg Bay, Muchalls, Longhaven, Whinnyfold, Montrose, Rattray Head, Buchan Ness and Newburgh. Plates 1-5 illustrate some of the sites from which watches have been made.

Since 1998, the Sea Watch Grampian Group has undertaken regular sea-based surveys in the region, mainly in coastal waters between Stonehaven and Aberdeen (Weir & Stockin, 2001; Weir *et al*., 2007; Canning, 2007; SWF unpublished data), although watches have also been made from ferries operating from Aberdeen to Shetland & Orkney as part of the NORCET surveys run as a collaborative project between University of Aberdeen, Sea Watch Foundation, and the East Grampian Coastal Partnership (EGCP). A summary of Sea Watch effort, both land-based and sea-based, is given in Table 1.

a)

b)

Plate 1. Views of a) Bullers of Buchan (Peterhead) and b) Whinnyfold

a)

b)

Plate 2. Views of a) Slains Castle and b) Collieston

a)

b)

Plate 3. Views of a) Aberdeen Harbour Entrance and b) Girdleness

a)

b)

Plate 4. Views of a) Souter Head, Cove Bay and b) Fowlsheugh, Stonehaven

a)

b)

Plate 5. Views of a) Scurdiness, Montrose and b) Victoria Cliffs, Arbroath

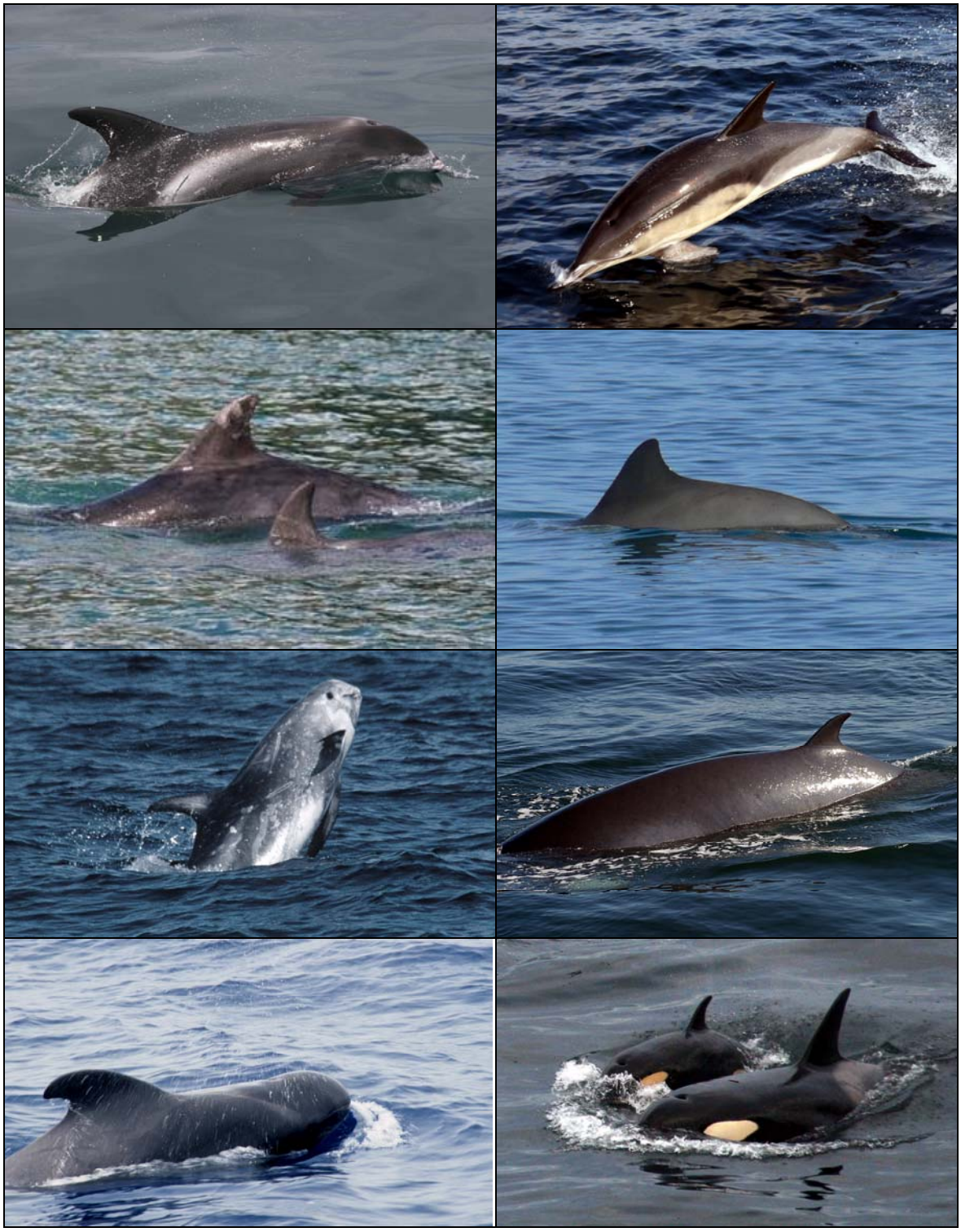


Plate 6. Illustrations of some of the cetacean species regularly recorded in the East Grampian region (*Top to bottom – Left*: White-beaked Dolphin, Bottlenose Dolphin, Risso's Dolphin, Long-finned Pilot Whale; *Right*::Short-beaked Common Dolphin, Harbour Porpoise, Minke Whale, Killer Whale)

3. THE EAST GRAMPIAN REGION

The East Grampian coast runs from Kinnaird Head in Fraserburgh to the mouth of the River North Esk by St. Cyrus, a total length of 100 miles (160 km). The analysis conducted here draws upon data from the coastal waters encompassed by this region but includes observations from areas immediately adjacent. This stretch of coast is very diverse with cliffs, rocky shores, long sandy beaches, estuaries, salt marsh and some of the most extensive sand dunes in the UK. Much of the coast is protected for its nature conservation value with national nature reserves at Forvie, Loch of Strathbeg and St Cyrus, as well as smaller less well-known sites such as the Buchan Ness to Collieston Special Area of Conservation. The cliffs at Fowlsheugh south of Stonehaven host large numbers of breeding cliff-nesting seabirds in summer, and form an RSPB reserve.

Between Fraserburgh and Boddam, the coastal scenery comprises extensive sandy beaches often backed by dunes between relatively low headlands (from north to south: Kinnaird Head, Cairnbulg Point, Rattray Head, Scotstown Head, Kirkton Head, and Buchan Ness). From Boddam (Buchan Ness) south to Cruden Bay, including Longhaven and the Bullers of Buchan, the coast is largely cliff-bound. Cruden Bay itself is a shallow sandy bay. Then from Whinnyfold to Collieston (including Slains Castle) are low cliffs. From Collieston south to Girdleness (Aberdeen), are long stretches of sand including the Sands of Forvie and Balmedie beach. Between Girdleness and St Cyrus, the coastline consists mostly of cliffs before the sandy beaches at Montrose, Lunan Bay, and Arbroath.

The coastal geology changes from north to south from the granites, schists and gneisses of Fraserburgh to the younger sedimentary rocks which dominate the south of the region. Near to Stonehaven, the Highland Boundary Fault can be viewed from the cliff tops. Sections of the cliffs in the south are made up of conglomerates, locally known as pudding stones, for example the areas surrounding Fowlsheugh and Dunnottar Castle.

From Kinnaird Head to Arbroath, the 30 m isobath follows the coastline around 3 km offshore, with depths 20 m or less within 1 km of land extending further offshore between Kinnaird Head and Peterhead, Buchan Ness and Aberdeen, and St Cyrus to Montrose. However, along a short piece of coast between Girdleness and Portlethen (south of Cove) and in the area off Peterhead, the 50 m isobath is only 3.5 km from the shore. Further offshore, several narrow and relatively deep (>100 m) troughs occur, the nearest being 17.5 km offshore. The Buchan Deep (>100 m) lies 23 km due east of Peterhead.

The main form of land-use in the coastal zone is agriculture with arable farming and the grazing of cattle and sheep. The dune areas are utilised for conservation as well as recreation, predominantly golf (approximately 20% of the dunes between Fraserburgh and Aberdeen is occupied by golf courses). Industry, with the exception of the St Fergus Gas Terminal is centred around the main areas of human population at Fraserburgh, Peterhead and Aberdeen, all of which are major ports. Recreation is widespread along the coast often around villages and towns where the infrastructure and network of paths enables easy access to the coast.

Although Peterhead and Fraserburgh are amongst the largest fishing ports in the UK, landings from those fleets are mostly of fish taken outside the region. Trawling (mainly demersal otter trawls) and to a lesser extent purse seining occur primarily offshore, particularly to the northeast, whilst there is some dredging for scallop or clam near-shore in the southern part of the region around Montrose and Arbroath (Lee *et al*., 2010). The northern North Sea has the most valuable demersal and *Nephrops* fisheries in the UK, as well as fisheries for herring, mackerel and horse mackerel, and shellfish (e.g. lobster) near the coast. This intense fishing activity has an environmental impact. Assessed commercial fish stocks are either not at full reproductive capacity or are not being harvested sustainably (Defra, 2010: Charting Progress 2). However, with the exception of stocks of haddock and saithe, the quality of demersal fish communities is improving; abundance, biomass and productivity are increasing but smaller fish still dominate (Defra, 2010). Sandeel, clupeids such as sprat, and gadoids such as whiting, may also be found in inshore waters, where besides being taken by marine mammals, they form important components of the diet of the chicks of seabirds such as kittiwakes and auks breeding in the region. Salmon seasonally enter the river mouths of the Don, Dee & Esk.

4. METHODOLOGY

The data used in these analyses come from a combination of systematic land- and vessel-based surveys, and more casual records. Although many people have submitted sightings over the last thirty years, the great majority comes from the small number of experienced observers listed in the acknowledgements.

Most records are from land-based observations either dedicated to looking for cetaceans or combined with sea-watches for seabirds on passage. These are timed watches from suitable vantage points such as headlands, conducted generally in conditions of good visibility and low sea state (Beaufort scale 2 or less). Observing is generally made with the naked eye interspersed with regular binocular scans. Sometimes a telescope (20-40x magnification) is used instead of binoculars. All sightings are recorded with species ID, group size, behaviour, and direction of movement noted. The number of observers and observation height are also recorded. Environmental conditions are recorded at 15-minute intervals or whenever a change took place. Information recorded included sea state, swell height, wind speed and direction, precipitation, and visibility. All information was recorded using standardised forms, downloadable from the Sea Watch website.

Vessel-based surveys have been carried out primarily from the 5m motor vessel *Tranquility*, operating out of Stonehaven and usually conducting a circular transect cruising at an average speed of 6-7 knots between Stonehaven and Aberdeen. Observers view at an eye height of 3 m above sea level and have unrestricted 360º viewing capability. Between two and six observers are on board during each survey, with two on watch at any one time, concentrating effort 180º forward on port and starboard sides respectively. Again, observations are carried out with the naked eye, interspersed with regular binocular scans. On sighting a cetacean, the time and location (using GPS) are noted on standardized Sea Watch recording forms along with species ID, group size,

presence of juveniles, direction of movement, and behaviour. Every 15 minutes, the vessel's position, course and speed are noted. Environmental conditions such as sea state, swell height, wind speed and direction and visibility are also recorded at 15-minute intervals., or whenever there is a course change. If opportunities allow, the vessel may approach the animals to conduct photo-ID using a digital SLR with fixed focal length or zoom lens, re-joining the survey route once photographing has been completed. Where possible, the entire dolphin group is photographed. Good quality images taken are stored in a local photo-identification catalogue administered by Caroline Weir (see http://www.ketosecology.co.uk/Aberdeenshire%20Cetacean%20Catalogue_Version%202.pdf). Photo-ID has been very helpful in confirming that individuals observed in the area derive from the Moray Firth bottlenose dolphin population, and may be seen repeatedly there both within and between years (see Weir *et al*., 2008).

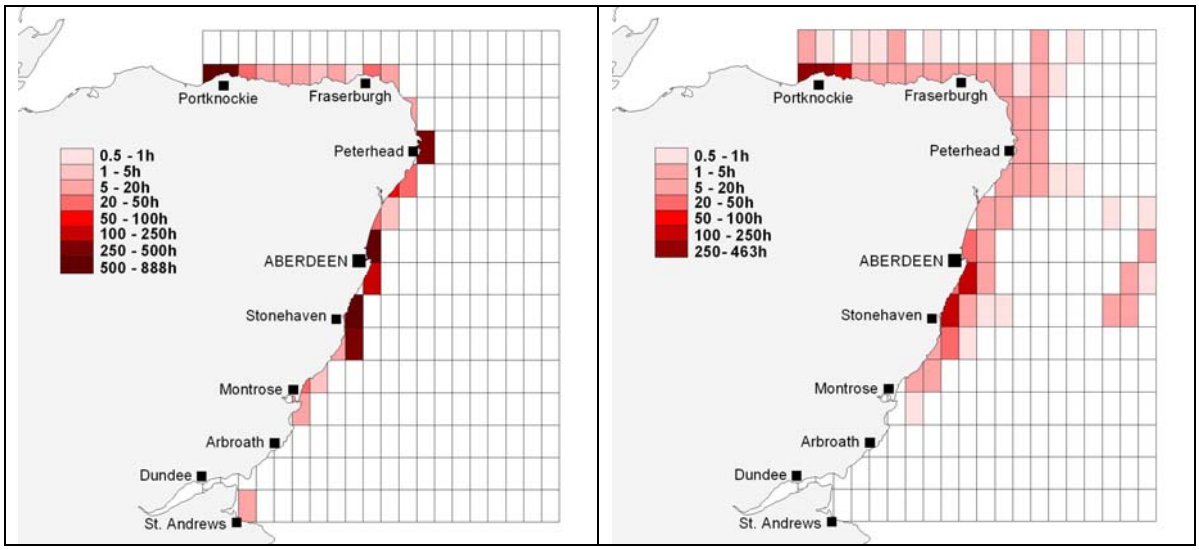
When interpreting the results presented here, a number of potential biases need to be taken into account. First, observation effort has generally increased across time periods (Table 1). It has also been concentrated around particular areas – Peterhead in the north, and in the vicinity of, and between, Stonehaven and Aberdeen, further south (Fig. 1). Effort has also varied seasonally with most taking place in the summer months, particularly July and August (Fig. 2a). For this reason, whereas overall sightings plots that include casual records provide some information on the relative status and distribution of a species, the effort-corrected plots and graphs will be more meaningful. One observer, Mike Innes, has undertaken timed watches consistently year-round from one site (Peterhead) since the 1970s and so for comparison with overall trends, his data have been analysed separately.

Detection rates from land and particularly at sea can also be affected by sea conditions. The effective sighting range is reduced with increasing sea state and swell height, whilst above 2 on the Beaufort scale, the presence of "white horses" can make it much more difficult to spot a surfacing animal. For this reason, more than 80% of systematic surveys both from land and sea are conducted in sea states of 2 or less (Fig. 2b). Casual sightings may be reported in any sea state although predominantly they are in similar conditions. However, a significant number of casual records do not have details of sea state recorded.

Casual sightings are usually submitted directly to the Sea Watch Sightings Officer either on paper or via the website. Before being accepted into the web-based database, the Sightings Officer or other Sea Watch staff check the species ID and information provided in other fields, adding coordinates if necessary (where only a location description has been given). All effort-based sightings data are forwarded to the Sea Watch Sightings Officer who then checks through all fields (including species ID) before they are entered onto computer using a Microsoft Access database structure developed specifically for the purpose (Baines & Evans, 2005). Records are then checked again for transcription errors and various macros run to identify errors (e.g. duplicate records, GPS coordinates on land, etc) before the data are incorporated into the main Access database. If there is doubt over species ID, the record will be downgraded to a more general taxonomic category (see Fig. 33). Data collected during prolonged encounters are linked using association codes on the computer database.

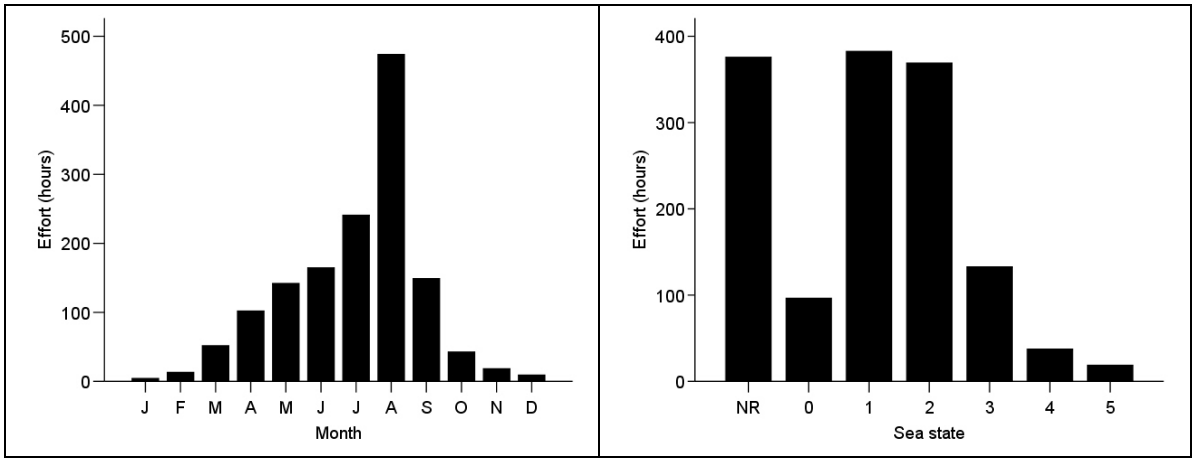
Table 1. Summary of Sea Watch observation effort, 1993-2007

Time Period	*No. of hours of observation*
Vessel	
1988-92	**2.00 h**
1993-97	**15.00 h**
1998-02	**138.40 h**
2003-07	**233.75 h**
Land	
1978-82	**2252.00 h**
1983-87	**2781.00 h**
1988-92	**1437.78 h**
1993-97	**617.25 h**
1998-02	**1043.23 h**
2003-07	**1897.50 h**



a) Land-based **b)** Boat-based

Fig. 1. Distribution of effort



a) Seasonal variation in effort **b)** Variation in effort with sea state

Fig. 2. Distribution of effort from vessel surveys with sea state & season

Table 2. Summary of Cetacean Sightings Records in East Grampian, 1973-2009

Species	No. records	%	No. individuals	%
Bottlenose Dolphin	4016	62.7	40068	79.1
Harbour Porpoise	1523	23.8	6295	12.4
White-beaked Dolphin	398	6.2	2788	5.5
Minke Whale	323	5.0	516	1.0
Risso's Dolphin	44	0.7	190	0.4
Killer Whale	39	0.6	86	0.2
Atlantic White-sided Dolphin	19	0.3	114	0.2
Short-beaked Common Dolphin	16	0.2	392	0.8
Long-finned Pilot Whale	12	0.2	168	0.3
Humpback Whale	7	0.1	8	<0.1
Fin Whale	3	<0.1	5	<0.1
Northern Bottlenose Whale	2	<0.1	3	<0.1
Striped Dolphin	1	<0.1	6	<0.1
Sperm Whale	1	<0.1	2	<0.1
TOTAL	**6,404**	**100.0**	**50,641**	**100.0**

5. STATUS & ECOLOGY

The relative frequency of sightings of all cetacean species recorded live since 1990 is given in Table 2. The status, seasonal occurrence, and ecology of the four species of cetaceans recorded regularly in recent years in the coastal waters of East Grampian region are described in detail below, whilst records of rarer species are summarised in the subsequent section. Plate 6 illustrates some of the more commonly recorded species.

5.1 REGULAR SPECIES

Bottlenose Dolphin (*Tursiops truncatus*) 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, north-east Scotland, North and West Wales, Southwest England and the Channel islands (Evans *et al*., 2003; Reid *et al*., 2003; Baines & Evans, 2009). All those localities receive influence from the Gulf Stream. The species also occurs offshore in the North Atlantic particularly along the shelf edge (often associating with long-finned pilot whales) as far north as the Faroe Islands.

In coastal waters, bottlenose dolphins often favour river estuaries, headlands or sandbanks where there is uneven bottom relief and/or strong tidal currents (Lewis & Evans, 1993; Liret *et al*., 1994; Wilson *et al*., 1997).

Although yet to be established, bottlenose dolphins occurring offshore in Europe may form separate populations to inshore groups, as occurs in the eastern United States (Evans & Teilmann, 2009). In British and Irish waters, the bottlenose dolphin is most frequently sighted within 10 km of land. The species is present throughout the year in various bays

in Western Ireland; in the Irish Sea (particularly Cardigan Bay); and in the northern North Sea from Caithness south to the North Yorkshire coast (particularly inner Moray Firth, Grampian coast, and St Andrews Bay). The species is scarce in the central and southern North Sea (Camphuysen & Peet, 2006), but it occurs seasonally along the south coast of England at particular localities (Evans *et al*, 2003).

Bottlenose dolphins can be seen regularly all around the East Grampian coast (see Fig. 3). Effort-based watches revealed virtually no individuals until the early 1990s (Fig. 8), when the species appears to have started extending its range southwards. 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; Stockin *et al.*, 2006; Canning, 2007; Weir *et al.*, 2008).

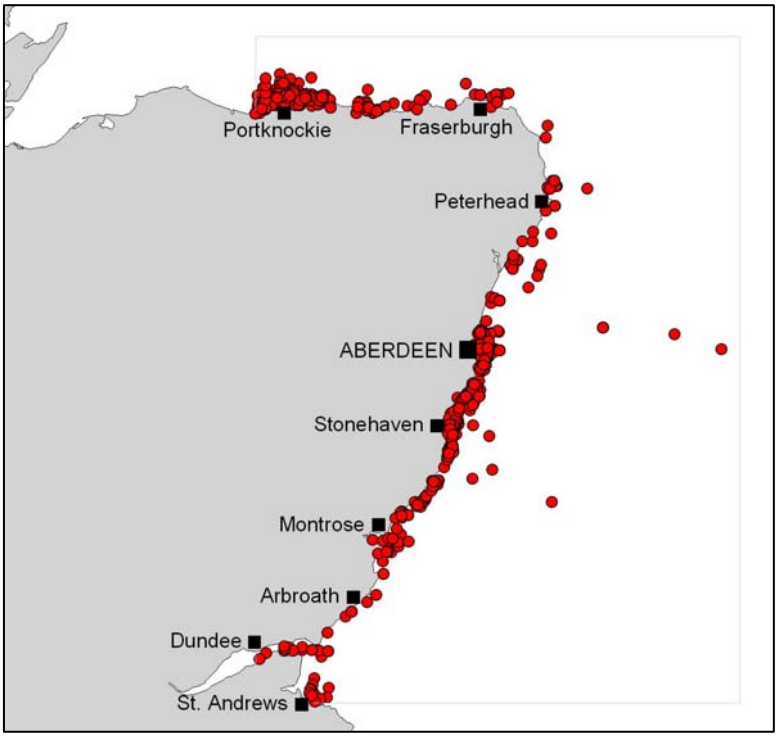
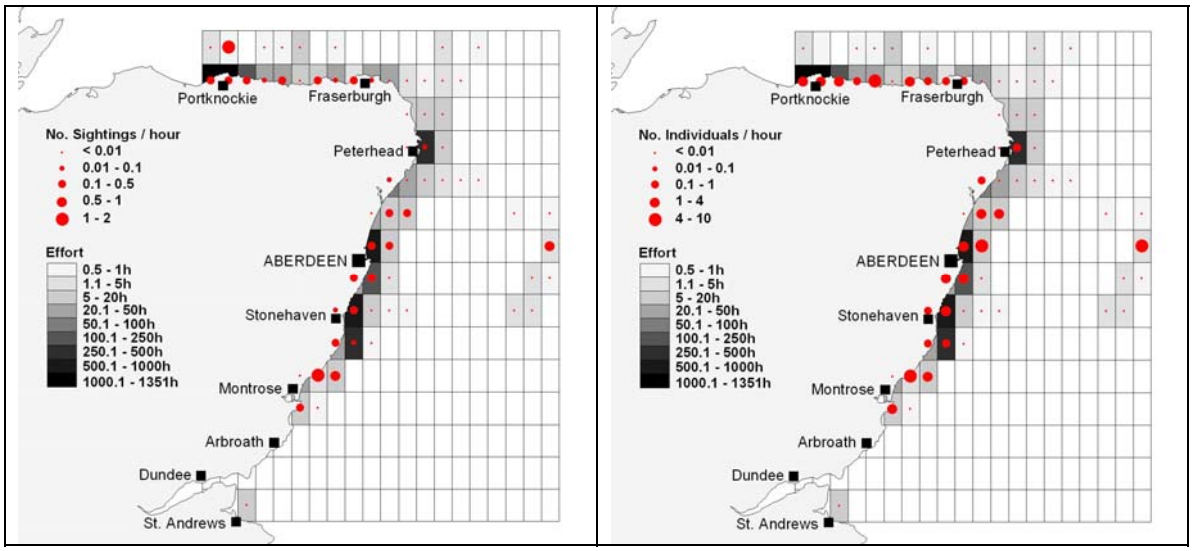


Fig. 3. Distribution of Bottlenose Dolphin sightings in East Grampian Region

More than 95% of all records in the region have been since 1993. Sightings have been mainly between Aberdeen and Stonehaven, but this undoubtedly reflects the greater survey coverage in that area. Nevertheless, within that region, there are two apparent hotspots – one around Aberdeen itself and the other between Stonehaven and Montrose (Fig. 4). The entrance to Aberdeen Harbour is frequently used by bottlenose dolphins, and they commonly feed near Torry Battery and around Girdleness (see Plate 2 for illustrations of these sites).



a) No. of BND sightings/hr **b)** No.of BND individuals/hr

Fig. 4. Distribution of Bottlenose Dolphin sightings corrected for effort

Bottlenose dolphins occur in the region in every month of the year although the overall number of sightings as well as sightings rates corrected for effort both show summer peaks between April and October (Fig. 5). Seasonal patterns of occurrence have changed over the years. Between 1993 and 1997, the first sightings included a number of relatively large groups (20-40 individuals), with sightings peaking in early autumn and virtually none between November and April (see Appendix 1a). Since 1998, however, bottlenose dolphins have been seen in all months of the year, although peak sightings rates and group sizes occur between May and September (Appendix 1a), the same time as further north in the Moray Firth (Wilson *et al*., 1997; Culloch & Robinson, 2008).

