

TEMPORAL AND SPATIAL DISTRIBUTION OF HARBOUR PORPOISES IN SHETLAND WATERS, 1990-95

Peter G.H. Evans, Caroline R. Weir and Helen E. Nice

Sea Watch Foundation, c/o Department of Zoology,
University of Oxford, South Parks Road, Oxford OX1 3PS, UK

INTRODUCTION In recent years, the harbour porpoise *Phocoena phocoena* has experienced widespread declines in Europe, becoming scarce or absent along the coasts of all countries bordering the southern North Sea. Over the last decade, declines have also been recorded from a number of localities in northern Britain bordering upon the northern North Sea. The Shetland Islands have long been a stronghold of the species in Britain, but marked declines have been observed during the 1980's. Whilst those declines have been taking place, there have been major changes in local fisheries, notably sandeels, but also other fish species. The cause of those changes remains unclear.

The main aim of this project was to investigate more fully the possible relationship between observed porpoise declines and oceanographic changes, including changes in the stocks of various potential prey species. Developments in technology have enabled one to learn much about the feeding ecology of small cetaceans without recourse to examination of stomach contents of dead animals. The objectives of this study were to identify the main determinants of harbour porpoise distribution in coastal waters of Shetland by non-intrusive field methods with particular reference to potential fish prey species. The present contribution examines spatial and temporal variation in porpoise abundance and relates this to variations in prey abundance.

METHODS During the month of August, 100-minute land-based systematic watches were carried out annually over a six-year period from 1990-95 at fifty sites distributed around the Shetland mainland (reduced to 25 in 1995). From the data collected, an abundance index was determined for three main regions: southern, north-western and north-eastern Shetland (see Fig. 1 for locations of the 50 sites and regional subdivisions). Watches were carried out in calm weather conditions (sea state 2 or less) so that data for different areas and different years could be directly compared. Additionally, boat transects were conducted at the same time, between 1977 and 1989, and throughout the 1990-95 study period. The month of August was selected because this was the time when porpoises in Shetland coastal waters appeared to reach peak numbers. Offshore surveys were undertaken using either the 32 ft motor fishing boat "Queen of Hearts", owned by Robbie Leask and skippered by him or Jimmie Burnie, or the 30 ft motor fishing boat, "Spirit of the North", owned and skippered by John Moncrieff from Lerwick.

RESULTS The land-based watches indicated that porpoises have a wide distribution around Shetland, but are concentrated towards south and east coasts of the mainland, particularly Whalsay, Noss Sound, Mousa Sound, and in the vicinity of Sumburgh Head (see Evans, 1995, 1996).

Fig. 2a showed long-term annual variation in the abundance of porpoises in Shetland, with declines occurring particularly between 1982 and 1990. During the six-year study period there has been an increase in porpoise numbers over the latter three years, compared with the 1990-93 data (Fig. 3). Each region showed annual variation in porpoise abundance indices (Fig. 4a). Because a sub-set of 25 sites were surveyed in 1995, the analysis was repeated using only these sites (Fig. 4b). The Southern region contained a greater abundance of

individuals throughout the study period, and has shown a substantial increase in numbers since 1991. The North-west and North-east regions show uneven fluctuations over the six-year period, although the North-west population appears to have declined over the last two years.

Other ecological studies of harbour porpoises in Shetland have shown that sandeels are most commonly recorded in close proximity to porpoises (Evans, 1996; Borges & Evans, this volume). The distribution of sandeel fishing grounds around Shetland is shown in Fig. 5. Many areas of porpoise concentration are correlated with sandeel distribution, including the important areas of south Noss Sound and Mousa Sound. Furthermore, a spatio-temporal analysis showed significant association between porpoises and sandeels but not with any other fish group (Evans, 1995, 1996; Evans and Borges, 1996). The changes in porpoise abundance shown in Fig. 2a, may therefore be related to annual variation in sandeel populations (Fig. 2b). It is interesting to note that sandeel spawning biomass declined markedly from 1984-92 when coastal summer populations of porpoises also apparently declined. During 1993 and 1994, sandeel spawning stock biomass was relatively high (Following high recruitment in 1991) and porpoise abundance was also higher. These findings indicate that in recent years the presence of porpoise numbers in Shetland inshore waters during summer has been determined primarily by the status of local sandeel stocks.

