

**The occurrence and distribution of  
bottlenose dolphins (*Tursiops truncatus*) and  
other cetacean species in the coastal waters of  
Aberdeenshire, Scotland.**



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## Summary

- Between 1999 and 2001, land- and vessel-based surveys were carried out to monitor cetaceans off the coast of Aberdeenshire. Approximately 315 hours of land-based observational data were collected, predominantly from Aberdeen Harbour, Girdleness Headland and Souter Head at Cove. Twenty-nine dedicated vessel-based surveys were conducted between May 1999 and October 2001, completing over 96 hours of survey coverage.
- Nine cetacean species were recorded off Aberdeenshire, comprising two species of baleen whale, six dolphin species and the harbour porpoise.
- Bottlenose dolphins were recorded along the entire coast of Aberdeenshire, but were predominantly observed in the region of Aberdeen Harbour. The majority of sightings were during February to May. Very young calves were recorded regularly, particularly during March to May. Bottlenose dolphins were observed within the harbour at all states of the tide, numbers peaked 2 to 3 hours after high tide. Seventeen individual bottlenose dolphins have been photo-identified in Aberdeenshire waters.
- Harbour porpoises were also recorded along the entire Aberdeenshire coastline. There was a marked seasonality in sightings, with a clear peak during August. Immature porpoises were recorded principally over the summer months between May and September, with a peak during June.
- White-beaked dolphin sightings were recorded mainly south of Aberdeen between Girdleness and Fowlsheugh, which may be related to the presence of deeper adjacent water. Sightings were largely restricted from June to August. White-beaked dolphins were generally sighted further from shore than other species, although sightings of them close to shore did occur. The majority of white-beaked dolphin schools contained 20 or fewer individuals, and an estimated 60% of groups contained juveniles.
- Five sightings of killer whales were recorded during the study period, all except one between June and August. Minke whales were reported during July and August suggesting a limited seasonal occurrence within Aberdeenshire coastal waters. Single sightings of common dolphin, Atlantic white-sided dolphin, long-finned pilot whale and fin whale were also recorded.
- The distribution of cetacean species off Aberdeenshire is likely to be related to movements of prey species into coastal waters; all the cetacean species were observed feeding within the region.
- Photo-identification and distributional data for bottlenose dolphins confirm that at least some proportion of animals observed off Aberdeenshire form part of the Moray Firth population. However, further research is planned in order to quantify the number of individuals involved.



## **The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

# **1. Introduction**

During the last century, there have been major changes in the quality of coastal waters and habitats throughout the world. Traditionally, controls on new developments are implemented only when harmful effects have been identified (Thompson *et al.* 2000). This approach poses particular problems for the conservation of many cetacean species since potential threats are diverse and population parameters can be difficult to estimate. There has been particular concern over the status of cetaceans such as the bottlenose dolphin (*Tursiops truncatus*), which inhabit coastal areas likely to be affected by human activities (Thompson, 1992; Wilson *et al.* 1999a). Successful conservation of populations of such mobile marine predators depends upon a good understanding of distribution and home range, as well as rates of mortality and reproduction.

In Europe, the distribution of bottlenose dolphins is believed to have contracted during the last century, particularly in the North Sea (Evans, 1980; Verveij & Wolff, 1982). Increases in pollution and other human activities in coastal waters have been implicated. Pollution and other environmental stresses may directly or indirectly increase the susceptibility of dolphins and porpoises to disease (Wilson *et al.* 1997a, 1999a,b, 2000; Reijnders *et al.* 1999).

The resident population of bottlenose dolphins in the Moray Firth, Scotland is considered to be of international importance. An area of the inner Moray Firth was recently designated as a candidate marine Special Area of Conservation (SAC) specifically for the conservation of this population. However, anecdotal evidence suggests that the range of bottlenose dolphins from the Moray Firth population extends considerably beyond the boundaries of the Moray Firth. This report examines the occurrence and distribution of the bottlenose dolphin in the coastal waters of Aberdeenshire, and the potential implications for management of the population.

## **1.1 Background**

The South Grampian Regional Group of the Sea Watch Foundation was established during April 1999. At this time, sightings of dolphins in Aberdeen Harbour were becoming a regularly reported event amongst local naturalists. The sightings raised questions about the extent, regularity and spatial pattern of dolphin occurrence in Aberdeenshire waters and why they were utilising the area. The Regional Group aimed to address these basic questions as well as provide information to the general public. A series of training days were held in summer 1999, and volunteers have submitted data forms since that time for inclusion to the database.

During May 1999, two preliminary vessel-based surveys were carried out by a group of experienced observers, to examine the potential for approaching bottlenose dolphins for photographic identification work and for carrying out general cetacean distribution surveys. Following the success of these preliminary surveys, Shell U.K. Exploration and Production funded a programme of vessel-based surveys during 2000 and 2001.



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### 1.2 Historical information

Most historical information on the occurrence and distribution of cetaceans in North Sea waters derives from long-term stranding records (Sheldrick, 1979) and incidental sightings (Evans, 1976, 1980). Researchers from the University of Aberdeen have been working on the resident population of bottlenose dolphins in the Moray Firth since 1990. This population size was estimated at 129 animals in 1995 (Wilson, 1995). Outside of the Moray Firth, the Sea Mammal Research Unit (SMRU) has done research on the bottlenose dolphins observed off St. Andrews. Also, surveys and photo-identification work, normally based in the inner Moray Firth, extended north to the Dornoch Firth between 1989 and 1991 (Lewis & Evans, 1993).

In recent years voluntary groups such as the Friends of the Moray Firth Dolphins (FMFD) have conducted surveys on behalf of the Sea Watch Foundation along the outer Moray Firth, mainly between Burghead and Cullen. The Moray Firth Dolphin Trust (MFDT) in Spey Bay and the Cetacean Research and Rescue Unit (CRRU) have also carried out photo-identification work on bottlenose dolphins on the south coast of the Moray Firth. During 1997 and 1998, a pilot study by CRRU revealed that bottlenose dolphins regularly used the area of coastline between Lossiemouth and Banff. The secluded bays and coves may have provided nursery areas for the large numbers of calves observed during summer months. Subsequent studies extended to the entire southern coastline of the outer Moray Firth, from Lossiemouth to Fraserburgh.

In 2000, CRRU began a photo-identification study of the minke whales (*Balaenoptera acutorostrata*) encountered annually in the inshore waters of the southern firth. Between 1997 and 2001, CRRU, FMFD and other organisations also recorded harbour porpoise (*Phocoena phocoena*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), long-finned pilot whale (*Globicephala melas*), killer whale (*Orcinus orca*), northern bottlenose whale (*Hyperoodon ampullatus*), sei whale (*Balaenoptera borealis*) and humpback whale (*Megaptera novaeangliae*) in the waters of the Moray Firth.

Beyond the Moray Firth region, bottlenose dolphins are considered scarce in the North Sea. The Shetland Sea Mammal Group (SSMG) has never recorded bottlenose dolphins, and the species is also uncommon on the Scottish coast south of the Firth of Forth and along the eastern coast of England. However, the white-beaked dolphin has been regularly recorded in these regions and is considered to be the most abundant dolphin species in the North Sea (Evans, 1992).

In a review of marine mammals in the North Sea, an apparent decrease in the number of harbour porpoise and bottlenose dolphin sightings in southern regions was reported (Reijnders & Lankester, 1990). Atlantic white-sided and white-beaked dolphins have been reported during surveys in the southern North Sea (Camphuysen, 1991), and just south of Aberdeenshire (Camphuysen *et al.* 1995). The Joint Nature Conservation Committee (JNCC) Seabirds at Sea Team recorded seabird and cetacean sightings in the North Sea between 1979 and 1987, including harbour porpoises, white-beaked dolphins and minke whales (Northridge *et al.* 1995). The Small Cetacean Abundance in the North Sea (SCANS) survey in 1995 found harbour porpoise to be the most abundant cetacean in the North Sea, with white-beaked dolphin and minke whale also commonly sighted north of 55°N (Hammond *et al.* 1995). Bottlenose dolphins were sighted only twice outside the Moray Firth during the SCANS survey.

Relatively few cetacean sightings have been reported by observers onboard seismic vessels in the central and northern North Sea (Stone, 1997, 1998, 2000), although white-beaked dolphins were frequently sighted in waters well offshore from Aberdeen during 1996. Surveys from seismic ships reported only two bottlenose dolphin sightings in North Sea waters between 1996 and 1998.

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Information from the various networks of amateur and professional observers suggests that harbour porpoises, white-beaked dolphins and minke whales are the most commonly sighted species in coastal waters of the North Sea, with bottlenose dolphins generally scarce outside of the Moray Firth (e.g. Evans, 1980, 1992). Sightings from offshore installations in the North Sea also indicate that harbour porpoise, minke whale and *Lagenorhynchus* dolphins are more frequently sighted in the central sector than the bottlenose dolphin (Weir, 2001).

Stranding records can also provide information on cetacean species occurring in North Sea waters. For example, sperm whales (*Physeter macrocephalus*) stranded in Orkney (1994), at Nairn (1995), in Cruden Bay (1996) and the Firth of Forth (1997), as well as on the Dutch and Danish coasts during the same period (Santos *et al.* 1999). Bottlenosed whales (*Hyperoodon ampullatus*) and Cuvier's beaked whales (*Ziphius cavirostris*) are amongst the other species occasionally recorded (Santos *et al.* 2001a, b).

### 1.3 Key species

#### 1.3.1 Harbour porpoise (*Phocoena phocoena*)

The harbour porpoise is the smallest species of cetacean found in European waters (Figure 1). As the name suggests, it is frequently sighted in coastal waters, but is also found throughout the European continental shelf and occurs regularly in the waters of the central North Sea far from shore. It is the most common and widely distributed of all cetacean species in northern Europe and is the most frequently stranded cetacean species in Scotland. The harbour porpoise tends to be elusive and difficult to observe due to its small size and undemonstrative surfacing behaviour. Porpoises generally occur singly or in small groups of two or three animals, although groups of 40 have been observed in the Moray Firth (Peter McDonald, pers comm.). Little is known about the distribution of this species in Aberdeenshire waters.

**Figure 1** Harbour porpoise observed off Cove, Aberdeen



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#### 1.3.2 Bottlenose dolphin (*Tursiops truncatus*)

The bottlenose dolphin (Figure 2) is one of the most studied cetacean species (Ross & Cockcroft, 1990; Wells & Scott, 1999) and is found in temperate and tropical waters worldwide. Occurring in both pelagic and coastal waters, bottlenose dolphins often inhabit bays and tidal creeks, and are even known to travel up rivers (Caldwell & Caldwell, 1972). Coastal populations exhibit various movement patterns, including seasonal migrations, year-round home ranges, periodic residency, and a combination of occasional long-range movements and repeated residency (Wells & Scott, 1999). The resident population in the Moray Firth



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is of national significance, and an area of the inner Moray Firth has been designated as a candidate marine Special Area of Conservation (SAC) for the species under the European Community's "Habitats Directive". The size of this population (129 animals, Wilson, 1995) is well below the limit of 250 individuals used by the IUCN to identify isolated populations as 'critically endangered'. Given current estimates of survival and reproductive rates for bottlenose dolphins in the Moray Firth, an annual decline of almost 6% per annum for this population has been predicted (Sanders-Reed *et al.* 1999).

**Figure 2** Bottlenose dolphin observed off Aberdeen Harbour



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### **1.3.3 White-beaked dolphin (*Lagenorhynchus albirostris*)**

The white-beaked dolphin has the most northerly distribution of the species of the genus *Lagenorhynchus*. Adults can measure 2.5-3.0 m and can be commonly found bow-ride fast moving vessels, although they tend to lose interest quickly if the vessel is travelling slowly. The white-beaked dolphin (Figure 3) is the most numerous dolphin species in the North Sea (Hammond *et al.* 1995; Northridge *et al.* 1997). Despite its widespread and regular occurrence in Scottish waters, there has been little research on the species and relatively little is known about its distribution and biology.

**Figure 3** White-beaked dolphin observed off Stonehaven



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### 1.3.4 Minke whale (*Balaenoptera acutorostrata*)

The minke whale has a worldwide distribution, is the most frequently sighted baleen whale in UK waters, and is relatively common within the North Sea. Minke whales (Figure 4) regularly enter coastal waters and can be sighted from land. They reach 8-10 m in length and are normally sighted singly or in groups of 2-4, although aggregations of up to 15 animals may be observed (Hoelzel & Stern 2000). Although frequently indifferent to vessels, they may approach and swim around ships and platforms. Minke whales occur seasonally in UK waters, with the majority of animals present during May to September (Evans, 1980, 1992). Research conducted on these whales has primarily focussed on prey and food energetics (Nordøy & Blix, 1995; Lindstørn *et al.* 1998) and diving behaviour (Stern 1992; Nordøy & Blix, 1993; Stockin *et al.* 2001).

**Figure 4** Minke whale observed feeding off Cove, Aberdeen.



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## 1.4 Cetacean diet and fisheries in Aberdeenshire waters

### 1.4.1 Diet of cetaceans in Aberdeenshire waters

The occurrence of marine mammals is often related to the presence of prey species. The four most frequently sighted cetacean species in the waters off Aberdeenshire have a fairly generalised diet, and take a range of fish species. The harbour porpoise feeds upon small pelagic fish, and varies in diet according to geographical region. In the waters off North-east Scotland, Rae (1965, 1973) found mostly herring (*Clupea harengus*) and whiting (*Merlangius merlangus*), but also sprat (*Sprattus sprattus*), sandeel (*Ammodytes marinus*), mackerel (*Scomber scombrus*) and cod (*Gadus morhua*) among the prey species in stranded porpoise stomachs. Martin (1995) found that the stomach contents of porpoises from the waters off North-east Scotland contained mostly sandeel and whiting, with lower proportions of herring, sprat, haddock (*Melanogrammus aeglefinus*), poor cod (*Trisopterus minutus*), saithe (*Pollachius virens*) and ling (*Molva molva*). Santos *et al.* (1994) identified coastal shoaling fish, primarily whiting and sandeels, as the main prey items recorded in the stomach contents of Scottish harbour porpoises.

In North-east Atlantic waters, the minke whale takes small, pelagic fish, and its distribution has been related to concentrations of sandeels and herring in Scottish waters (Evans, 1980). Unlike most other baleen whales, minke whales are known to feed on economically important fish species like herring, cod and haddock (Nordøy & Blix, 1991; Haug *et al.* 1993; Lindstørn *et al.* 1998).

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Bottlenose dolphins are opportunistic feeders and take a wide variety of fish and invertebrate species. They have been recorded feeding upon salmon (*Salmo salar*) during the summer months in the Moray and Cromarty Firths (Evans 1980; Wilson *et al.* 1997b). Stomachs of animals stranded in Scotland contained salmon, *Gadidae* (cod family) and octopus (*Eledone cirrhosa*) (Santos *et al.* 2001c).

White-beaked dolphins probably also take a range of fish and cephalopod species, and Evans (1980) related their distribution to spawning herring and mackerel concentrations off North Scotland. Camphuysen *et al.* (1995) recorded large numbers of white-beaked dolphins actively feeding in regions where trawl catches were dominated by concentrations of herring and sprat. Santos *et al.* (1994) reported the main prey of white-beaked dolphins stranded in Scottish waters to be whiting.

### **1.4.2 Fisheries in North-east Scotland**

Traditionally, vessels from Aberdeen participated in the distant water fisheries off Iceland and the Faroe Islands. Today, these fisheries have been replaced primarily by fishing activity on the West Coast and in the North Sea. The northeast coast of Scotland is the location of Europe's largest market for demersal whitefish (Peterhead), while Fraserburgh and Aberdeen also have substantial whitefish markets. Most demersal species are caught by bottom trawlers. Key pelagic species landed in Aberdeen, Fraserburgh and Peterhead include herring and mackerel. These fish are primarily caught by large purse-seine or pelagic trawl gears. Sprat are another pelagic species found in these waters, and supported a fishery off the Aberdeenshire coast before their availability declined. The distribution and seasonality of fish occurrence are likely to be a governing factor in determining those of cetacean species, and the occurrence of prey species in Aberdeenshire and Scottish waters is briefly described here.

Scotland lies centrally in the European part of the geographic range of the Atlantic salmon and has approximately 400 salmon rivers around its coasts. The timing of spawning varies between rivers and also within major river systems. Runs of adult salmon enter most of the larger east coast rivers in every month of the year. In the rivers Dee and Don in Aberdeen, spawning populations include many multi-sea-winter fish, which enter rivers prior to May (Scottish Salmon Strategy Task Force, 1997). Sea trout have a similar life cycle but remain largely in coastal waters during the marine phase of their life cycle. Predators of salmon include otters, seals (Carter *et al.* 2001) and bottlenose dolphins (Santos *et al.* 2001c). A study by Thompson & Mackay (1999) in a river in North-east Scotland revealed that almost a fifth of salmon sampled (19.5%) had been damaged by predators, and measurements of scratches indicated that damage typically attributed to seals might actually be the result of attacks by odontocete cetaceans.

Catches of salmon and sea trout (*Salmo trutta*) have declined in a number of major Scottish rivers (Tony Hawkins, pers comm.), including the River Dee in Aberdeen. Over the past 20 years, the coastal and estuarine net fisheries have dramatically declined and almost disappeared, although in many cases netting stations have been bought out to protect angling interests.

Scottish demersal fisheries in the North Sea have traditionally been based on three species of the family *Gadidae*, namely cod, haddock and whiting. All have been overfished, with the status of haddock and cod stocks in particular giving cause for concern (Cook, 1997a,b; Anon. 2000). Other commercially important demersal species include saithe and monkfish (*Lophius piscatorius*). Scottish pelagic fisheries target mackerel, herring and blue whiting, although there is also some fishing for argentinines.

Cod is one of the most important fish species caught by the Scottish fleet and occurs predominantly in the northern and central North Sea. Spawning takes place between January and April and occurs off the northeast coast of Scotland (Coull *et al.* 1998). North Sea Haddock is valued at £50 million (ICES, 2001) and is caught in abundance off northeast Scotland, although spawning grounds are located off Shetland and to the west of Scotland. Peak spawning occurs between February and April.

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Whiting is another widespread species found in the North Sea, with high numbers of immature fish occurring off the coasts of Scotland (Zheng *et al.* 2001, In Press). Spawning grounds are known to exist off the Aberdeenshire coast and spawning generally occurs between January and June. Saithe vary in abundance throughout the year but can be caught all year round as part of a mixed fishery. In late summer and autumn young saithe are found in large numbers within Scottish coastal waters, usually on grounds unsuitable for commercial fishing. Spawning occurs between January-April near the edge of the continental shelf (Coull *et al.* 1998).

Mackerel is by weight the most abundant pelagic species in the North Sea. North Sea mackerel over-winter in the deep waters to the north and east of Shetland but migrate south in the late spring and early summer to spawn in the central North Sea between May and July (Coull *et al.* 1998). Herring is by weight, the second most abundant species landed by the pelagic fleet. One of the North Sea herring populations spawns between August and October along and off the coast of North-east Scotland (Coull *et al.* 1998). Blue whiting spawn between April and June, with peak spawning occurring in May. Spawning grounds are located in deep waters off the west coast of Scotland.

The largest industrial fishery in the North Sea is for the sandeel, primarily Raitt's sandeel (*Ammodytes marinus*). These small fish are inactive for most of the winter, burying themselves in the sediment until December-January, when they emerge to spawn. The larvae hatch from between February-April and fully metamorphose into small fish by June-July. The sandy areas where sand eels are abundant have a patchy distribution but do tend to occur in areas of high current speed. By far the largest sandeel fisheries off the Scottish coast are those operating over a number of banks to the east of the Firth of Forth, including the Marr Bank and the Wee Bankie. These areas support local fisheries for cod and haddock out of the small Fife ports and are close to the salmon producing rivers of the Tay and Forth (Hawkins *et al.* 1998).