Sighting rates and overall numbers have generally declined from the early years, both from vessel (Fig. 6) and land-based surveys (Fig. 7) although there have been fairly wide fluctuations between years, and the long-term trend does not indicate any major change once they appeared in the region in the early 1990s (Fig. 8). Using the homogeneous long-term dataset collected by Mike Innes from Peterhead, sightings rates similarly show no sustained trend after 1996 (Fig. 9).

Bottlenose dolphins have an extended breeding season, but with births peaking between May and October in both the Moray Firth and Cardigan Bay populations (Wilson, 1995; Grellier, 2000; Evans *et al*., 2003; Sea Watch, unpublished data). They feed upon a variety of demersal or benthic (e.g. eels, flounder, dab, sole, turbot, haddock, hake, mullet, and cod) and mid-water fish (e.g. salmon, trout, bass, scad (horse mackerel), herring, blue whiting), as well as marine invertebrates (cephalopods and shellfish) (Santos *et al*., 2001; Spitz *et al*., 2006). Around the entrance to the Rivers Don and Dee, dolphins have been observed pursuing salmonid fish.

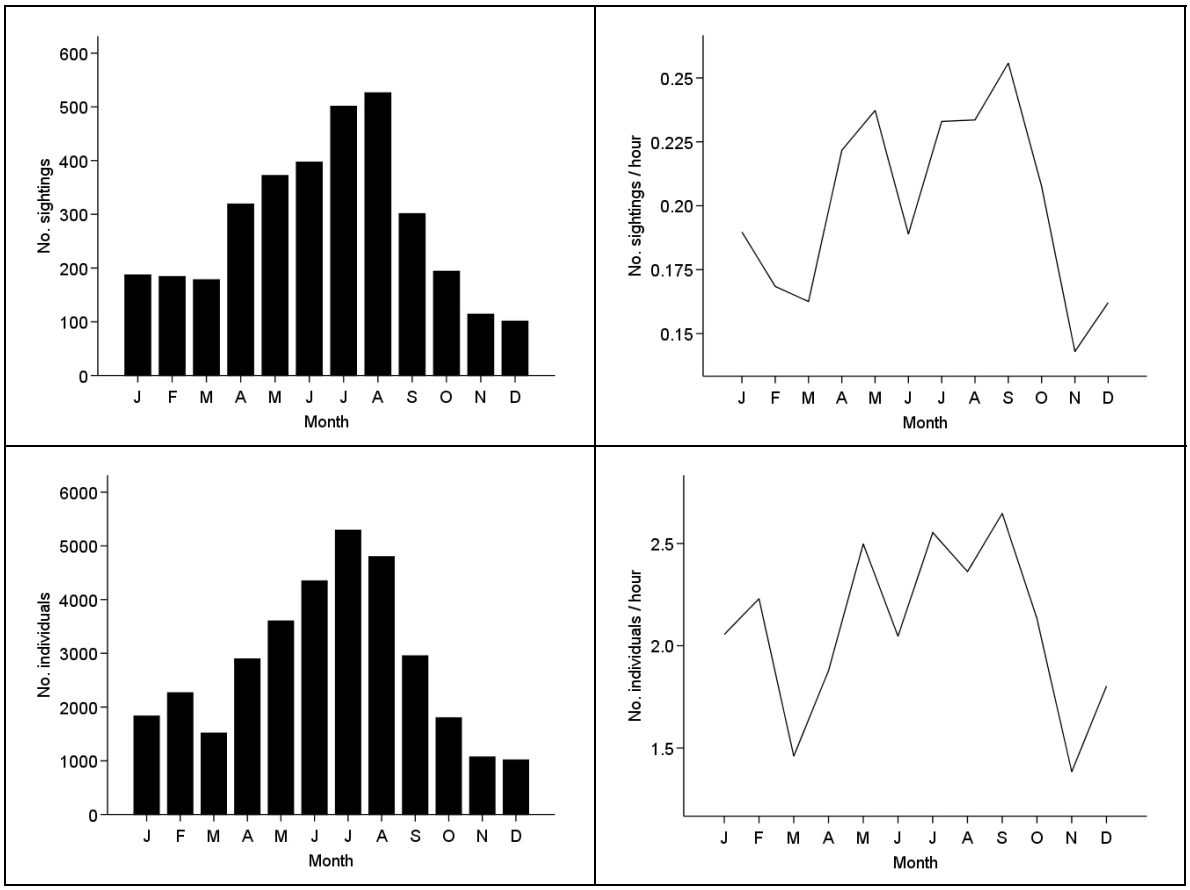
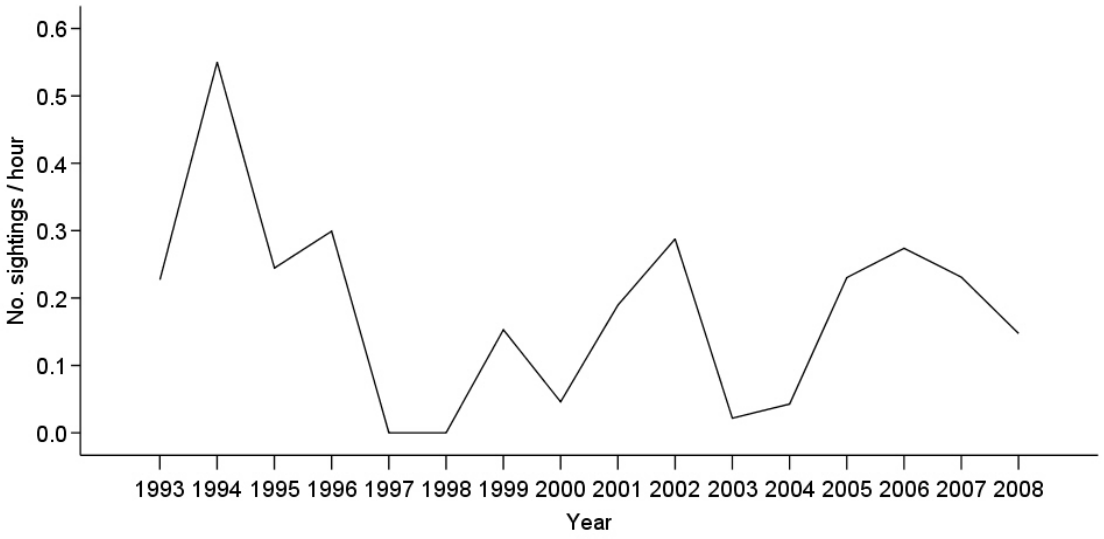


Fig. 5. Seasonal occurrence of Bottlenose Dolphins from land-based watches
(TL: No. sightings; BL: No. individuals; TR: No. sightings/hr; BR: No. individuals/hr)

The bottlenose dolphin makes a wide range of vocalisations. Echolocation clicks (used for orientation and foraging) are composed of intense short duration broadband clicks (40-130 kHz) (Au, 1993). Clicks are broadcast in episodic trains that can continue for the duration of a dive and culminate in buzzes and whines as targets are approached. Burst pulse vocalisations (barks, yelps and donkey-like brays) may have a variety of social and feeding related functions (0.2-16 kHz) (Janik, 2000). Whistles are pure tone frequency modulated calls ranging from 2-20 kHz. Clicks and whistle vocalisations can be made simultaneously. Hearing sensitivity is highest between c. 30 and 120 kHz.

a)



b)

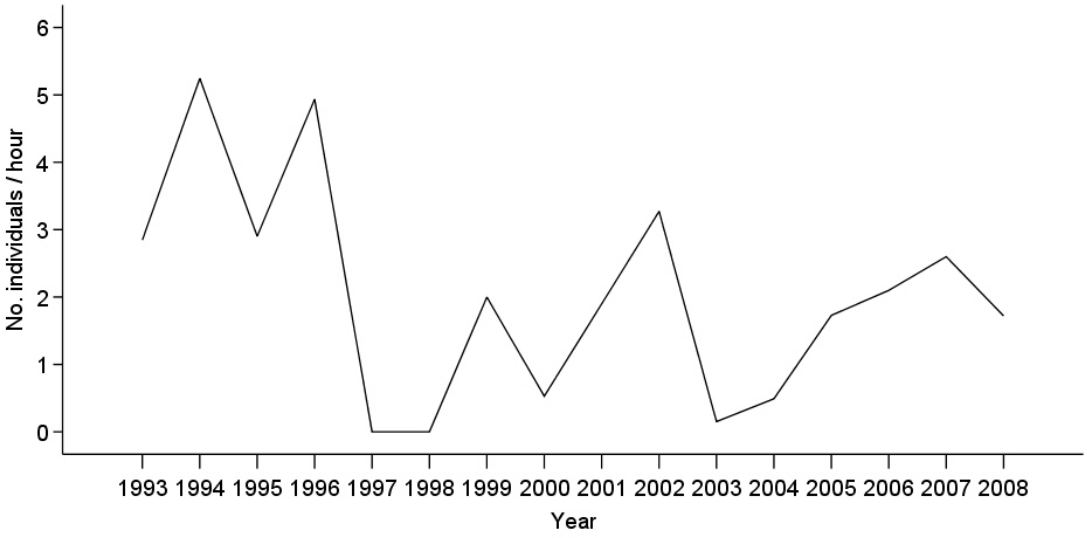
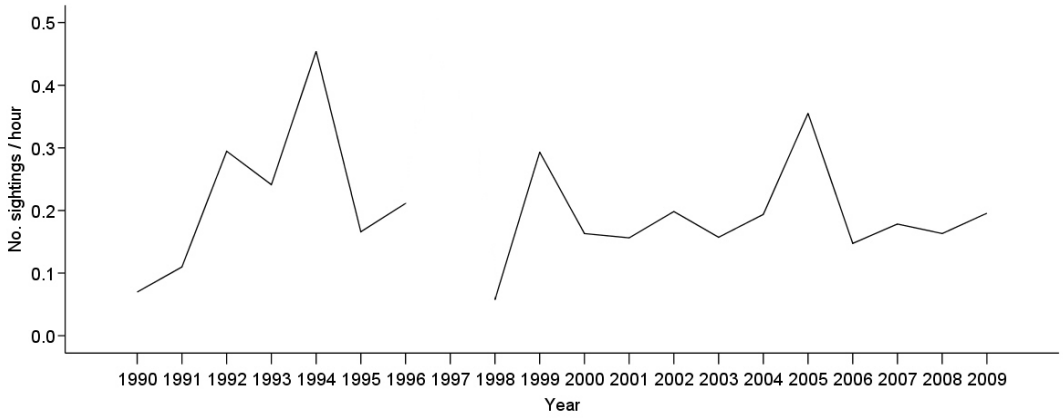


Fig. 6. Trends in Bottlenose Dolphin sightings rates from boat surveys
a) No. sightings/hr; b) No. individuals/hr

a)



b)

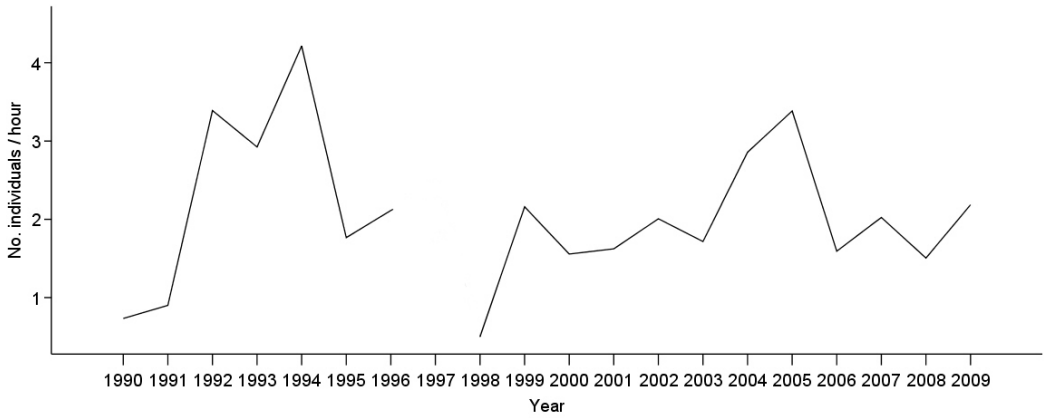
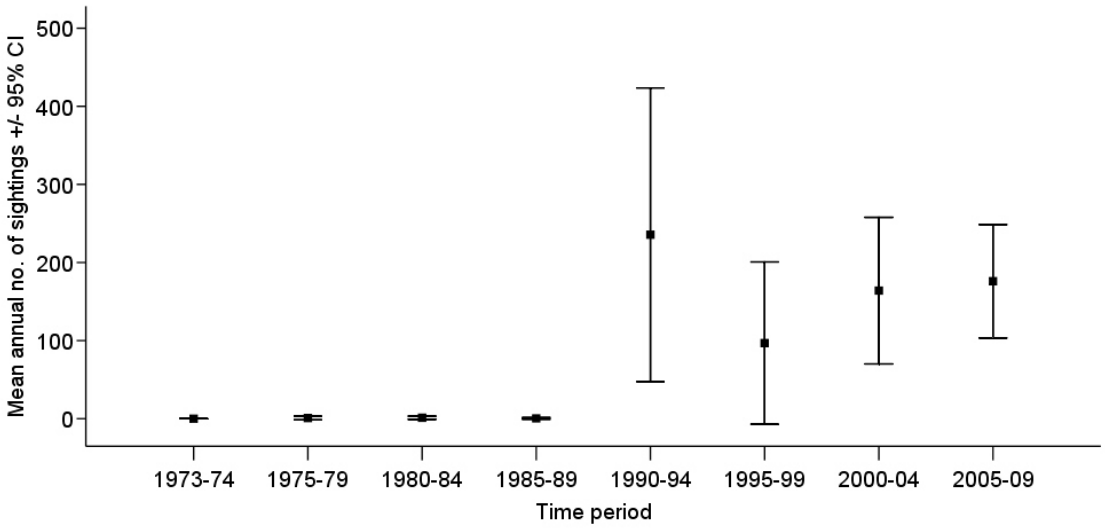


Fig. 7. Trends in Bottlenose Dolphin sightings rates from land-based surveys
a) No. sightings/hr; b) No. individuals/hr

a)



b)

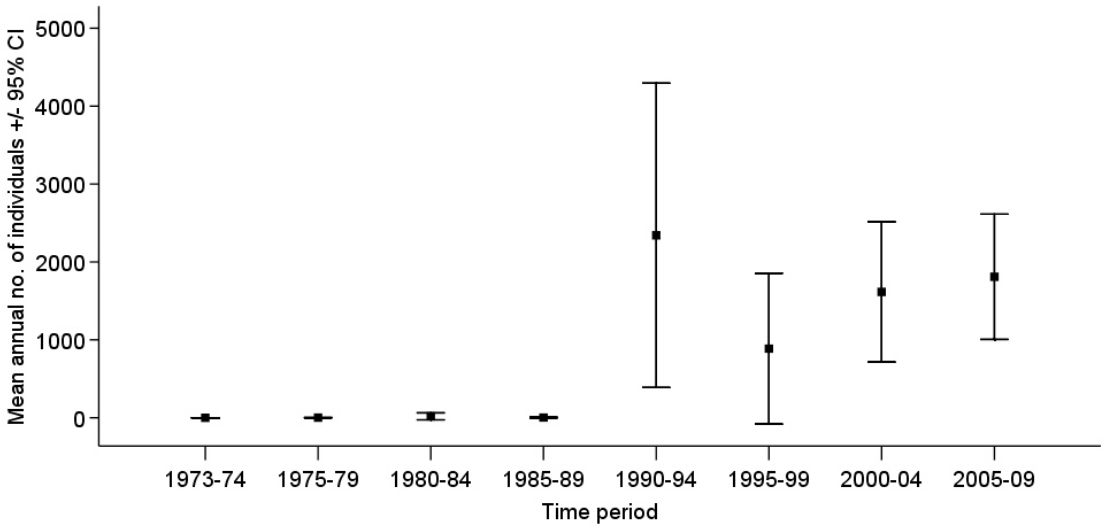
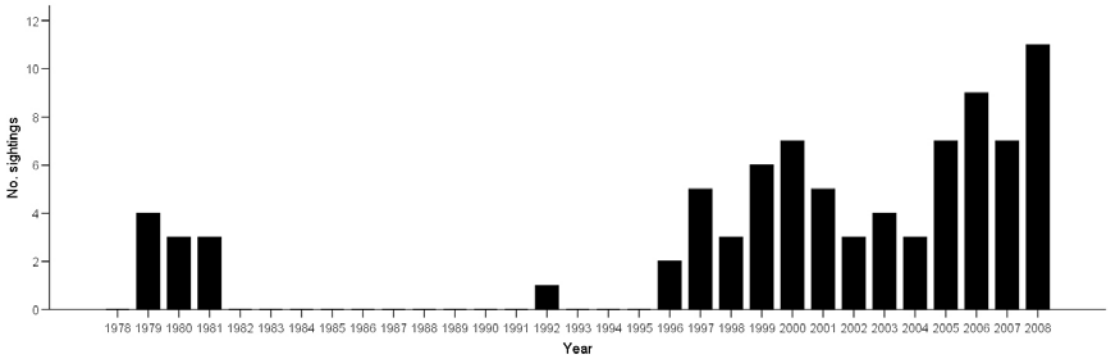


Fig. 8. Long-term trends in Bottlenose Dolphin sightings from all surveys, 1973-2009
a) Mean annual no. of. sightings; b) Mean annual no. of individuals

a)



b)

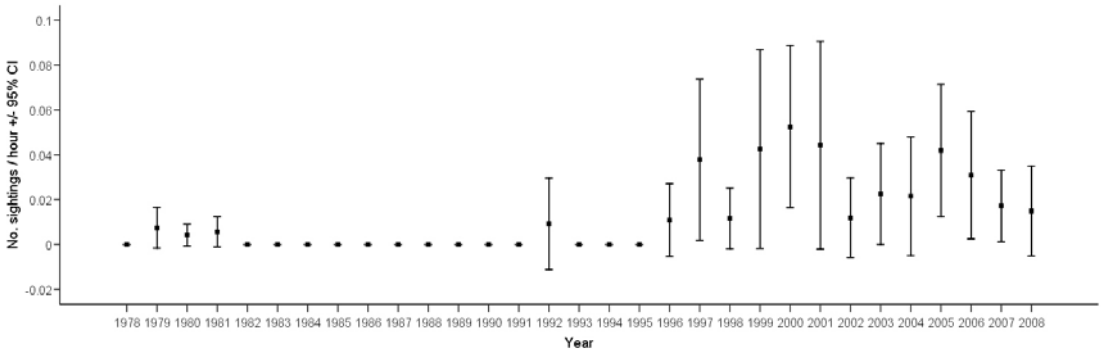


Fig. 9. Long-term trends in a) no.of sightings & b) sightings rates of bottlenose dolphin from Peterhead

International protection includes Appendix II of CMS Agreement on the Conservation of Migratory Species of Wild Animals (BONN Convention, 1983); Appendix II of BERN Convention on the Conservation of European Wildlife and Natural Habitats (applied to this species, from 1987); and Annex II of the EC Habitats Directive (1992) (prohibiting all forms of deliberate capture, killing or disturbance, especially during breeding, rearing or migration; bans the keeping, sale, or exchange of such species; and requiring that member states monitor the incidental capture and killing of all cetaceans, and carries out research on conservation measures to prevent such accidents). Like all cetacean species, it is also listed on Annex IV Animal and Plant Species of Community Interest in Need of Strict Protection of the EC Habitats Directive (1992). It is listed on List C1 of Council Regulation and, since 1985, has been treated by the European Community as if it is on CITES Appendix II (trade controlled to prevent overexploitation). Status listed by IUCN (Reeves *et al*., 2003) as "Data Deficient". In the UK, it receives special protection in respect of particular methods of killing or taking under The Wildlife and Countryside Act (1981) and the Wildlife (Northern Ireland) Order (1985). It is one of the species for which the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS) (1992), applies.

Harbour Porpoise (*Phocoena phocoena*) Distribution restricted to temperate and sub-arctic seas of the northern hemisphere. In the eastern North Atlantic, the harbour porpoise is widely distributed over the continental shelf from the Barents Sea south to the coast of France and Spain, although from the 1970s to 1990s, it became scarce in the southernmost North Sea, English Channel, and Bay of Biscay (Evans *et al*, 2008). Nevertheless, it remains the commonest cetacean recorded in British and Irish waters, though most abundant along the south and west coasts of Ireland, western and northern Scotland including the Hebrides and Northern Isles, in East Scotland and Northeast England, and in some coastal areas within the Irish Sea (mainly off south-west Wales where some of the largest concentrations occur). Only small numbers occur off the south coast of England, and the declines noted in coastal areas of the southern North Sea during the 1970s, extended to and included some more northern and Atlantic sites during the early 1980s. There was a reversal in this trend during the 1990s but in the last decade, there is some evidence for a southwards shift in abundance towards the central and southern North Sea (Evans, 1992; Evans *et al*., 2003; Hammond, 2008).

Next to the bottlenose dolphin, the harbour porpoise is the most commonly reported cetacean species in the Grampian Region. In most regions around the British Isles, it is the most commonly observed cetacean species. The porpoise is widely distributed in East Grampian with no particular area of concentration (Figs. 10-11), although there is some evidence that the species has shifted away from locations used by bottlenose dolphins (Canning, 2007), possibly in response to their aggressive behaviour to the species (Ross & Wilson, 1996; Wilson *et al*., 2004).

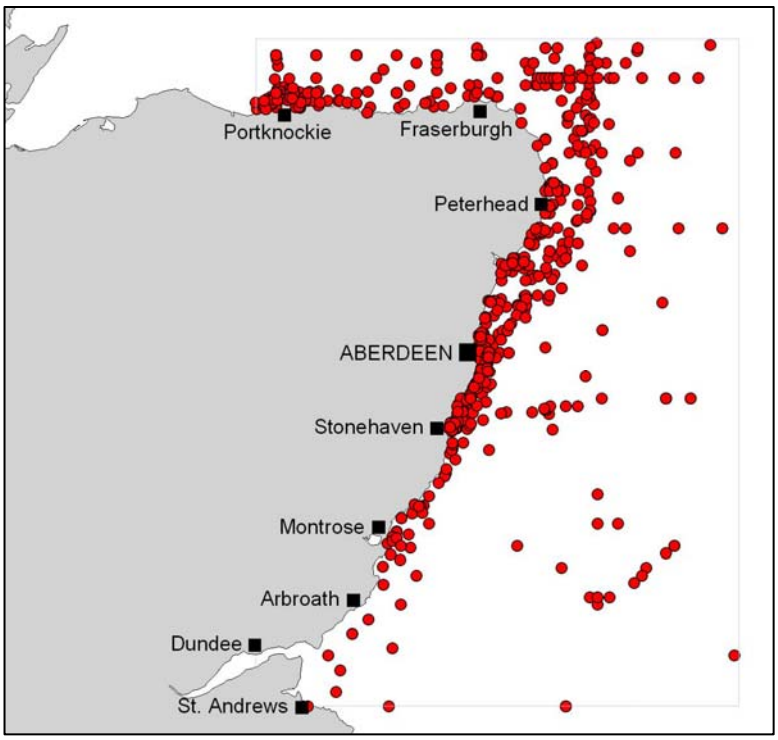
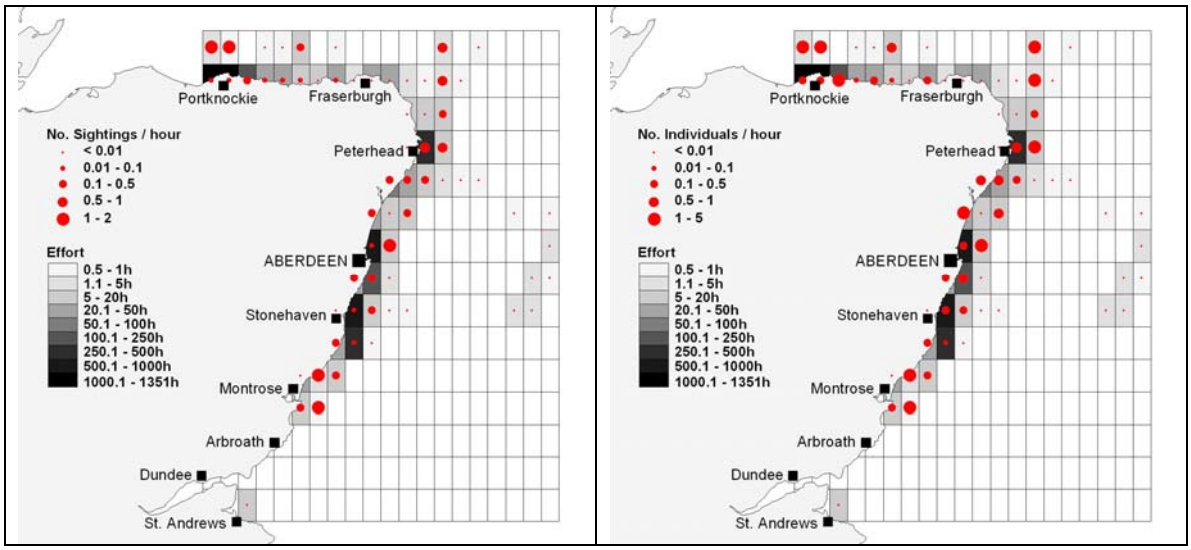


Fig. 10. Distribution of Harbour Porpoise sightings in East Grampian Region

The species is seen in all months of the year, although sighting rates, mean group size and numbers of individuals per unit effort all reach a peak in the second half of the year particularly between August and October (Fig.12, Appendix 1b; see also Weir & Stockin, 2001; Evans *et al*., 2003; Canning, 2007; Robinson *et al*., 2007; Sea Watch unpublished data). Although groups were substantially larger during the 1990s, mean group size has peaked in late summer in all three of the time periods (Appendix 1b).