CONCLUSIONS Harbour porpoises are concentrated principally in the southern and eastern regions of Shetland mainland, and can be observed frequently in the following areas: Skaw (Whalsay), Mousa Sound, Noss Sound, St. Ninian's Isle, and Quendale Bay, with numbers increasing through the summer to a peak in August or September. Each of these areas can be watched very readily from land. The distribution and abundance of harbour porpoises around the Shetland coast may be partially explained by that of the sandeel, a known prey species. Porpoises and sandeels are significantly associated in both time and space. Harbour porpoises summering in nearshore waters of Shetland declined markedly during the 1980's at a time when local sandeel stocks also declined. Since 1991, the Southern region of Shetland mainland has shown a continual increase in porpoise numbers, and is now an important stronghold for the species, with aggregations at times numbering in the low hundreds. The resulting overall increase in porpoise numbers since 1991 indicates a recovery from previous population declines, and highlights the current importance of Shetland waters for this species. Although harbour porpoises showed a decline in numbers during the 1980's in Shetland coastal waters, since 1991 this trend has been reversed. This is thought to be at least partly due to the increase in local sandeel populations following a very good recruitment year in 1991. It remains to be seen whether the trend will be sustained during the 1990's.

ACKNOWLEDGMENTS The Shetland porpoise project has received generous funding from WWF-UK, Shetland Amenity Trust, Shetland Wildlife Fund and Scottish Natural Heritage. Thanks also go to all volunteers who have worked on the project, particularly Paula Barnett, Lisa Borges, Quentin Carson, Heidi Cluley, Judith Denkinger, James Farrell, Paul Fisher, Lucy Gilbert, Dorien Hoogerheide, Lisa Kendrick, Rachael Limer, Ian Rees, Julie Wainwright and Katy West. Robbie Leask and John Moncrieff have kindly provided the services of their boats, and Martin Heubeck, Pete Ewins, Pete Kinnear, Mike Richardson, and Bobby Tulloch contributed to the offshore boat surveys. Over the years, British Petroleum and Shell UK have given valuable logistic support.

REFERENCES

Evans, P.G.H. 1994. Whales and dolphins in Shetland waters. *Shetland Cetacean Report, 1993*: 8-14.

Evans, P.G.H. 1995. The foraging ecology of harbour porpoises in the Shetland Islands. *Shetland Cetacean Report, 1994*: 25-30.

Evans, P.G.H. 1996. *Ecological studies of the harbour porpoise in Shetland, North Scotland: Final Report*. Sea Watch Foundation, Oxford. 106pp.

Evans, P.G.H. and Borges, L. 1996. Feeding ecology of the harbour porpoise in Shetland, North Scotland. Pp. 173-178. In *European Research on Cetaceans – 9*. Proc. 9th Ann. Conf. of the European Cetacean Society (Eds. P.G.H. Evans and H. Nice). European cetacean Society, Kiel, Germany.