## **1.5 Aims**

The present study had three main aims:

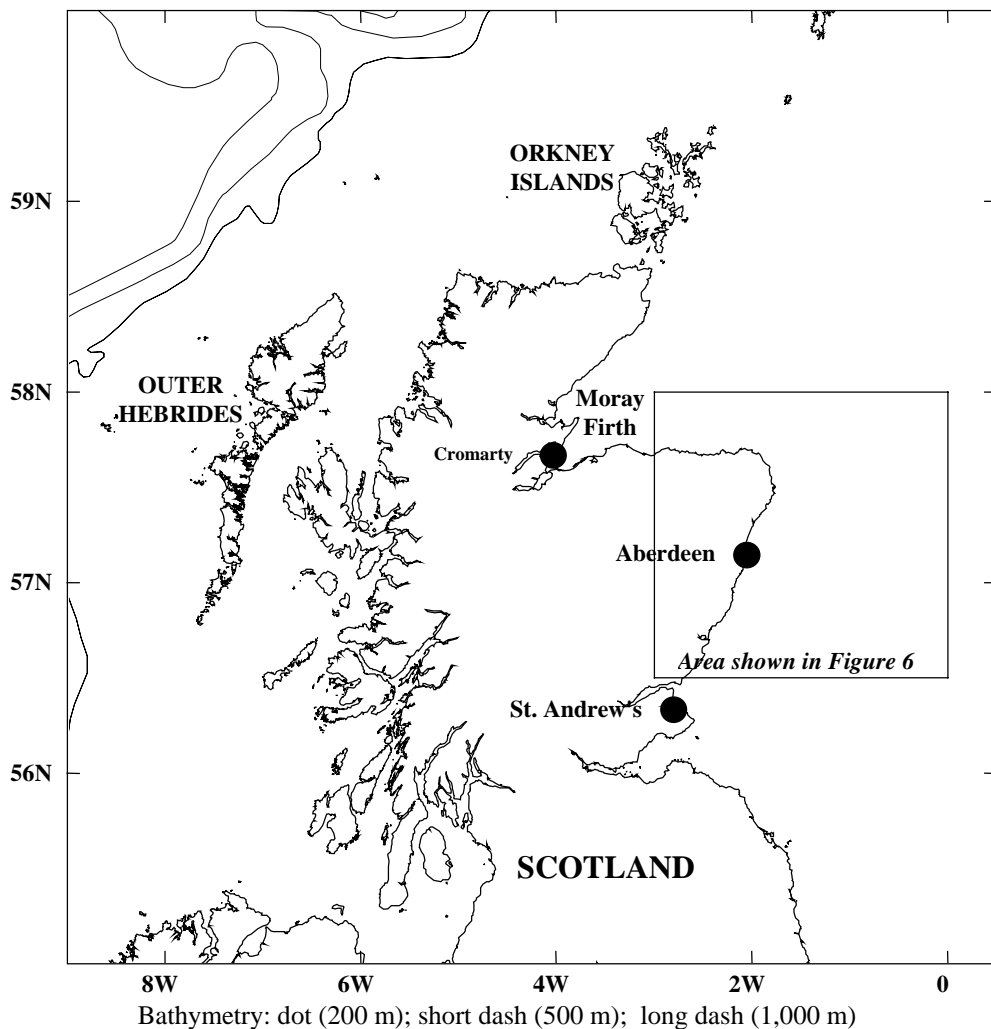
1. To examine the temporal and spatial distribution of bottlenose dolphins along the Aberdeenshire coastline.
2. To establish the relationship between bottlenose dolphins occurring off the Aberdeenshire coast and those in the Moray Firth.
3. To investigate the distribution of other cetacean species occurring in coastal waters within the region, such as the harbour porpoise, the white-beaked dolphin, and the minke whale.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

## 2 Methodology

### 2.1 The study area

The study area is located off the coast of Aberdeenshire in northeast Scotland (Figure 5).

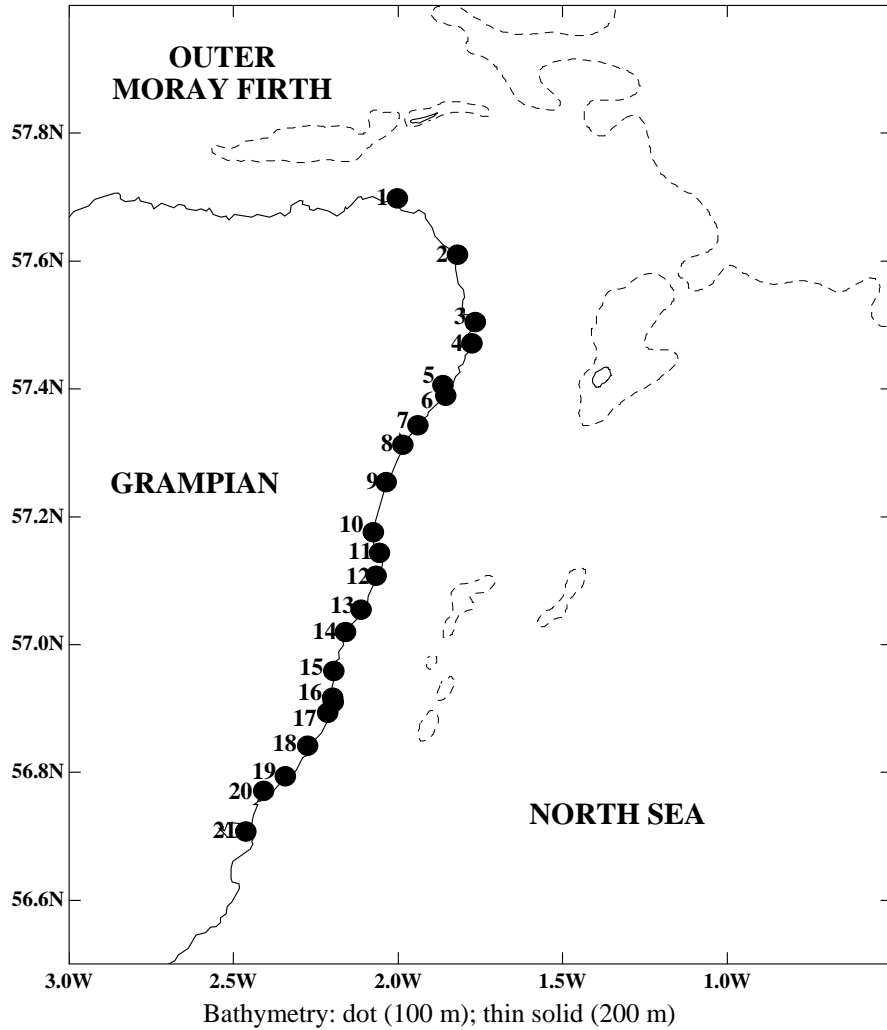


**Figure 5** Location of the study area

Data were collected along the Northeast coast of Scotland between Fraserburgh in the north and Arbroath in the south (Figure 6). The waters of the North Sea are generally shallow. Between Girdleness Point (Aberdeen) and Peterhead, the coastline extends as a large and shallow bay that does not exceed 20 m depth until about 2 km from land. South of Aberdeen the coastline consists mostly of cliffs and the 20 m isobath runs well within 1 km from land. Along a short piece of coast between Girdleness Point and Portlethen (just south of Aberdeen) 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 off Peterhead.

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Figure 6 Location of key sites of data collection



- |  |                              |
|--|------------------------------|
| 1 Kinnaird Head, Fraserburgh           | 12 Souter Head, Cove         |
| 2 Rattray Head                         | 13 Portlethen                |
| 3 Peterhead                            | 14 Muchalls                  |
| 4 Boddam                               | 15 Stonehaven Bay            |
| 5 Cruden Bay                           | 16 Fowlsheugh & Crawton Ness |
| 6 Whinnyfold                           | 17 Catterline                |
| 7 Collieston                           | 18 Inverbervie               |
| 8 Newburgh                             | 19 Johnshaven                |
| 9 Balmedie                             | 20 St.Cyrus                  |
| 10 Mouth of Don                        | 21 Montrose                  |
| 11 Aberdeen Harbour & Girdleness Point |                              |

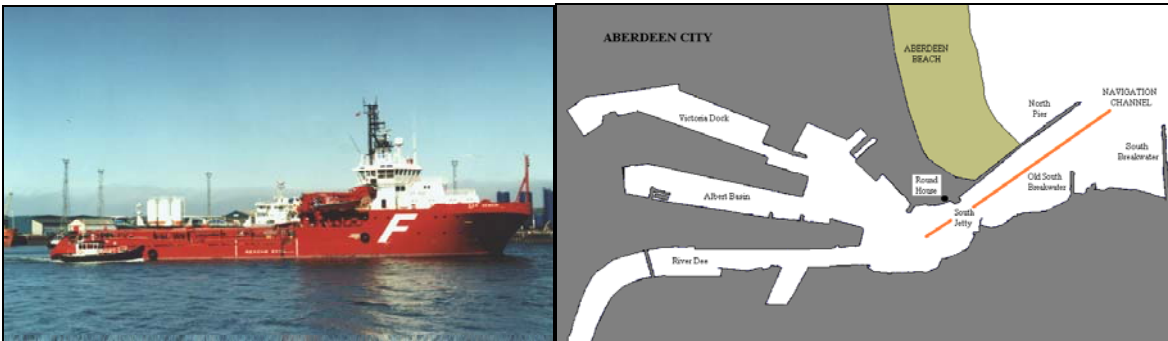
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Aberdeen Harbour lies at the centre of the study area, and is the key land-based observation site in the present study. The Harbour operates 24 hours a day and is a major port for the oil industry, cargo and container traffic, ferries, cruise ships and fishing vessels (Figure 7).

**Figure 7** Aberdeen Harbour

(a) Offshore supply vessel with pilot boat

(b) Aerial plan of Aberdeen Harbour



## 2.2 Data collection

Data were collected using a combination of land- and vessel-based surveys. Both systematic observations (timed surveys) and casual records were submitted for inclusion on the database. The majority of systematic observations were carried out by a small number of experienced observers, while many observers with varying experience submitted casual records. To ensure standardisation, volunteers attended training days at Aberdeen Harbour during May 1999.

In addition, a number of people had notes of cetacean sightings from previous years. These were included as casual records on the database. The vast majority of these records came from ornithologists who had carried out sea-watches during the spring and autumn for migrant seabirds, and had also made a note of cetaceans.

## 2.3 Land-based surveys

Land-based surveys were the primary source of data on cetacean distribution in the region. Surveys were conducted from suitable headlands or other vantage points. Standard Sea Watch recording forms were used, with some amendment for the Aberdeen region. The start and end time (GMT) of timed watches were recorded, along with the location of the survey. The number of observers and observation height were noted. Environmental conditions were recorded at 15-minute intervals or whenever they changed. Information recorded included sea state, swell height, wind speed and direction, precipitation, and visibility. Surveys were carried out largely with the naked eye, supplemented by regular scans using binoculars. Some observers also used telescopes with a 20x-40x magnification. Telescopes were of particular use over the summer months when distant splashing from offshore species that had been detected by eye could be checked and often identified.

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## **2.4 Vessel-based surveys**

Vessel-based surveys were carried out from two vessels, but primarily from ‘*Tranquillity*’, a 5 m motor vessel (Figure 8). This vessel had a 360° viewing capacity and an eye height 3 m above sea level. A minimum of two trained and experienced observers were onboard during survey, accompanied by between 3 and 6 volunteers who varied in experience. An average speed of 7 knots was achieved during vessel-based surveys. Surveys were carried out using a rotational system of observers on the port and starboard sides. Effort was concentrated forward of the vessel, but scans took in 360°. Observation was primarily carried out with the naked eye, but was backed up with regular scans using 8x or 10x binoculars.

Standardised Sea Watch Foundation recording forms were used to record cetacean sightings and effort. Every 15 min, the vessel position was recorded using the onboard GPS (Global Positioning System). Vessel course and speed were also noted. Environmental conditions such as sea state, swell height, wind speed and direction and visibility were also recorded in 15-min intervals.

On sighting cetaceans, the time (GMT) and position were immediately noted. Information recorded included species identification, number of animals, behaviour and direction of travel. On occasion, the vessel left the survey route to approach animals for identification purposes but the survey route was re-joined as soon as possible.

**Figure 8** The survey vessel “*Tranquillity*”



## **2.5 Photo-identification**

### **2.5.1 Introduction**

To study the distribution, abundance and dynamics of an animal population, it is essential to be able to follow individuals within a population through time. Where species are only visible for brief periods of time, photo-identification studies can be used. Photo-identification is a process where individual animals are photographed and then later identified by the use of their unique markings. This process can be used to catalogue the movements of individual animals over space and time, using a mark-recapture principle. This technique has been widely applied to improve our understanding of distribution, seasonality, life-history parameters, social ecology and population size in various cetacean species.



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In bottlenose dolphins the features used to identify individuals mostly take the form of notches and cuts in the edges of the dorsal fin, but also uses body scarring and pigmentation. Despite its apparent simplicity, there are many factors that complicate this methodology, notably the difficulties in obtaining pictures, the ambiguous nature of the markings and the huge number of matching decisions this process generates (Stevick *et al.* 2001). In Scotland, photo-identification work has been carried out for several years on bottlenose dolphins in the Moray Firth (Wilson *et al.* 1995). The identification of individual dolphins along the Aberdeenshire coast was carried out to establish to what extent animals might move between these geographically separate regions.

### **2.5.2 Aberdeenshire photo-identification**

The present study used photographs of bottlenose dolphins recorded in Aberdeenshire waters during 2001. Animals recorded were encountered during vessel-based sighting surveys between Stonehaven and Aberdeen. As with previous studies, a wide variety of identification marks were used to recognise individual animals. These included obvious permanent features such as pieces missing from the trailing end of the dorsal fin (nicks), as well as other features which may or may not be permanent, e.g. de-pigmented areas, lesions and rake marks. Schools of dolphins containing young calves were not approached for photo-identification purposes.

### **2.5.3 Methodology**

Photo-identification work was carried out during vessel-based surveys, when the vessel was manoeuvred carefully alongside dolphins to enable close proximity for photography. Approach to the dolphins was generally made at a shallow angle to their direction of travel so that the boat would eventually run parallel to their track within 20 to 50 m. The side from which to follow them was chosen depending on their direction of travel relative to the position of the sun. Generally the sun was kept behind the photographer so that it lit up features on the fins of the dolphins. Alterations to the speed and course of the boat were kept to a minimum to limit disturbance. Once on a parallel track, vessel position was maintained, unless the dolphins changed course such that the boat needed to be on the other side of the school. In these situations the boat was slowed and steered behind rather than in front of the animals.

Individual animals were photographed using Nikon F80 and Nikon F5 SLR cameras fitted with Nikon-AF Nikkor 75-300 mm and 400 mm zoom lens respectively. Parameters recorded with each encounter included film frame numbers, GPS positions, date, time and group size. By eliminating the need to manually focus, the autofocus facility permitted the photographer to devote valuable time to selecting dolphins to photograph. The camera was prefocused on the sea where the dolphins were anticipated to surface, so that the focusing time on surfacing was minimised. The zoom lens allowed useful identification pictures to be taken with dolphins surfacing over a wide range of distances at sea. This lens did not have the maximum possible light-gathering capacity but was of a suitable weight to be held on a rocking platform for long periods of time.

Kodak Elite Chrome ISO 400 film was used for the majority of this study. Colour transparency film was chosen over black and white, as it recorded a wide range of subtle coloration patterns, which proved useful in individual identification. Transparency (slide) film was used as it could be projected at the range of different sizes that was required during the matching process. Upon encountering a school, the aim was to photograph each animal's dorsal fin and back from at least one side (preferably from both). For this reason, it was important for the photographer to get a clear idea of the number of animals in the school, and of the relative position of any sub-groups.

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Once slide films were processed, the information from each boat survey could be analysed. Slides were stored in transparent plastic A4 sheets, with each film being individually marked with a unique identification number starting with the year, in the form of 01/1. The slides were next examined with an eight times loupe magnifier over a light-table to assess whether each was of the left or right-hand side of the animal. An L or an R was then marked on the frame of each slide. At this point, the process of matching fins from each encounter could begin.

## 2.6 Tidal data

To examine the relationship between sightings of bottlenose dolphins and tidal state, the predicted time of high water for Aberdeen Harbour was ascertained using TIDECALC (1991). Only cetacean data collected in the immediate vicinity of the harbour mouth and where the time of the sighting was accurately recorded, were utilised during tidal analysis.

The time of each high tide and tidal height (metres) was noted during each effort-related survey. The nearest high tide was also recorded for sightings of bottlenose dolphins and harbour porpoises (these were the only two species noted with regularity in the immediate vicinity of the harbour). Both effort and sightings data were then split into categories dependent upon tidal state. The allocated categories were hourly tidal states, which were related to the time of high tide (Table 1).

Table 1 Categories of time utilised during tidal state analysis															
Hour	-7	-6	-5	-4	-3	-2	-1	High Tide	+1	+2	+3	+4	+5	+6	+7
Min	-360	-300	-240	-180	-120	-60	0 to	0	0 to	+60 to	+120	+180	+240	+300	+360
	to -	to -	to -	to -	to -	to -	-60		+60	+120	to	to	to	to	to
	420	360	300	240	180	120					+180	+240	+300	+360	+420

Each timed watch and each timed cetacean encounter was divided into minutes and allocated to a tidal category. The percentage of time spent by cetacean species and by observers at each state of tide could then be examined. Data were analysed in terms of utilisation of the harbour region in relation to tidal state, i.e. in terms of percentage time that animals were present in the harbour at different states of the tide, rather than changes in the actual number of animals. Occupancy of the harbour area by each species was calculated for each tidal state using the following calculation to correct for effort bias:

$$\text{Percentage utilisation} = \frac{\text{Total number of minutes an animal was present}}{\text{Total number of minutes of effort}} \times 100$$

## 2.7 Data management

Data were computer coded and entered onto a Microsoft Excel computer database according to the methods outlined by Heimlich-Boran (1996). For the purposes of standardisation, only one person coded and entered data onto the database. That person validated and where necessary downgraded sightings that were of a questionable nature. This most usually took the form of a definite identification such as bottlenose dolphin being down-graded to dolphin species, but occasionally a sighting with an adequate description was upgraded. Data collected during prolonged encounters (>30-min) were linked using association codes on the computer database.



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### 2.8 Data limitations

Data collected using a number of different observers have inherent limitations. It is difficult to standardise for observer variation in detection rate, ability to identify the species, and accuracy in completing forms. However a small number of experienced observers (n=5) carried out the majority (>75%) of effort-related surveys, and it is therefore considered that these data are generally comparable. Casual records submitted by inexperienced observers were carefully scrutinised before being accepted, and were downgraded in instances where it was not possible to be sure of the observers identification skills.

The majority of sightings reported by volunteers were from the Aberdeen Harbour area, where animals are relatively easy to detect. Headlands in other regions of the coast were watched generally by more experienced observers such as bird-watchers, whose ability to detect inconspicuous species such as the harbour porpoise was higher than average. Variation among species identification and completion of forms has been overcome to a certain extent by having only one person coding data onto computer, and therefore acting to validate the database.

Data collection varied across the year, with fewer data collected over the winter months. Any distributions described here will need to account for the lower level of coverage during winter. The detection rate of cetaceans also varies with sea state, with small and/or inconspicuous species such as the harbour porpoise becoming difficult to detect with increasing sea state (Palka, 1996; Stevick *et al.* 2001). However, the majority of data collected in the current study was taken in Beaufort sea state 1 or 2 (Section 3.1.2). Therefore, no significant bias due to weather conditions is considered likely within the current data set.

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### 3 Results

The results of the present study are presented in separate sections, representing land-based and vessel-based surveys. For each survey type, the level of coverage, the number of sightings and the species accounts are covered. Both land- and vessel-based surveys were subject to weather conditions, and both the seasonal level of coverage and variation in sea state are therefore addressed in each section. The sightings rate of most small cetaceans is expected to show a significant decrease in sea states higher than Beaufort 3 (Clarke, 1982; Palka, 1996). Therefore, data collected in the present study, relating to sea states above Beaufort 3 have been deleted from further analyses.

For the purposes of this report, a distinction has been drawn between a SIGHTING of a cetacean species and an ENCOUNTER (A sighting being defined as a visible observation lasting less than 30 mins as opposed to greater than 30 mins.) It was particularly necessary to make the distinction between a sighting and an encounter when coding and analysing land-based data, especially since groups of dolphins were frequently observed for periods that exceed one hour. During these encounters, sightings were coded every 30 min and linked on the database using an association code. Thus a group of dolphins feeding in the harbour for several hours would constitute a single sighting in the following analyses, but data from the entire encounter may be used in certain analyses such as occurrence in relation to tide.

The number of animals constituting group size was often given as a best estimate, with minimum and maximum numbers being quoted. Where possible the best estimate was used, but in cases where the number of animals was unclear, a cautionary approach was applied and the minimum number was entered onto the database. In instances where no clear indication of numbers could be ascertained, the sighting was recorded simply as a ‘presence’ of that species and no attempt was made to quantify the sighting.

#### 3.1 Land-based surveys

##### 3.1.1 Survey coverage

22,276 min of land-based effort data has been collected since 1994. However, majority of this data (85%) has been collected since the activation of the Regional Group 1999 (Table 2). Data collected prior to 1999 came largely from ornithologists who notes kept notes of observed cetaceans whilst conducting sea bird surveys.