Sightings rates per unit effort both from boat and land-based surveys were much lower during the 1990s than the early 2000s but since 2004, they have declined again (Figs. 13-14). Over the longer term (from 1970s onwards), the mean number of sightings per year has shown no sustained trend but instead exhibited more or less regular fluctuations (Fig. 15), whilst the no. of sightings per unit effort from the Peterhead study increased in the late 1970s but has been declining since the early 2000s (Fig. 16).

The main diet of porpoises is small fish (usually less than 40 cm length) such as juvenile herring, sprat, sandeel, whiting, saithe, and pollack, although particularly in winter months, prey such as dab, flounder, sole, and cod are taken (Santos & Pierce, 2003; Santos *et al*., 2004). Breeding occurs mainly between May and August, with a peak in June, though some can be as early as March (Lockyer, 1995, 2003; Evans *et al*., 2008). Social groups often gather in late summer (August-September) for mating (Evans *et al*., 2008).



a) No. of HP sightings/hr **b)** No.of HP individuals/hr

Fig. 11. Distribution of Harbour Porpoise sightings corrected for effort

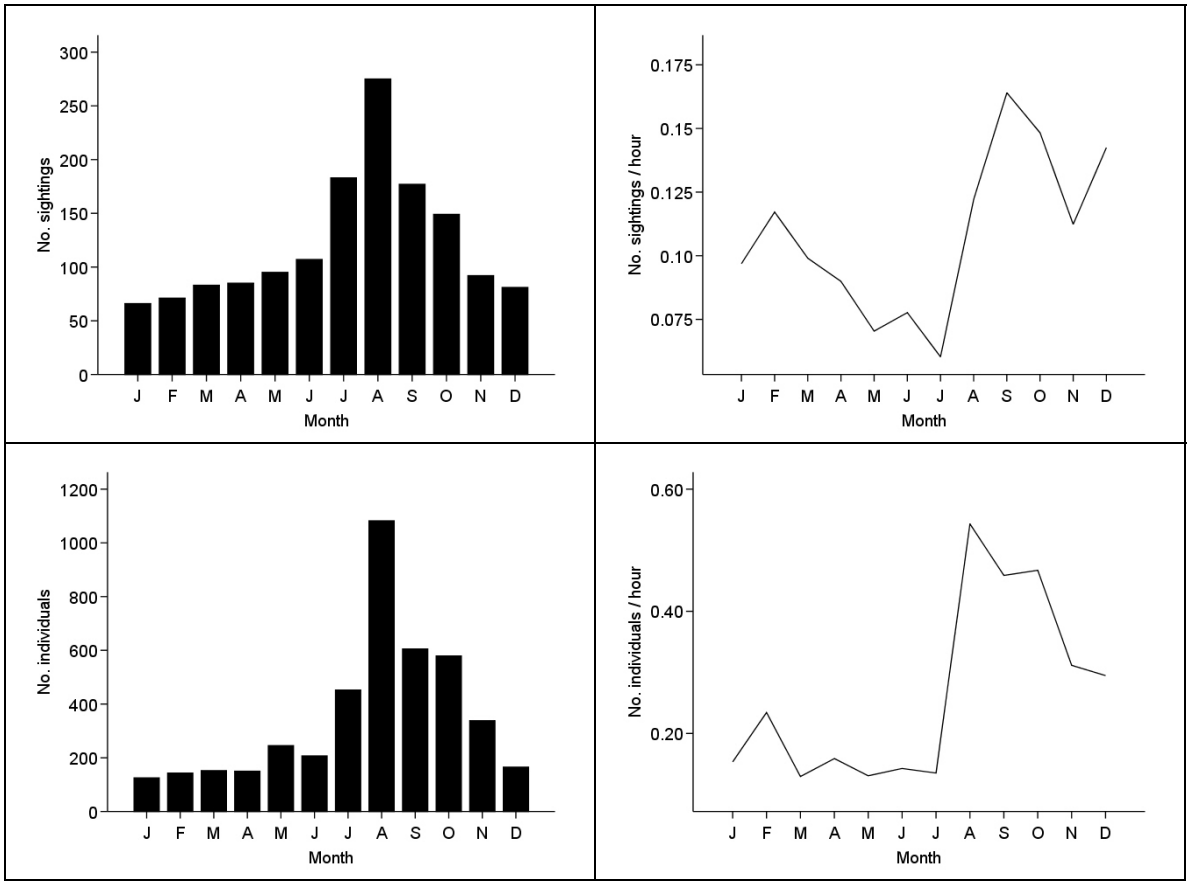
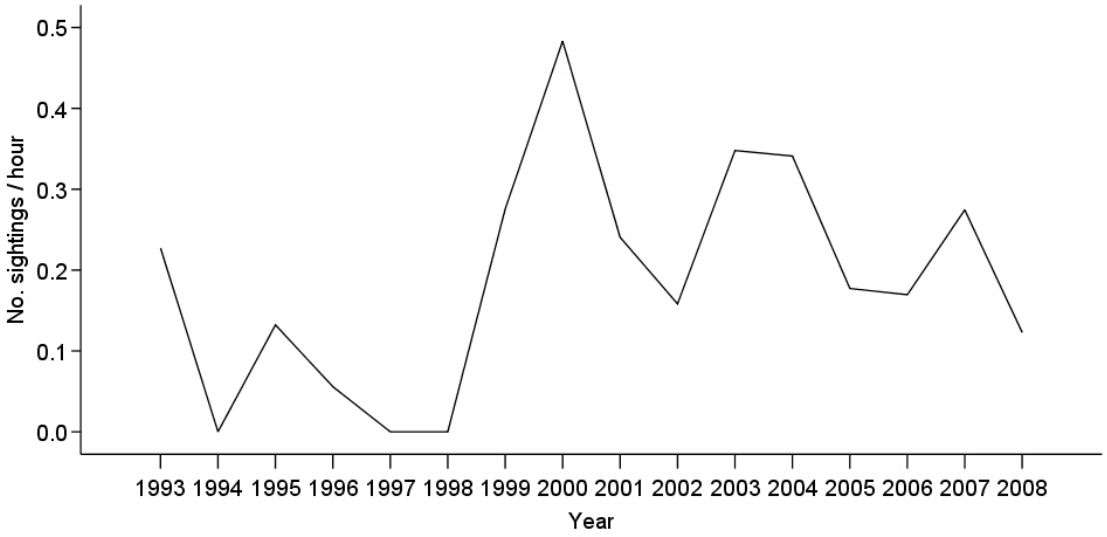


Fig. 12. Seasonal occurrence of Harbour Porpoises from land-based watches
(TL: No. sightings; BL: No. individuals; TR: No. sightings/hr; BR: No. individuals/hr)

a)



b)

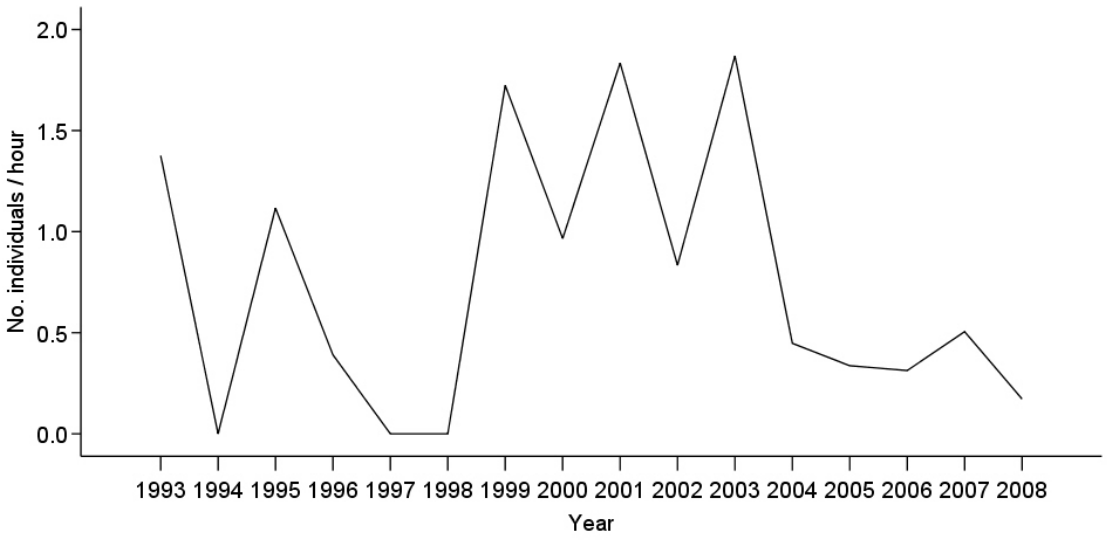
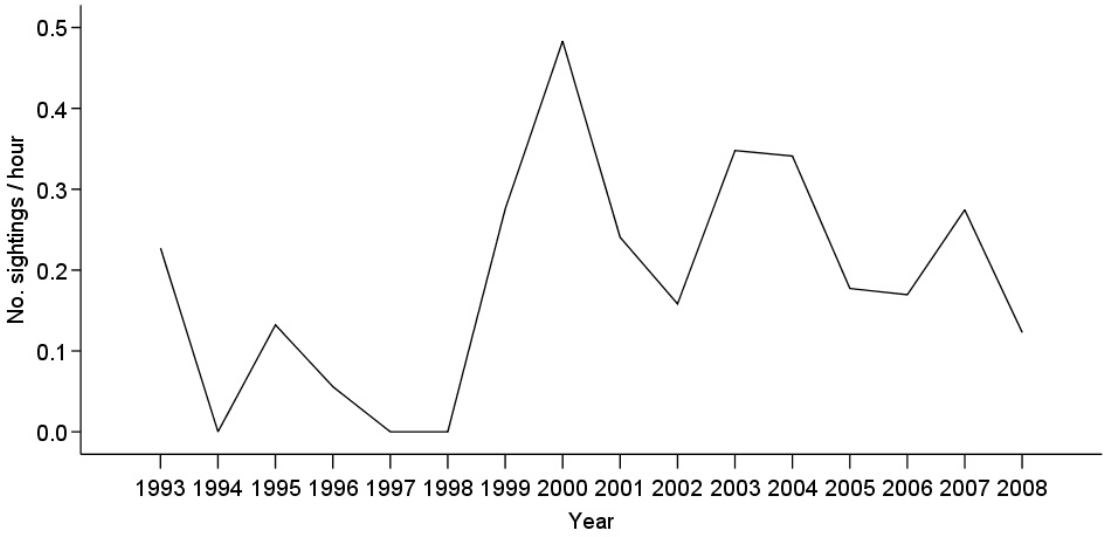


Fig. 13. Trends in Harbour Porpoise sightings rates from boat surveys
a) No. sightings/hr; b) No. individuals/hr

a)



b)

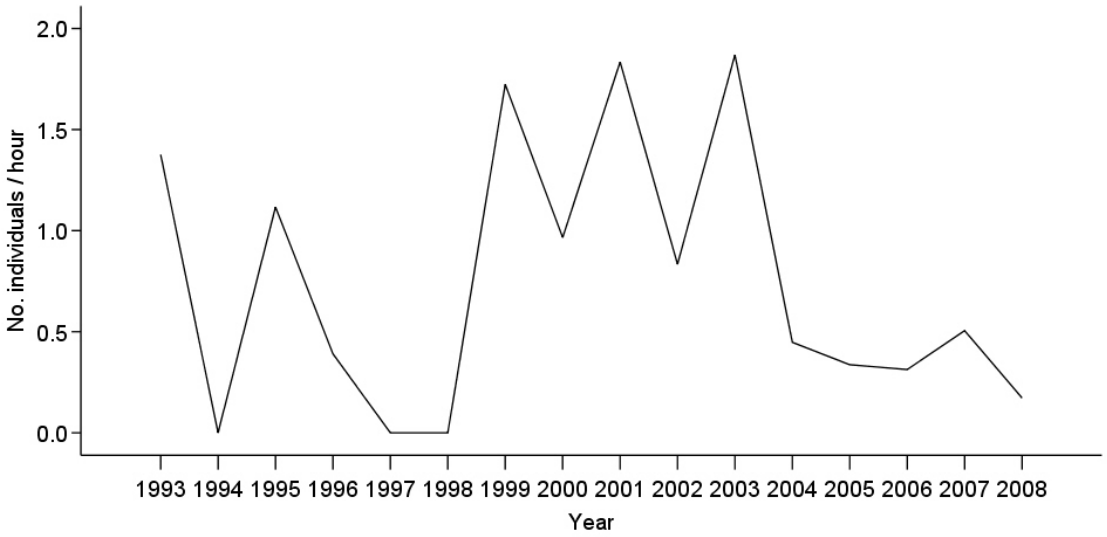
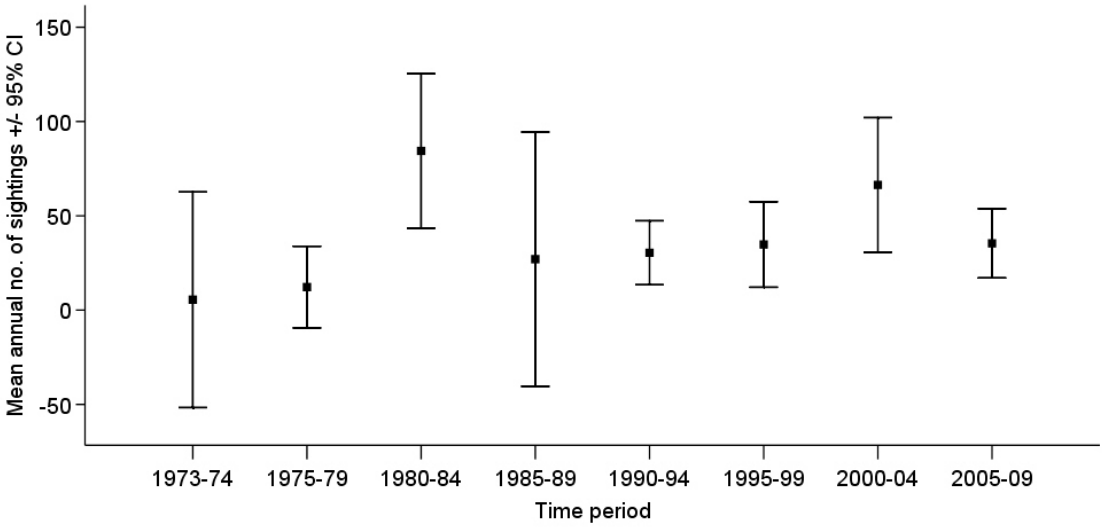


Fig. 14. Trends in Harbour Porpoise sightings rates from land-based surveys
b) No. sightings/hr; b) No. individuals/hr

a)



b)

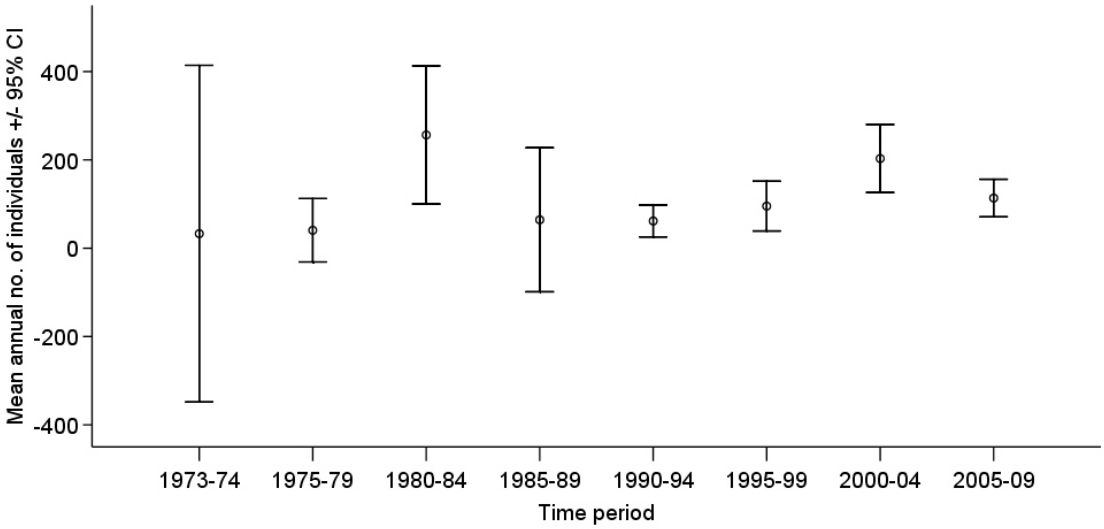
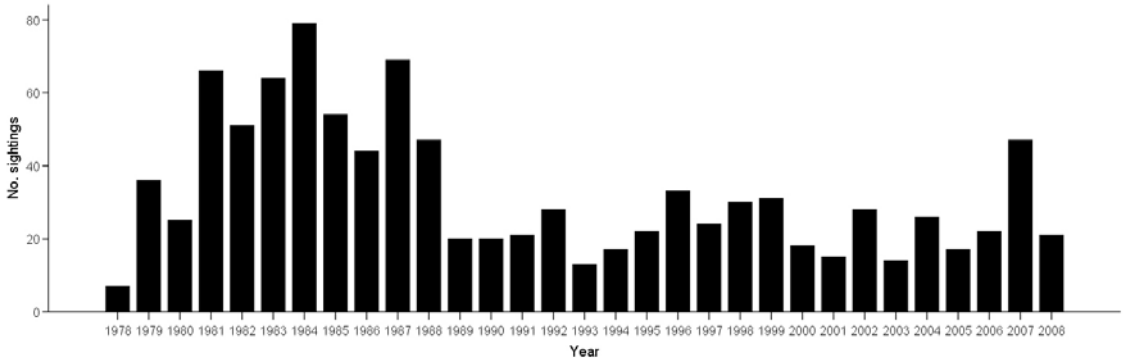


Fig. 15. Long-term trends in Harbour Porpoise sightings from all surveys
a) Mean annual no. of sightings; b) Mean annual no. of individuals

a)



b)

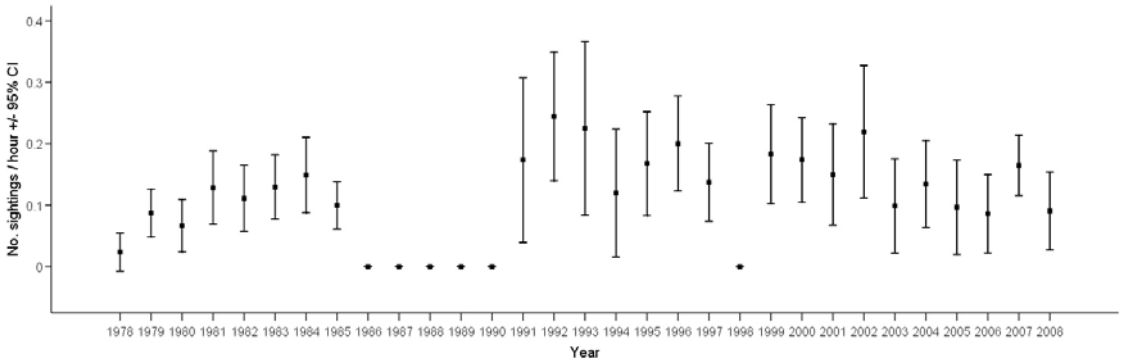


Fig. 16. Long-term trends in a) no.of sightings & b) sightings rates of Harbour Porpoise from Peterhead (no effort data available for the years 1986-90 or 1998)

Harbour porpoises produce high-frequency sounds used for echolocation and communication, but do not make frequency-modulated whistles typical of many delphinids. The high frequency sounds are comprised entirely of click trains, produced in two narrow band frequency components, one weaker one of longer duration (c. 0.2 msec) at between 1-20 kHz (Schevill *et al.*, 1969; Goodson *et al.*, 1995) and the other between 120-160 kHz (peaking around 125-130 kHz) of shorter duration (c. 0.02 msec) (Mohl & Andersen, 1973; Kamminga, 1990; Amundin, 1991; Akamatsu *et al.*, 1992; Goodson *et al.*, 1995). Repetition rates of pulses range between 0.5-1,000 clicks per sec (Amundin, 1991). Maximum source level is estimated at between 178 and 205 dB re 1µPa at 1 m (Villadsgaard *et al.*, 2007). The contexts in which these click trains are used are not well understood but intense buzzes have been related to feeding (Verboom & Kastelein, 1997; Verfuß *et al.*, 2005]. Hearing sensitivity is highest between c. 10 and 150 kHz.

International protection includes Appendix II of CMS Agreement on the Conservation of Migratory Species of Wild Animals (BONN Convention, 1983); Appendix II of BERN Convention on the Conservation of European Wildlife and Natural Habitats (applied to this species, from 1987); and Annex II of the EU Habitats Directive (1992) (prohibiting all forms of deliberate capture, killing or disturbance, especially during breeding, rearing or migration; banning the keeping, sale, or exchange of such species; and requiring that

member states monitor the incidental capture and killing of all cetaceans, and carries out research on conservation measures to prevent such accidents). Like all cetacean species, it is also listed on Annex IV Animal and Plant Species of Community Interest in Need of Strict Protection of the EU Habitats Directive (1992). It is listed on List C1 of Council Regulation and, since 1985, has been treated by the European Community as if it is on CITES Appendix II (trade controlled to prevent overexploitation). Status listed by IUCN (Reeves *et al*., 2003) as "Vulnerable". In the UK, it receives special protection in respect of particular methods of killing or taking under The Wildlife & Countryside Act (1981) and the Wildlife (Northern Ireland) Order (1985). It is one of the species for which the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS) (1992), applies.

White-beaked Dolphin (*Lagenorhynchus albirostris*) The white-beaked dolphin is restricted to temperate and sub-polar seas of the North Atlantic. 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).

The species is common in British and Irish waters, and is found most abundantly in the central and northern North Sea across to north-west Scotland, although it also occurs less commonly in the southern North Sea, and occasionally in Western and Southern Ireland, St George's Channel, English Channel, and northern Bay of Biscay (Evans *et al*., 2003; Reid *et al*., 2003; Evans & Smeenk, 2008a). From line transect surveys in July 1994 (Hammond *et al.*, 2002), a population estimate of 7,856 white-beaked dolphins (4,032-13,301) was made for the North Sea and Channel. An abundance estimate of 11,760 (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, covering European continental shelf seas from South West Norway, south to Atlantic Portugal, gave an estimate of 16,800 (CV=0.26), with the majority in the North Sea and off North-west Britain (Hammond, 2008). The abundance estimate for the North Sea (including Shetland & Orkney) was 10,570, with none recorded in the Channel (Hammond, 2008).

In the northern North Sea, white-beaked dolphins typically occur mainly offshore and in late summer between June and September (particularly in August); 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). It is rarely reported between November and April. However, in recent years, the species may 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^{o}N. Similar reductions in sightings and strandings have been observed when comparing the 1980s-90s with the period since 2002 (Evans, 1998, 1992; Northridge *et al*., 1995; Evans *et al*. 2003; MacLeod *et al*., 2005; Canning *et al*., 2008).