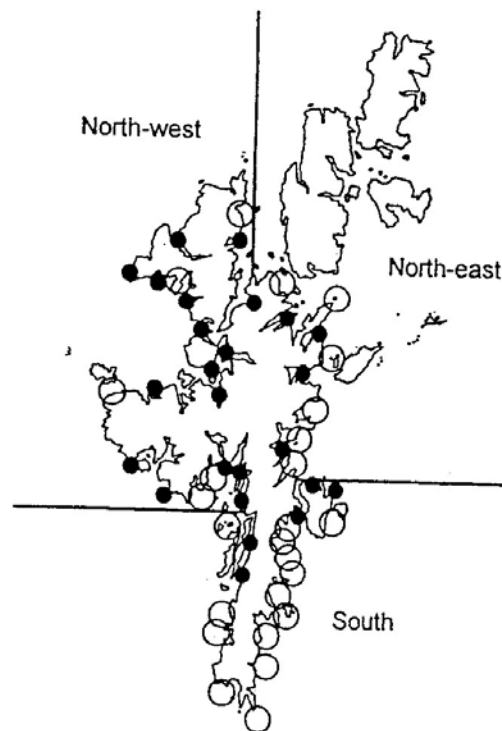


Fig. 1. Distribution of land-based sites watched around Shetland mainland, solid circles 1990-94; hollow circles 1990-95.

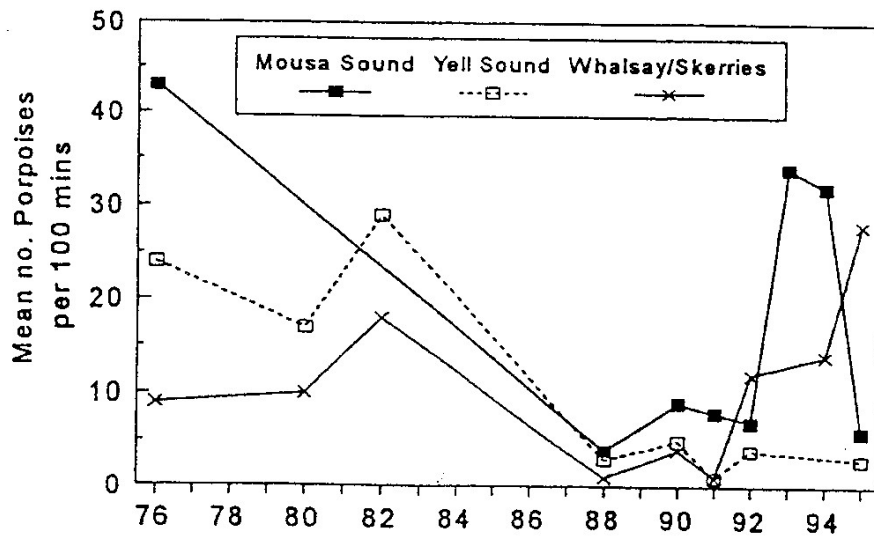


Fig. 2a. Population changes of the harbour porpoise in Shetland.

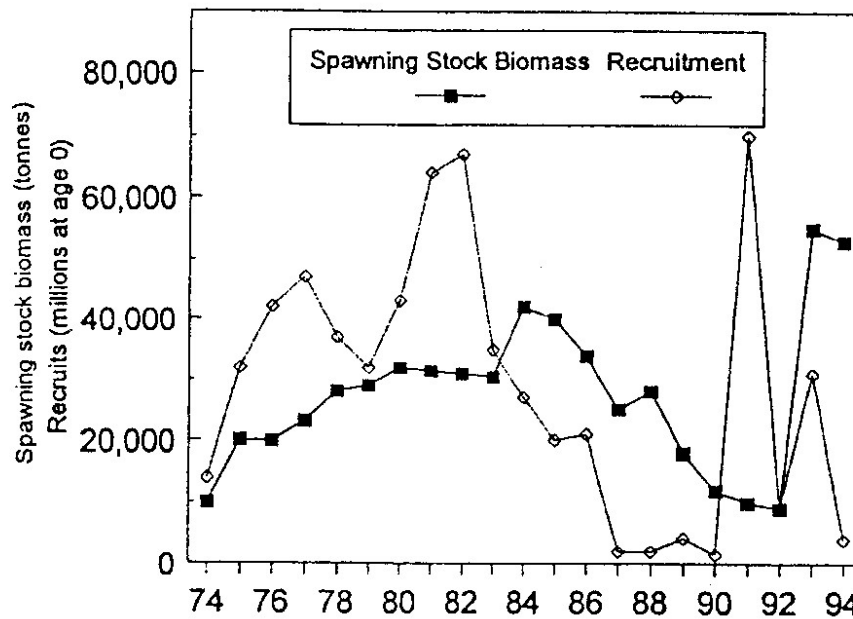


Fig. 2b. Annual changes in biomass and recruitment of sandeel stocks in Shetland waters. From Anon (1995) Report to the Working Group on the Assessment of Norway Pout and Sandeel. ICES, Copenhagen.