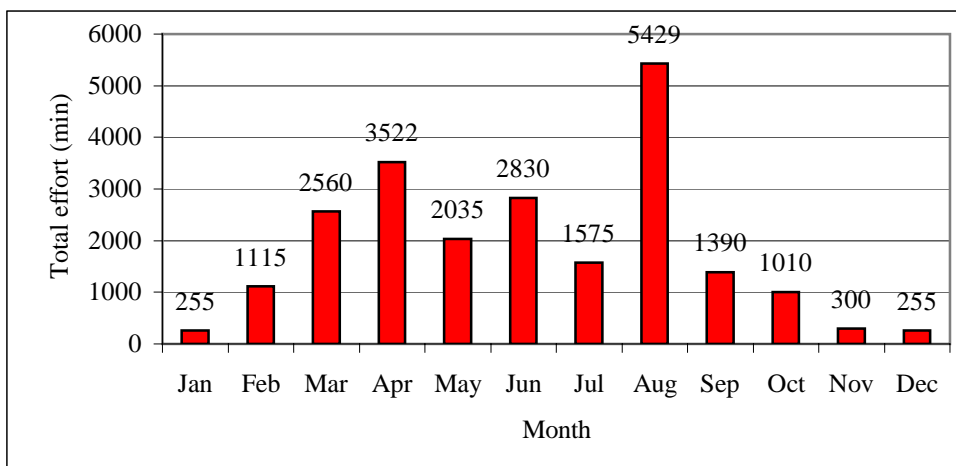
<b>Table 2 Annual land-based effort (1994-2001)</b>	
<b>Year</b>	<b>Total effort (mins)</b>
2001	5,794
2000	10,685
1999	2,417
1998	0
1997	445
1996	890
1995	1,805
1994	240

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Land surveys were predominantly conducted from 3 key sites, although 16 sites ranging from Rattray Head in the north, to St.Cyrus in the south were also sporadically sampled (Table 3).

<b>Table 3 Total effort (min) at land-based sites</b>		
<b>Site name</b>	<b>Total effort (min)</b>	<b>Percentage of total effort</b>
Balmedie	240	1
Collieston	1710	8
Cove (Souter Head)	3810	17
Donmouth	60	<1
Doonies Yawn	60	<1
Girdleness	5814	26
Harbour (Torry Battery)	7557	34
Muchalls	120	<1
Newburgh	15	<1
Nigg Bay	355	2
North Broad Craig	115	<1
Rattray Head	120	<1
Stonehaven	1865	8
Slains Castle	90	<1
St Cyrus	80	<1
Whinnyfold	265	1

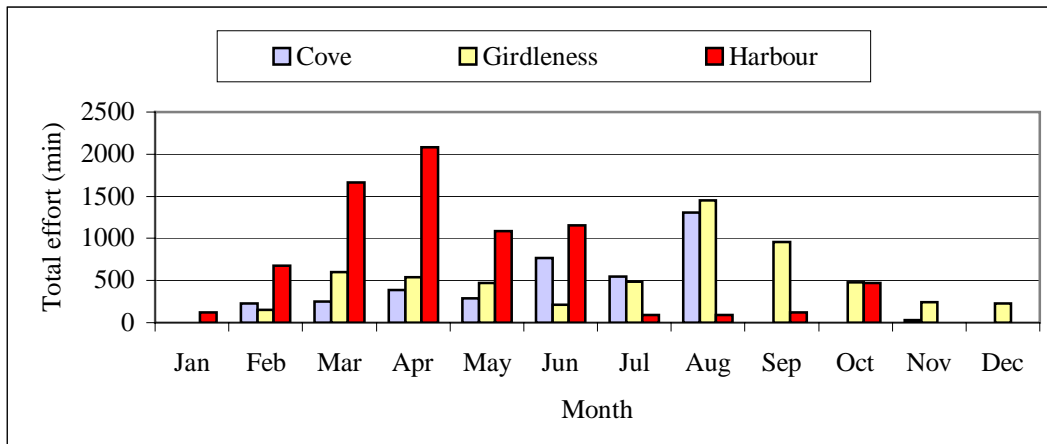
The 3 key sites: Aberdeen Harbour, Girdleness Headland, and Souter Head, received over 77% of the total coverage. Although effort data were collected in every month of the year, the level of survey effort varied according to season, with higher levels of coverage being achieved during April and August (Figure 9).



**Figure 9** Total effort in minutes per month for 1994-2001

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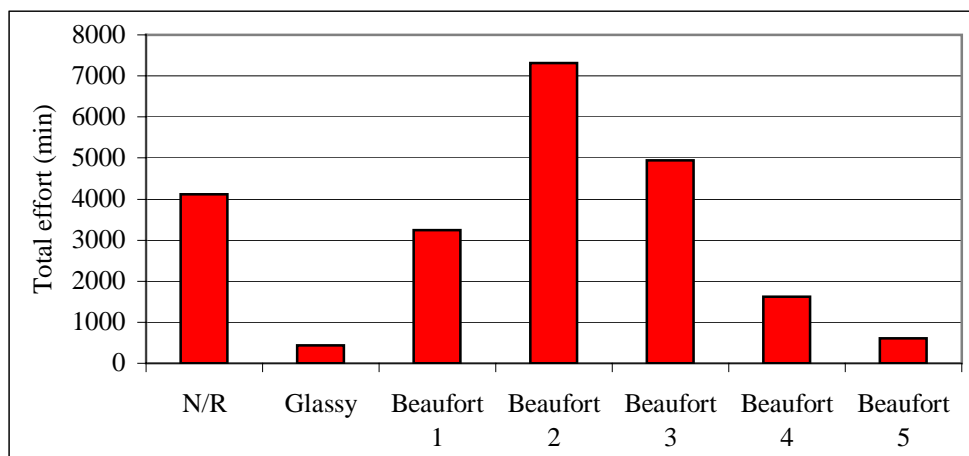
Figure 10 shows the variation in survey effort according to month, for each of the three key survey sites. It is apparent that the harbour received most coverage during the spring and early summer, while coverage on the headlands of Girdleness and Cove peaked during August. Such biases in survey data are considered during the following discussions of cetacean distribution.



**Figure 10** Total effort per month for key land-based survey sites

A total of 17 observers carried out dedicated land-based surveys for cetaceans. Eleven of these trained observers were considered ‘experienced’, comprising 88% of the total effort. The remaining volunteers, who were less experienced, only conducted surveys at Aberdeen Harbour, where confusion over species identification was considered to be relatively unlikely. Five very experienced observers (CC 17%; KH 24%; KS 6%; AU 5%; CW 24%), accounted for over 76% of effort-related surveys, thus resulting in a large reduction in observer bias.

The majority of land-based data were collected during sea states of 1 to 3 (Figure 11). Biases due to variation in environmental conditions are therefore considered unlikely in the present study.



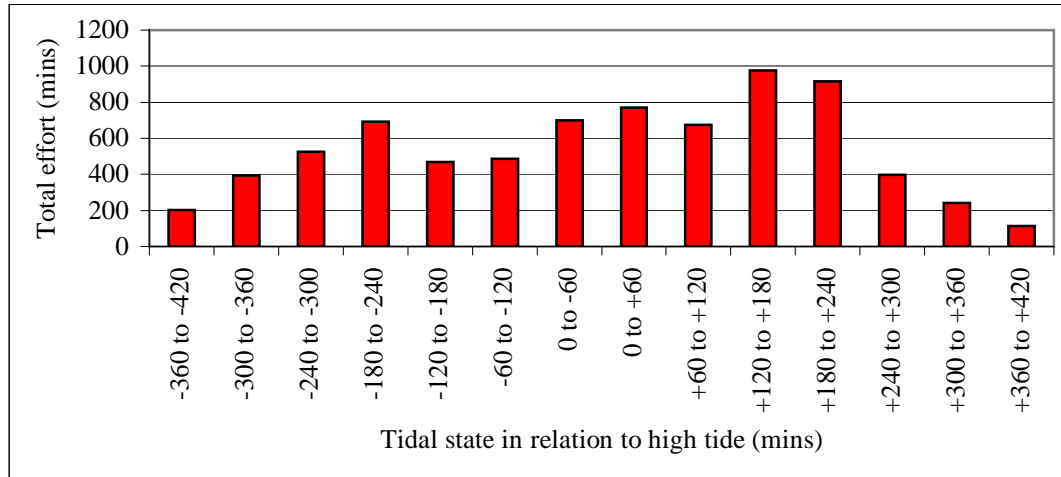
**Figure 11** Distribution of effort (mins) in relation to sea state

### 3.1.2 Tidal data

The methodology used to analyse tidal trends is discussed in section 2.6. Tidal data were analysed for two species, the harbour porpoise and the bottlenose dolphin (these were the only two species observed within the immediate vicinity of the harbour). Only effort-related data were utilised during the analysis, although casual records of both species occurred at all tidal states.

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Data were collected at the harbour during all states of the tide (Figure 12), although a higher level of effort was achieved 2-4 hours after high tide.



**Figure 12** Distribution of effort (mins) in relation to tidal state at Aberdeen Harbour

### 3.1.3 Cetacean sightings

A total of 635 cetacean sightings were recorded during the dedicated and casual land-based surveys. This total includes two species of baleen whale, six dolphin species and the harbour porpoise (Table 4). In addition, a number of unidentified sightings, in particular groups of unidentified dolphins occurred during the present study. Although listed below, these are not considered further in this report.

<b>Table 4</b> Total number of cetacean sightings during casual and effort-related surveys		
<b>Species</b>	<b>No. of sightings</b>	<b>No. of animals (min.)</b>
Fin whale	1	2
Minke whale	13	24
Killer whale	5	13
Long-finned pilot whale	2	15
Atlantic white-sided dolphin	1	1
White-beaked dolphin	103*	778*
Bottlenose dolphin	299*	2,457*
Common dolphin	1	2
Harbour porpoise	171	457
Unidentified whale sp.	1	1
Unidentified dolphin/porpoise sp.	35	172
*Includes 2 WBD sightings and 3 BND sightings where the number of animals was not reported		

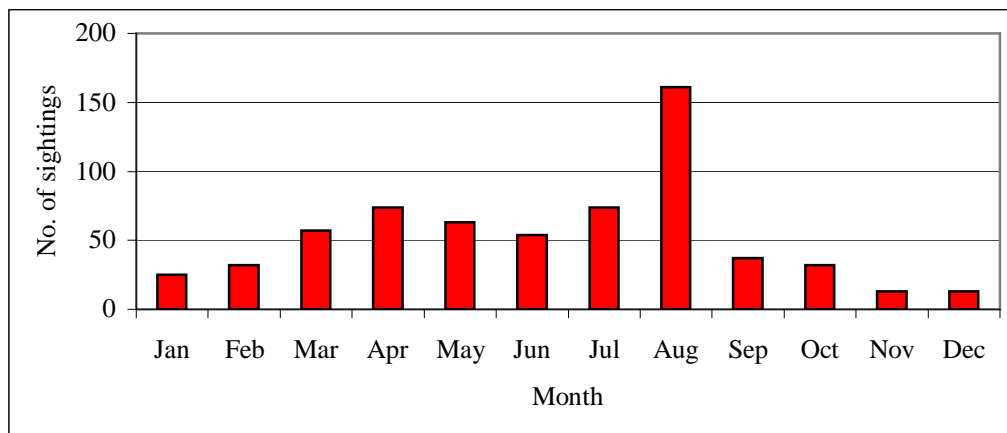
Of the 636 sightings recorded, 385 were casual records submitted by regional volunteers, and 251 were sightings made during dedicated land-based surveys by experienced observers. Sightings were reported by 43 individuals and in various formats. However, five observers reported over half of the total land-based sightings.

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Sightings have been reported from almost a decade of observations. However, majority of reported sightings occurred between 1999 and 2001 (Table 5).

<b>Table 5</b> Distribution of cetacean sightings (1992 –2001)	
<b>Year</b>	<b>No. of cetacean sightings</b>
1992	1
1993	4
1994	6
1995	20
1996	12
1997	11
1998	12
1999	58
2000	260
2001	252

Although the pattern of reported sightings shows a similar seasonal distribution to effort data, the pattern is not quite so marked, with a good number of sightings occurring year round. It is clear that species can be observed during any month in Aberdeenshire waters (Figure 13). The majority of records over the winter months relate to casual rather than effort-related sightings, since conditions are generally less amenable for carrying out timed surveys.



**Figure 13** Seasonal distribution of casual and dedicated land-based cetacean records

During analysis of land-based survey data, some previous studies have eliminated data where the start of a timed survey was the same as the start of a recorded dolphin sighting. This assumes an observer may only have started to record timed effort data because animals were observed in the area (Dixon, 1994). While this may certainly have occurred on occasion, it is considered unlikely in the present study because:

- Timed surveys occurred from sites that were accessible only by special effort, e.g. head lands and the harbour that usually had to be accessed by car. It is therefore likely that the observer was travelling to the site specifically to conduct a watch, regardless of the presence of cetaceans at the start.
- In many circumstances, bottlenose dolphins were present in the harbour at the start of a survey, throughout the survey duration, and even after the observers departure. Discarding this data would bias the survey, since the utilisation of harbour waters by bottlenose dolphins would be strongly underestimated.



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- The majority of effort-related land-based surveys were conducted by a small number of experienced observers, who in the absence of any cetaceans, were extremely diligent about reporting ‘negative’ survey data i.e. these observers did not carry out surveys only in the presence of animals.
- Dolphins that were observed in the harbour by observers passing through the area were noted as casual records and were not entered as effort based sightings even if observer stopped to view the animals for a longer period of time. Likewise, observers who reported prolonged dolphin sightings of several hours, without submitting effort-related data forms watch forms, were still only entered onto the database as casual sightings.

### **3.1.4 Harbour porpoise**

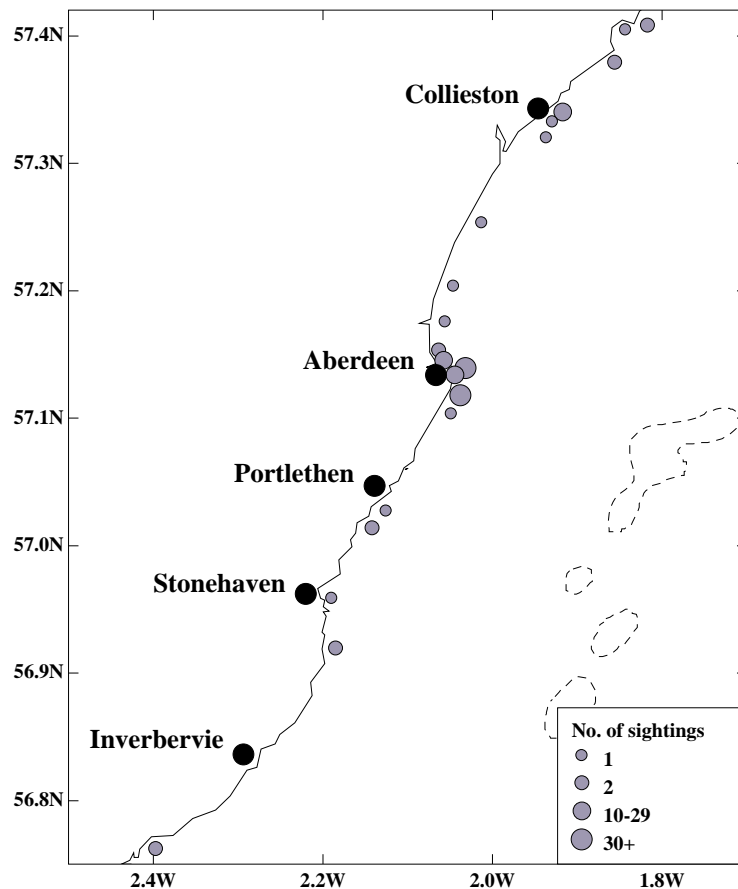
#### **3.1.4.1 Sightings**

A total of 171 harbour porpoise sightings were reported during land-based observations, of which 44.4% (n=76) were casual and 66.6% (n=95) were effort-related sightings. This is the only species for which casual records are fewer than effort-related records, and it is likely that the diminutive nature of the harbour porpoise makes it difficult to observe by inexperienced or casual observers. Indeed, just two experienced observers made over half of all harbour porpoise sightings on the database. Harbour porpoises have been reported in every year that records have been submitted, although the bulk of sightings were made during 2000 and 2001. It is certain that harbour porpoises are under-recorded in Aberdeenshire waters, since many observers (especially ornithologists) report frequently seeing them but unlike dolphin sightings, rarely make detailed notes of such encounters.

#### **3.1.4.2 Distribution**

Porpoises were reported along the entire Aberdeenshire coastline, with clusters of sightings at the main survey sites. Sightings were predominantly from headlands at Girdleness and Cove, but porpoises were regularly reported from the shallow sloped area along Aberdeen Bay and off Collieston and Cruden Bay (Figure 14). Porpoises were less regularly observed to the south of the survey area off Stonehaven. However, it should be noted that observer coverage in this area was generally carried out by less experienced observers. Certainly, harbour porpoises appeared to be extremely common during southbound vessel-based surveys towards Inverbervie (Section 3.2.3).

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**Figure 14** Distribution of land-based harbour porpoise sightings

Despite the apparent under-recording of harbour porpoises sightings, this species remained the most commonly sighted cetacean during effort-related surveys at both Girdleness and Cove. The sighting rate for harbour porpoises varied between the three sites; Cove had the highest sighting rate of one sighting every 131 min. Girdleness produced a sighting every 242 min, while the enclosed waters of the harbour produced the lowest sighting rate for porpoises, of one sighting every 540 min.

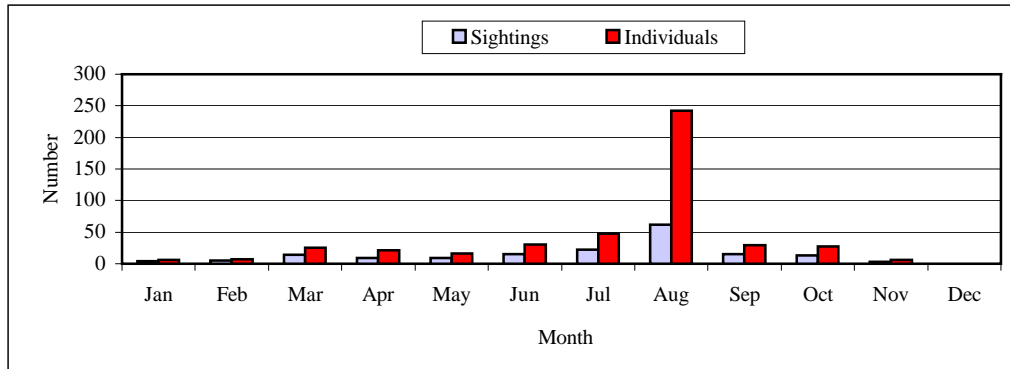
### 3.1.4.3 Group composition

The vast majority of the 171 porpoise sightings were of single (n=63) or pairs of animals (n=55). Over 82% of sightings comprised groups of 3 or fewer animals. 27.7 % of sightings whose group composition were recorded (n= 119) contained immature animals (classified as juveniles or calves). Where more than one animal was present in a group, two adults formed the most common composition (n=21), with presumed mother-calf pairings being the second most common combination (n=14). Aggregations of 20+ porpoises were reported in August on three occasions.

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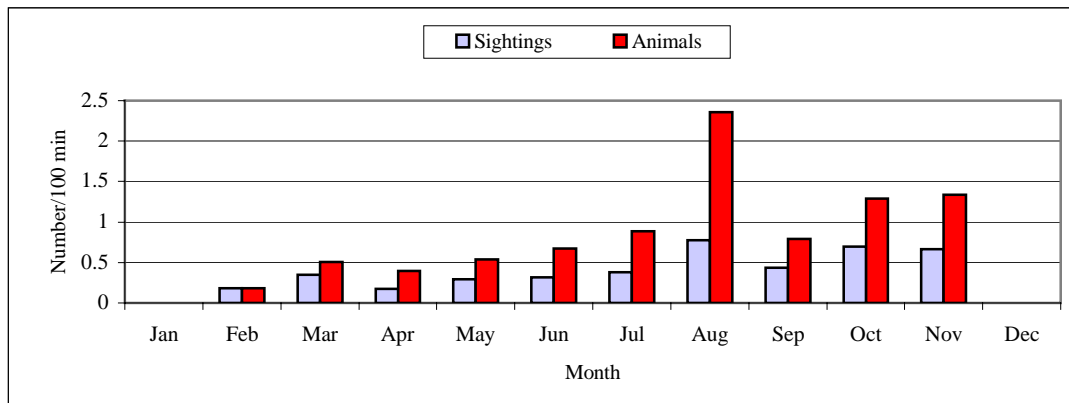
**3.1.4.4 Seasonal trends**

Harbour porpoises showed a marked seasonality in both number of sightings and number of individuals, with a clear peak during August (Figure 15).