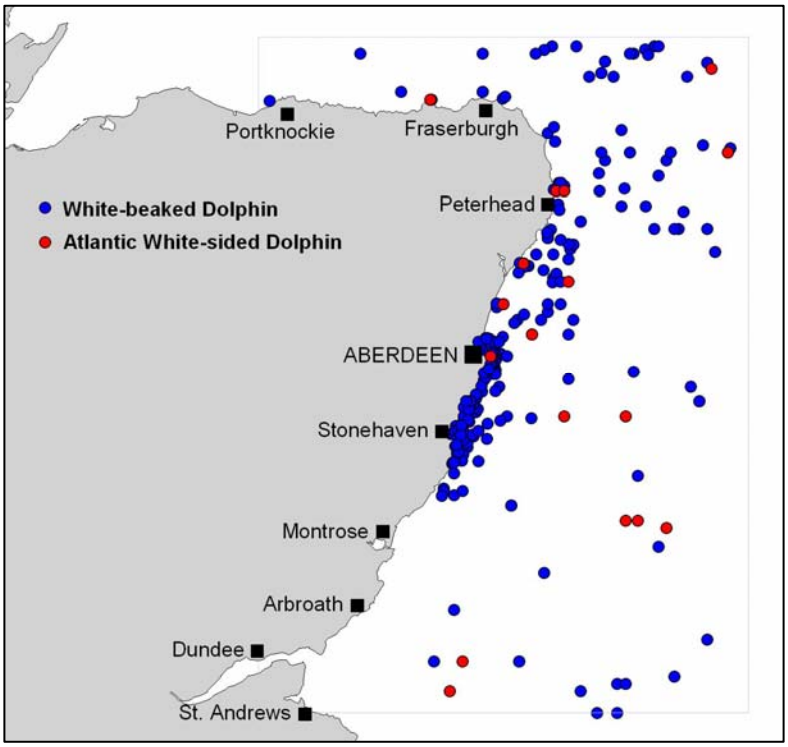
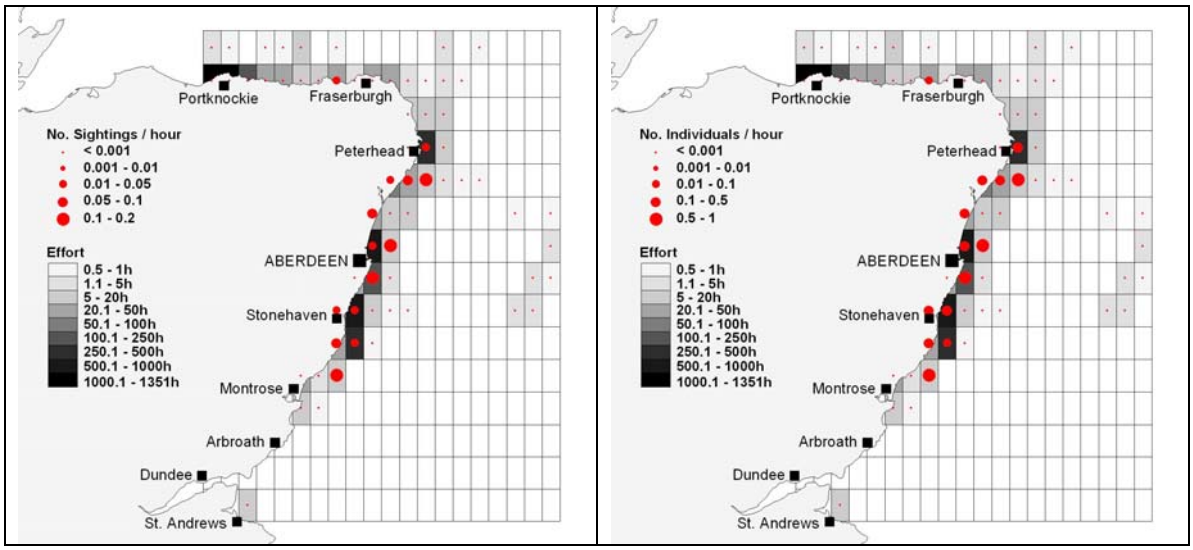


Fig. 17. Distribution of White-beaked and Atlantic White-sided Dolphin sightings in East Grampian Region

Off the Grampian coast, white-beaked dolphins have been seen regularly over a wide area both nearshore and offshore (Figs. 17 & 18). The number of sightings reports and sighting rates from effort-based observations both peak in the region during July and August, which are also the months when numbers of individuals per unit effort peak (Fig. 19). As elsewhere in UK coastal waters, white-beaked dolphins appear to be very seasonal, coming into the region almost exclusively in mid to late summer (Evans *et al*., 2003; Evans & Smeenk, 2008a), although there have been a few sightings in the region outside this period (Appendix 1e).

Local trends in sightings and individual rates indicate strong peaks in 2000 and again in 2004, for both vessel based and land-based surveys (Figs. 20 & 21). Before 1999, the species was recorded only occasionally (Fig. 22), and both overall sightings and sighting rates have declined since 2004 (Fig. 20-22).



a) No. of WBD sightings/hr **b)** No.of WBD individuals/hr

Fig. 18. Distribution of White-beaked Dolphin sightings corrected for effort

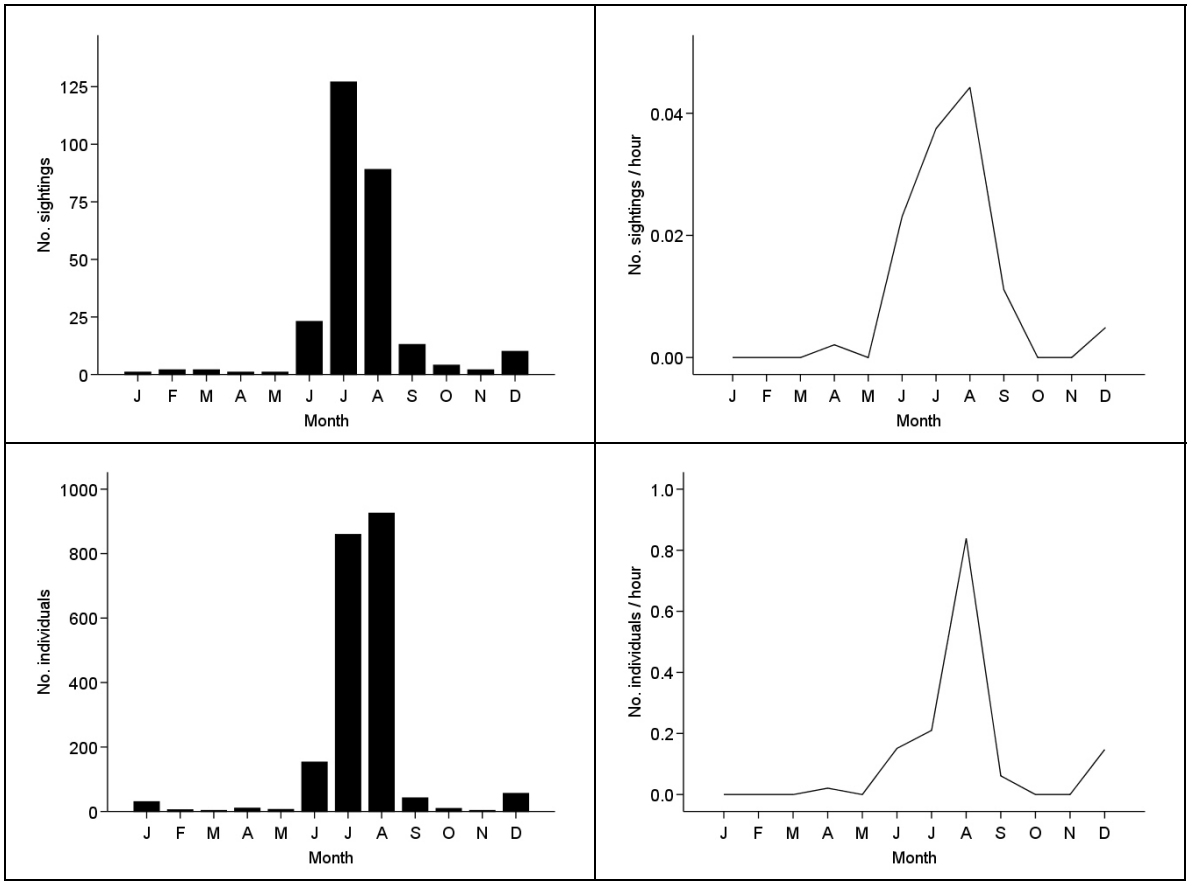
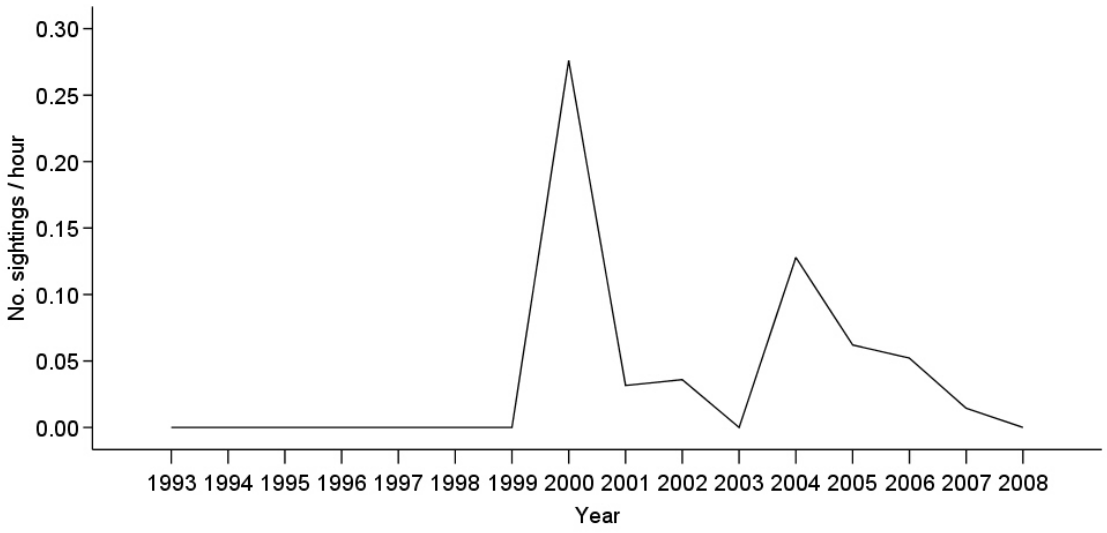


Fig. 19. Seasonal occurrence of White-beaked Dolphins from land-based watches
(TL: No. sightings; BL: No. individuals; TR: No. sightings/hr; BR: No. individuals/hr)

a)



b)

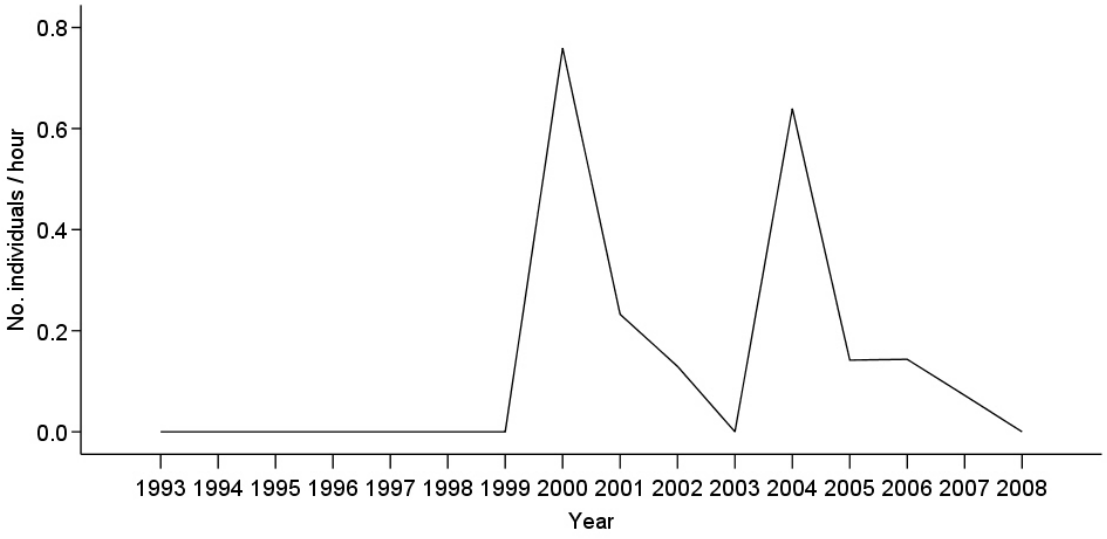
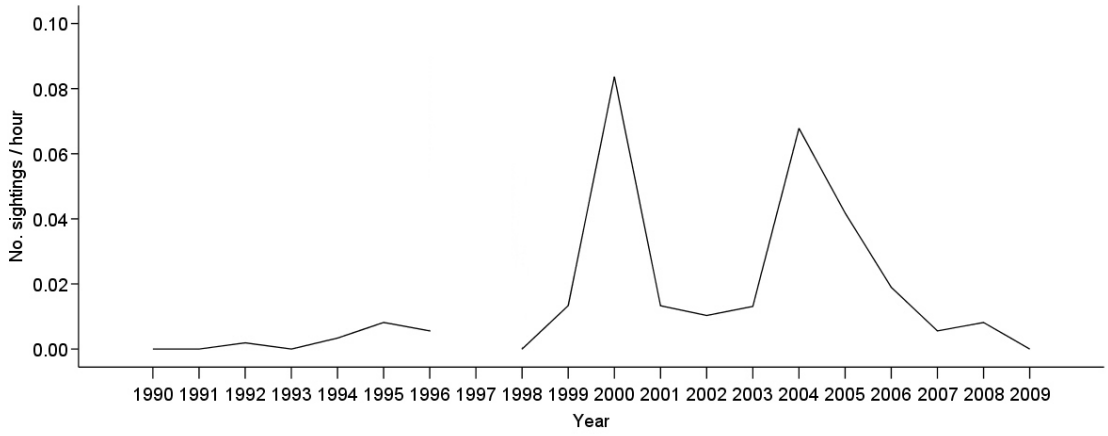


Fig. 20. Trends in White-beaked Dolphin sightings rates from boat surveys
c) No. sightings/hr; b) No. individuals/hr

a)



b)

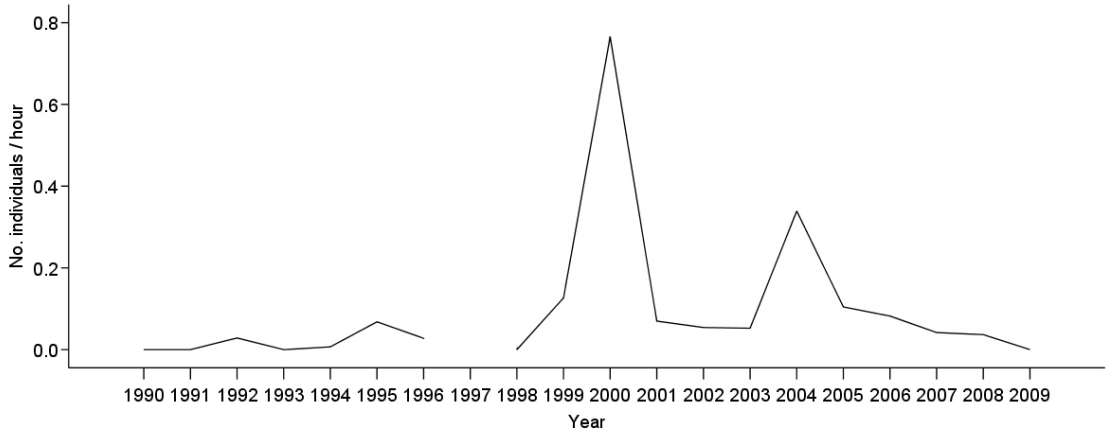
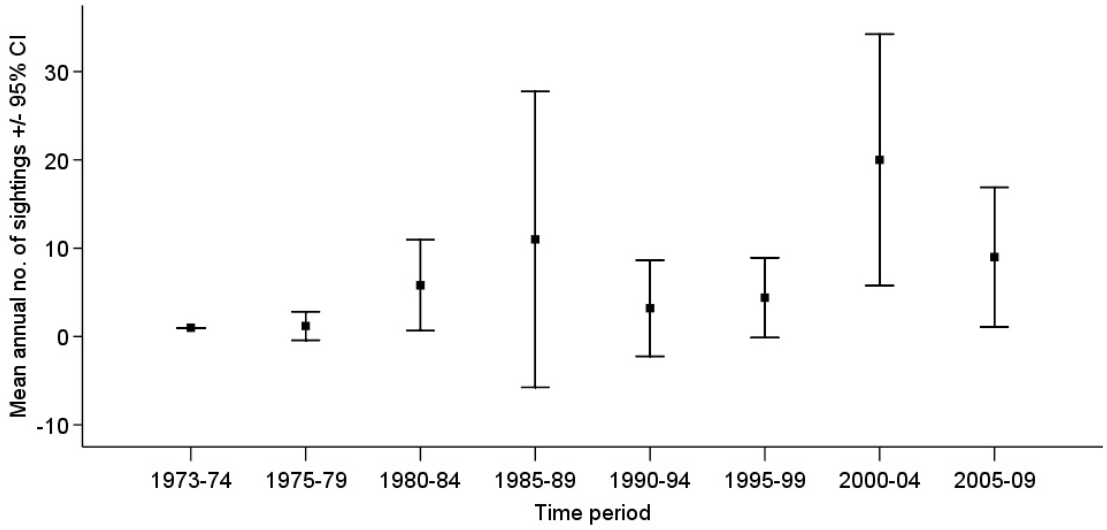


Fig. 21. Trends in White-beaked Dolphin sightings rates from land-based surveys
d) No. sightings/hr; b) No. individuals/hr

a)



b)

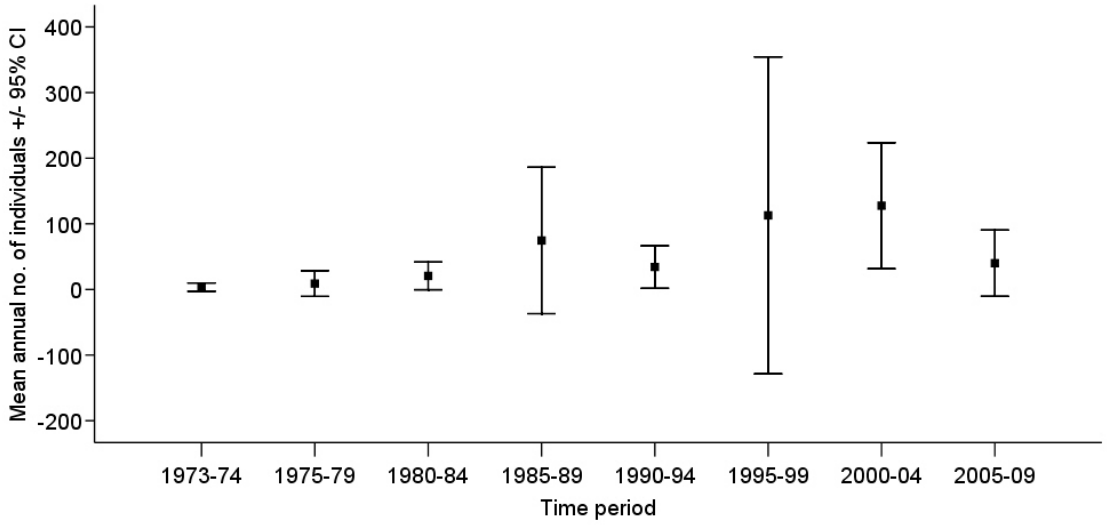


Fig. 22. Long-term trends in White-beaked Dolphin sightings from all surveys
a) Mean annual no. of sightings; b) Mean annual no. of individuals

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

Vocalisations are poorly known but include whistles of 6.5 kHz to at least 15 kHz frequency (often around 8 kHz), with average source levels (SL) of 180 dB re 1 μPa @ 1 m, and echolocation clicks of up to at least 325 kHz, with click bursts of 100-750 pulses per second, and maximum SL of 214 dB re 1 μPa @ 1 m (mean SL = 204 dB, mean inter-click interval = 51 ms) (Watkins *pers. comm*., Mitson & Morris 1988, Mitson 1990, Reeves *et al.*, 1999b, Rasmussen *et al.*, 1999).

International protection includes Appendix II of CMS Agreement on the Conservation of Migratory Species of Wild Animals (BONN Convention, 1983); Appendix II of BERN Convention on the Conservation of European Wildlife and Natural Habitats (applied to this species, from 1987); and Annex IV Animal and Plant Species of Community Interest in Need of Strict Protection of the EC Habitats Directive (1992). It is listed on List C1 of Council Regulation and since 1985, has been treated by the European Community as if it is on CITES Appendix II (trade controlled to prevent overexploitation). Its status is listed by IUCN (Reeves *et al*., 2003) as "Least Concern". In UK, it receives protection under The Wildlife and Countryside Act (1981) and the Wildlife (Northern Ireland) Order (1985). It is one of the species for which the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS) (1992), applies.

Minke Whale (*Balaenoptera acutorostrata*) 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 although it also occurs regularly in the northern and central North Sea as far south as the Yorkshire coast. It is seen in small numbers in the Irish Sea but is rare in the Channel and southernmost North Sea, as well as south of here in the Bay of Biscay (Anderwald *et al*., 2008). There is some indication of an increase since the 1980s, with populations concentrated in the northern North Sea, and around North and West Scotland (Evans *et al*. 2003; Anderwald *et al*., 2008)

The only published population estimate for minke whales in UK waters is from the North Sea, English Channel and Celtic Sea; the line transect survey (SCANS I) 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 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 around one thousand whales, but the numbers actually caught have been much less.

The species is the fourth most commonly recorded species in the region. Minke whale sightings are widely distributed through the region (Fig. 23), often occurring close to the coast particularly between Stonehaven and Aberdeen (Fig. 24).

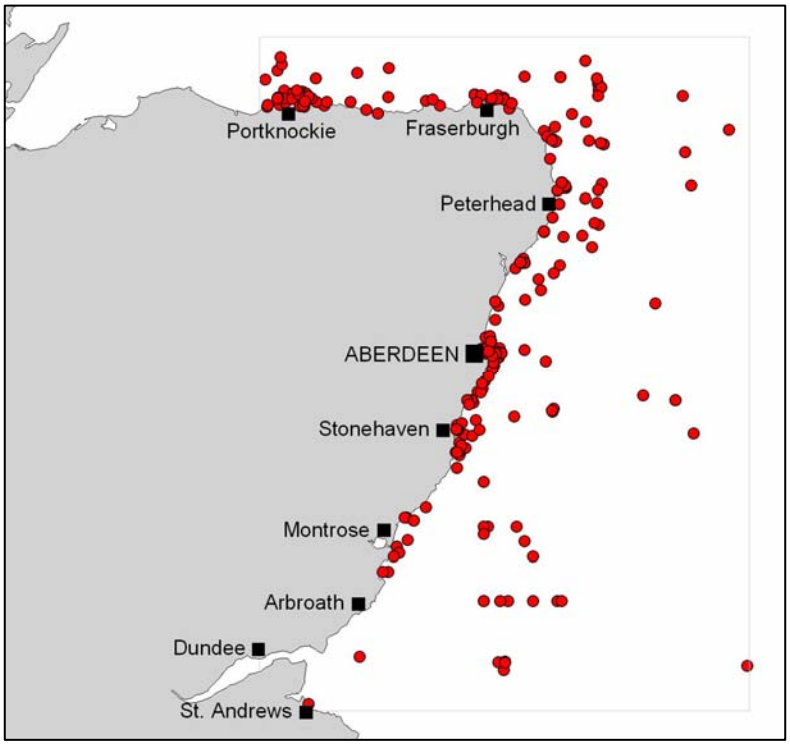
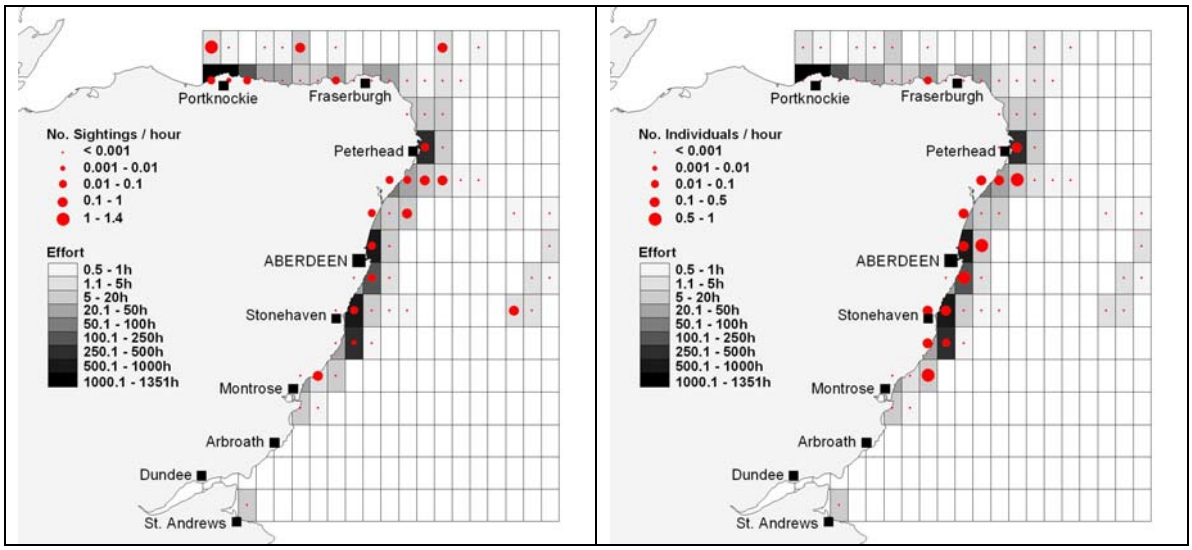


Fig. 23. Distribution of Minke Whale sightings in East Grampian Region

Although recorded in every month of the year except January, both sightings and sightings rates show strong peaks in July and August, as do the number of individual and individual rates (Fig. 25). In the Outer Moray Firth, the species is seen mainly between July and October (Robinson *et al*., 2007), with larger numbers in some years (e.g. 2003 & 2005) than others (e.g. 2004), associated with warm water plume events (Tetley *et al*., 2008).