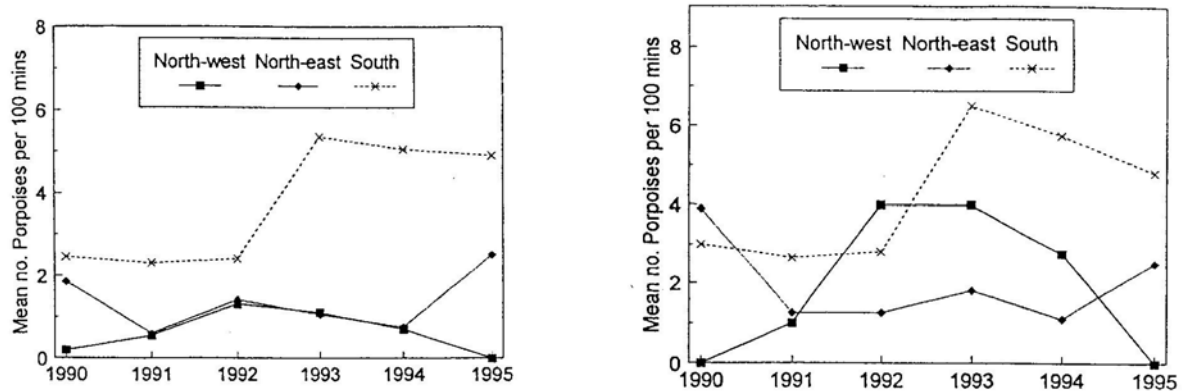


Fig. 3. (a) Annual changes in porpoise abundance indices for three main regions of the Shetland mainland (1990-94 = 50 sites, 1990-95 = 25 sites); (b) Annual changes in porpoise abundance indices for subset of 25 sites within three main regions of the Shetland mainland.