**Figure 15** Monthly distribution of harbour porpoise sightings

This above trend remained apparent even when casual sightings were disregarded and only effort-corrected data were used (Figure 16)

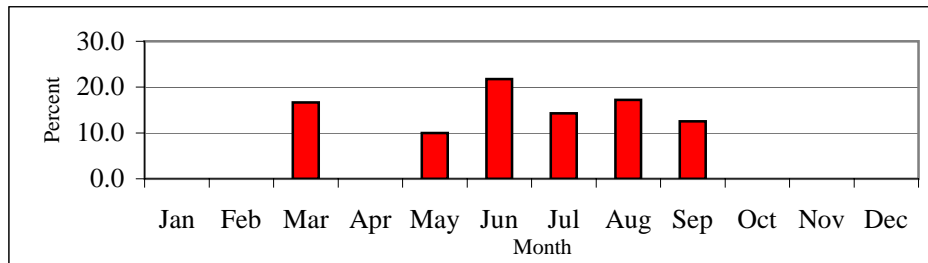


**Figure 16** Effort-related sightings and number of porpoises observed monthly

It is likely that the peak in August is a genuine trend, since results are consistent despite variation in sea state, or use of casual and/or effort-related sightings. However, it is unclear whether animals are moving into Aberdeenshire waters from other coastal regions, or simply moving inshore from offshore waters. This apparent peak in porpoise abundance does correspond with the occurrence of minke whales off the Aberdeenshire headlands in August, and may possibly correspond with the movement of a shared prey source. Effort-related distribution maps for the harbour porpoise in the North Sea illustrate a distinct coastal distribution of animals in August compared to July (Peter Evans, pers comm.). This suggests that an inshore movement of porpoises occurs throughout North Sea waters during this time of year.

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Immature porpoises (juveniles and calves) were recorded principally over the summer months between May and September, with a peak during June (Figure 17). It is possible that June represents the actual porpoise calving period for animals in the Aberdeenshire region, since several very small calves were observed at this time.



**Figure 17** Percentage of juveniles/calves in porpoise sightings where group composition was noted

The distribution of harbour porpoise sightings in each season is shown in Figure 19. Porpoises were recorded throughout the year, but sightings show a clear increase in number, and appear more widespread during the summer and autumn months.

### 3.1.4.5 Behaviour

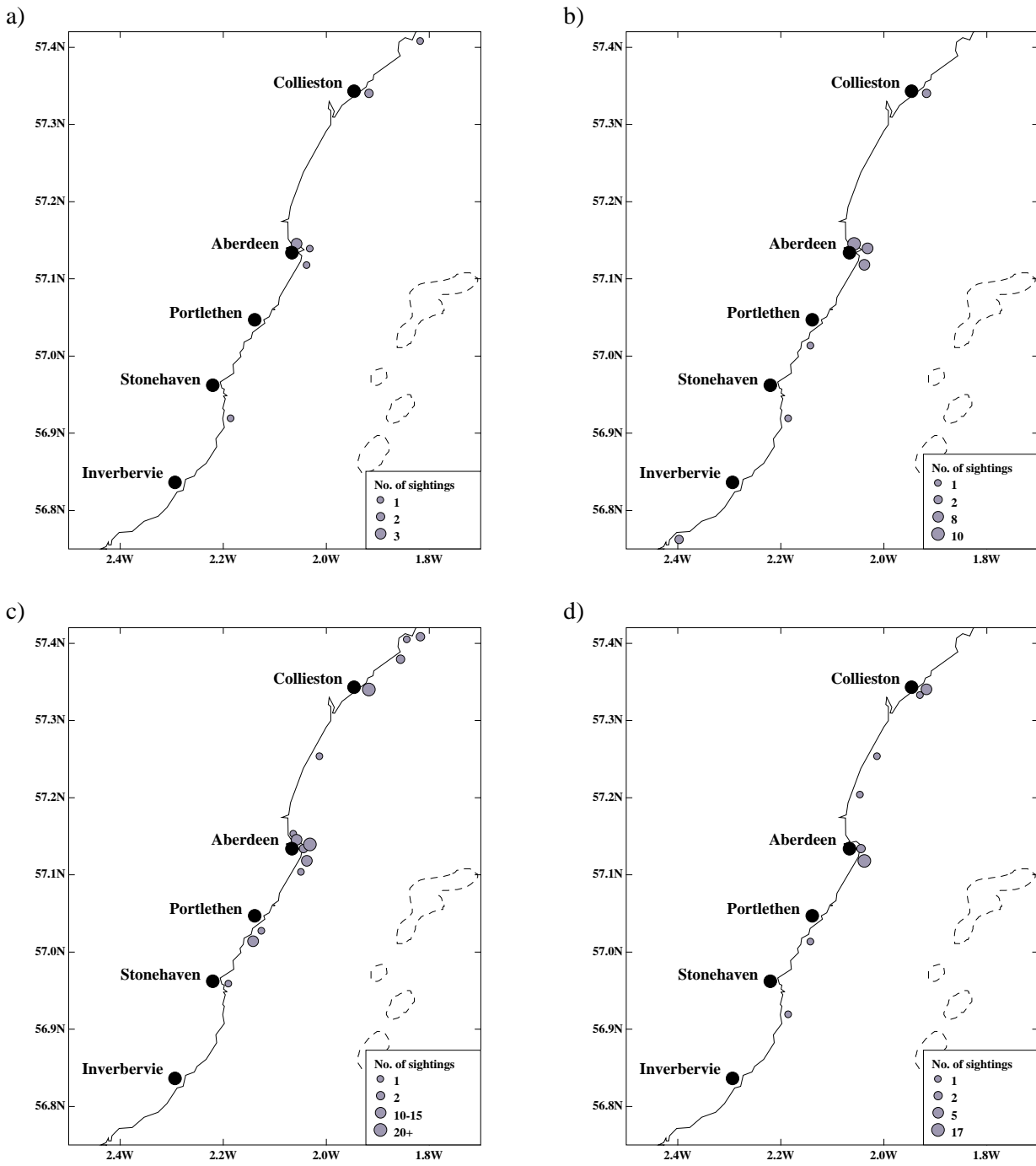
Porpoises are typically undemonstrative animals, and sightings typically involved animals surfacing two or three times only. As a result, it was often difficult to allocate behaviours other than transiting or travelling. However, porpoises were observed feeding on several occasions, with active surface-rushing, splashing, and constant changes of direction. On numerous occasions Gannets (*Morus bassanus*), Fulmars (*Fulmarus glacialis*), various gulls of the genus *Larus* accompanied porpoises during such feeding activity (Figure 18). Porpoises were periodically observed resting or ‘logging’ at the surface, and on rare occasions at Aberdeen harbour, porpoises were also observed ‘surfing’ the swell into the harbour mouth. On one occasion, two porpoises, which actively surfed both the swell and the boats wake, followed observers in an inflatable boat, approaching within metres of the vessel before repeating the behaviour.

**Figure 18** Various seabird species feeding on sprat off Muchalls



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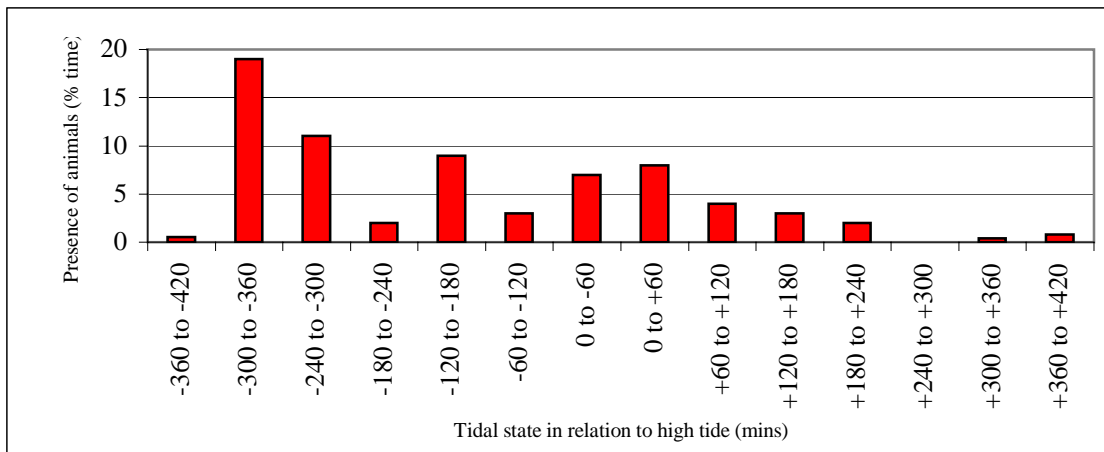


**Figure 19** Location of harbour porpoise sightings in a) Winter (December to January); b) Spring (March to May); c) Summer (June to August) and d) Autumn (September to November)

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**3.1.4.6 Tidal analysis**

A total of 14 effort-related sightings of harbour porpoises occurred within Aberdeen harbour, accounting for 393 min of observation time. Percentage utilisation of the harbour region by porpoises according to tidal state is illustrated in Figure 20.



**Figure 20** Utilisation of Aberdeen harbour in relation to tidal state by harbour porpoises.

While the tidal dataset for harbour porpoises is limited, there is some evidence to suggest that porpoises favour flood tides, the period after low tide when the tide has turned and is flowing back into the harbour. Porpoises spent relatively little time in the harbour during ebb tides, when the tide was falling after high tide.

**3.1.5 Bottlenose dolphin**

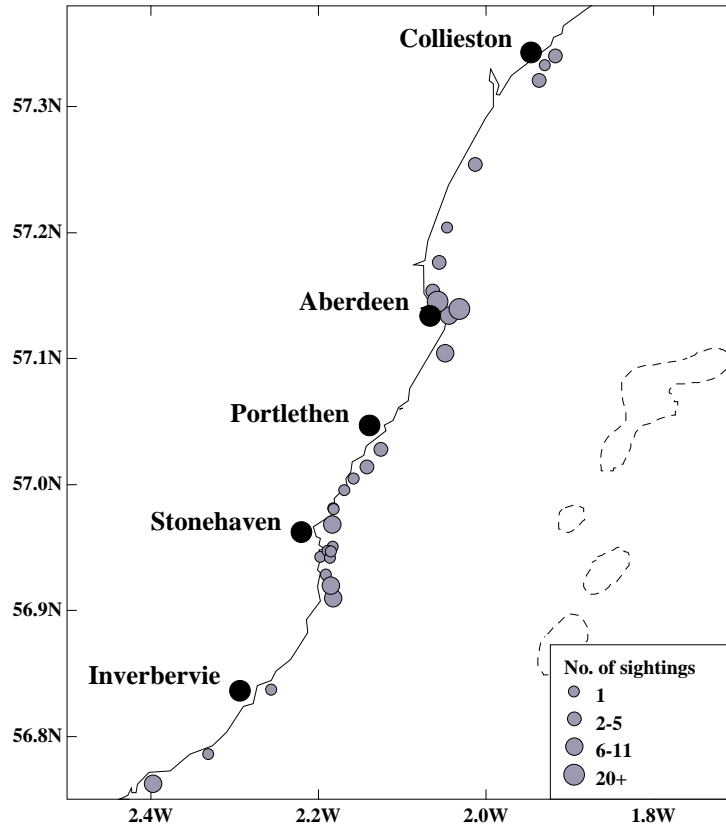
**3.1.5.1 Sightings**

A total of 299 bottlenose dolphin sightings have been recorded since 1992 (comprising 213 casual records and 86 effort-related sightings). However, 92% of these records (n=276) have been collected during 2000-2001. It is unclear whether these figures represent a genuine increase in sightings within the region or rather an increase in observer coverage. However, it is likely to be a result of both factors, since the number of bottlenose dolphins occurring off the coast of Fife has also shown a steady increase since 1992, and particularly since 1996 (Ian Cumming, pers comm.). Anecdotal evidence also suggests an increase in the frequency and number of bottlenose dolphins since 1993, as noted by various ornithologists (Ian Phillips, pers comm.), Aberdeen Harbour Authority (Eddie Aitken, pers comm.) and FRS Marine Laboratory (Tony Hawkins, pers comm.).

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

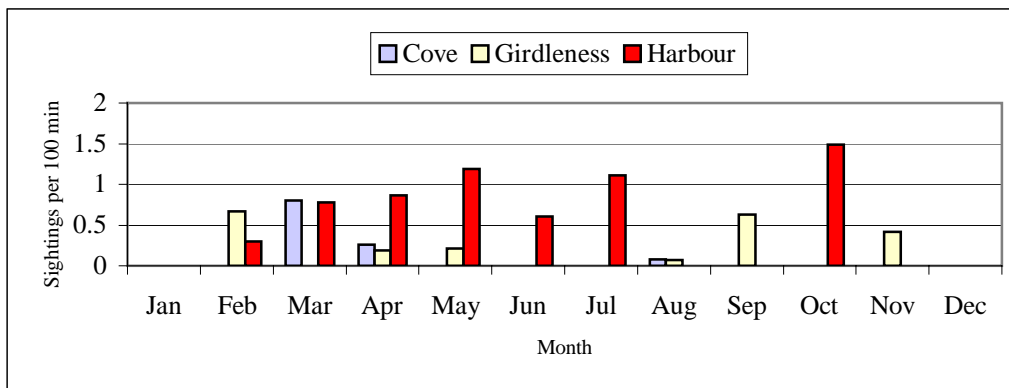
**3.1.5.2 Distribution**

Bottlenose dolphins were recorded along the entire coast of Aberdeenshire (Figure 21). Several sightings were also reported further north off Rattray Head and Fraserburgh.



**Figure 21** Distribution of bottlenose dolphin sightings

The distribution is assumed to be continuous along the coast; the distribution shown here reflects the bias in distribution of observers, rather than an absence of animals. However there was also considerable variation in their occurrence between sites, as shown by effort-related data from the three observation main sites (Figure 22). At Cove, the sightings rate was one sighting for every 953 min of survey effort. This was reduced to a sighting every 529 min at Girdleness, while Aberdeen Harbour had the highest sighting rate of 1 sighting every 122 min.



**Figure 22** Survey sightings per unit effort (SPUE) from the three key study sites

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

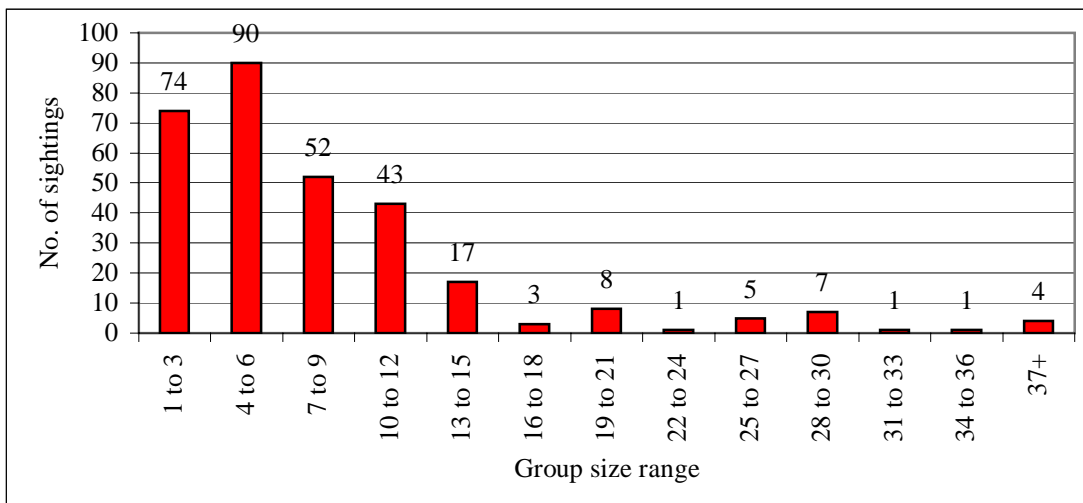
Bottlenose dolphins were predominantly observed in the Harbour region, while the majority of sightings from all three sites were made during the spring months of February to May. At Aberdeen harbour, a single sighting during a month of low survey effort (July) explains a false ‘peak’ in occurrence. Note that no sightings occurred during July at Girdleness or Cove despite high levels of survey effort.

This distribution is likely to be partially explained by the observed behaviour of the animals. Aberdeen harbour clearly provides bottlenose dolphins with a key feeding habitat within the study area, with animals often remaining within the harbour region for several hours whilst engaged in feeding behaviours (Section 3.1.6.5). Over 82% of dolphin sightings in the harbour lasted for longer than 30 min, with 40% exceeding an hour. Eight sightings involved encounters of  $\geq 3.5$  hr, and the longest recorded encounter lasted 6.5 hr. It is clear that bottlenose dolphins may therefore remain engaged in feeding behaviour within the harbour for periods of several hours at a time, greatly increasing the likelihood of being recorded. By contrast, dolphins recorded elsewhere along the coast tended to be in transit, thus sightings frequently were shorter in duration.

**3.1.5.3 Group composition**

Estimating group size and tracking the movements of bottlenose dolphins in the Aberdeen harbour region was often problematic, particularly when only a single observer was present. Dolphins travelling along the coast were normally sighted in fairly compact groups, which were relatively easy to follow, but on entering the harbour the animals frequently segregated into small sub-groups, scattering over a larger area. In some instances groups of 25+ bottlenose dolphins would be present in the harbour region, but all moving apparently independently of each other. In these circumstances it proved impossible to distinguish new animals joining the group, or existing animals moved off. In such circumstances a best estimate of numbers was derived from the number of sub-groups present.

Group size of bottlenose dolphins ranged from 1 to 60, with an overall average of 8 animals per school (mean = 8, median = 6.0). Group size was strongly skewed towards smaller schools of 1 to 6 animals, with schools of over 15 animals proving less common (Figure 23).

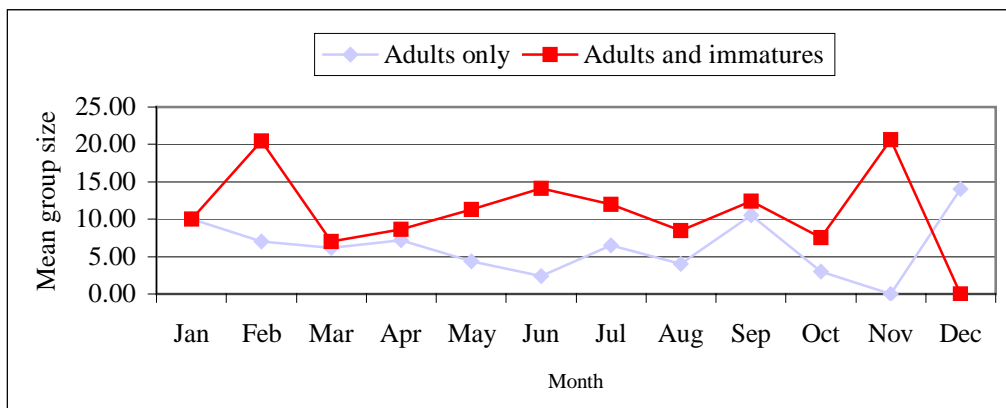


**Figure 23** Frequency of occurrence of group size in Aberdeenshire bottlenose dolphins



**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

Group composition was noted in only 46.5% of bottlenose dolphin sightings (n=139). However, of these sightings, 58 groups consisted of adult animals only, with 72% of these groups (n= 42) containing six or fewer animals (mean = 8). Immature animals (juveniles/calves) were present in 81 sightings, which accounts for over half of those sightings for which group composition was assessed. Groups containing juveniles had a slightly higher mean group size of 10.9 animals, and this tendency for schools containing juveniles to have a larger group size was consistent throughout the year (Figure 24). Immature animals were observed to comprise 16% of the population (based on animals in which group composition was assessed). Very young calves (identified from their relatively small size and from the pale foetal folds (Figure 25) were recorded regularly off Aberdeenshire, particularly during spring and early summer.