Elsewhere around the British Isles, most sightings also occur in July-August although the species can be seen anytime between May and October, and at least small numbers remain in coastal 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 between autumn and spring; however, breeding locations are unknown. There is no information on whether a more extensive latitudinal migration takes place (Anderwald & Evans, 2007).



a) No. of MW sightings/hr **b)** No.of MW individuals/hr

Fig. 24. Distribution of Minke Whale sightings corrected for effort

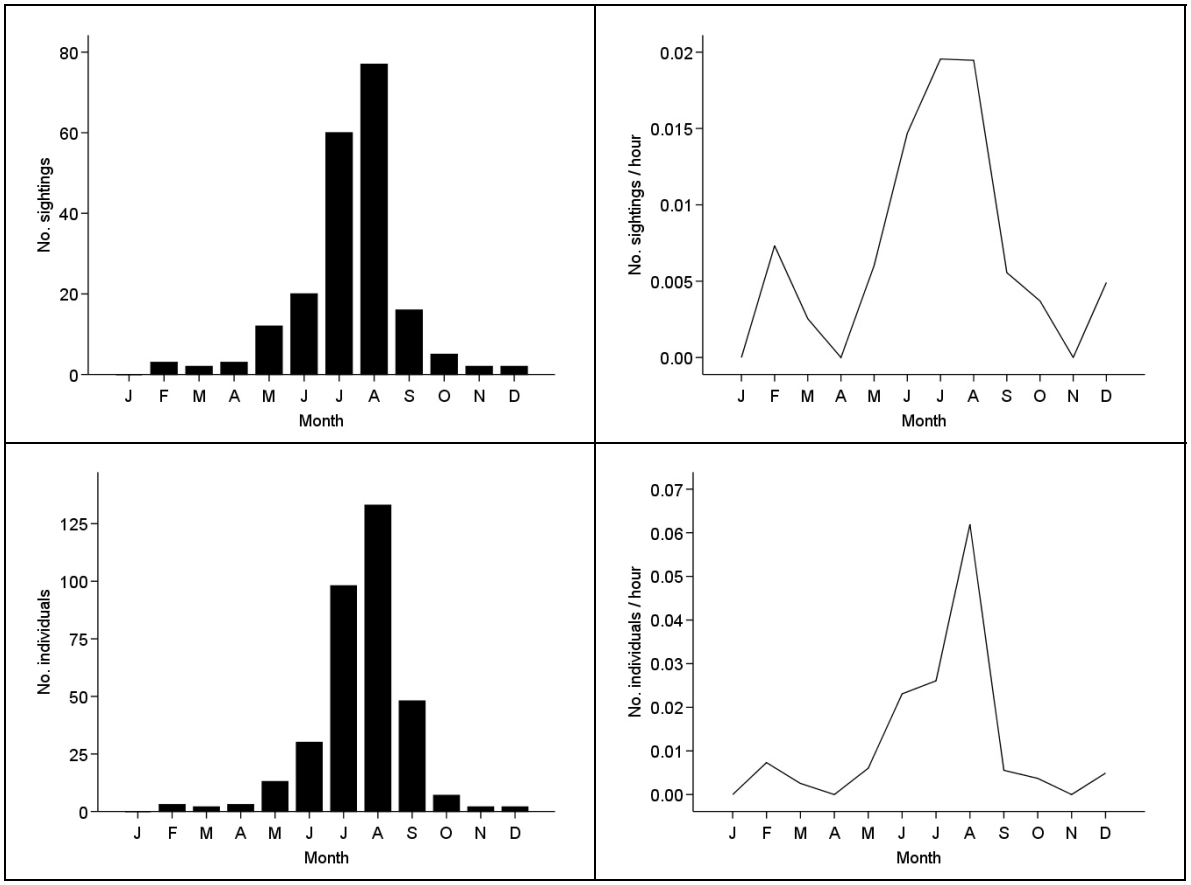
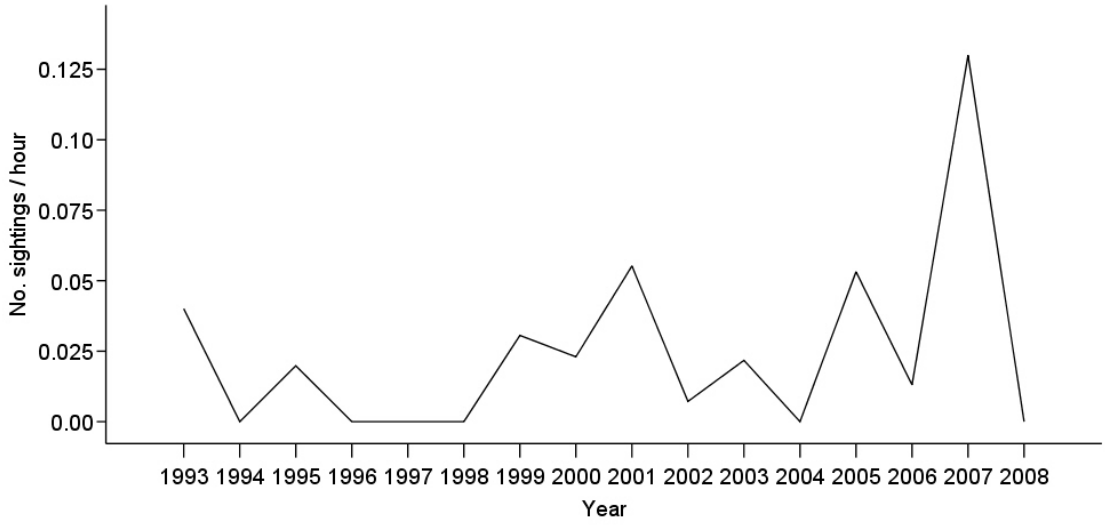


Fig. 25. Seasonal occurrence of Minke Whales from land-based watches
(TL: No. sightings; BL: No. individuals; TR: No. sightings/hr; BR: No. individuals/hr)

a)



b)

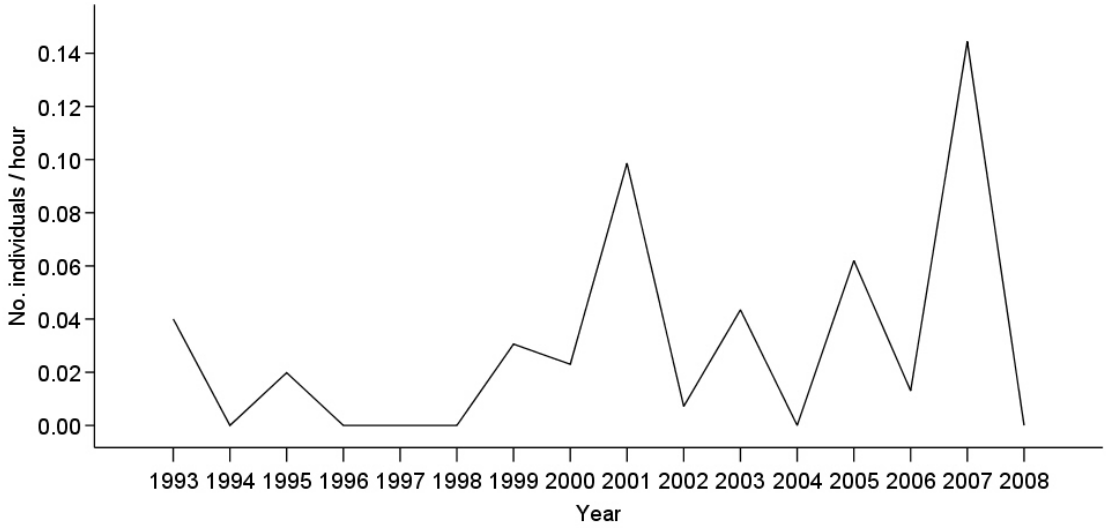
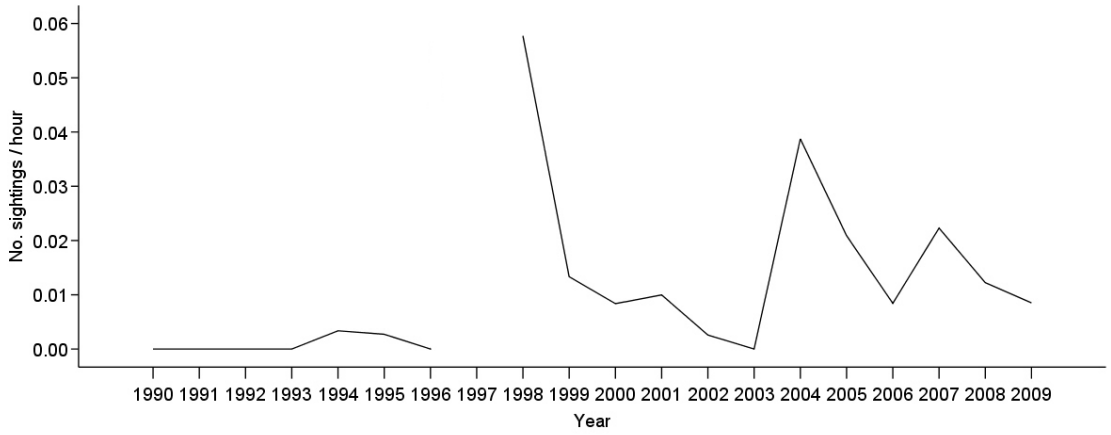


Fig. 26. Trends in Minke Whale sightings rates from boat surveys
a) No. sightings/hr; b) No. individuals/hr

a)



b)

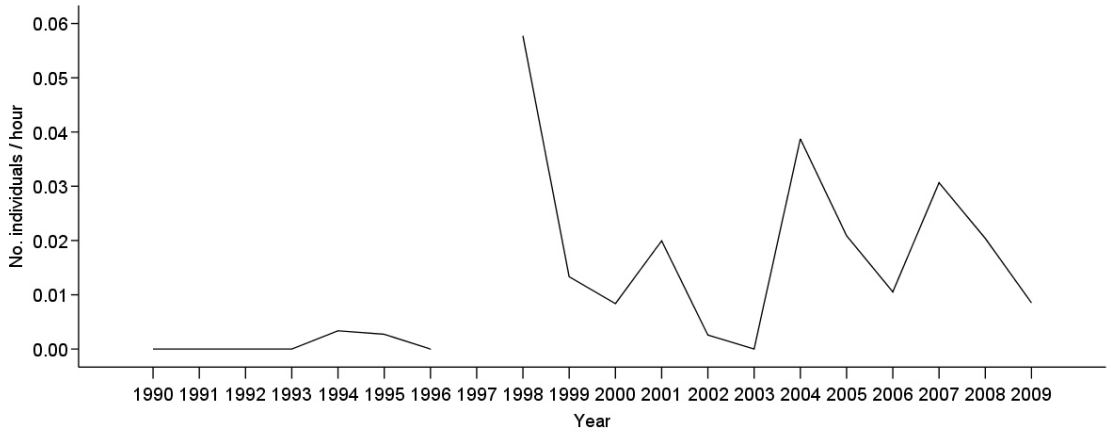
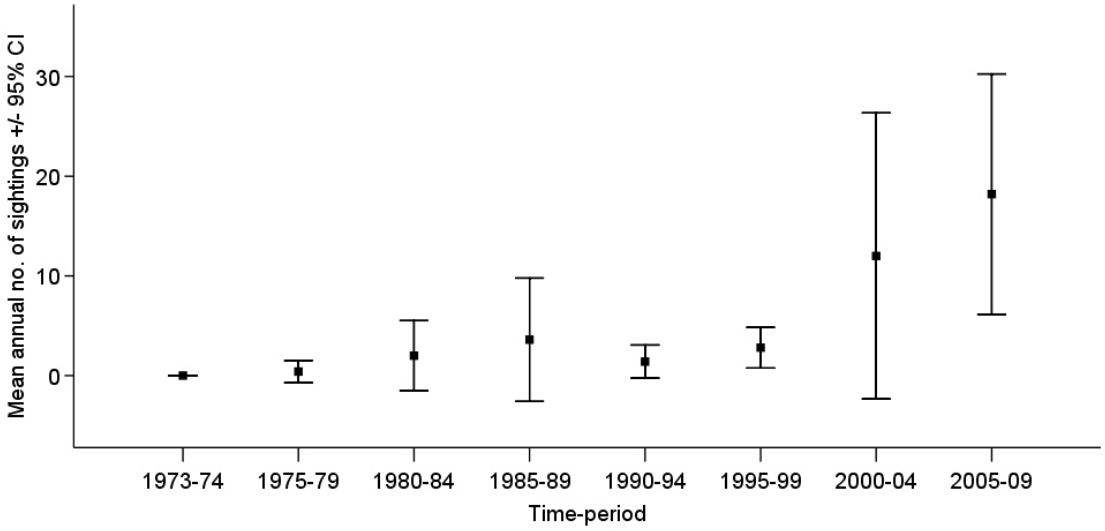


Fig. 27. Trends in Minke Whale sightings rates from land surveys
a) No. sightings/hr; b) No. individuals/hr
(NB: there was too little effort to record a sightings rate in 1997)

a)



b)

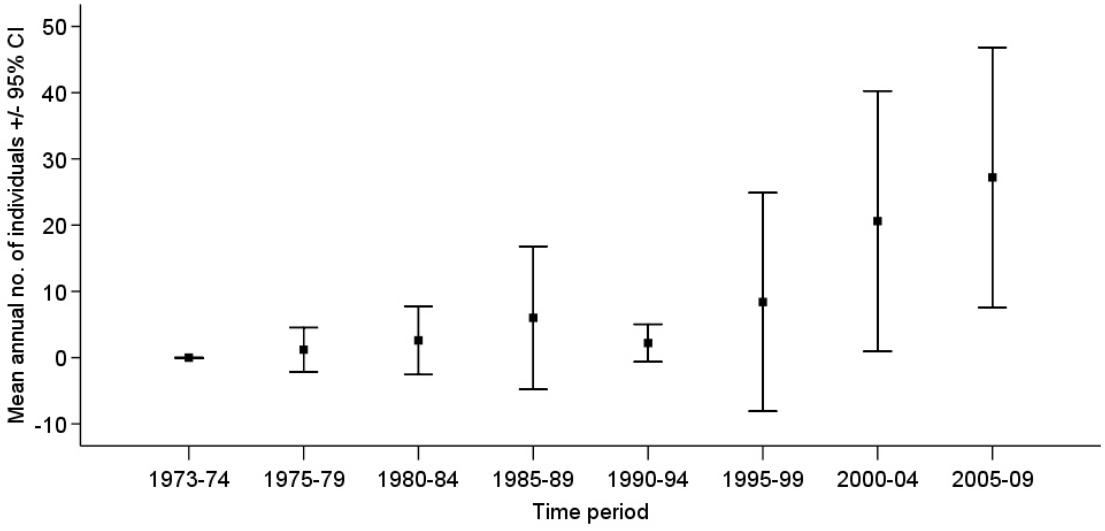


Fig. 28. Long-term trends in Minke Whale sightings from all surveys
a) Mean annual no.of sightings; b) Mean annual no. of individuals

Sightings rates per unit effort both from boat and land-based surveys were lower during the 1990s than the subsequent decade, since when they have fluctuated between years with no obvious trend (Figs. 27 & 28). Over the longer term (from 1970s onwards), the mean number of sightings & individuals per year remained very low until the mid 1990s since when they have generally increased (Fig. 29).

The species is most commonly seen singly or, less commonly, in loose groups of up to three. However, in late summer in northern and northwest Britain, loose feeding aggregations of up to 15 animals may form (Evans *et al*., 2003; Reid *et al*., 2003; Anderwald *et al*., 2008). Only very small groups have been seen in the East Grampian region, however.

Minke whales feed upon a variety of fish species, notably herring, sandeel, cod, haddock, and saithe, as well as on invertebrates like euphausiids and pteropods, which they take, particularly in polar regions (Nordøy *et al*., 1995; Olsen & Holst, 2001; Pierce *et al*., 2004). Feeding occurs often in areas of upwelling or strong currents around headlands and small islands, primarily during the summer. Feeding minke whales in late summer are commonly associated with flocks of Manx shearwater, northern gannet, kittiwake and various *Larus* gulls.

Vocalisations involve intense, low frequency, broadband (0.5-1 kHz bandwidth) and harmonic down-sweeps with maximum source level of 165 dB re 1μPa. These include short broadband downsweeps (mainly 0.13-0.06 kHz lasting 200-300 msecs); 'grunts' (mainly between 0.08-0.14 kHz, but up to 2 kHz, lasting 165-320 msecs); and thumps (often downsweeps; mainly 0.1-0.2 kHz, lasting 50-70 msecs) (Schevill & Watkins, 1972; Winn & Perkins, 1976; Thompson *et al*., 1979; Edds, 1988).

International protection includes Appendix II of CMS Agreement on the Conservation of Migratory Species of Wild Animals (BONN Convention, 1983); Appendix III (can be exploited so long as regulation keeps populations out of danger) of BERN Convention on the Conservation of European Wildlife and Natural Habitats (1982); and Annex IV Animal and Plant Species of Community Interest in Need of Strict Protection of the EU Habitats Directive (1992). It is listed on List C1 of Council Regulation and is treated by the European Community as if it is on CITES Appendix I (trade strictly controlled, and not for primarily commercial purposes, with exception of West Greenland); one of the species managed by the International Whaling Commission. Status listed by IUCN as Near Threatened (Reeves *et al*., 2003). In UK, it receives protection under The Wildlife & Countryside Act (1981) and the Wildlife (Northern Ireland) Order (1985).

5.2 OTHER SPECIES

Ten other cetacean species have been sighted alive in the East Grampian region. Their status, distribution and seasonal occurrence will be summarised below:

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^{o}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 leading to a distribution concentrated around the Hebrides, the Northern Isles and the northern North Sea (Evans *et al*., 2003; Reid *et al*., 2003).

Most sightings of Atlantic white-sided dolphins in East Grampian have occurred offshore, reflecting its ecology elsewhere (Fig. 17). More than 75% of sightings have been in the months of July and August, although the species has been recorded in winter and spring as well. Nearly all groups have numbered less than ten individuals, the notable exception being in July 1993 when a school of fifty was recorded. However, since 2003, there has been no live sighting of the species recorded in the East Grampian region, with a sighting of twelve white-sided dolphins in August 2005 further west in the Outer Moray Firth (Robinson *et al*., 2007).

Short-beaked Common Dolphin (*Delphinus delphis*)

The short-beaked common dolphin has a worldwide distribution in tropical, subtropical and temperate seas in both hemispheres. It is widely distributed in the eastern North Atlantic, mainly in deeper waters from the Iberian Peninsula north to West Scotland (Evans *et al*., 2003; Murphy *et al*., 2008). 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).

Common dolphin sightings in East Grampian are widely scattered through the region (Fig. 29). Around 75% of sightings have occurred in the months of June, July and August, but there have also been records in February, September and October. Most sightings have numbered less than 20 individuals, although in July 2007, a large school estimated to number around 300 individuals was observed in the northeastern part of the region. The number of records between decades has been two in the 1970s, three in the 1980s, two in the 1990s, and ten in the 2000s, possibly reflecting the recent increased presence of the species in the North Sea.

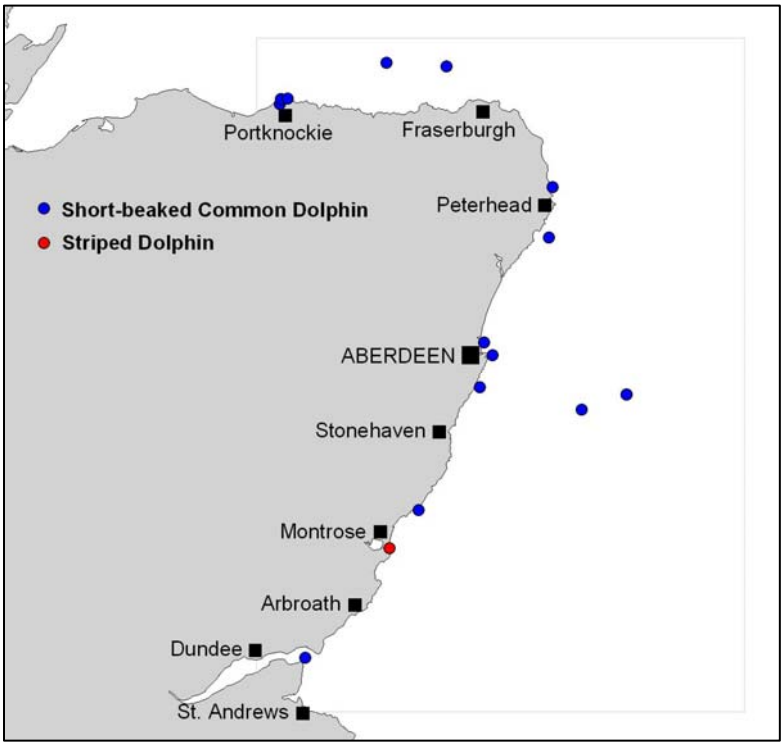


Fig. 29. Distribution of Short-beaked Common Dolphin and Striped Dolphin sightings in East Grampian Region

Striped Dolphin (*Stenella coeruleoalba*)

This species has a worldwide distribution, mainly in tropical and warm temperate waters. In the Northeast Atlantic, striped dolphins occur mainly offshore from the continental shelf of Spain, Portugal and France although it is the commonest dolphin in the western Mediterranean. Around the British Isles, it is an occasional visitor, recorded mainly from the southwest (Evans, 1992; Evans *et al.*, 2003; Reid *et al*., 2003; Evans & Collet, 2008). It occasionally strays into shelf waters further north as far as Scotland (Evans & Collet, 2008). Records in the mid Atlantic to 62^{o} N suggest that its distribution offshore is extended northward by Gulf Stream (Evans, 1992; Evans *et al*., 2003).

There have been a number of strandings (both live and dead) in Northeast Scotland, particularly in the last ten years (Jepson, 2005; Sabin *et al*., 2006; Deaville & Jepson, 2007, 2008, 2009). The only live sighting of the species in the East Grampian Region has been a group of six individuals identified near Montrose on 12 January 2006 (Fig. 29).

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 (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 but the species is also regularly observed in the Northern Isles, the Irish Sea, 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; Evans, 2008).

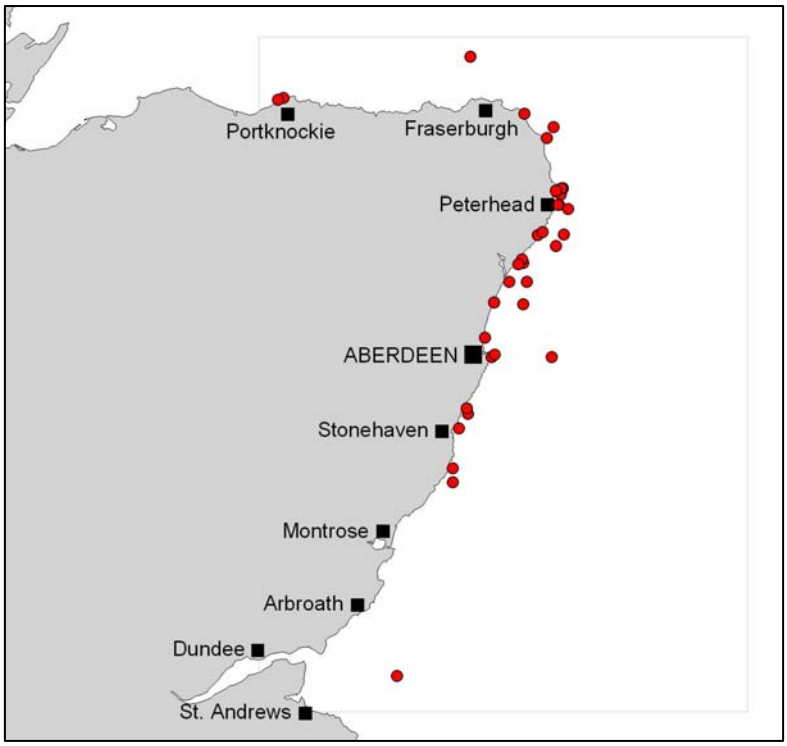


Fig. 30. Distribution of Risso's Dolphin sightings in East Grampian Region

In recent years, Risso's dolphins have been observed regularly in the northern and central North Sea (Sea Watch, unpubl. data). In the East Grampian Region, sightings are widely distrtibuted, though mainly north of Stonehaven (Fig. 30). The species has been recorded year-round (except December) although just under 60% of sightings have occurred in the months of July, August and September. A similar seasonal pattern exists in the Hebrides (Evans *et al*., 2003). Group sizes have all been small – ten animals or less. The number of records between decades has been two in the 1970s, six in the 1980s, four in the 1990s, and 34 in the 2000s, reflecting the marked increased presence of the species in the North Sea over the last ten years.

Killer Whale (*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 (Evans *et al*., 2003; Reid *et al*., 2003; Boran *et al*., 2008b).

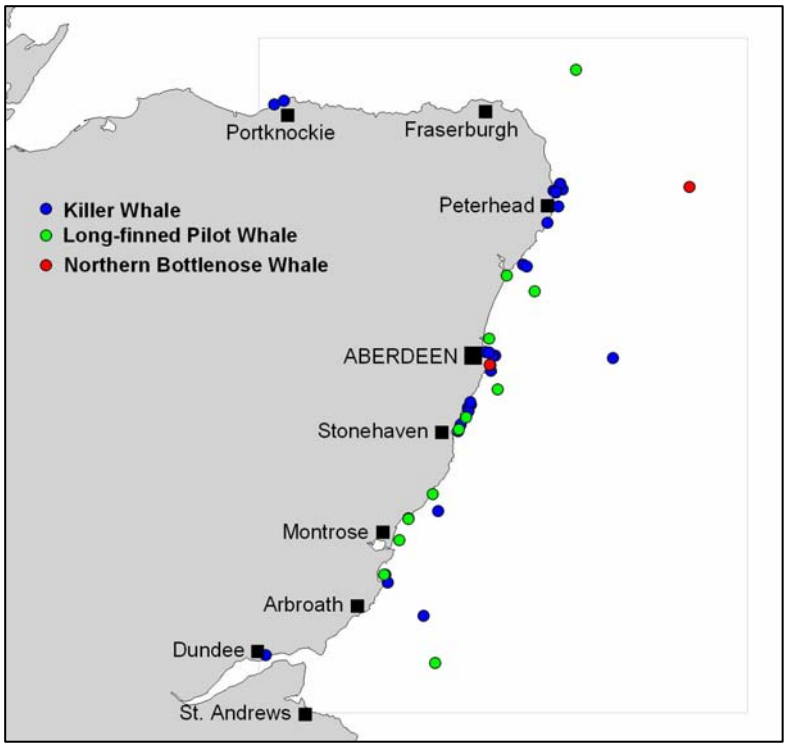


Fig. 31. Distribution of Killer Whale, Long-finned Pilot Whale and Northern Bottlenose Whale sightings in East Grampian Region

In the East Grampian Region, there have been 40 sightings since the 1970s, scattered over a wide area (Fig. 31). All of the sightings have occurred between May and December, although 70% have been in the months of July, August, and September. Most sightings have been of single animals, the rest being of small groups up to seven individuals. The number of records per decade has been two in the 1970s, ten in the 1980s, six in the 1990s, and 22 in the 2000s.