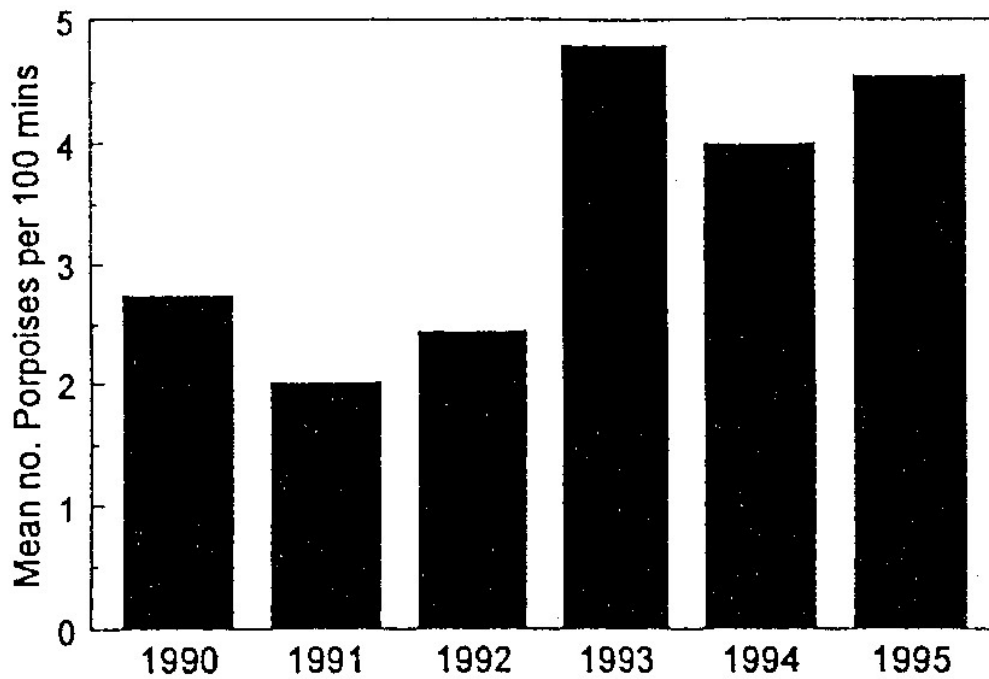


Fig. 4. Annual variation in numbers of harbour porpoises in Shetland at 25 mainland sites.

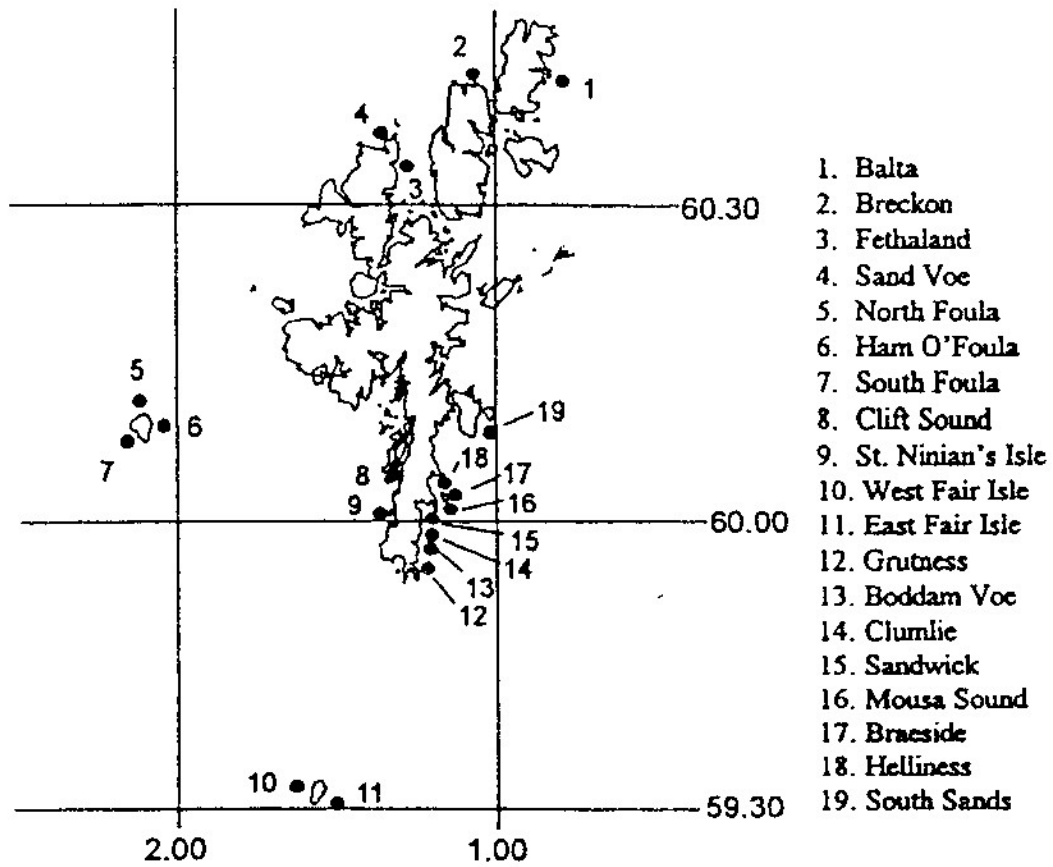


Fig. 5. The sandeel fishing grounds around Shetland.