**Figure 24** Monthly mean group sizes for bottlenose dolphin groups containing adults only and those including juveniles

**Figure 25** Group of bottlenose dolphins including young calf, identified by foetal folds, pale colouring and small size



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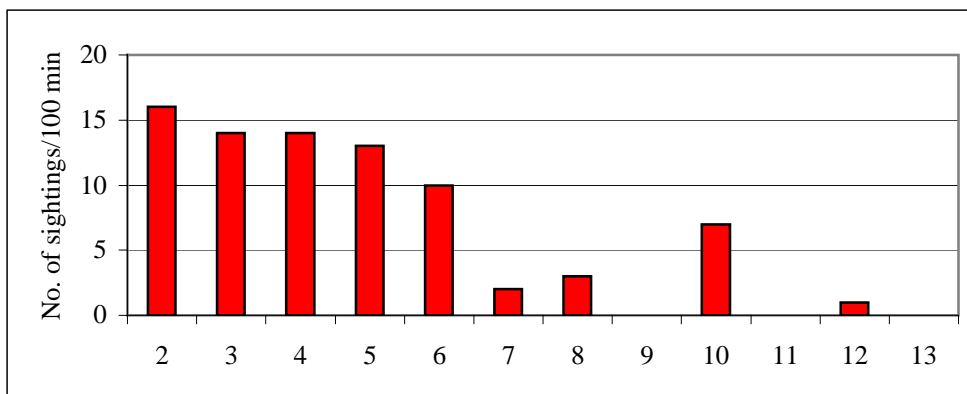
### 3.1.5.4 Seasonal trends

Bottlenose dolphins were recorded along the Aberdeenshire coast throughout the year, but showed distinct temporal patterns in occurrence. Table 6 illustrates the total number of bottlenose dolphin records reported on a monthly basis. N.B. Increased number of sightings in April and May.

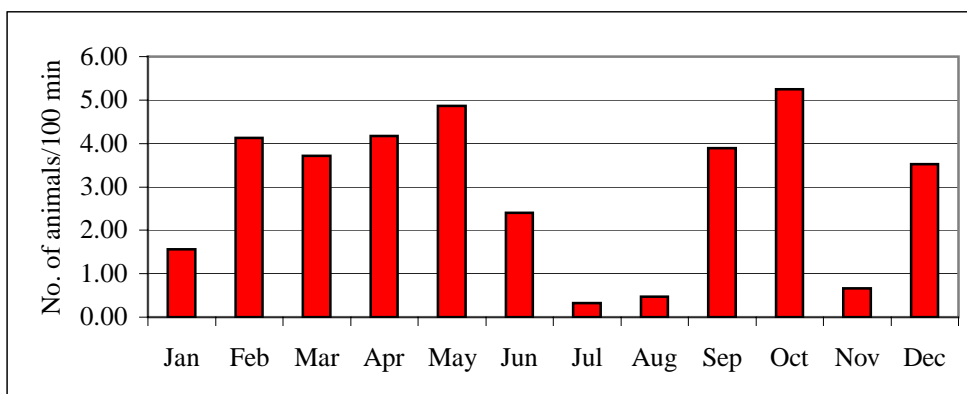
The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

<b>Table 6</b> Monthly distribution of bottlenose dolphin sightings (1992-2001)			
<b>Month</b>	<b>Total no. of sightings</b>	<b>Total no. of animals</b>	<b>Mean group size</b>
Jan	20	136	6.80
Feb	27	273	10.11
Mar	40	258	6.45
Apr	57	406	7.12
May	53	535	10.09
Jun	22	258	11.73
Jul	13	104	8.00
Aug	15	74	4.93
Sep	16	130	8.13
Oct	16	93	5.81
Nov	9	115	12.78
Dec	8	75	9.38

This trend is more apparent using only effort-related data (Figure 26a/b), where both the number of sightings and the number of animals recorded per 100 min watch drops sharply between June and August. The survey data also indicate a peak in both sightings and numbers of animals between March and May, as also noted during vessel-based surveys (Section 3.2.4.1).



**Figure 26a** Monthly number of bottlenose dolphin sightings per 100 min. survey effort



**Figure 26b** Monthly number of bottlenose dolphins per 100 min. survey effort

## **The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

These data suggest that bottlenose dolphins in Aberdeenshire waters show a distinct seasonal peak between March and May, with a decrease in occurrence over the summer months of June to August. It would seem that animals present off the coast of Aberdeenshire over the summer still utilise the harbour waters as a feeding ground since the harbour data trend does not reflect that for the region as a whole (Figure 22). However, it should be noted that there were only 17 sightings (8 during effort-related surveys) of bottlenose dolphins at the harbour between June and August. In this instance it is likely that the dearth of casual sightings is more reflective of the true absence of the animals during the summer rather than the very few dedicated surveys that were undertaken at this time. Although small groups are observed on occasion throughout the year, the main concentration of bottlenose dolphins off the Fife coast occurs between June and September, with distinct peaks in both number and sightings during July and August (Cumming, 1997, 1998, 1999, 2000). This pattern of abundance is also similar in the Moray Firth, where sightings peak in late summer but decline during the spring months (Wilson *et al* 1997).

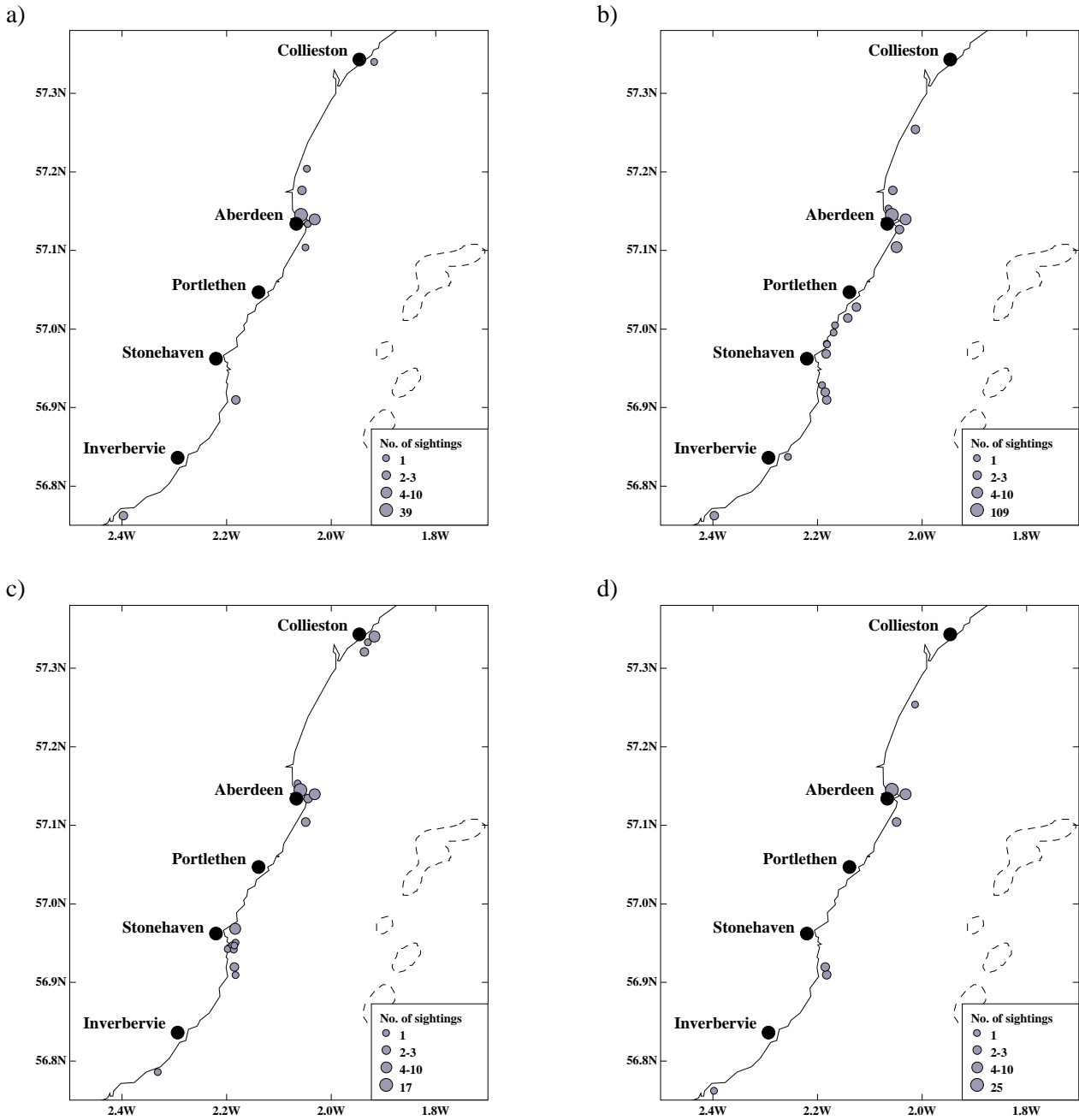
The temporal distribution of bottlenose dolphin sightings is illustrated in Figure 27. Sightings appear both more frequent and more widespread along the Aberdeenshire coast during the spring months of March to May, despite higher effort levels during the summer months of July and August. Indeed, sightings of bottlenose dolphins appear to be more numerous in the autumn and winter than during the summer months, despite little dedicated effort during the winter months of November to January. Despite lower effort levels in the winter, casual sighting records (Table 6) suggest that animals remain present within the region at this time. Indeed, observations made during the present study suggest that bottlenose dolphin numbers increase again from October onwards, with animals utilising the Aberdeenshire region and particularly the harbour area throughout the entire winter period.

### **3.1.5.5 Behaviour**

Many types of behaviour have been recorded off the coast of Aberdeenshire during the present survey. The two major categories of behaviour frequently observed are feeding/foraging, which occurred primarily within the harbour region, and travelling, which was the typical observation elsewhere along the coast. Feeding was recognised by a number of different behaviours. The actual throwing of fish was observed on numerous occasions, as was repetitive breaching and tail splashing. Animals dispersed over an area and constantly changing direction while diving (often lifting their tail flukes) was also interpreted as foraging. On occasion, dolphins were observed feeding co-operatively by apparently herding fish towards one another. The North Pier and South Breakwater (Figure 7) were regularly utilised by the dolphins during their foraging/feeding behaviours, and animals would appear to deliberately move towards the breakwaters, possibly in an effort to trap prey. Feeding animals were most often recorded between the North Pier and South Breakwater, in the Navigation Channel. Occasionally dolphins would travel up the Navigation Channel as far as the Round House, and on several occasions animals were even observed off the end of Albert Quay.

A reaction of bottlenose dolphins to shipping was noted on several instances. The Navigation Channel at Aberdeen Harbour is relatively narrow, and dolphins were often recorded in very close proximity to vessels ranging from small fishing trawlers, large cargo vessels and passenger ferries. Generally, dolphins were observed moving out of the channel as vessels passed through, usually returning to re-commence feeding. On occasion there was evidence to suggest that traffic disrupted dolphin feeding behaviour, as animals took considerable time to return to their previous locations and/or activities. Active avoidance of vessels by bottlenose dolphins was witnessed on occasion; this seemed to occur irrespective of behaviour at the time of disturbance and irrespective of juvenile presence in the group. By contrast, bottlenose dolphins were sporadically observed bow-riding vessels into the harbour, including the large passenger ferries. On this basis, it has proven extremely difficult to draw firm conclusions about the reaction of bottlenose dolphins to vessel traffic. Results from the present study certainly highlight this to be an area requiring further research.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.



**Figure 27** Location of bottlenose dolphin sightings in a) Winter (December to January); b) Spring (March to May); c) Summer (June to August) and d) Autumn (September to November)

## The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

Social behaviour was frequently observed by animals within the harbour, but rarely observed elsewhere along the coast when animals were in transit. Feeding behaviour within the harbour appeared interspersed with rest/social interactions. Social behaviour included synchronous breaching (particularly by juveniles) and side lunging. A particular juvenile dolphin was observed in the harbour on many occasions during March and April 2000. Its range of activities included ‘surfing’ the waves along the North Pier, ‘spy-hopping’ with only the beak and melon protruding from the water, and swimming ‘belly-up’ under the water. On occasion animals were also observed ‘playing’ with litter such as plastic refuse (Figure 28)

**Figure 28** Bottlenose dolphin playing with plastic bag inside Aberdeen Harbour



© Keith Ringland

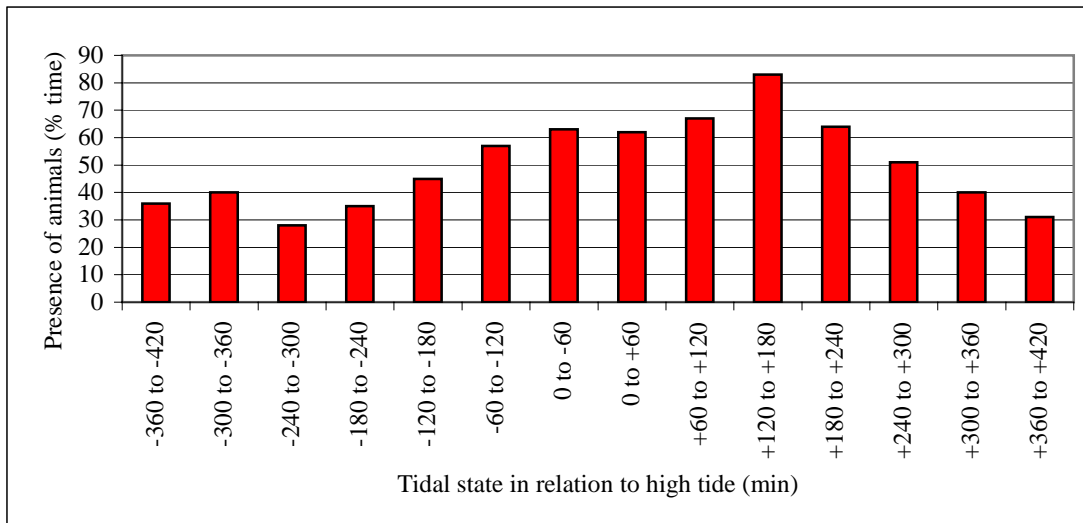
Animals observed outside of the harbour region were typically seen transiting parallel to the coast. Animals were always within 1 km of shore (predominantly within 150 m of land). Between Aberdeen and Fowlsheugh animals regularly passed the cliffs within 20 m of shore. Animals recorded transiting were usually in closely aggregated groups, although there may be several sub-groups within a few minutes of each other. Transiting animals were usually recorded swimming slowly and regularly surfacing, but on occasion animals were moving rapidly and porpoising through the water. Breaching was observed in transiting animals, but feeding was rarely recorded out with the harbour region. Animals travelling along the coast periodically approached and travelled alongside vessels, even in the presence of very young calves.

### 3.1.5.6 Tidal analysis

Bottlenose dolphins were observed within the harbour for a total of 4,211 min. It is generally acknowledged that the dolphins enter the harbour primarily to feed, as demonstrated by the behaviour described in section 3.1.6.5. Observations made during the present study suggest that the harbour region provides bottlenose dolphins with an important feeding area off Aberdeenshire. It is possible that the state of tide within the harbour may therefore have an important role in determining the presence of dolphins.

Effort-related sightings of bottlenose dolphins occurring within the vicinity of Aberdeen Harbour were used for tidal analysis (n=61). 72.1% of these sightings were classified as encounters, as the animals remained within the vicinity for extended periods of time (>30 min). The results illustrate that bottlenose dolphins were present within the harbour at all states of the tide (Figure 29). However, there was a peak in utilisation at 2 to 3 hours preceding high tide.

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**



**Figure 29** Utilisation of Aberdeen harbour by bottlenose dolphins, in relation to tidal state

From three hours after high tide, the occurrence of bottlenose dolphins in the harbour shows a steady decrease during the ebb tide. These data suggest bottlenose dolphins favour high tide and the succeeding period of four hours after high tide.

### 3.1.6 White-beaked dolphin

#### 3.1.6.1 Sightings

During the present study 103 white-beaked dolphin sightings were reported, comprising 55 casual records and 48 effort-related sightings. White-beaked dolphins have been reported since 1993 and it is likely that their presence in the coastal waters of Aberdeenshire is very regular on an annual basis. White-beaked dolphins distinctly showed a more offshore distribution than either harbour porpoises or bottlenose dolphins. Animals were often located from distant splashes (visible several km from shore) and identified using telescopes. In the peak of summer (August) it was possible to observe white-beaked dolphins very easily from shore with the naked eye, but during other months it was necessary to scan with binoculars and/or telescope to detect them. Inexperienced observers therefore reported very few white-beaked dolphins; the majority of animals were observed by ornithologists carrying out dedicated telescope watches for seabirds, effort-related watches from Souter Head by one of the authors, and from effort-related boat-based bird surveys between Stonehaven and Fowlsheugh seabird colonies. As a result, the vast majority of white-beaked dolphin sightings came from cliffs and headlands or from vessels: only 10 sightings were recorded from shallow bays such as Nigg Bay, Aberdeen beach and Forvie.

#### 3.1.6.2 Distribution

The vast majority of white-beaked dolphin sightings were recorded along the coast between Girdleness and Fowlsheugh (Figure 30). Although this may be partly due to the location of observers, it is also noticeable that along this stretch of coast, the 20 m depth contour lies within 1 km of land, and the 30 m within 1.5 km. Along the rest of the region, the 20 m contour is up to 3 km from the coast and the 30 m contour up to 6 km. The coastline between Aberdeen south to Fowlsheugh therefore comprises relatively deep water in proximity to cliffs, and it is possible that this deeper water may be governing the coastal distribution of white-beaked dolphins.

White-beaked dolphins were sighted further from shore than any other species, with an average distance from shore of 1-2 km. However, they were also observed within 500 m of the cliffs during peak summer.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

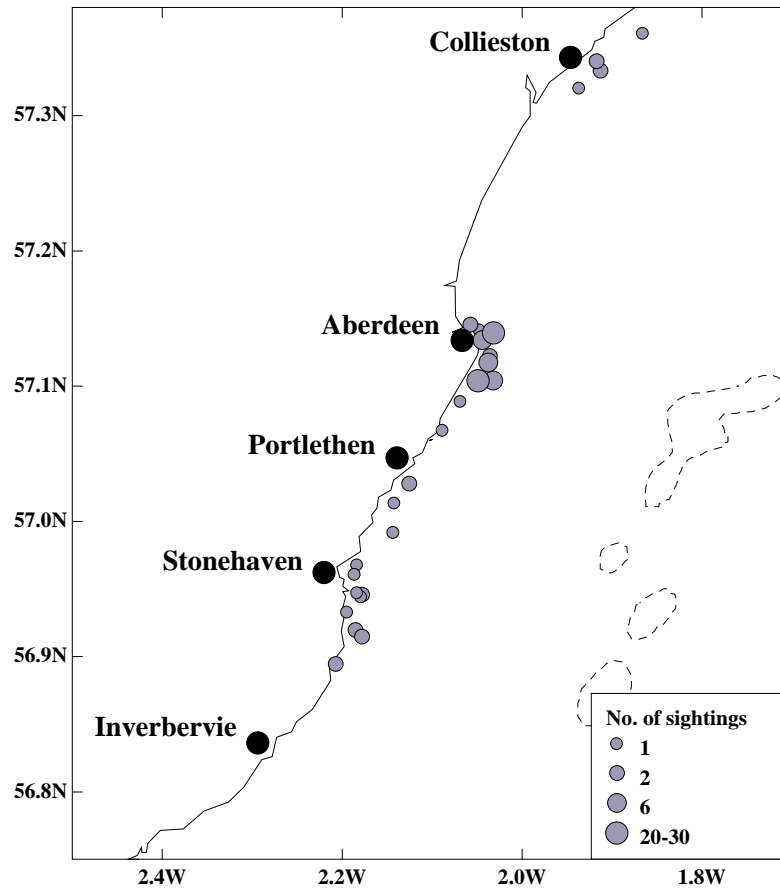


Figure 30 Distribution of white-beaked dolphin sightings

### 3.1.6.3 Group composition

Group size of white-beaked dolphins varied between 1 and 100 animals (although the 100 animals reported comprised of several sub-groups). The majority of white-beaked dolphin schools (>95%) contained 20 or fewer individuals (Figure 31). The mean group size was 7.7 animals (median = 4, mode = 2). Only five sightings involved more than 20 animals: single groups of 25, 30 and 100 animals, and two groups of 32.