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, the North Sea mainly off northern Scotland, western Ireland and the South-west Channel Approaches; it also occurs south to the Iberian Peninsula and is common in the Mediterranean (Evans *et al*., 2003; Reid *et al*., 2003; 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).

There are only twelve records of sightings of long-finned pilot whales in the East Grampian Region, from widely scattered localities (Fig. 31). The species has been recorded in the months of January, March, April, June, July, October, November and December, with no particular seasonal pattern of occurrence. Eleven of the sightings were of single individuals or groups of seven or less. The notable exception was a pod of c. 130 pilot whales observed offshore in April 1987. The number of records per decade has been none in the 1970s, three in the 1980s, one in the 1990s, and eight in the 2000s.

Northern Bottlenose Whale (*Hyperoodon ampullatus*)
The northern bottlenose whale is distributed through the temperate and arctic North Atlantic, from the ice-edge to the Azores, occurring particularly in deep canyons. The main regions of concentration, identified from former whaling activities, appear to be west of Norway, west of Spitsbergen, north of Iceland, the Davis Strait off Labrador, off the Faroes and in The Gully off eastern Canada (Reeves *et al.* 1993; Hooker *et al*., 2008). In Northwest Europe, the species is sighted primarily in waters exceeding 1,000 m, such as Faroe-Shetland Channel, Rockall Trough, and the southern Bay of Biscay (Weir, 2001; Evans *et al*., 2003; Reid *et al.*, 2003).

There have been just two live sightings of northern bottlenose whale in the East Grampian Region (Fig. 31). One individual was observed some miles offshore east of Peterhead on 24 August 1997 whilst two were seen close to Aberdeen on 24 January 2006. Interestingly, the latter two were seen just five days after a bottlenose whale entered the River Thames before live stranding, raising the possibility that a small pod came into the North Sea around that time.

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 around 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).

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).

There has been just one sighting in the East Grampian region over the last twenty years, with two animals seen off Peterhead on 19 October 1998. However, there was also a live-stranding of six sperm whales in Cruden Bay on 28 Jan 1996.

Fin Whale (*Balaenoptera physalus*)

The species has a worldwide distribution, occurring mainly in temperate and polar seas of both hemispheres. Although fin whales may show seasonal latitudinal migration, remaining in polar seas only during summer, those further south around the British Isles appear to be present year-round (Clark & Charif, 1998; Evans *et al*., 2003). This is the commonest large whale in the eastern North Atlantic, Bay of Biscay and Mediterranean (Notarbartolo di Sciara & Evans, 2008). Around the British Isles, it is distributed mainly along the Atlantic seaboard, along or beyond the edge of the continental shelf. Most sightings in coastal waters come from the Shetland Islands, Outer Hebrides, Southwest Ireland and the Celtic Sea between S Ireland and SW England (Evans 1992, Evans *et al*., 2003; Reid *et al*., 2003). There is some indication from sightings that fin whales move generally northwards off Northwest Scotland between June and October, when numbers may concentrate in areas like Rockall Trough and Faroe-Shetland Channel (Evans *et al*., 2003; Notarbartolo di Sciara & Evans, 2008).

There have been eight sightings of fin whale in the East Grampian region since the 1970s, but some of these almost certainly are of the same individuals, representing a single whale on 13 August 1984, and two animals on 5 August 1997, both sightings occurring offshore south-east of Stonehaven (Fig. 32).

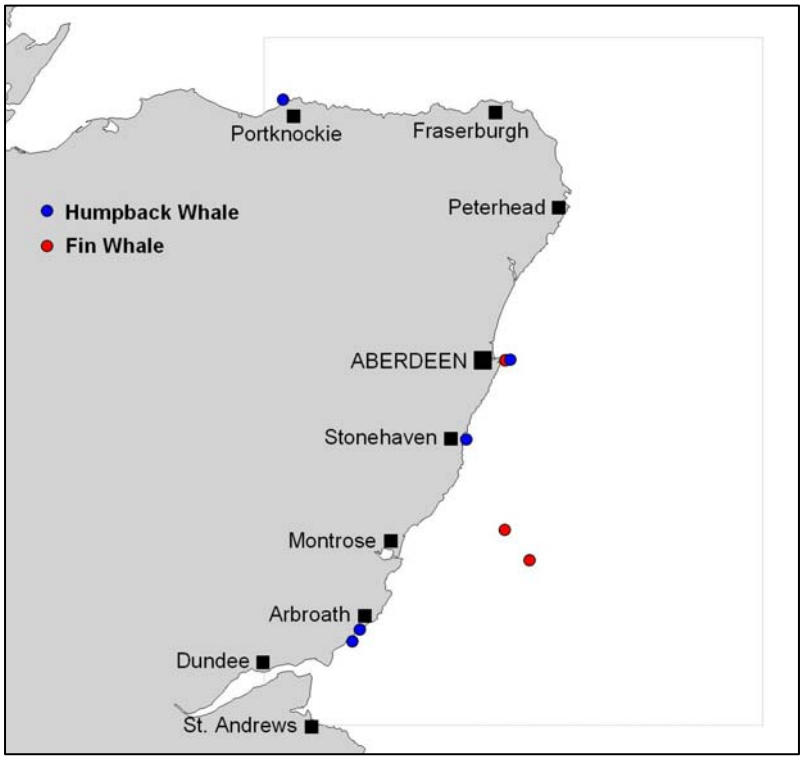


Fig. 32. Distribution of Fin Whale and Humpback Whale sightings in East Grampian Region

Humpback Whale (*Megaptera novaeangliae*)

Humpback whales are found worldwide, occasionally occurring to the ice edge. The species is highly migratory, feeding in summer in high latitudes, and mating and calving in winter in tropical waters, although a few over-winter on their feeding grounds. They show strong individual fidelity to feeding areas. In the North Atlantic, these include the Gulf of Maine, Gulf of St Lawrence, Newfoundland/Labrador, Greenland, Iceland and Norway, whilst some individuals have been sighted in separate years in the same areas around the British Isles (Clapham & Evans, 2008). The matching of photographically and genetically identified individuals indicates that the eastern North Atlantic population migrates primarily to West Indies, although some animals winter in the Cape Verde Islands; genetic analysis suggests a third, unknown, breeding area (Clapham & Evans, 2008). Despite fidelity to specific feeding grounds, whales from all North Atlantic areas mix spatially and genetically in the West Indies in winter.

Sightings from around the British Isles have increased markedly since the early 1980s; occurring in three main areas – the Northern Isles south to Eastern Scotland; the northern Irish Sea to West Scotland; and the Celtic Sea between Southern Ireland, West Wales and Southwest England (Evans, 1980, 1992; Evans *et al*. 2003; Reid *et al*., 2003; Clapham & Evans, 2008).

There have been sightings of up to eight humpback whales at scattered localities in the East Grampian Region (Fig. 32). All but one have been of single individuals, on 24 July 2001 off Cullen, then 27 July and 11 August 2001 off Findochty and Portnockie; an adult and calf on 13 Feb 2002 off Cove; on 24 July and 12 August 2002 off Banff; on 6 June 2004 off Girdleness; on 18 July 2006 off St Cyrus; on 22 Feb 2007 off Arbroath (later stranding in Castlesea Bay, Auchmithie); and on 26 Nov 2007 off Stonehaven.

Other records

There have been a number of sightings of cetaceans whose species identity could not be confirmed (Fig. 33). The majority of these were dolphins, probably either white-beaked or Atlantic white-sided dolphins.

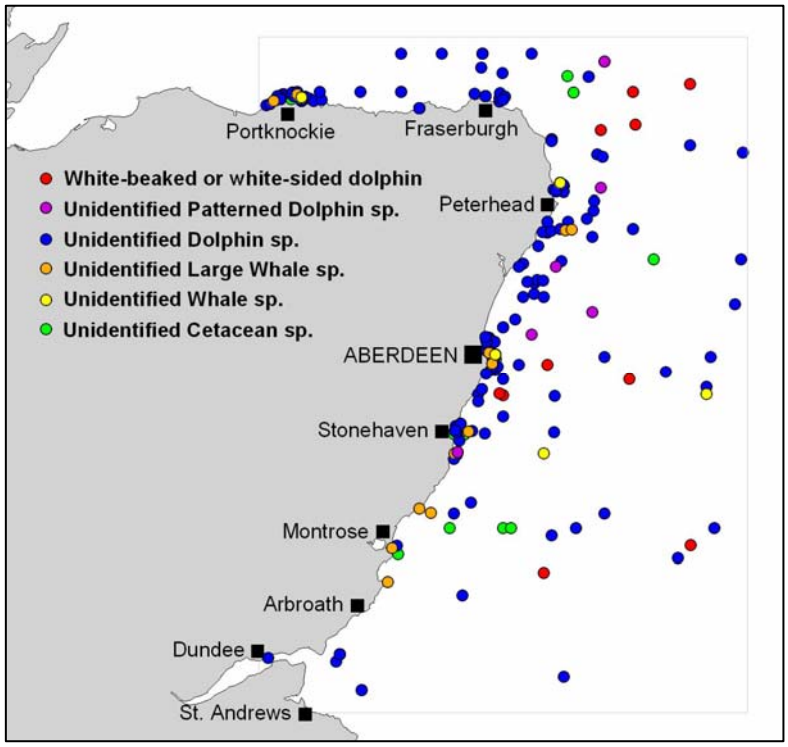


Fig. 33. Distribution of sightings of unidentified cetaceans in East Grampian Region

6. SUMMARY & CONCLUSIONS

Fifteen cetacean species have been recorded along the Grampian coast since 1990, making the region one of the richest for cetaceans in the UK. Of these, nine have been recorded regularly, although only four are considered significant members of the coastal marine mammal community of the East Grampian Region. These are bottlenose dolphin, harbour porpoise, white-beaked dolphin and minke whale. The first two are given special conservation status under the EU Habitats & Species Directive.

Different cetacean species exhibit different seasonal peaks of occurrence. Bottlenose dolphins can be seen year round but peak occurrence and peak numbers take place between May and September. Harbour porpoises also may be seen year round, but with peak occurrence and numbers between August and October. White-beaked dolphins are much more seasonal, with few sightings outside the months of June to August. Minke whales are also seasonal, with very few sightings outside May to September, the great majority occurring in July and August.

Bottlenose dolphins started to appear regularly in East Grampian in the early 1990s, but after around 1996 have shown no persistent trend. Harbour porpoises have fluctuated in numbers over the long-term, increasing in the late 1970s, but declining since the early 2000s. White-beaked dolphin sightings rates indicate strong peaks in 2000 and again in 2004, but have declined since then. Before 1999, the species was recorded only occasionally. Minke whale sightings rates remained low until the mid-1990s since when they have generally increased although with fluctuations between years. Of species occurring in the region on a more casual basis, records of short-beaked common dolphin and Risso's dolphin have markedly increased since 2000, and even accounting for increased reporting, the indication is that both species are now more common in the region than in previous decades. In contrast, there has not been a live sighting of an Atlantic white-sided dolphin in the region since 2003.

7. ACKNOWLEDGEMENTS

We are very grateful to all those who have conducted surveys and collected sightings data over the years. Notable amongst these are those who have also served in a coordinating role – Sarah Canning, Kevin Hepworth, Ian Sim, Karen Stockin, and Caroline Weir, as well as the following persons: David & Elizabeth Adams, Eddie Aitken, Paul Baxter, Phil Bloor, Ian Buchan, Ciarán Cronin, Sue Edwards, Ian Francis, Ian Hay, Richard Hobson, Mike Innes, Peter Macdonald, Ian Phillips, Nick Picozzi, Sharon Robertson, Harry Scott, Andy Upton, Dylan Walker, Toni Watt, Andy Webb, Gary White, and John Wilson. Funding and support over the years has come from a variety of sources, notably Aberdeen University, Amerada Hess, BG Group, BP, East Grampian Coastal Partnership, Kerr McGee, Shell UK Exploration and Production, Talisman Energy (UK) Ltd, and Total E&P UK plc.

Photographs in the report were taken by Pia Anderwald, Colin Bird, Peter Evans, Kevin Hepworth, and Caroline Weir.

This report is funded by the East Grampian Coastal Partnership, with a contribution from BP as part of the matched voluntary funding scheme with Kevin Hepworth.

8. REFERENCES

Akamatsu, T., Hatakeyama, Y., Kojima, T., and Soeda, H. (1992) The rate with which a harbor porpoise uses echolocation at night. Pp. 299-316. In: *Marine mammal sensory systems* (Eds. J.A. Thomas *et al*.) Plenum Press, New York.

Amundin, M. (1991) *Sound production in odontocetes with emphasis on the harbour porpoise Phocoena phocoena.* Doctoral dissertation, University of Stockholm.

Anderwald, P. and Evans, P.G.H. (2007) Minke whale populations in the North Atlantic: an overview with special reference to UK waters. Pp. 8-13. In: *An integrated approach to non-lethal research on minke whales in European waters.* (Eds. K.P. Robinson, P.T. Stevick and C.D. Macleod). Proceedings of the Workshop. European Cetacean Society Special Publication Series No. 47. 49pp.

Anderwald, P., Evans, P.G.H., Hoelzel, A.R., and Papastavrou, V. (2008) Minke whale *Balenoptera acutorostrata*. Pp. 665-669. In: (Eds. S. Harris & D.W. Yalden) *Mammals of the British Isles: Handbook.* The Mammal Society, Southampton. 799pp.

Baines, M.E. and Evans, P.G.H. (2005) *Sea Watch Foundation Database Manual*. Sea Watch Foundation, Oxford. 40pp.

Baines, M.E. and Evans, P.G.H. (2009) *Atlas of the Marine Mammals of Wales.* CCW Monitoring Report No.68. 82pp.

Boran, J.R., Evans, P.G.H., and Martin, A.R. (2008a) Long-finned pilot whale *Globicephala melas*. Pp. 735-738. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Boran, J.R., Hoelzel, A.R., and Evans, P.G.H. (2008b) Killer whale *Orcinus orca*. Pp. 743-747. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Camphuysen, C.J. and Peet, G. (2006.) *Whales and dolphins of the North Sea*. Fontaine Uitgevers, Kortenhoef.

Canning, S.J. (2007) *Cetacean Distribution and Habitat Use along the East Coast of Scotland*. PhD Thesis, University of Aberdeen. 181pp.

Canning, S.J., Santos, M.B., Reid, R.J., Evans, P.G.H., Sabin, R.C., Bailey, N., and Pierce, G.J. (2008) Seasonal distribution of white-beaked dolphins (*Lagenorhynchus albirostris*) in UK waters with new information on diet and habitat use. *Journal of Marine Biological Association U.K*, **88**(6), 1159-1166.

Clapham, P.J. and Evans, P.G.H. (2008) Humpback whale *Megaptera novaeangliae.* Pp. 663-665. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp

Clark, C.W. and Charif, R.A. (1998) *Acoustic monitoring of large whales to the west of Britain and Ireland using bottom-mounted hydrophone arrays, October 1996 - September 1997*. JNCC Report No. 281. 25pp.

Clarke, M.R. (1986) Cephalopods in the diet of odontocetes. Pp. 281-322. In: *Research on Dolphins* (Eds. M.M. Bryden and R. Harrison). Clarendon Press, Oxford.

Culloch, R.M. and Robinson, K.P. (2008) Bottlenose dolphins using coastal regions adjacent to a Special Area of Conservation (SAC) in north-east Scotland. *Journal of the Marine Biological Association of the UK*, **88**(6), 1237-1243.

Deaville, R. and Jepson, P.D. (2007) *UK Cetacean Strandings Investigation Programme*. Annual Report to Defra for the period 1st January – 31st December 2006 (Contract number CR0346). Institute of Zoology, London. 43pp.

Deaville, R. and Jepson, P.D. (2008) *UK Cetacean Strandings Investigation Programme*. Annual Report to Defra for the period 1st January – 31st December 2007 (Contract number CR0346). Institute of Zoology, London. 49pp.

Deaville, R. and Jepson, P.D. (2009) *UK Cetacean Strandings Investigation Programme*. Annual Report to Defra for the period 1st January – 31st December 2008 (Contract number CR0364). Institute of Zoology, London. 56pp.

Defra (2010) *Charting Progress 2*. An Assessment of the State of UK Seas. Report prepared by the UK Marine Moniroring and Assessment Strategy (UKMMAS) Community. Department of the Environment, Food & Rural Affairs, London. 194pp.

Desportes, G. (1985) *La nutrition des Odontocètes en Atlantique Nord-Est* (*côtes Françaises - Iles Feroë*). PhD Thesis, University of Poitiers. 190pp

Evans, P.G.H. (1980) Cetaceans in British Waters. *Mammal Review*, **10**, 1-52.

Evans, P.G.H. (1987) *The Natural History of Whales and Dolphins.* Christopher Helm, London. 360pp.

Evans, P.G.H. (1992) *Status Review of Cetaceans in British and Irish Waters.* UK Dept. of the Environment, London. 98pp.

Evans, P.G.H. (1996) Whales, dolphins and porpoises. Chapter 5.15. Pp. 131-134. In *Coasts and Seas of the United Kingdom. Region 3. North-east Scotland: Cape Wrath to St Cyrus.* (Editors J.H. Barne, C.F. Robson, S.S. Kaznowska & J.P. Doody). Joint Nature Conservation Committee, Peterborough.

Evans, P.G.H. (2008). Risso's dolphin *Grampus griseus.* Pp. 740-743. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Evans, P.G.H. and Smeenk, C.S. (2008a) White-beaked Dolphin *Lagenorhynchus albirostris*. Pp. 724-728. In: (Eds. S. Harris & D.W. Yalden) *Mammals of the British Isles: Handbook.* The Mammal Society, Southampton. 799pp.

Evans, P.G.H. and Smeenk, C. (2008b) Atlantic White-sided Dolphin *Leucopleura acutus*. Pp. 727-731 In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Evans, P.G.H. and Teilmann, J. (Editors) (2009) *Report of ASCOBANS/HELCOM Small Cetacean Population Structure Workshop*. ASCOBANS/UNEP Secretariat, Bonn, Germany. 140pp.

Evans, P.G.H., Anderwald, P., and Baines, M.E. (2003) *UK Cetacean Status Review*. Report to English Nature & Countryside Council for Wales. Sea Watch Foundation, Oxford, UK. 160pp.

Evans, P.G.H., Boyd, I.L. and MacLeod, C.D. (2010) Impacts of climate change on marine mammals. *Marine Climate Change Impacts Partnership (MCCIP) Annual Report Card 2009-2010 Scientific Review*: 1-14.

Evans, P.G.H., Harding, S., Tyler, G., and Hall, S. (1986) *Analysis of Cetacean Sightings in the British Isles, 1958-1985.* Nature Conservancy Council, Peterborough. 71pp.

Evans, P.G.H., Lockyer, C.H., Smeenk, C., Addink, M., and Read, A.J. (2008) Harbour Porpoise *Phocoena phocoena*. Pp.704-709. In: *Mammals of the British Isles*. (Eds. S. Harris and D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Goodson, A.D., Kastelein, R.A., and Sturtivant, C.R. (1995) Source levels and echolocation signal characteristics of juvenile harbour porpoises *Phocoena phocoena*. Pp. 41-54. In: *Harbour porpoises, laboratory studies to reduce bycatches* (Eds. P.E. Nachtigall *et al*.). De Spil, Woerden, The Netherlands.

Gordon, J.C.D. and Evans, P.G.H. (2008) Sperm whale *Physeter macrocephalus*. Pp. 678-683. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook, 4th Edition. The Mammal Society, Southampton. 800pp.

Grellier, K. (2000) *Reproductive biology of female bottlenose dolphins using the Moray Firth, Scotland*. MSc. Thesis, Univ. of Aberdeen.

Hammond, P.S. (2008) *Small cetaceans in the European Atlantic and North Sea (SCANS II).* Final Report to the European Commission under contract LIFE04NAT/GB/000245.

Hammond, P.S., Berggren, P., Benke, H., Borchers, D.L., Collet, A., Heide-Jørgensen, M.P., Heimlich, S., Hiby, A.R., Leopold, M.F., and Øien, N. (2002) Abundance of harbour porpoise and other cetaceans in the North Sea and adjacent waters. *Journal of Applied Ecology*, **39**, 361-376.

Janik V.M. (2000) Food-related bray calls in wild bottlenose dolphins (*Tursiops truncatus*). *Proceedings of the Royal Society of London - Series B: Biological Sciences*, **267**, 923-927.

Jepson, P.D. (editor) (2005) *Trends in cetacean strandings around the UK coastline and cetacean and marine turtle post-mortem investigations, 2000 to 2004 inclusive (contract CRO 238).*. Report to Defra. UK Cetacean Strandings Investigation Programme, Institute of Zoology, London. 85pp.

Kamminga, C. (1990) Echolocation signal types of odontocetes. Pp. 9-21. In: *Animal Sonar*. NATO Advanced Studies Institute. Vol. A156.

Lee, J. South, A.B., and Jennings, S. (2010) Developing reliable, repeatable, and accessible methods to provide high-resolution estimates of fishing-effort distributions from vessel monitoring system (VMS) data. *ICES Journal of Marine Science*, **67**, 1260-1271.

Lewis, E.J. and Evans, P.G.H. (1993) Comparative ecology of bottle-nosed dolphins (*Tursiops truncatus*) in Cardigan Bay and the Moray Firth. Pp. 57-62. In: *European Research on Cetaceans - 7.* (Ed. P.G.H. Evans). European Cetacean Society, Cambridge, England. 306pp.

Liret, C., Allali, P., Creton, P., Guinet, C., and Ridoux, V. (1994) Foraging activity pattern of bottlenose dolphins around Ile de Sein, France, and its relationships with environmental parameters. Pp. 188-191. In *European Research on Cetaceans - 8*. Editor P.G.H. Evans. European Cetacean Society, Lugano, Switzerland. 288pp.

Lockyer, C. (1995) Investigations of aspects of the life history of the harbour porpoise, *Phocoena phocoena*, in British waters. *Report of the International Whaling Commission*, (Special Issue **14**), 189-197.

Lockyer, C. (2003) Harbour porpoises (*Phocoena phocoena*) in the North Atlantic: Biological parameters. *NAMMCO Scientific Publications*, **5**, 71-89.

Mitson, R.B. (1990) Very-high-frequency acoustic emissions from the white-beaked dolphin (*Lagenorhynchus albirostris*). Pp. 283-294. In *Sensory abilities of cetaceans. Laboratory and field evidence.* (Eds. J.A. Thomas & R.A. Kastelein). Plenum Press, New York.

Mitson, R.B. and Morris, R.J. (1988) Evidence of high frequency acoustic emissions from the white-beaked dolphin (*Lagenorhynchus albirostris*). *Journal of Acoustical Society of America*, **83**, 825-826.

Murphy, S., Evans, P.G.H., and Collet, A. (2008) Common dolphin *Delphinus delphis*. Pp. 719-724. In: *Mammals of The British Isle*s (Eds. S. Harris & D.W. Yalden). Handbook, 4th Edition. The Mammal Society, Southampton. 800pp.

Nordøy, E.S., Folkow, L.P., Mårtensson, P.-E., and Blix, A.S. (1995) Food requirements of Northeast Atlantic minke whales. Pp. 307-317. In *Whales, Seals, Fish and Man* (editors A.S. Blix, L. Walløe and Ø. Ulltang). Elsevier, Amsterdam. 720pp.

Northridge, S., Tasker, M.L., Webb, A., and Williams, J.M. (1995) Seasonal distribution and relative abundance of harbour porpoises *Phocoena phocoena* (L.), white-beaked dolphins *Lagenorhynchus albirostris* (Gray) and minke whales *Balaenoptera acutorostrata* (Lacepède) in the waters around the British Isles. *ICES Journal of Marine Science*, 52: 55-66.

Notarbartolo di Sciara, G. and Evans, P.G.H. (2008) Fin whale *Balaenoptera physalus*. Pp. 669-672. In: *Mammals of the British Isles*. (Eds. S. Harris & D.W. Yalden). Handbook. 4th Edition. The Mammal Society, Southampton. 800pp.

Olsen E. and Holst J.C. (2001) A note on common minke whale (*Balaenoptera acutorostrata*) diets in the Norwegian Sea and the North Sea. *Journal of Cetacean Research and Management*, **3**(2): 179-183.

Payne, P.M. and Heinemann, D.W. (1993) The distribution of pilot whales *Globicephala* spp. In the shelf-edge and slope waters of the northeastern United States, 1978-1988. *Reports of the International Whaling Commission* (special issue **14**), 51-68.

Pierce, G.J., Santos, M.B., Reid, R.J., Patterson, I.A.P., and Ross, H.M. (2004) Diet of minke whales *Balaenoptera acutorostrata* in Scottish (UK) waters with notes on strandings of this species in Scotland 1992-2002. *Journal of the Marine Biological Association of the United Kingdom*, **84**, 1241-1244.

Rasmusssen, M.H., Miller, L.A., and Au, W.W.L. (1999) The sounds and calculated source levels from the white-beaked dolphin reported in Icelandic waters. Pp. 43-47. In: *European Research on Cetaceans – 13.* Proceedings of 13th Annual Conference of the European Cetacean Society, Valencia, Spain, 5-8 April 1999 (Eds P.G.H. Evans, J. Cruz, & J.A. Raga). European Cetacean Society, Kiel, Germany. 484pp.