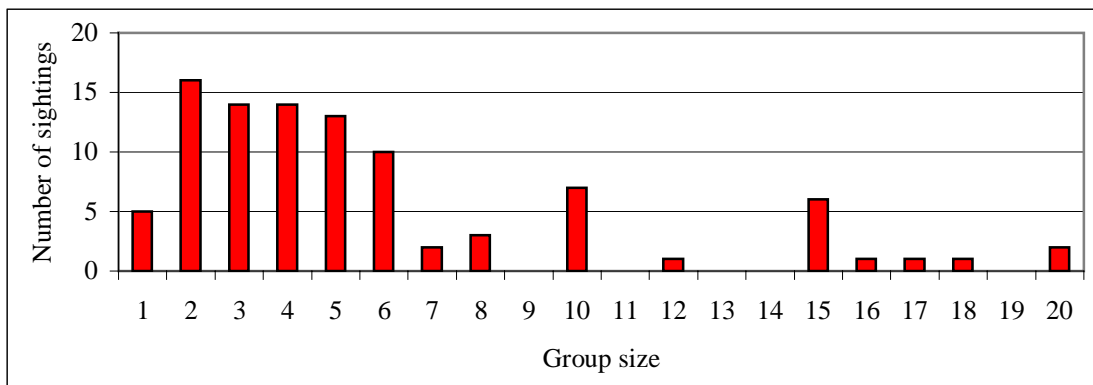


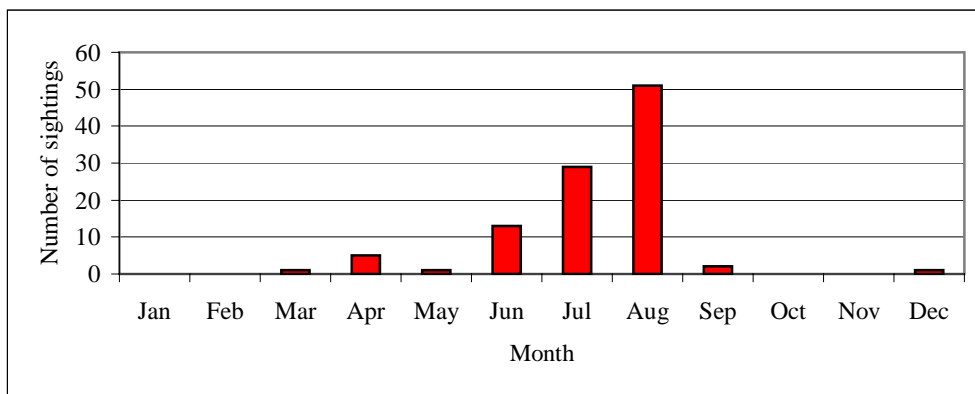
Figure 31 Frequency of group size in white-beaked dolphins

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

Group composition was assessed during 58 white-beaked dolphin sightings (395 animals). Juvenile white-beaked dolphins were present in over 60% (n=35), while 23 groups consisted of adults only. The mean group size of pods of adult white-beaked dolphins was 4.22 animals, which increased markedly to a mean of 8.51 animals in the presence of juveniles. As expected, mother-calf pairs tended to closely associate in white-beaked dolphin schools. During June 2000 a recognisable individual with a white horizontal stripe from the trailing edge of the dorsal fin, was watched for several consecutive evenings. This animal was assumed to be an adult female as it was closely accompanied at all times by a very young calf. The marked adult and her calf were part of a small pod of dolphins including another adult dolphin with a juvenile, and a larger adult with a more prominent dorsal fin that was thought to be a mature male.

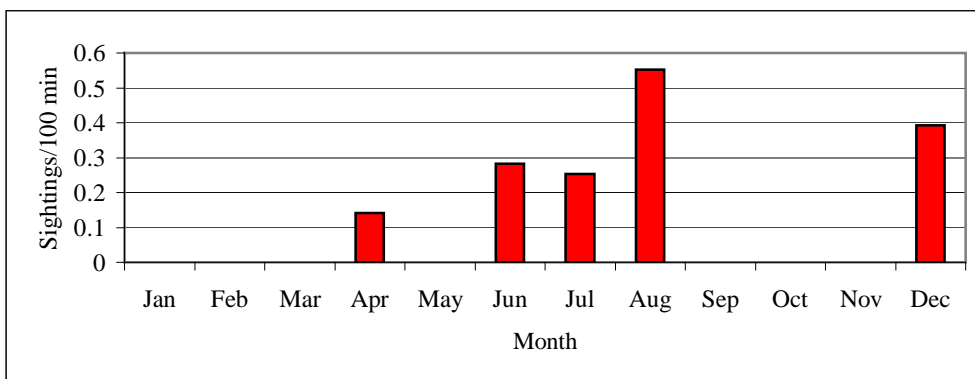
**3.1.6.4 Seasonal trends**

White-beaked dolphins showed a very distinctive seasonal occurrence, being recorded almost entirely in the summer months of June to August, with a very clear peak during August (Figure 32).



**Figure 32** Monthly distribution of all white-beaked dolphin sightings

The pattern of occurrence over the summer months is also reflected by effort-related survey data in Figure 33 (N.B. Anomalous data in December results from a single sighting during a month of very low effort).



**Figure 33** Effort-related seasonal trend in white-beaked dolphin sightings



## **The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

There was evidence to suggest that individual white-beaked dolphins remain within an area over a period of days. The distinctive individual white-beaked dolphin described in section 3.1.6.3 was observed on several successive evenings from Souter Head, Cove during June 2000 (Caroline Weir, pers obs.), and a very similarly marked animal with a distinctive broad white stripe on its dorsal fin was seen on several occasions off Girdleness and Stonehaven in August 1996 (Ian Phillips, pers comm.). Certainly, white-beaked dolphins could be viewed from cliffs along Cove on almost every evening between June and August 2000, so it seems likely that these animals move into coastal Aberdeenshire on a seasonal basis and may remain throughout the summer months.

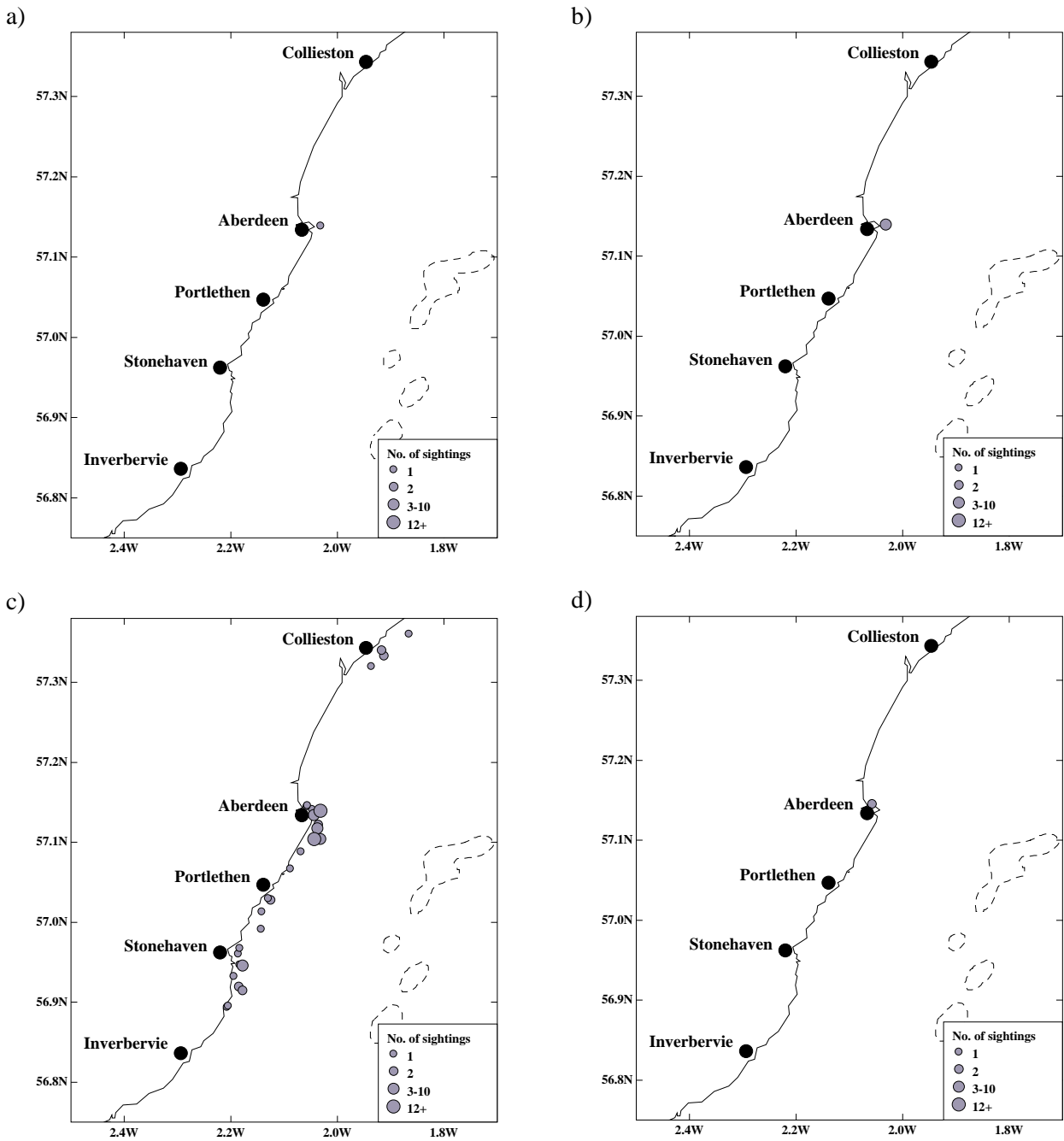
The seasonal distribution of white-beaked dolphin sightings is illustrated in Figure 34. It appears that white-beaked dolphins are very much summer inhabitants of Aberdeenshire coastal waters, sightings at other times of the year being relatively scarce. Immature dolphins were recorded in over half of white-beaked dolphin groups. All juveniles occurred between June and August, peaking in July when 65% of aged schools contained juvenile animals.

### **3.1.6.5 Behaviour**

The cliffs at Souter Head provided an ideal platform to observe white-beaked dolphins behaving 'normally' in the wild. Although the species is common in Scottish waters, it is most often recorded during vessel-based transects when its behaviour is affected by the presence of the survey boat. Few locations allow the undistributed observation of this oceanic species of dolphin. The presence of white-beaked dolphins in the coastal waters of Aberdeenshire appeared to be in response to the availability of prey species; animals being engaged in feeding behaviour for the majority of the time. Dolphins were seen tossing fish in the air on several occasions, often repeatedly over a short period of time. Tail-slapping was common during feeding, along with breaching. Breaching appeared to have an important role during fish-herding behaviour. White-beaked dolphins frequently displayed co-operative feeding behaviour, where a group of dolphins would split into sub-groups to herd fish. Dolphin sub-groups would spread out over a wide area (>1 km) in a seemingly random fashion and then converge on an area where fish had presumably been concentrated. Again, breaching frequently formed a component of this behaviour.

In contrast to bottlenose dolphins, white-beaked dolphins were very rarely seen transiting purposefully in a particular direction, but rather seemed to forage irregularly along the coast with constant changes of direction and speed. It is possible that rather than transiting between distinct foraging areas as seems to be the case with bottlenose dolphins, the white-beaked dolphins were finding prey throughout the region, and exhibiting little else other than foraging/feeding behaviours. Little recognisable play/social behaviour was observed in this species, although a young calf was observed breaching continuously close to shore for several minutes during a survey in July 2000. White-beaked dolphins were observed bow-riding cargo vessels on two occasions off Souter Head: on both occasions, the animals appeared briefly at the bow of the vessels before departing to resume former groups and activities. Dolphins also approached the small tour boats operating out of Stonehaven, including the research vessel used in the present study.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.



**Figure 34** Location of white-beaked dolphin sightings in a) Winter (December to January); b) Spring (March to May); c) Summer (June to August) and d) Autumn (September to November)

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

### 3.1.7 Common dolphin

A sighting of two common dolphins was recorded off Girdleness Point in August 1994 by an experienced observer. Although Evans (1980) reports common dolphins as relatively frequent off northeast Scotland, this was certainly not the case in the present survey. However, the pelagic nature of this species may have led to them being under-recorded in coastal surveys conducted during the present study. The species is more typical of warm water to the southwest of the UK, and may be genuinely scarce in the North Sea, although there is evidence from stranding records, that the species may show long-term temporal variation within the North Sea (Peter Evans, pers comm.). The Atlantic white-sided dolphin is regularly misidentified as the common dolphin by inexperienced observers in North Sea waters (Weir, 2001) and the common dolphin may therefore be scarcer in the region than presently recognised. Two small groups of dolphins thought to be this species were recorded off Fowlsheugh in 1993 and Girdleness in 1995 (Ian Phillips, pers comm.).

### 3.1.8 Atlantic white-sided dolphin

A single Atlantic white-sided dolphin was recorded with a small group of bottlenose dolphins (3-4 animals) at Collieston in July 1999. The group of dolphins were seen travelling in a south-easterly direction along the coast by an experienced observer. Atlantic white-sided dolphins are most frequently sighted in deep-offshore waters along the shelf break (Weir *et al.* 2001), but have also been regularly reported in the shelf waters of the central and northern North Sea (Weir, 2001; Evans, 1980, 1992). Mixed schools of Atlantic white-sided and bottlenose dolphins have been reported in offshore waters (Pollock *et al.* 2001), but the sighting reported in the present study appears unusual due to its coastal nature.

### 3.1.9 Long-finned pilot whale

Pilot whales are relatively easy to identify at sea, but only two sightings of this species were reported in the present study. A pod of whales (10+ animals) were observed moving slowly off Donmouth in March 1999. In October 2001, five animals including one juvenile, was observed 2 miles off Findon. The long-finned pilot whale is mostly pelagic in nature, feeding primarily on deep-water squid. However, movements into the North Sea are not uncommon with animals regularly recorded from offshore installations in the central and northern regions (Weir, 2001; Sea Watch, unpubl. data.). Pilot whale sightings in coastal waters peak over the autumn and winter months (Evans, 1991, 1992). As such, this species may be under-recorded in the present survey due to the lower levels of coverage over the winter, especially in relation to vessel-based effort.

### 3.1.10 Killer whale

There have been five sightings of killer whales reported during the present study period, and all except for one occurred over the summer months between June and August (Table 7). The exception was a single adult male observed off Stonehaven during October 2001.

<b>Table 7 Killer whale sightings off Aberdeenshire (1999-2001)</b>			
<b>Number of animals</b>	<b>Date</b>	<b>Location</b>	<b>Direction of movement</b>
3/4	12/7/99	Collieston	NE
2/3 (incl. 1 male)	28/8/99	Muchalls	S
1 (female/immature)	13/6/00	Cove	S
6	28/8/01	Girdleness	N
1 (male)	9/10/01	Stonehaven	Unknown

## **The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

Killer whales are regularly observed in the central and northern regions of the North Sea, as far south as the Farne Islands. The occurrence of killer whale sightings between June and August in the present dataset, is reflected for the whole of the east coast of Scotland and England in larger datasets. Such a trend may reflect a movement of animals inshore, possibly following prey species such as salmon and herring (Evans, 1988). Two other sightings from the study area reported by Hammond and Lockyer (1988) involved groups of 4 and 2 animals, moving southwards during July.

A further two casual killer whale sightings have been reported during sea-watches in the region (Ian Phillips, pers comm.). The first of these involved a male and two females off Aberdeen beach in July 1989. Seals had apparently hauled out onto the beach during this sighting and several harbour porpoises were observing moving into very shallow waters, perhaps suggesting that these particular animals were transient whales that hunt other marine mammals. The second group were also recorded during the month of July off Girdleness. These two sightings provide further evidence for the seasonal occurrence of this species in the region.

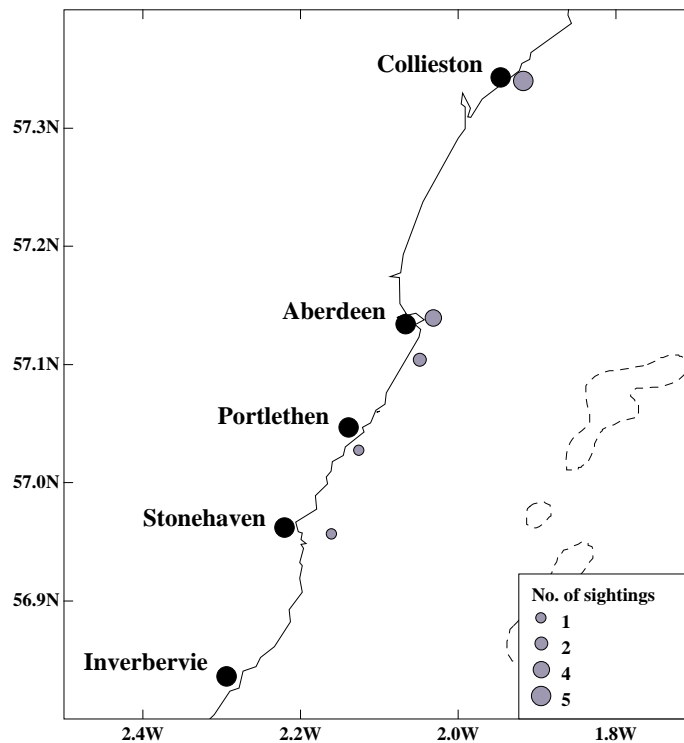
### **3.1.11 Minke whale**

There have been 13 sightings of minke whales during the present study, with a total of 24 animals being reported. The majority of sightings have involved single animals and, on occasion, pairs of animals (n=4). An exception was an aggregation of whales sighted off Girdleness Point August 1997 (8-10 animals), one of which was observed to breach a mile from shore. The animals appeared to be in association with two fin whales, bottlenose and white-beaked dolphins and harbour porpoise.

All 13 of the minke whale sightings reported in the present study occurred during July and August, suggesting a distinct seasonal occurrence within Aberdeenshire coastal waters. A similar seasonal trend was also found by Northridge *et al.* (1995) for the east coast of Northern England, and off the coast of Fife, where majority of sightings between 1997 and 2000 have occurred between August and October (Cumming, 1997, 1998, 1999, 2000).

All reported sightings involved adult animals, although a juvenile minke whale was recorded during a vessel-based survey (Section 3.2.6). Minke whale sightings have occurred from headlands at Collieston, Girdleness and Cove, with single sightings off Newtonhill and from a vessel off Stonehaven (Figure 35). Over recent years (1992-2001) there have been numerous (n=7) minke whale strandings occurring along the Aberdeenshire coast, and also along the adjacent coastlines of the Moray Firth and Fife (n=4) (Unpubl. data, SAC 2001). Nearly two thirds of these strandings (63.6%) have taken place in the months August to October, again suggesting the seasonal presence of this species off North East Scotland.

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**



**Figure 35** Distribution of minke whale sightings from land-based surveys and casual records.

Minke whales were not observed to travel in any particular direction and it is uncertain as to whether animals were moving through Aberdeenshire waters during July and August in any distinct migration pattern. However, the majority of sightings involved feeding animals, including some individuals that were observed lunge-feeding. Feeding associations between minke whales and harbour porpoises were observed on several occasions, suggesting a possible common prey source. In the coastal waters of northern Norway, minke whales caught during the summer and autumn were found to have been feeding predominantly on herring (Haug *et al.* 1995), and it is possible that herring schools in Aberdeenshire waters attract both porpoises and minke whales during August.

### 3.1.12 Fin whale

In August 1997, two fin whales were recorded off Girdleness Point by several experienced observers. The animals were surfacing several kilometres off the headland, but observers on shore using telescopes reported tall, vertical blows, long backs and relatively small, sloping dorsal fins. Minke whales, bottlenose and white-beaked dolphins and harbour porpoises were also observed in the area on the same evening, suggesting that unusual feeding conditions may have brought the fin whales close in to shore. Probable fin whales were also recorded in the North Sea during a survey in July 1995, including one animal feeding close to shore in the company of harbour porpoises off Fraserburgh (Camphuysen & Winter, 1995), and a small number have been recorded from offshore oil-rigs in the North Sea (Weir, 2001). Fin whales are common over continental shelf waters off the northeastern United States during the summer months (Hain *et al.* 1992), but tend to be more typical of deep-water, offshore habitat in UK waters (Pollock *et al.* 2000). However, it seems likely that a small number of fin whales occur annually in North Sea waters.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

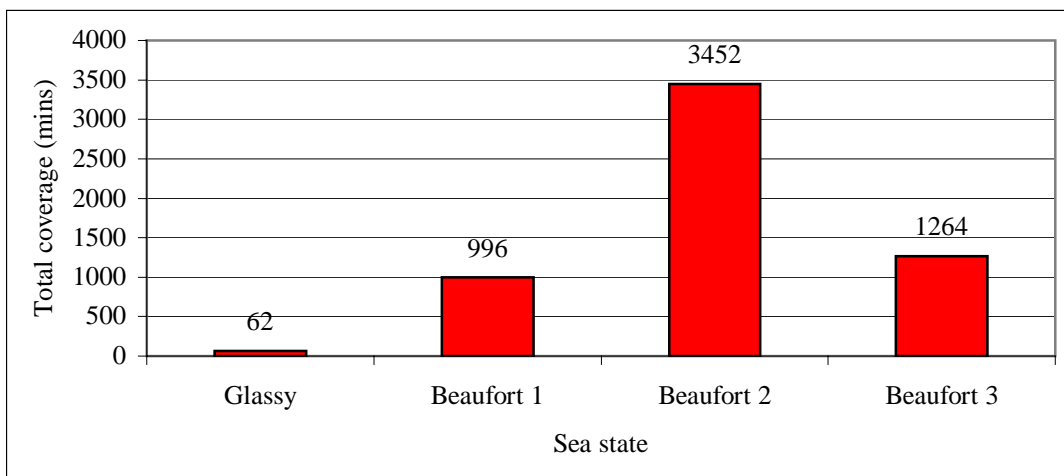
### 3.2 Vessel-based surveys

#### 3.2.1 Survey coverage

A total of 29 dedicated vessel-based surveys were conducted between May 1999 and October 2001. Due to weather constraints, no vessel-based surveys were carried out over the winter months of November to February. The majority of surveys ran northwards along the coast between Stonehaven and Aberdeen, covering a total return distance of approximately 24 km. On two occasions, the vessel surveyed the area south of Stonehaven to Inverbervie. On all except for two of the surveys, one or both of the authors were present to provide a level of consistency and experience. On the other two surveys, suitably experienced and trained volunteers were utilised.