Reeves, R.R., Mitchell, E., and Whitehead, H. (1993) Status of the northern bottlenose whale, *Hyperoodon ampullatus*. *Canadian Field-Naturalist*, **107**, 490-508.

Reeves, R.R., Smeenk, C., Kinze, C.C., Brownell, Jr, R.L., and Lien, J. (1999) White-beaked dolphin *Lagenorhynchus albirostris* Gray, 1846. Pp. 1-30. In *Handbook of marine mammals, Vol. 6: The second book of dolphins and the porpoises*. (Eds. S.H. Ridgway & R. Harrison) Academic Press, San Diego/London.

Reeves, R.R., Smith, B.D., Crespo, E.A., and Notarbartolo di Sciara, G. (compilers) (2003) *Dolphins, Whales, and Porpoises.* 2002-2010 Conservation Action Plan for the World's Cetaceans. IUCN/SSC Cetacean Specialist Group, Gland, Switzerland & Cambridge, UK. 139pp.

Reid, J.B., Evans, P.G.H., and Northridge, S.P. (editors) (2003) *Atlas of Cetacean Distribution in North-west European Waters.* Joint Nature Conservation Committee, Peterborough. 76pp.

Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Culloch, R.M., Haskins, G.N., Zapponi, L., Whaley, A.R., Weare, J.S., and Tetley, M.J. (2007) The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). *Lutra*, **50**(1), 19-30.

Robinson K.P., Tetley M.J. & Mitchelson-Jacob E.G. (2009) The distribution and habitat preference of coastally occurring minke whales (*Balaenoptera acutorostrata*) in north-east Scotland. *Journal of Coastal Conservation*, **13**(1), 39-48.

Ross, H.M. and Wilson, B. (1996) Violent interactions between bottlenose dolphins and harbour porpoises. *Proceedings of the Royal Society* B, **263**, 283-286

Santos, M.B. and Pierce, G.J. (2003) The diet of harbour porpoise (*Phocoena phocoena*) in the eastern North Atlantic. *Oceanography and Marine Biology: an Annual Review, 2003*, **41**, 355-390.

Santos, M.B., Pierce, G.J., Reid, R.J., Patterson, I.A.P., Ross, H.M., and Mente, E. (2001) Stomach contents of bottlenose dolphins (*Tursiops truncatus*) in Scottish waters. *Journal of the Marine Biological Association of the United Kingdom*, **81**, 873-878

Santos. M.B, Pierce. G.J, Learmonth. J.A, Reid. R.J, Ross. H.M, Patterson. I.A.P, Reid. D.G, and Beare. D, (2004). Variability in the diet of harbor porpoises (*Phocoena phocoena*) in Scottish waters 1992–2003. *Marine Mammal Science*, **20**, 1–27.

Schevill, W.E. and Watkins, W.A. 1972. Intense low-frequency sounds from an Antarctic minke whale, *Balaenoptera acutorostrata*. *Breviora*, **388**, 1-7.

Schevill, W.E., Watkins, W.A., and Ray, C. (1969) Click structure in the porpoise, *Phocoena phocoena*. *Journal of Mammalogy*, **50**, 721-728.

Spitz, J., Rousseau, Y., and Ridoux, V. (2006) Diet overlap between harbour porpoise and bottlenose dolphin: An argument in favour of interference competition for food? *Estuarine, Coastal and Shelf Science*, **70**, 259-270.

Stockin, K.A., Weir, C.R. and Pierce, G.J. (2006) Examining the importance of Aberdeenshire (UK) coastal waters for North Sea bottlenose dolphins (*Tursiops truncatus*). *Journal of the Marine Biological Association of the United Kingdom*, **86**, 201-207.

Sturtivant, C.R., Datta, R., and Goodson, A.D. (1994) A review of echolocation research on the harbour porpoise *Phocoena phocoena* and the common dolphin *Delphinus delphis*. Pp. 164-168. In: *European Research on Cetaceans - 8*. Proc. 8th Ann. Conf. ECS, Montpelier, France, 2-5th March 1994 (Ed. P.G.H. Evans). European Cetacean Society, Cambridge. 288pp.

Tetley, M.J., Mitchelson-Jacob E.G, and Robinson, K.P. (2008) The summer distribution of coastal minke whales (*Balaenoptera acutorostrata*) in the southern Moray Firth, northeast Scotland, in relation to co-occurring mesoscale oceanographic features. *Remote Sensing of Environment*, **112**(8), 3449-3454.

Thompson, P.O., Winn, H.E., and Perkins, P.J. 1979. Mysticete sounds. Pp. 403-431. In: *Behavior of Marine Animals. Vol. 3 Cetaceans*. (Editors H.W. Winn & B.L. Olla). Plenum Press, NY.

Verboom, W.C. and Kastelein, R.A. (1997) Structure of harbour porpoise (*Phocoena phocoena*) click train signals. Pp. 343-363. In *The biology of the harbour porpoise* (Eds. A.J. Read *et al*.). De Spil Publishers, Woerden, The Netherlands.

Verfuß, U.L., Miller, L.A., and Schnitzler, H.-U. (2005). Spatial orientation in echolocating harbour porpoises (*Phocoena phocoena*). *The Journal of Experimental Biology*, **208**, 3385-3394.

Villadsgaard, A., Wahlberg, M., and Tougaard, J. (2007) Echolocation signals of wild harbour porpoises, *Phocoena phocoena*. *Journal of Experimental Biology*, **210**, 56-64.

Weir, C.R. (2001) Sightings of beaked whale species (Cetacea: Ziphiidae) in the waters to the north and west of Scotland and the Faroe Islands. Pp. 239-243. In: *European Research on Cetaceans – 14* (Eds. P.G.H. Evans, R. Pitt-Aiken and E. Rogan). Proc. of the 14th Ann. Conf. of the European Cetacean Society, Cork, Ireland, 2-5 April 2000. European Cetacean Society, Rome, Italy.

Weir, C.R. and Stockin, K.A. (2001) *The occurrence and distribution of bottlenose dolphins (Tursiops truncates) and other cetacean species in the coastal waters of Aberdeenshire, Scotland*. Sea Watch Foundation, Aberdeen. 68pp.

Weir, C.R., Stockin, K.A., and Pierce, G.J. (2007) Spatial and temporal trends in the distribution of harbour porpoises, white-beaked dolphins and minke whales off Aberdeenshire (UK), north-western North Sea. *Journal of Marine Biological Association U.K.* **87**, 327-338.

Weir, C.R., Canning, S., Hepworth, K., Sim, I., and Stockin, K.A. (2008) A Long-Term Opportunistic Photo-Identification Study of Bottlenose Dolphins (*Tursiops truncatus*) off Aberdeen, United Kingdom: Conservation Value and Limitations. *Aquatic Mammals*, **34**, 436-447.

Wilson, B. (1995) *The ecology of bottlenose dolphins in the Moray Firth, Scotland: A population at the northern extreme of the species' range.* PhD Thesis, University of Aberdeen.

Wilson, B., Thompson, P.M., and Hammond, P.S. (1997) Habitat use by bottlenose dolphins: seasonal distribution and stratified movement patterns in the Moray Firth, Scotland. *Journal of Applied Ecology*, **34**, 1365-1374.

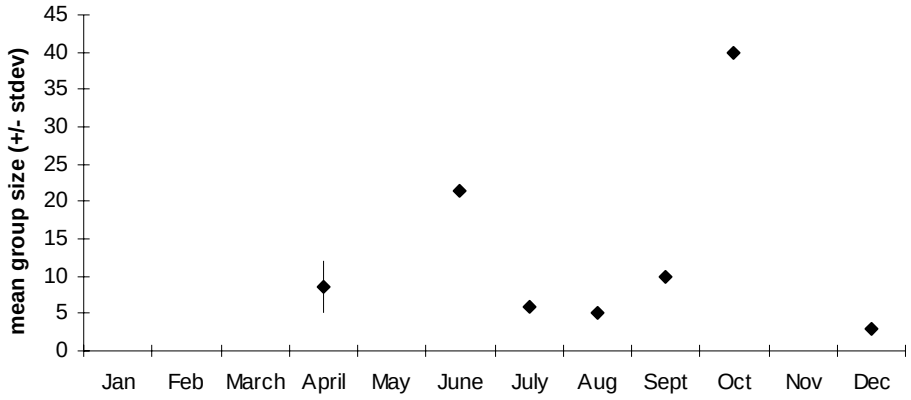
Wilson, B., Reid, R.J., Grellier, K., Thompson, P.M., and Hammond, P.S. (2004) Considering the temporal when managing the spatial: a population range expansion impacts protected areas-based management for bottlenose dolphins. *Animal Conservation*, **7**, 331-338

Winn, H.E. and Perkins, P.J. 1976. Distribution and sounds of the minke whale, with a review of mysticete sounds. *Cetology*, **19**, 1-11.

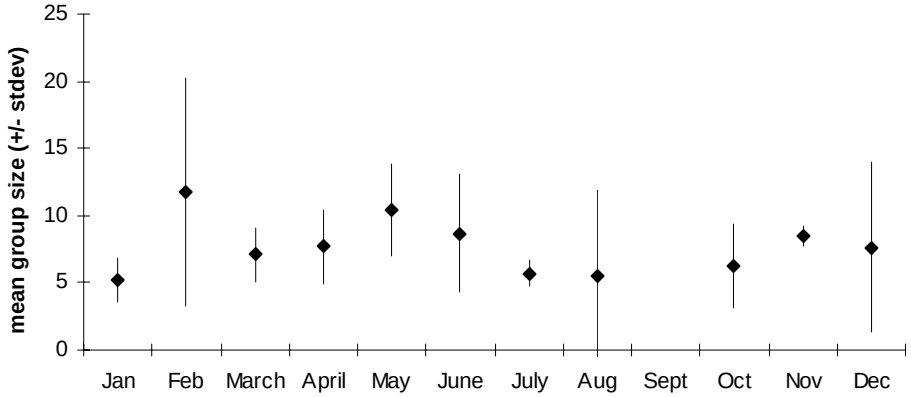
APPENDIX 1 – Long-term Patterns of Occurrence

a) Bottlenose Dolphin mean group size from land-based watches

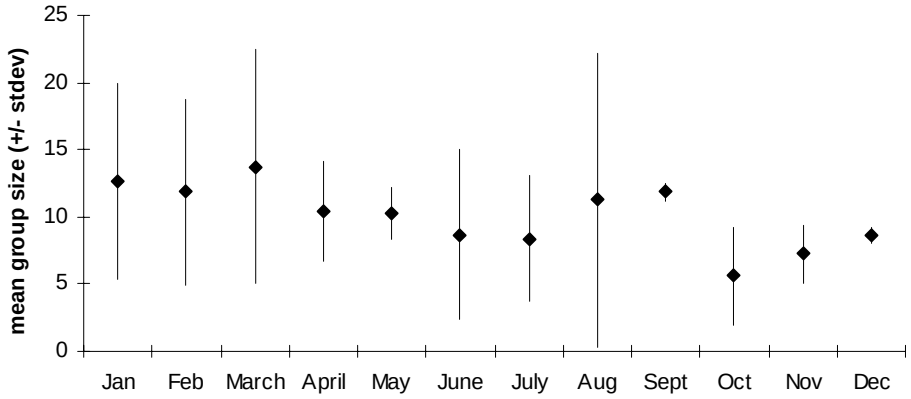
1993-1997



1998-2002

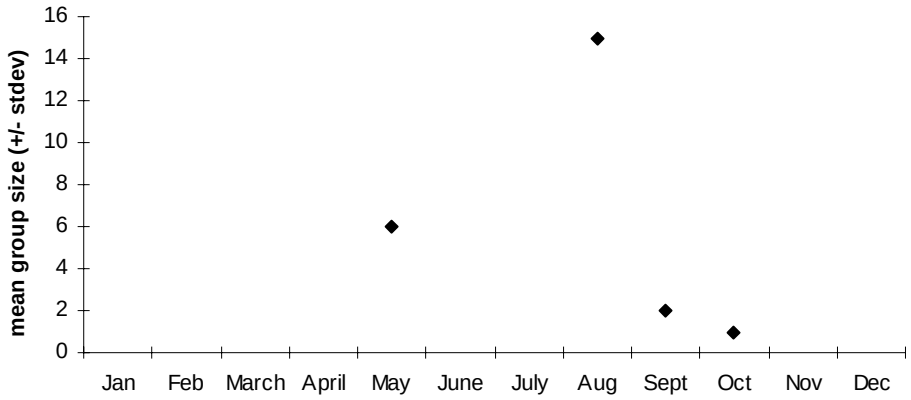


2003-2007

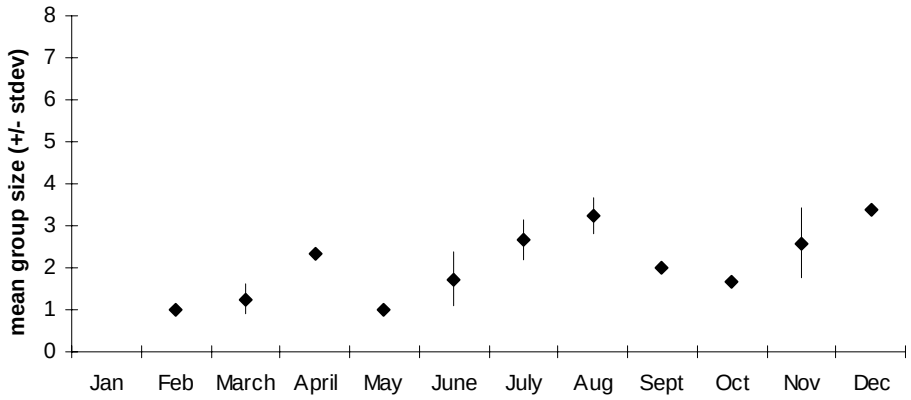


b) Harbour Porpoise mean group size from land-based watches

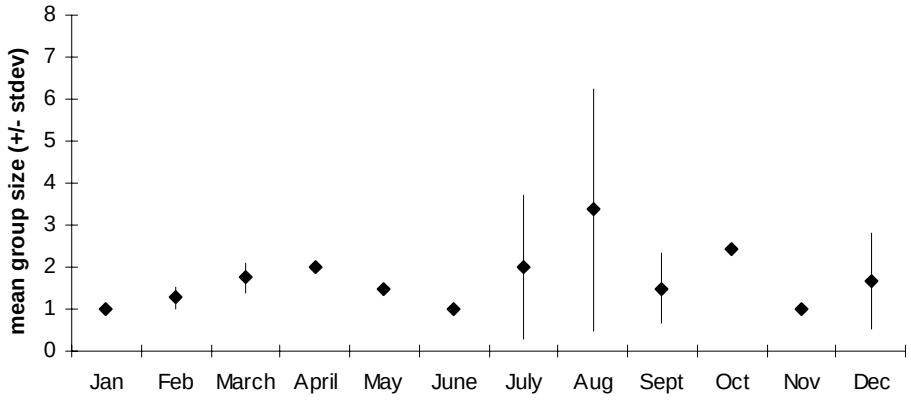
1993-1997



1998-2002

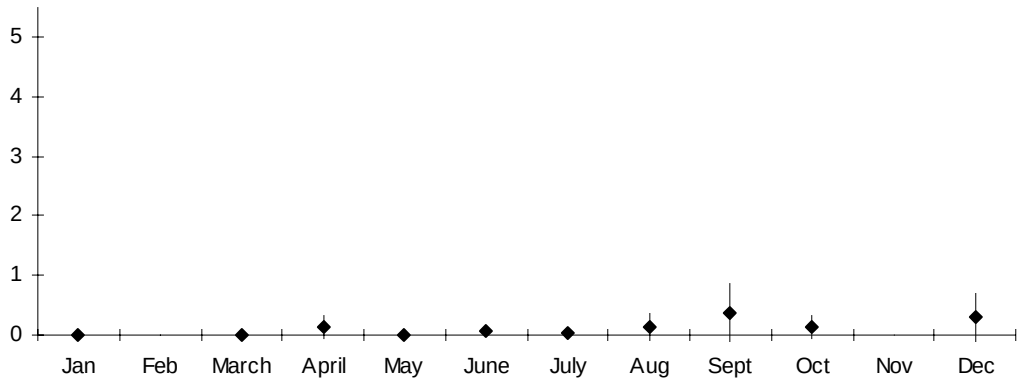


2003-2007

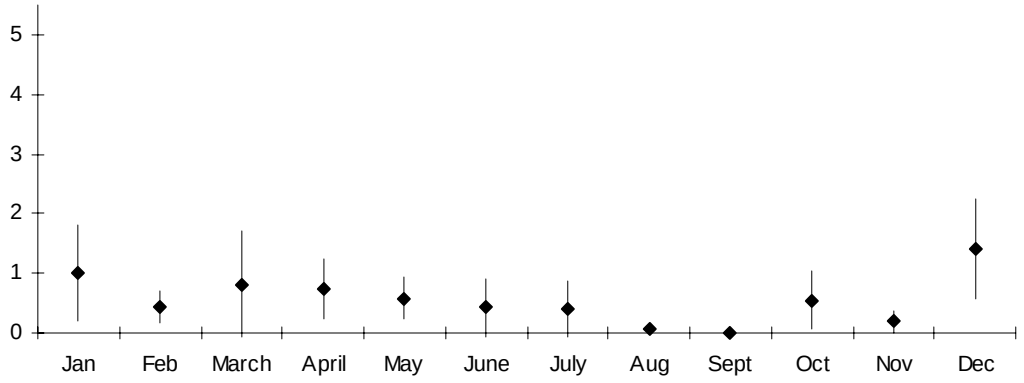


c) Bottlenose dolphin sightings rates from land-based watches

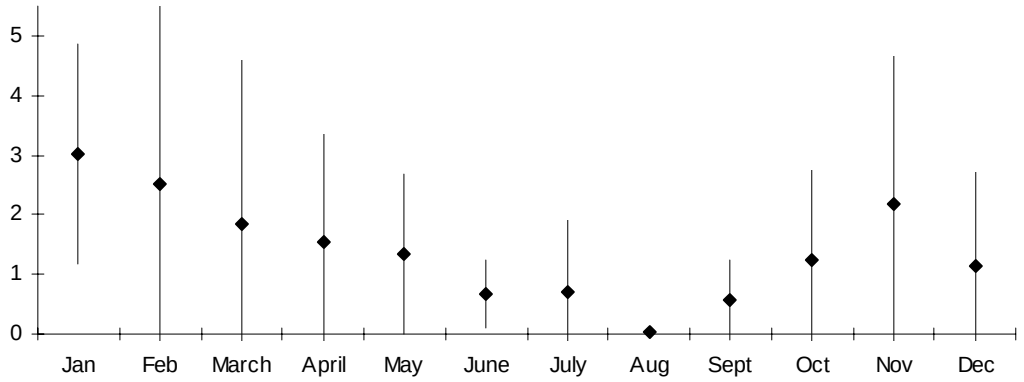
1993-1997



1998-2002

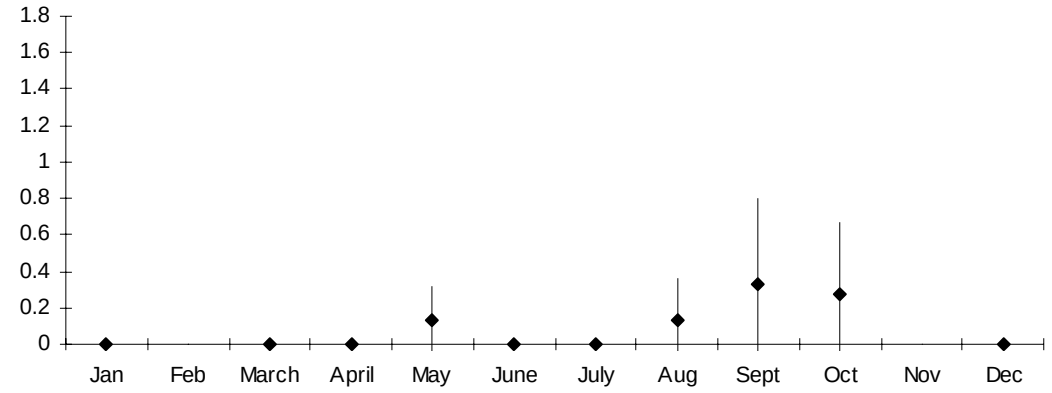


2003-2007

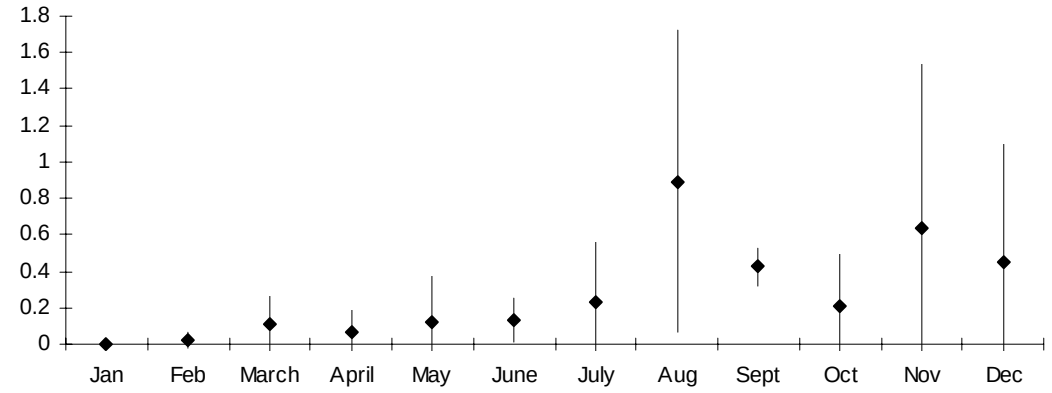


d) Harbour porpoise sightings rates from land-based watches

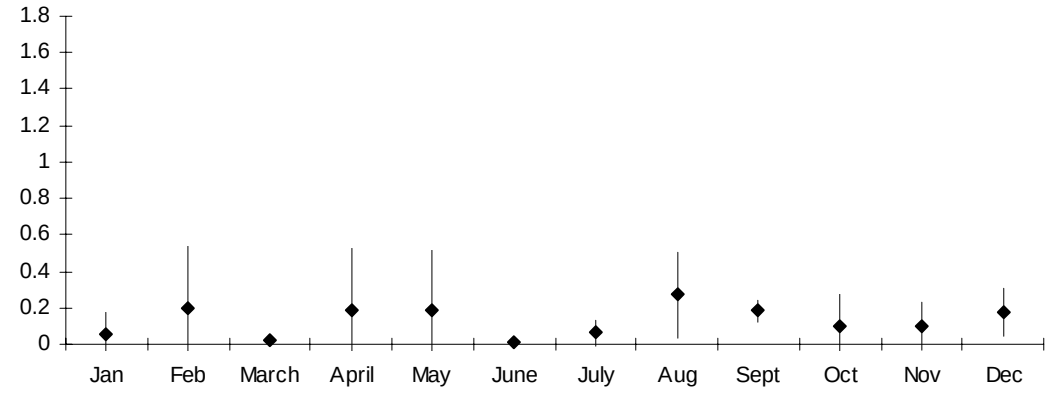
1993-1997



1998-2002

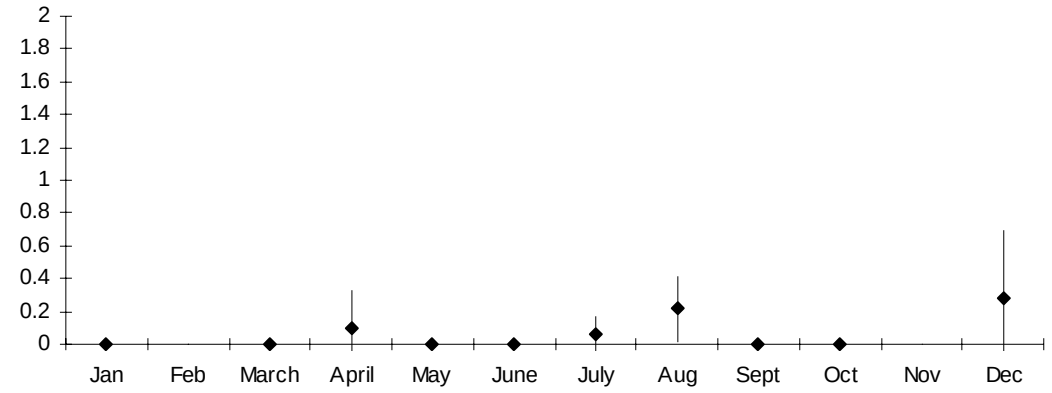


2003-2007

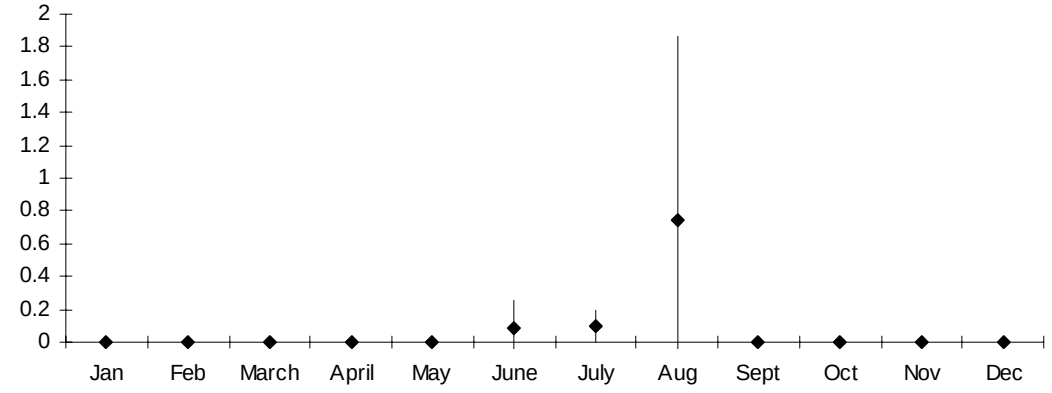


e) White-beaked dolphin sightings rates from land-based watches

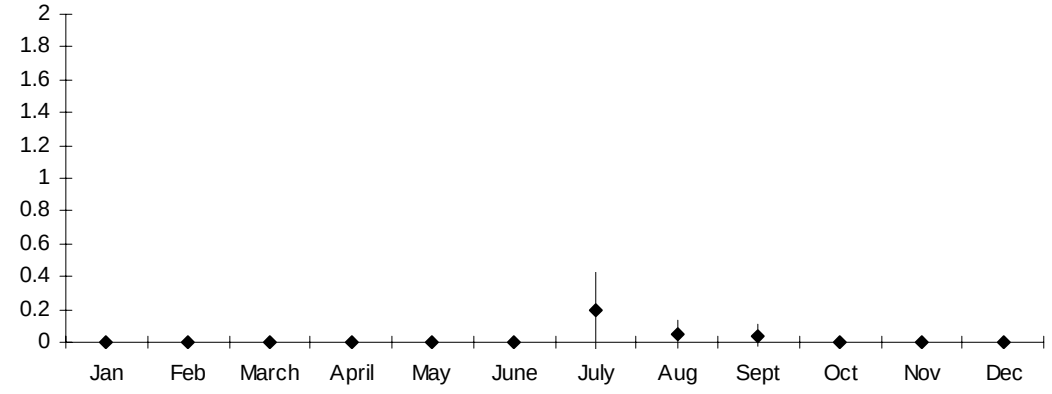
1993-1997



1998-2002

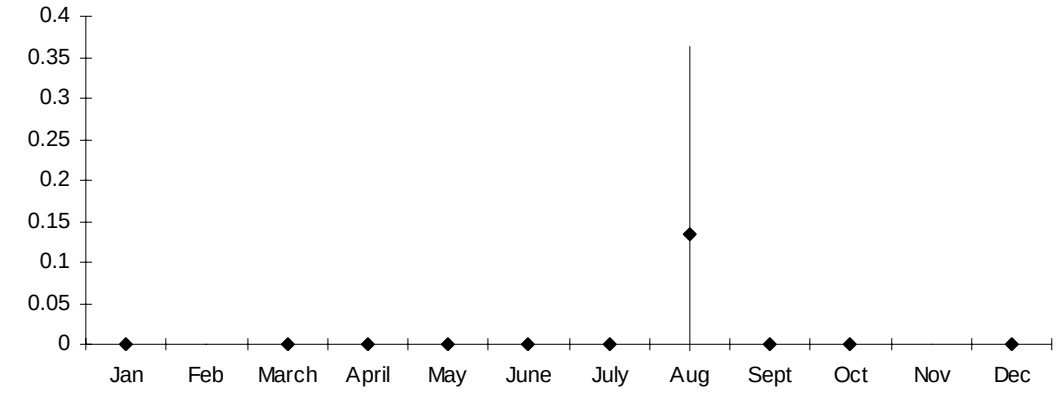


2003-2007

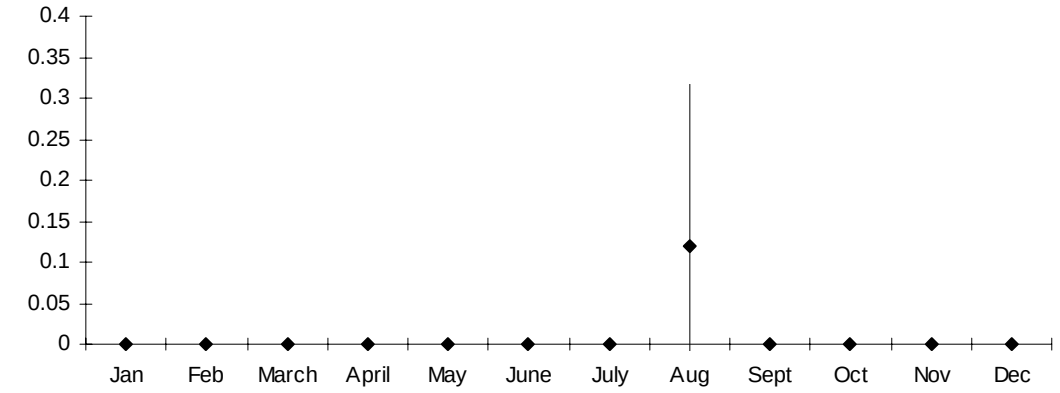


f) Minke whale sightings rates from land-based watches

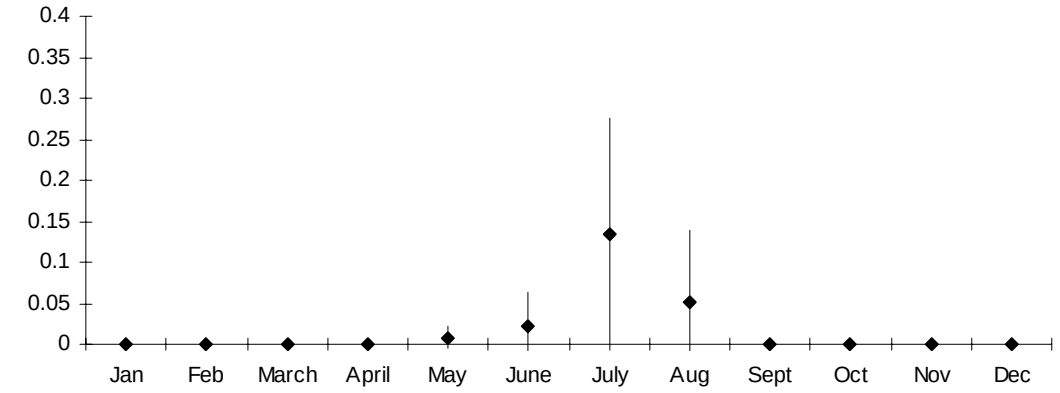
1993-1997



1998-2002

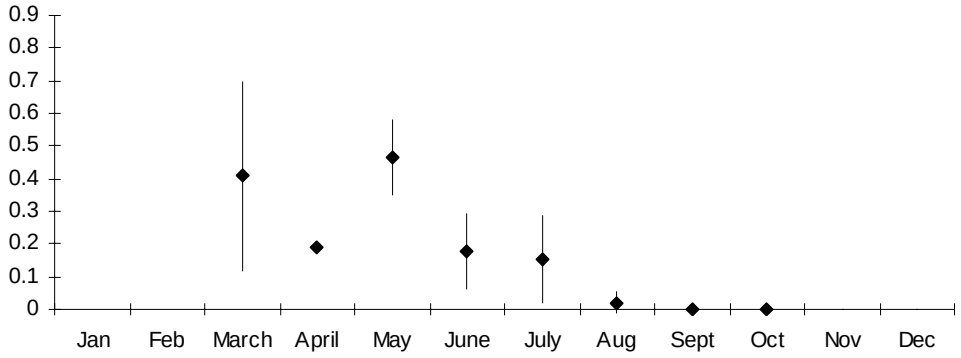


2003-2007

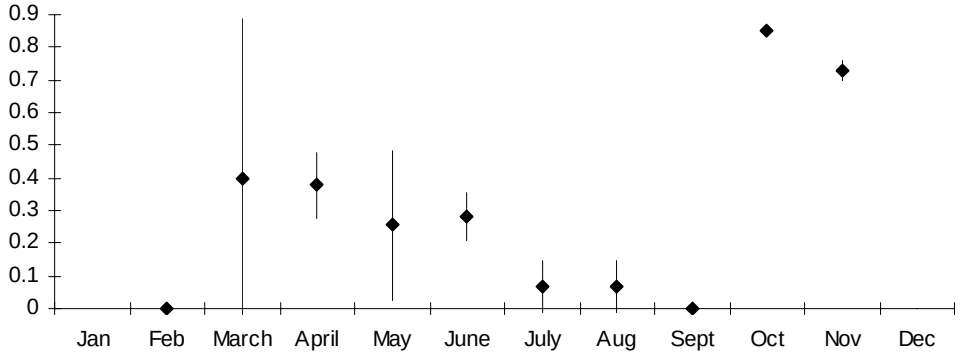


g) Bottlenose dolphin sighting rates from vessel-based surveys

1999-2002

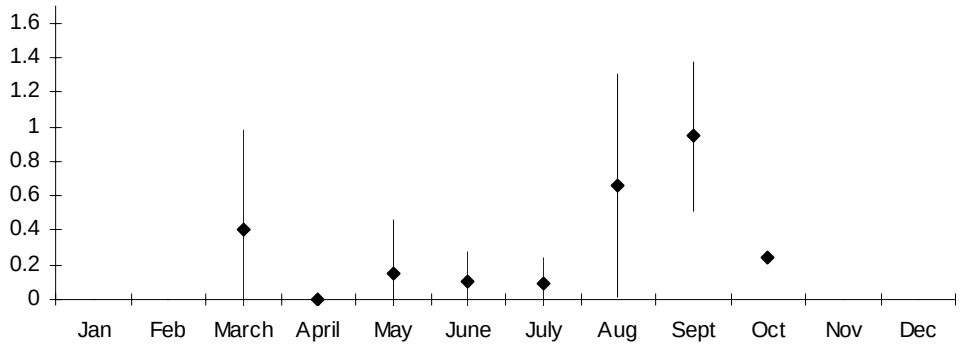


2004-2007

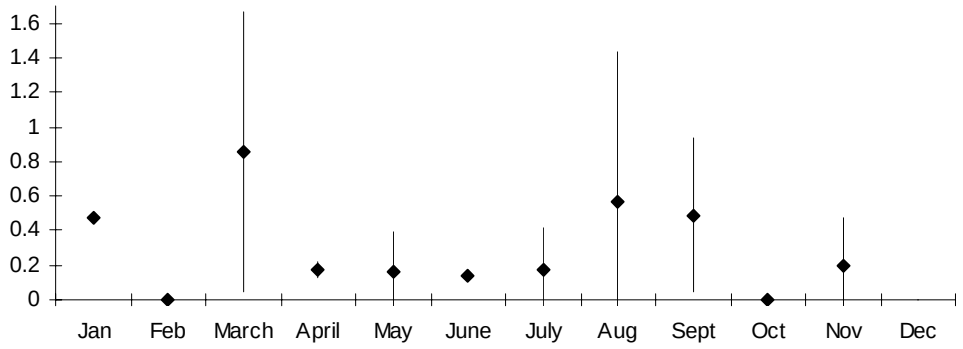


g) Harbour porpoise sighting rates from vessel-based surveys

1999-2002

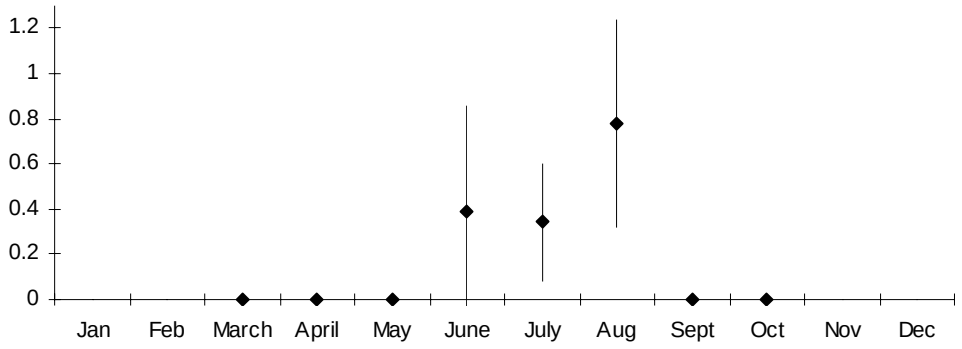


2004-2007

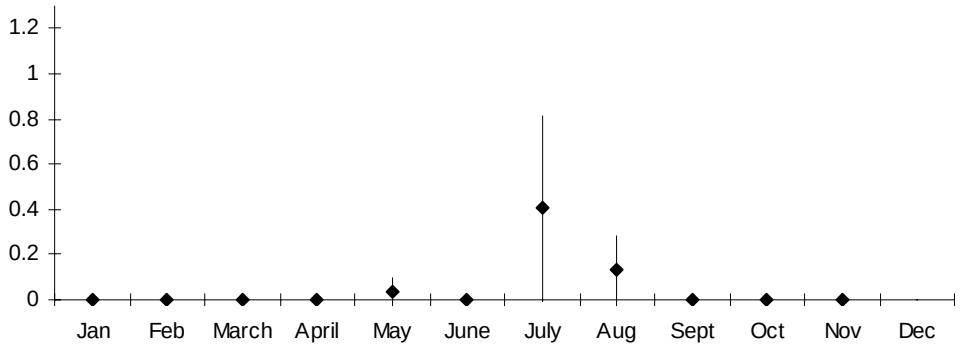


h) White-beaked dolphin sighting rates from vessel-based surveys

1999-2002

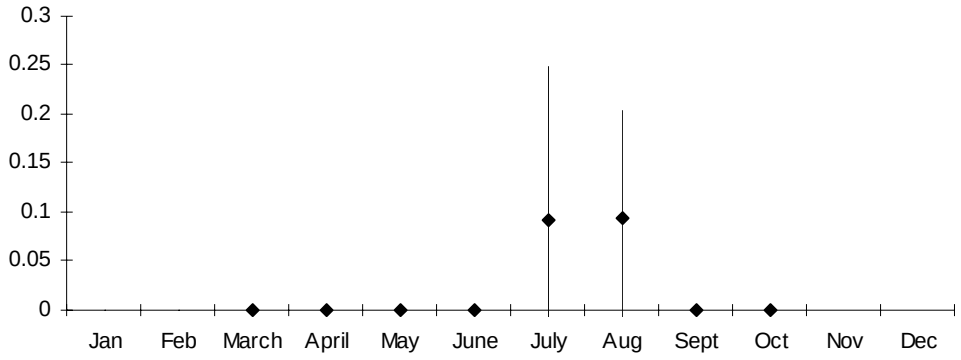


2004-2007

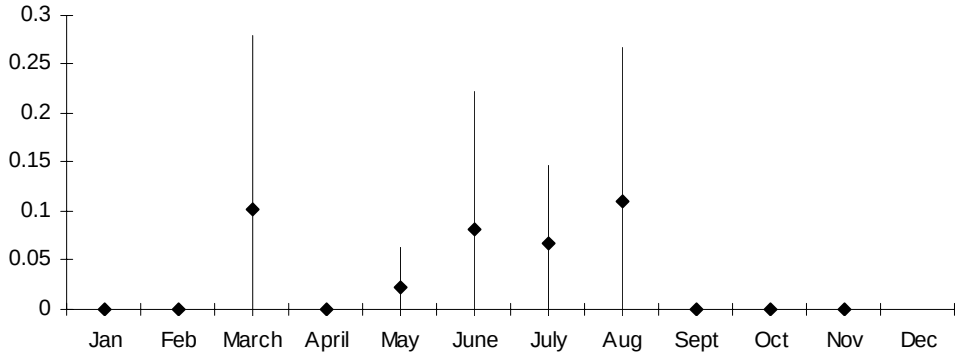


i) Minke whale sighting rates from vessel-based surveys

1999-2002

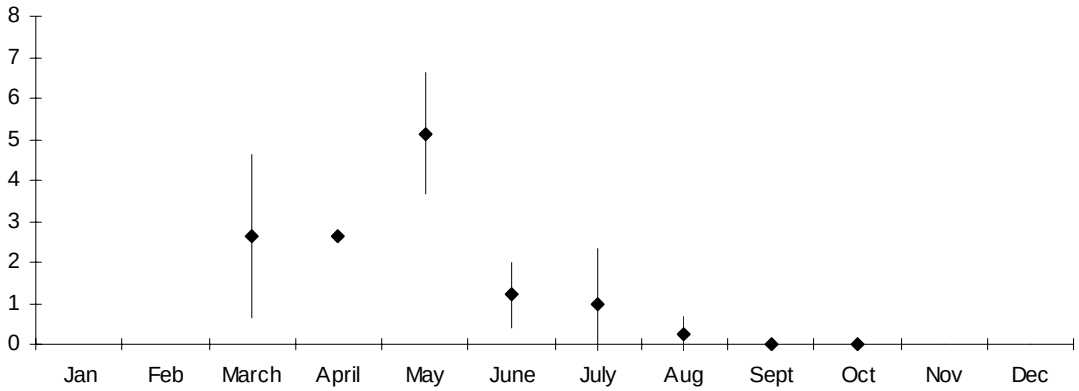


2004-2007

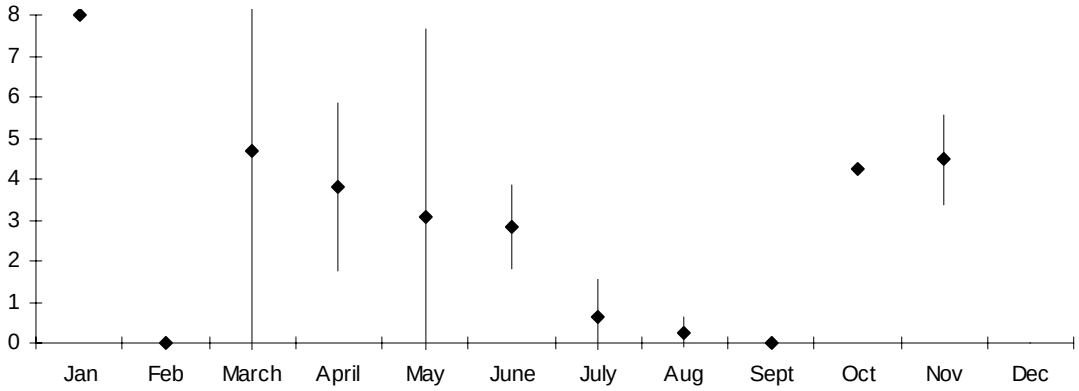


j) Individual bottlenose dolphin rates from vessel-based watches

1999-2002

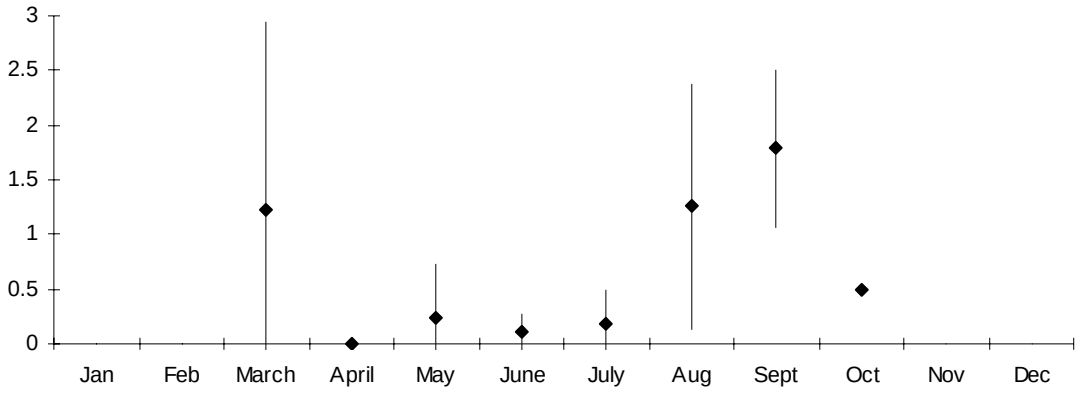


2004-2007

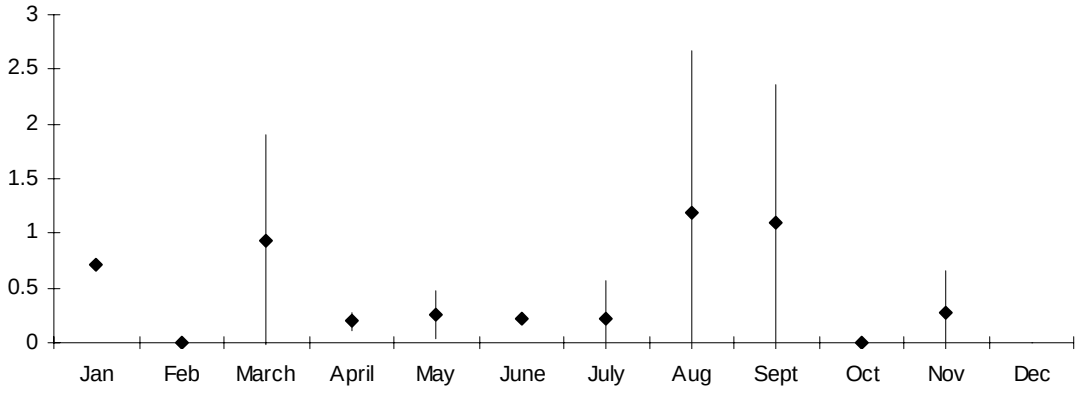


k) Individual harbour porpoise rates from vessel-based watches

1999-2002

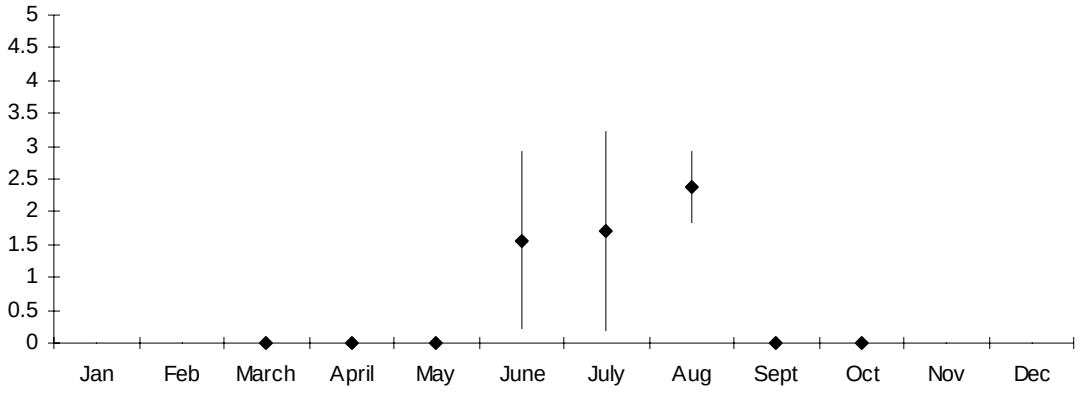


2004-2007

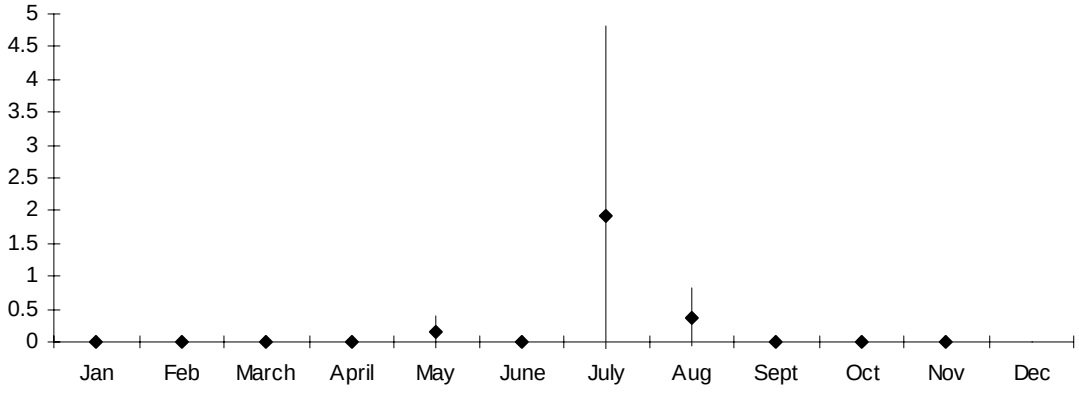


l) Individual white-beaked dolphin rates from vessel-based watches

1999-2002

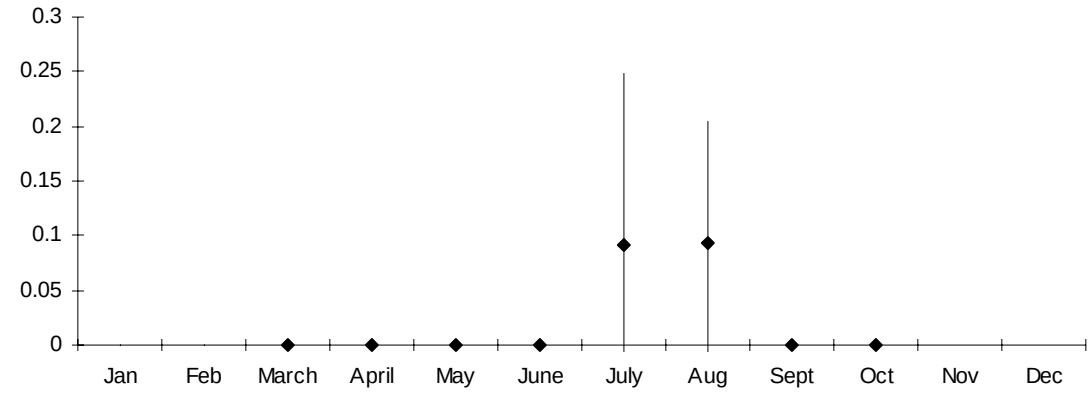


2004-2007



m) Individual minke whale rates from vessel-based watches

1999-2002



2004-2007