In general, surveys were in good weather conditions for detecting cetaceans. However, three surveys (<sup>1</sup>30/9/00, <sup>2</sup>21/4/01 and <sup>3</sup>1/9/01) are not included further in this report since they were carried out in conditions deemed unsuitable for detecting cetaceans (<sup>1,2</sup>sea state of higher than Beaufort 3; <sup>3</sup> fog).

The remaining 26 surveys were carried out in a sea state of 3 or less and in good visibility. The majority of surveys (60%) occurred in sea state 2 (Figure 36), and it is broadly considered that the detection of cetaceans during vessel-based surveys would not have been unduly affected by weather conditions.



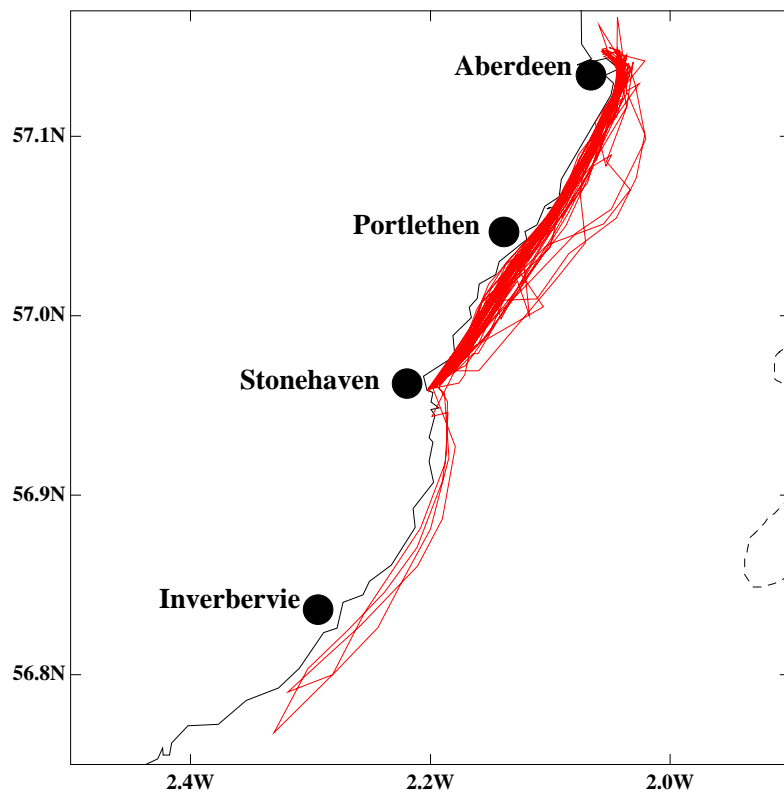
**Figure 36** Total vessel-based survey coverage (mins) in various Beaufort sea state conditions

A total of 5,774 minutes of vessel-based coverage was obtained during the 26 surveys. Vessel-based survey coverage peaked over the summer months between May and August, with May having the highest level of coverage (Table 8). The peak in survey coverage during the summer period is explained by both calmer sea conditions and by longer daylight hours.

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

<b>Table 8 Monthly distribution of vessel-based survey coverage (1999-2001)</b>		
<b>Month</b>	<b>Number of surveys</b>	<b>Total coverage (mins)</b>
March	1	195
April	1	200
May	8	1,813
June	4	803
July	2	505
August	6	1,383
September	3	630
October	1	245
<b>TOTAL</b>	<b>26</b>	<b>5,774</b>

The extent of vessel-based survey coverage is shown in Figure 37. It can be seen that survey coverage is concentrated along the coast between Stonehaven and Aberdeen, within about 1.5 km of the coast. On occasion, and when weather permitted, coverage extended as far as 3.5 km from the coastline. However, the vessel remained in coastal waters where the chance of encountering the focus species bottlenose dolphins, was considered higher.



**Figure 37** Plot of the routes taken during 26 vessel-based surveys (1999-2001)

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

### 3.2.2 Cetacean sightings

A total of 96 cetacean sightings were made during dedicated vessel-based surveys (Table 9). These comprised four cetacean species, the harbour porpoise, bottlenose and white-beaked dolphins and the minke whale. An additional two sightings were made of unidentified dolphins or porpoises.

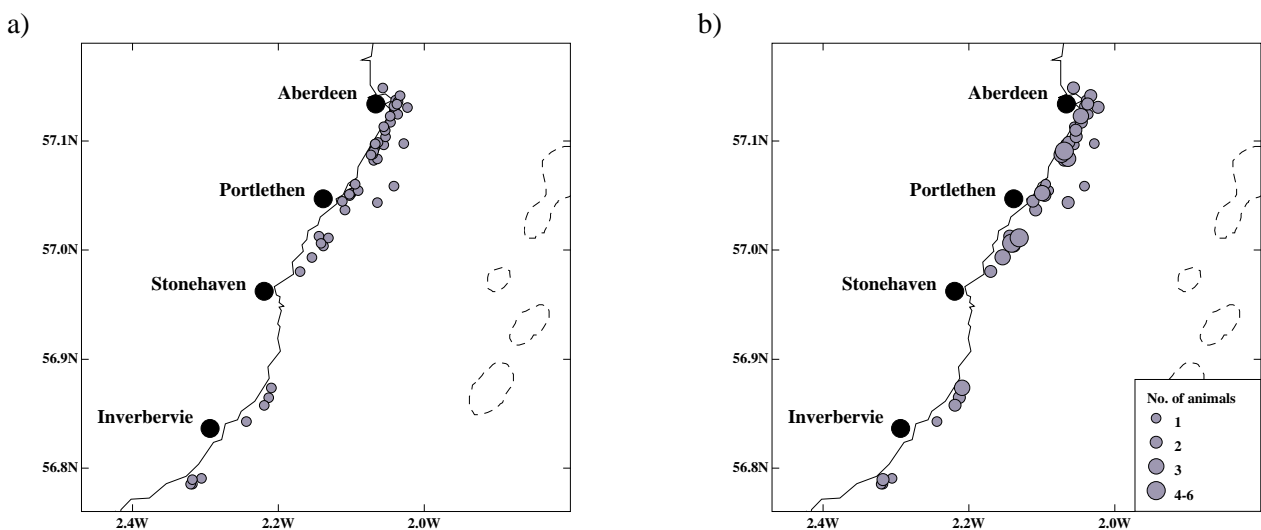
<b>Table 9</b> Total number of cetaceans recorded during vessel-based surveys (1999-2001)		
<b>Species</b>	<b>Total number of sightings</b>	<b>Total number of animals</b>
Harbour porpoise	49	92
Bottlenose dolphin	23	180
White-beaked dolphin	20	91
Unidentified dolphin sp.	2	4
Minke whale	2	2
<b>TOTAL</b>	<b>96</b>	<b>369</b>

In general, cetacean sightings made during vessel surveys were brief (< 30 min), and predominantly involved transiting. On occasion, both dolphin species were recorded interacting with the vessel for longer periods, and photo-identification work was attempted while animals were in proximity to the survey vessel.

### 3.2.3 Harbour porpoise

The harbour porpoise was the most frequently sighted cetacean species during dedicated vessel-based surveys, with a total of 49 sightings and 92 animals recorded. Porpoise sightings were usually very brief, and predominantly involved animals breaking the surface several times before diving. The authors observed no obvious positive or negative reaction to the presence of the survey vessel

Harbour porpoises were recorded throughout the vessel survey area, but exhibited a distinctly clumped distribution around Findon Ness to the north of Portlethen, and between Cove Bay and Girdleness (Figure 38). Porpoises were recorded predominantly along the coast, but several sightings also occurred on transects which ran further from shore (up to 3.5 km offshore).

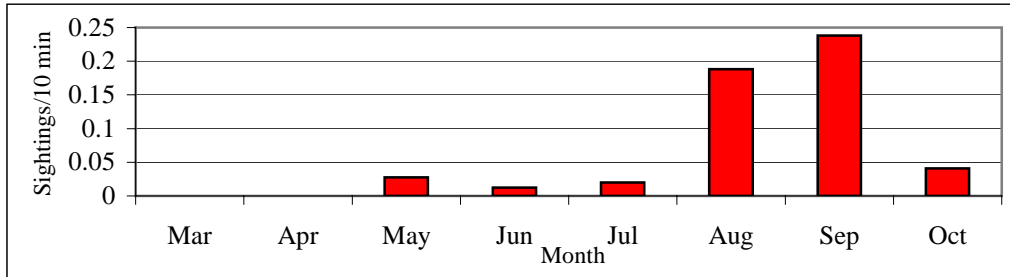


**Figure 38** Location of harbour porpoise a) sightings and b) numbers from dedicated vessel-based surveys 1999-2001



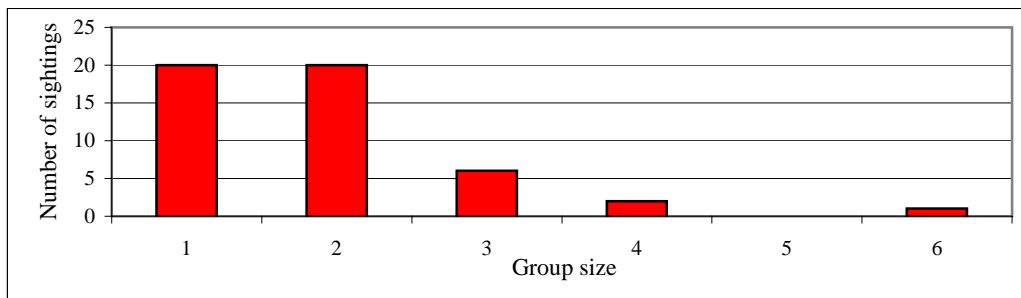
**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

Sightings of harbour porpoises peaked during August and September (Figure 39), with a low sightings rate during other months of the year.



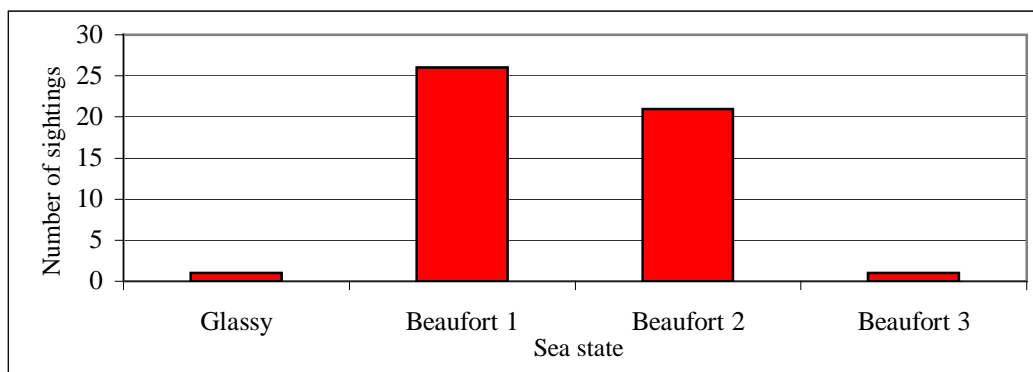
**Figure 39** Monthly distribution of harbour porpoise sightings

Group composition was assessed during 90 porpoise sightings. Immature animals (juveniles and calves) accounted for 17.7% of the total number of observed animals. Over 93% of these immatures were sighted during August and September. Harbour porpoises were predominantly sighted as single animals or in pairs (Figure 40), although occasionally groups of between 3 to 6 animals were observed.



**Figure 40** Group size of harbour porpoise

Harbour porpoise sightings were likely to have been affected by sea state, since the detection rate of porpoises decreases markedly as sea state increases (Palka, 1996). Figure 41 illustrates that the majority of porpoise sightings occurred in sea state 1 and 2. Over 52% of sightings occurred in sea state 1, despite only 17% of survey effort occurring during this sea state.



**Figure 41** Number of harbour porpoise sightings in relation to sea state

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

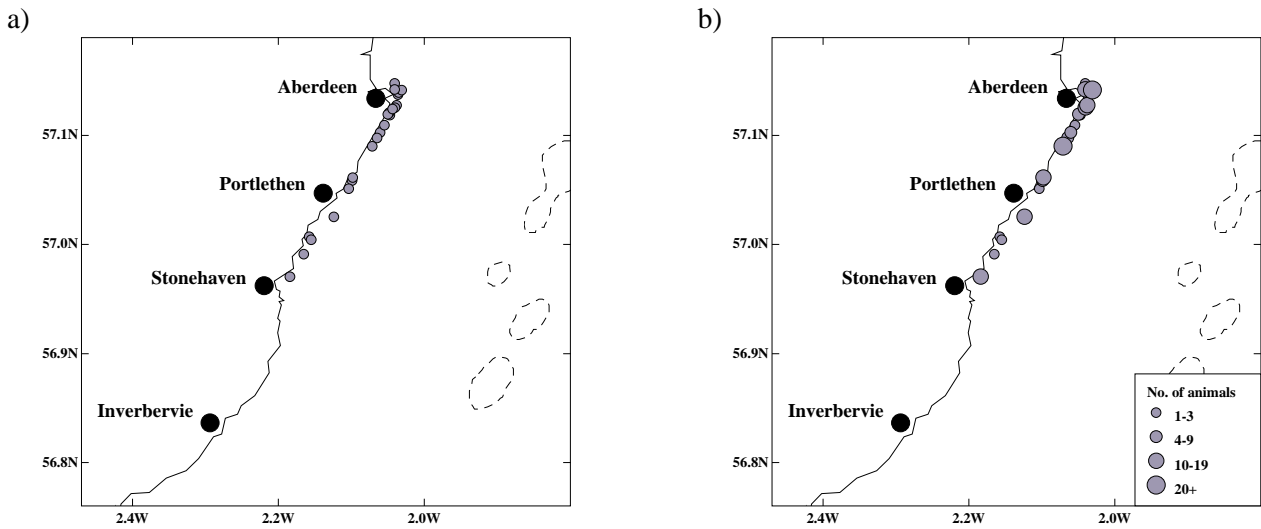
### 3.2.4 Bottlenose dolphin

#### 3.2.4.1 Sightings and distribution

Bottlenose dolphins were sighted on 23 occasions during vessel surveys, and were the most numerous cetacean species recorded with a total of 180 animals. Dolphins were frequently encountered transiting along the coast, often while feeding off Girdleness and the harbour area. All sightings occurred within 1 km of the coastline, and most were within a few hundred metres from land. Bottlenose dolphins proved to be very tolerant of the survey vessel and often travelled alongside the boat for prolonged periods during transects. Four encounters exceeded an hour in length, and on one occasion in May 2000 dolphins travelled with the survey vessel for over 2 hours in total.

Bottlenose dolphins were very obvious at sea, being large and distinctive animals. Both their high detectability and also their inquisitive behaviour suggest that it is unlikely that animals were over-looked during vessel-based surveys.

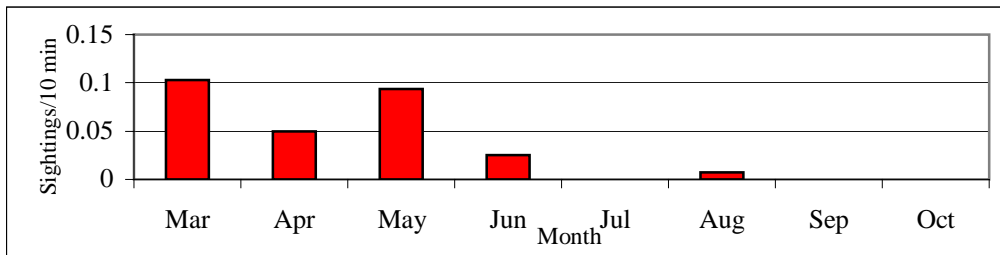
Dolphin encounters occurred almost everywhere along the coastline, although a larger number of sightings are located along the stretch of coast between Cove Bay and Aberdeen Harbour (Figure 42). Sightings are fewer in the southern portion of the survey area between Portlethen and Stonehaven. The two surveys that ran southwards between Stonehaven and Inverbervie occurred during June and August, which land-based surveys have shown is not the peak time of occurrence for bottlenose dolphins. The scarcity of sightings over this area does not therefore reflect an absence of animals, but rather a lack of coverage at appropriate times of the year.



**Figure 42** Location of bottlenose dolphin a) sightings and b) numbers from dedicated vessel-based surveys 1999-2001

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

Bottlenose dolphin sightings showed a very marked seasonal distribution. Dolphins were recorded between March and August, with sightings occurring principally during March and May (Figure 43). Despite adequate levels of survey coverage and good sighting conditions between July and September, only one bottlenose dolphin sighting was recorded at this time.



**Figure 43** Monthly distribution of bottlenose dolphin sightings

Group sizes of bottlenose dolphins ranged from single animals to a group of 28. Over 56% of sightings involved groups of 4 or fewer animals, while two sightings were of large groups containing over 20 animals. Juveniles formed over 20% of the total number of animals observed. Group size of bottlenose dolphins was much larger when juveniles were present in the school. The mean group size of adult only schools was 2.4 animals, as opposed to 12.8 in the presence of immature animals.

### 3.2.4.2 Photo-identification

Due to logistical constraints, no dedicated photo-identification of bottlenose dolphins occurred until 2001. However, on a single occasion during March 2000, animals were photographed closely from land at North Pier at Aberdeen Harbour (Figure 28), resulting in the successful identification of two individuals (A1 and A15). Both of these animals were subsequently recorded again in 2001 during vessel-based surveys (Table 10).

Six vessel-based encounters between April and August 2001 yielded photo identification opportunities. Approximately 1,200 photographic frames were taken during these encounters, and a total of 17 animals were identified (Figure 44). Of these, 41.2 % (n = 7) were re-encountered during subsequent vessel surveys during the 15-week field season (Table 10). Over 70% of animals (n = 12) were distinguished by more than one type of identifiable feature. Permanent features e.g. nicks, certain types of pigmentation and dorsal fin shape accounted for 82.4 % of identifications (n = 14). Semi-permanent features alone, e.g. skin lesions accounted for the identification of a further 17.6 % of animals (n = 3).

The number of marked individuals identified in each encounter ranged from 1 to 7 animals (mean = 2.8, median = 2.5). A third of individuals (29.5%) were identified using both left and right hand side dorsal fin images (n = 5), whilst 70.5% of animals were identified from either left hand side (n = 10) and right hand side (n = 2) images alone. These single-sided records accounting for 58.6% and 11.9% of identified animals respectively.

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

<b>Table 10 Individual bottlenose dolphins catalogued in Aberdeenshire coastal waters</b>		
<b>Animal ID No.</b>	<b>Date of first encounter</b>	<b>Date of re-sighting</b>
A1	23/06/01	04/08/01
A2	04/08/01	11/08/01
A3	04/08/01	N/A
A4	04/08/01	N/A
A5	12/05/01	23/06/01
A6	04/08/01	N/A
A7	23/06/01	N/A
A8	23/06/01	N/A
A9	23/06/01	N/A
A10	28/04/01	12/05/01
A11	28/04/01	N/A
A12	05/05/01	23/06/01
A13	23/06/01	N/A
A14	28/04/01	05/05/01
A15	23/06/01	N/A
A16	23/06/01	N/A
A17	05/05/01	12/05/01

\*A1 and A15 were recorded from land on 5/3/00. All other sightings from vessel.

It is likely that the animals present in Aberdeenshire waters form part of the resident Moray Firth population, given the isolated nature of this population from any other recognised bottlenose dolphin populations in the UK, and the extension of the Moray Firth’s coastline southwards into Aberdeenshire waters. Although a proportion of animals identified along the Aberdeenshire coast are recognised as animals observed in the Moray Firth, it is still not possible to conclude that all animals observed in Aberdeenshire waters form part of this resident population. This is largely due to the small sample size of identified animals in the present study (n=17). However, despite discussion of a possible offshore sub-population (Carter *et al.* 2001) this remains the most probable scenario. Should this prove correct, it would suggest that at least 13.2 % of the estimated Moray Firth dolphin population (n = 129) were utilising Aberdeenshire waters during 2001. Indeed, given the small scale of this pilot study, it is suggested that 13.2 % may be a very conservative estimate, and that the percentage of Moray Firth animals present in Aberdeenshire waters is actually far greater.

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

a) Animal A1 (L)



b) Animal A2 (L)



c) Animal A3 (L)



d) Animal A4 (L)



e) Animal A5 (L)



f) Animal A6 (L)



**Figure 44 a-f** Individual bottlenose dolphins, A1-A6, identified in Aberdeenshire waters during vessel-based surveys in 2001

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

g) Animal A7 (L)



h) Animal A8 (L)



i) Animal A9 (L)



j) Animal A10 (R)



k) Animal A11 (L)



l) Animal A12 (R)



**Figure 44 g-l** Individual bottlenose dolphins, A7-A12, identified in Aberdeenshire waters during vessel-based surveys in 2001

The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

m) Animal A13 (L)



n) Animal A14 (R)



o) Animal A15 (R)



p) Animal A16 (L)



q) Animal A17 (L)



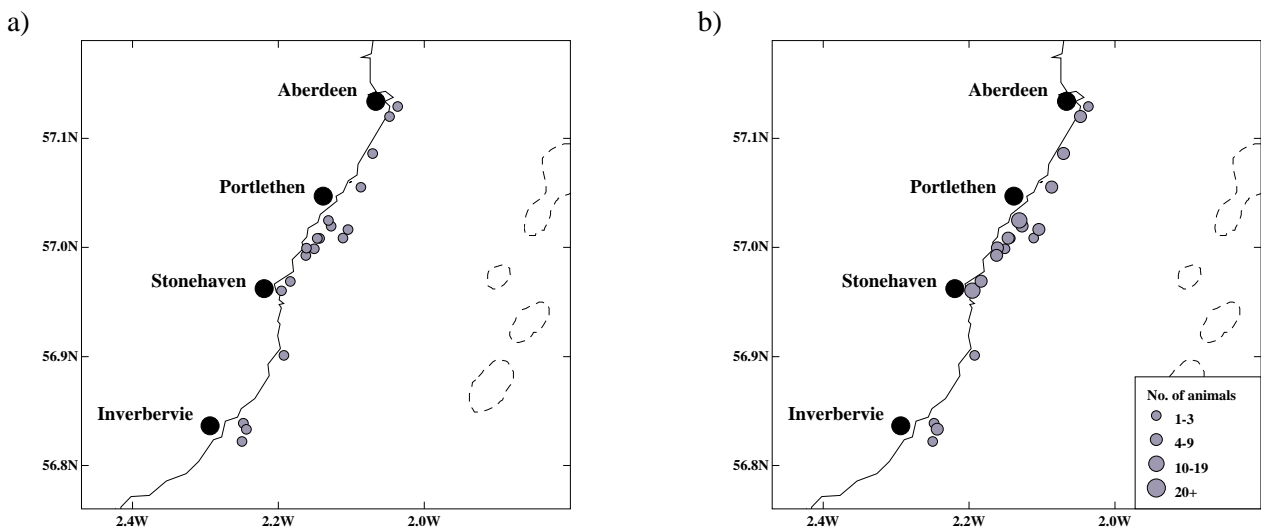
**Figure 44 m-q** Individual bottlenose dolphins, A13-A17, identified in Aberdeenshire waters during vessel-based surveys in 2001

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

### 3.2.5 White-beaked dolphin

During vessel-based surveys 20 white-beaked dolphin sightings were recorded, comprising over 90 animals. White-beaked dolphins were generally more active in the water than bottlenose dolphins, and were usually encountered feeding in variable directions with breaching and splashing. Dolphins were not observed to react negatively to the vessel; indeed they regularly broke off from feeding and approached the survey vessel for brief periods of bow-riding.

The distribution of white-beaked dolphin sightings is shown in Figure 45. Dolphins were scattered along the entire coastline and occurred close to shore and at distances of 3.5 km from land. The survey vessel did not survey areas beyond from shore than 3.5 km, despite several apparent sightings of white-beaked dolphins further offshore. Although highly conspicuous when breaching, white-beaked dolphins were not always easy to detect when surfacing quietly at a distance from the vessel and it is probable that some animals were overlooked during the survey.

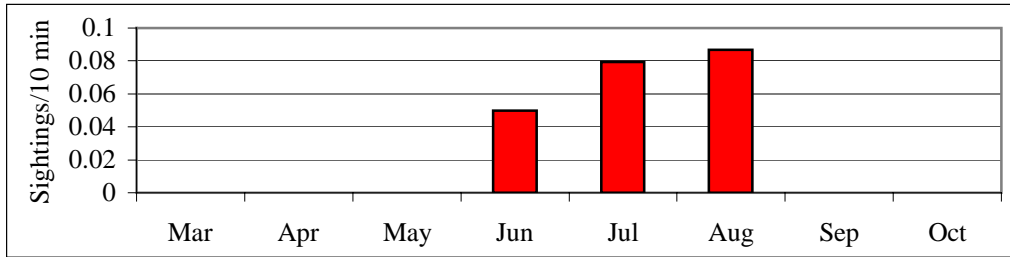


**Figure 45** Location of white-beaked dolphin a) sightings and b) numbers from dedicated vessel-based surveys 1999-2001

White-beaked dolphin sightings occurred only over the summer months from June to August, and showed a gradual increase in frequency over the three months to reach a peak in August (Figure 46). White-beaked dolphin schools contained a mean of 4.6 animals. However pod size increased from a mean of 3.4 animals in adult only pods, to a mean of 8.2 animals in pods containing immature dolphins. Juvenile animals formed almost 18% of the total number of animals that were aged, and were recorded in all three months that white-beaked dolphins were observed.



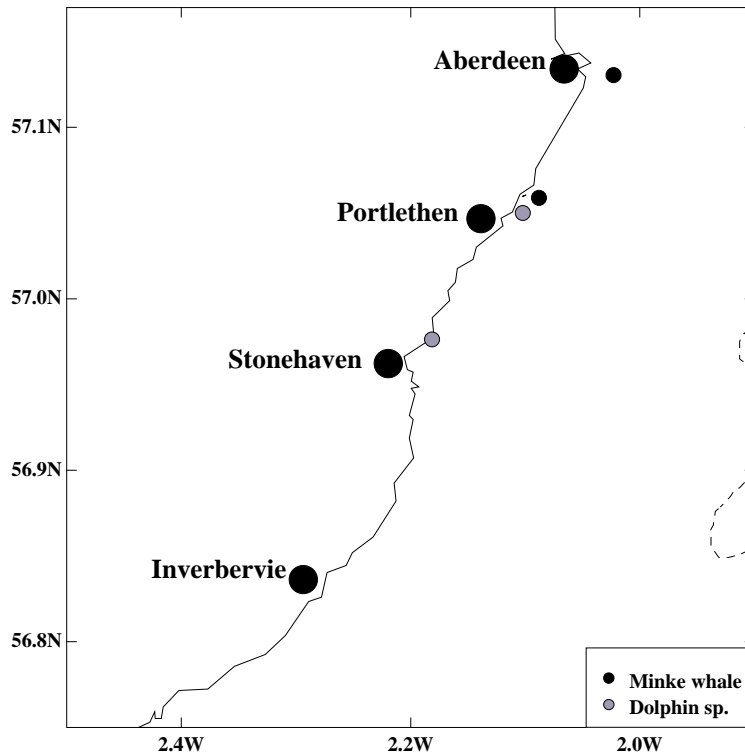
**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**



**Figure 46** Monthly distribution of white-beaked dolphin sightings

### 3.2.6 Minke whale

Two minke whales were recorded during vessel-based surveys (Figure 47). Both animals were sub-adults and were observed during August in 2000 and 2001. Both of the minke whales recorded during surveys were feeding, and each were observed for over 30 min.



**Figure 47** Location of minke whale and unidentified dolphin sightings from dedicated vessel-based surveys, 1999-2001

### 3.2.7 Unidentified cetaceans

Two sightings were made in August and September 2000, where animals could not be identified to species (Figure 47). Both sightings were either dolphins or porpoises and both involved pairs of animals.

## The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.

### 4 Discussion

The data presented in this report illustrate that the coastal waters of Aberdeenshire are clearly of importance for several species of cetaceans. The harbour porpoise occurs in the area throughout the year, while the region is of seasonal importance for two species of dolphin, the bottlenose and the white-beaked. In addition, the data suggest that this region may form a feeding area for minke whales in the late summer, possibly prior to migration. The seasonal trends observed for all four species are apparent from both land- and vessel-based surveys. These trends may be related to factors such as the presence of prey species, inter-specific competition and requirements for breeding/nursery habitat.

The bottlenose dolphin is the only cetacean species to have been studied intensively in northeast Scotland, and is therefore the only species for which it is possible to discuss movement patterns in relation to knowledge of adjacent areas. The data collected in this study show the bottlenose dolphin to be commonly occurring in Aberdeenshire waters, and anecdotal evidence suggests this may be a relatively recent phenomenon. In the mid-1990's, photo-identification studies confirmed the presence of bottlenose dolphins from the Moray Firth in the Aberdeen region and off the coast of Fife (see Wilson *et al.* 1997b). However, sightings data were too scarce to indicate whether this represented seasonal migratory movements, or if the Aberdeenshire coast was part of their 'normal' range (Lewis & Evans, 1993; Dixon, 1994).

Numbers of sightings of bottlenose dolphins along the southern Moray Firth are low in November, December, and March-April (Dixon, 1994; Stockin, 1999). Data presented in this report indicate that some bottlenose dolphins from the Moray Firth show a seasonal shift in distribution over this period, moving south into the waters off Aberdeenshire. In another recent study, photographs of bottlenose dolphins from St. Andrews Bay have been matched with the Moray Firth dolphin photo-ID library, showing that animals from the Moray Firth are regularly spending much of their summer as far south as St. Andrews (Cumming, 2000).

Under Annex II of the EU Habitats and Species Directive, the UK has designated two Special Areas of Conservation (SACs) for the bottlenose dolphin, in Cardigan Bay (West Wales) and in the inner Moray Firth (Scotland). These two sites have 'resident' populations of dolphins and provide feeding, calving and nursery areas. There has been some concern recently that the Moray Firth population of bottlenose dolphins is declining, and the decline is estimated to be around 6% per year (Sanders-Reed *et al.* 1999). This apparent decline over recent years has coincided with the increased frequency of bottlenose dolphin sighting off the Aberdeenshire coast (winter/spring) and off the coast of Fife (summer). A considerable portion of the Moray Firth population may be located along the east coast of Scotland at any one time. For example, a group of 60+ bottlenose dolphins were recorded off Aberdeen in May 1999 (this study), while groups of 60+ were seen off the coast of Fife in the summers of 1997, 1998 and 1999. An estimated 80+ animals were additionally recorded off Fife Ness in June 1998 (see Cumming, 1997, 1998, 1999, 2000). Although such high numbers of dolphins in one group are uncommon, between 1997 and 2001, groups of 20+ bottlenose dolphins were regularly recorded from Aberdeenshire between February and May, while similar sized groups were recorded between June and September off Fife (Cumming, 1997, 1998, 1999, 2000). Recently, bottlenose dolphins assumed to be from the Moray Firth population have also been regularly recorded off the Tyneside coast of northeast England (Andrew Tait, pers comm.).

Thus recent evidence indicates regular use of habitats outside the Moray Firth SAC and, given that the larger groups seen represent around half of the Moray Firth population, it is valid to ask whether the present SAC encompasses a sufficient proportion of the dolphins' normal home range. Conclusions about long-term trends in abundance of the Moray Firth bottlenose dolphin population may also need to be revised in the light of the recent sightings data, which apparently indicates more than the 'occasional' extension to range, as reported by Wilson *et al.* (1999a).

**The occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) and other cetacean species in the coastal waters of Aberdeenshire, Scotland.**

It is unclear why the occurrence of bottlenose dolphins off Aberdeenshire is so seasonal. Numbers of animals clearly peak during the spring and are in decline during the height of summer between July and September. It is interesting that the summer months are the time that sightings of all other cetacean species reach a peak in the study area.

The peak in sightings of white-beaked dolphins between June and October seen in the present study suggests a seasonal movement into coastal waters along the Aberdeenshire coast during the summer and autumn. The white-beaked dolphin is the most numerous dolphin species in Scottish continental shelf waters in general (Evans, 1992; Pollock *et al.* 2000) and in the North Sea (Hammond *et al.* 1995). Several studies have suggested that the white-beaked dolphin and the closely related Atlantic white-sided dolphin may be separated ecologically by factors such as water depth, seabed relief or distance from shore (Northridge *et al.* 1995; Pollock *et al.* 2000). Results from the present study are consistent with this, with only a single white-sided dolphin was recorded in coastal Aberdeenshire waters, although groups of 100+ were sighted at during the summers of 2000 and 2001 in offshore North Sea waters (Sam Taylor, pers comm.). Furthermore, results of the present study also indicate some spatial and temporal segregation of white-beaked and bottlenose dolphins. White-beaked dolphins tend to occur much further offshore than bottlenose dolphins, although it should be noted that bottlenose dolphins have become more frequent in deeper oceanic waters (1000m) over recent years (Taylor and Reid, 2001; Pollock *et al.* 2000). During the summer months of June to September, bottlenose dolphins were scarce off the Aberdeenshire coast, but more frequently sighted in the Moray Firth to the north (Wilson *et al.* 1997b; Dixon, 1994; Kevin Robinson, pers comm.), and off the coast of Fife to the south (Cumming, 1997, 1998, 1999, 2000). At the same time, white-beaked dolphins moved in to Aberdeenshire coastal waters, apparently occupying the same ecological niche that bottlenose dolphins utilised during the winter and spring.

It is unclear at present whether the two species directly compete for resources. Bottlenose and white-beaked dolphins were seen at the same time on only two occasions during the entire study. The first observation, in August 1997, involved over 100 white-beaked dolphins and a small school of 5 bottlenose dolphins off Girdleness Point. Although both were present within the observer's field of view, they were not interacting and were spatially separated. On the second occasion, in August 2001, both dolphin species were present within 700 m of each other in Nigg Bay, and again no direct inter-action was noted. On both occasions, other cetacean species were present (harbour porpoises in both cases, and also minke and fin whales in 1997). Mixed schools of bottlenose and white-beaked dolphins have also been observed on occasions off the coast of southwest Ireland (Evans 1980) and in the coastal waters of northwest Scotland (Evans, pers comm.). Interestingly, strandings of bottlenose and white-beaked dolphins around the British Isles are also allopatric in nature (Sheldrick, 1979), suggesting that the species distributions do not greatly overlap.

In Moray Firth waters, antagonistic interactions between the bottlenose dolphin and the harbour porpoise have been witnessed in the field, and identified from tooth marks and traumatic injuries on recovered porpoise carcasses (Ross & Wilson, 1996). During the present study, only five observations were made of porpoises and bottlenose dolphins in the same area simultaneously. On three of these occasions, no interaction between the species was noted. On one occasion, a porpoise was observed to rapidly leave the harbour area (where it had been feeding), as a group of three adult bottlenose dolphins arrived. In March 2001, six bottlenose dolphins including two juveniles were present in Aberdeen Harbour, and were seen to change behaviour from slow milling to very fast swimming, breaching and splashing. A single harbour porpoise was observed in the presence of two juvenile dolphins. During this sighting the porpoise appeared to be harassed by the two animals. However, no final outcome was observed and since the two dolphins were previously observed 'surfing' waves into the harbour, it is not possible to accurately interpret the meaning of the previous behaviour.

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The movement of cetacean species off Aberdeenshire may be related to that of their prey species, since all four of the regularly sighted species were observed to be feeding in the region. Both harbour porpoises and minke whales were particularly common in August off Girdleness Headland, where they were often recorded together. Minke whales and porpoises have been observed feeding in close proximity to one another by several authors (e.g. Evans, 1980; Boran *et al.* 1995; Camphuysen & Winter, 1995), and it is likely that the two species may exploit a shared prey species such as sandeels or herring.

The movement of white-beaked dolphins into coastal waters during June to September may have a number of explanations, but is probably also related to the movement of prey species since the majority of sightings involved feeding animals. Many young calves were recorded, and it is possible that moving into shallower, coastal waters may also act to reduce the risk of predation to juveniles. However, large sharks and killer whales are not particularly numerous within the region, and predation pressure on small odontocete cetaceans off North-east Scotland is unlikely to be a major factor governing their distribution. August peaks in white-beaked dolphin numbers off Northern Scotland have been related to the presence of spawning herring (Evans, 1980), but anecdotal evidence suggests that mackerel movements may be responsible for the inshore movement of white-beaked dolphins off Aberdeenshire. Local fishermen in the region of Stonehaven were catching large numbers of mackerel during July when white-beaked dolphins were recorded close inshore (Brian Bartlett, pers comm.), and mackerel are known to spawn in the central North Sea between May and July. It is difficult to understand why bottlenose dolphins would leave an area where prey species are apparently abundant, since the two dolphin species are known to feed on a similar range of prey species. However it is possible that bottlenose dolphins move into the Moray Firth to exploit different prey species at this time.

Since the Aberdeenshire coast has many rivers with salmon runs, salmon availability may influence the seasonal movement of dolphins into the area, explaining, for example, the seasonal occurrence of bottlenose dolphins in the river Dee estuary. According to Ballance (1992), bottlenose dolphins in the Gulf of California were observed most frequently in areas close to estuaries, and she suggested that dolphins used such areas to feed. Estuarine areas, inshore bays, and river mouths have repeatedly been found to be sites of high dolphin occurrence (Ballance, 1990; Hansen, 1990; Scott *et al.* 1990), as they are characterised by high levels of primary productivity and prey abundance (Acevedo, 1991). Enclosed waters such as estuaries also serve to concentrate potential prey like salmonids, bass, etc. into a small area, making them easier to exploit by mammalian predators. In a recent study of marine mammal impacts upon salmonids in Scottish estuaries, it was reported that bottlenose dolphins show a strong seasonal occurrence within the river Dee estuary (Aberdeen harbour) with a peak between January and May (Carter *et al.* 2001), which agrees with the findings of the present survey. Bottlenose dolphins are regularly observed throwing large fish in the harbour mouth, and are known to feed on salmonids (salmon and sea trout) from both field observations (Wilson, 1997b), and from stomach contents of stranded animals (Santos *et al.* 2001c). It is likely that the occurrence of bottlenose dolphins in Aberdeen Harbour during the spring is correlated with the return to spawn of multi-sea-winter salmon (fish that enter rivers prior to 1 May). The movement of bottlenose dolphins away from Aberdeenshire in the summer may reflect an increase in salmonids in the Moray Firth and the Firth of Forth/River Tay at this time, since salmonids spawn at different times in different regions.

The designation of marine Special Areas of Conservation (SACs) for porpoises is currently under consideration. The criteria used to designate such areas include year-round presence of the species within the region, a significantly higher level of importance for the species within the SAC than in surrounding areas, and evidence that important life-cycle activities, such as feeding and/or breeding, take place in the area.

The current survey has shown that the waters along the coast of Aberdeenshire hold harbour porpoises throughout the year, that concentrations of porpoises occur in the region particularly during the late summer and autumn, and that over 15% of porpoises that could be aged were juveniles/calves. Data presented in the present report complement results from JNCC and SCANS surveys which indicated higher concentrations of porpoises along the coasts of North-east Scotland than in other regions of the North Sea (Northridge *et al.*



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1995; Hammond *et al.* 1995). The present study suggested that porpoises occur regularly off Aberdeenshire, at least between Inverbervie in the south and Peterhead in the North. The JNCC's Seabirds at Sea team identified the east coast of Scotland as having a higher abundance of porpoises than other areas throughout the year, as well as being one of only two major groupings of porpoises in the entire North Sea over the winter months (Northridge *et al.* 1995). Within the other winter grouping, an area to the north of Germany has recently been identified as a harbour porpoise calving ground and suggested as a protected area for the species (Sonntag *et al.* 1999).

It is likely that the waters off Aberdeenshire provide important feeding (and possibly breeding) habitat for the harbour porpoise and the bottlenose dolphin, and a seasonal feeding habitat for white-beaked dolphins and minke whales. More research is required within the region to confirm the spatial and temporal trends presented in this report, to investigate in more detail the underlying causes of these trends, and to determine what percentage of the "Aberdeenshire" bottlenose dolphins are part of the Moray Firth population.



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