JOINT
NATURE
CONSERVATION
COMMITTEE

An atlas of seabird distribution in north-west European waters

The Joint Nature Conservation Committee is a forum through which the three country nature conservation agencies, the Countryside Council for Wales, English Nature and Scottish Natural Heritage, deliver their special statutory responsibilities for Great Britain as a whole and internationally. These special responsibilities, known as the special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems. The special functions are:

- to devise and maintain common standards and protocols for nature conservation;
- to promote, through common standards, the free interchange of data between the country agencies and with external partners;
- to advise on nature conservation issues affecting Great Britain as a whole;
- to pursue wider international goals for nature conservation (encouraging sustainable development, biological diversity and earth science conservation), including the provision of relevant advice to the Government;
- to commission new research and collate existing knowledge in support of these activities, and to disseminate the results.

JOINT NATURE CONSERVATION COMMITTEE

Published by JNCC, Peterborough

ISBN 1 873701 94 2

Cover artwork by Lesniak Jones Liddell Ltd, Newcastle-under-Lyme

Printed by Potters, Meridian House plc, Peterborough

An atlas of seabird distribution in north-west European waters

C.J. Stone, A. Webb, C. Barton, N. Ratcliffe, T.C. Reed, M.L. Tasker, C.J. Camphuysen* & M.W. Pienkowski

Joint Nature Conservation Committee,
Monkstone House, City Road, Peterborough, PE1 1JY, United Kingdom.

*Nederlands Instituut voor Onderzoek der Zee,
Postbox 59, 1790 AB Den Burg, Texel, The Netherlands.

with contributions from:

Ornis Consult
National Institute for Marine and Coastal Management / RIKZ
Nederlandse Zeevogelgroep
Instituut voor Bos- en Natuuronderzoek
Instituut voor Natuur Behoud
National Environmental Research Institute Kalø
Norsk Institutt for Naturforskning
Vogelwarte Helgoland

Address for enquiries:

Seabirds and Cetaceans Branch, Joint Nature Conservation Committee,
17 Rubislaw Terrace, Aberdeen, AB1 1XE, United Kingdom.

Published by JNCC, Peterborough

ISBN 1 873701 94 2

COASTGUARD
Marine Pollution Control Unit

British Gas

dti

Chevron

Chevron

Esso

MARATHON

AMOCO

BP

AMERADA HESS LIMITED

HESS

elf

CONTENTS

FOREWORD

In the late 1970s, nature conservationists in north-western Europe were faced with a serious challenge. The discovery of major oil potential in the North Sea highlighted the almost total lack of knowledge of the distributions of seabirds and sea mammals in their main habitat - away from the coasts. We did know, however, that these areas were internationally important for the seabird populations they support. The nations exploiting the hydrocarbon reserves had a duty - in many cases underlined by international commitments into which they had entered - to conserve these populations. However, the survey to be undertaken was huge. In the case of the United Kingdom, the sea area of responsibility is of the same order of size as the nation's land area.

Fortunately, the industry itself, in recognising the challenges in operating in the novel conditions of the hostile waters off north-western Europe, also recognised the need for reliable environmental data. This common need for information led to a series of partnerships to survey the seasonal distributions of seabirds and large sea mammals, assess their vulnerability, and make the information available in a way which could be used readily by the industry and regulatory authorities. This has been a major contribution to fulfilling the responsibility to make wise use of non-renewable resources, and fits well with the concepts more recently embodied in the Convention on Biological Diversity signed at the "Earth Summit" in Rio in 1992.

A particularly pleasing aspect of cooperation has been the partnership developed between the neighbouring nations of north-western Europe. This has involved agreeing standards for survey, assessment and data-handling, and the sharing of information. This allows this publication to be an atlas bringing together work from several countries, including Denmark, Germany, the Netherlands, Norway, Sweden and the United Kingdom, with assistance also from the Republic of Ireland, France and the Faeroe Islands. This has enabled the most up-to-date information to be provided in one comprehensive atlas.

This book provides the basic results, deliberately with little discussion in order to make the information available for use with the minimum delay. In 1987 we developed a way of summarising simply information on seasonal patterns of vulnerability (Tasker & Pienkowski 1987). This was further refined by Carter *et al.* (1993). The latter made use of most of the data from the North Sea incorporated in the current publication and is, in many ways, a partner volume. To complete the updated set, we are producing in parallel with the current volume a publication on vulnerability covering the western parts of the area addressed in the present book. We continue also our programme of papers in the scientific literature which examine the results in more detail and relate them to other environmental factors. We plan to expand cooperative analyses with other workers in these subject areas.

The whole programme has depended on contributions from a great many individuals and organisations. I noted above the partnership in data-sharing between statutory and voluntary organisations in several countries. Throughout our work, financial support was provided by the oil and gas industries, related government departments, and the nature conservation agencies, with major help of other kinds given by shipping and ferry companies, research institutes, fishery protection and commercial vessels, and weather forecasters. We acknowledge these more fully in the following section. However, I would like to take the opportunity of the Foreword to thank the team members. There have been many changes over the years, although Mark Tasker (now Head of JNCC's Seabirds & Cetaceans Branch) has been involved in one capacity or another throughout the exercise since 1979 and Andy Webb, the current Team Leader, has been a member since 1983. It has been an exciting role to have this programme within my responsibilities for the past 10 years. Whilst I know the team are all enthusiasts who enjoy their work, the conditions can be taxing. The approved clothing for making observations from the bridge-wing is normally worn by workers in refrigeration plants - and they are not subject to wind-chill! Subsequent handling of the data gathered is also a taxing exercise, and the demands of analyses of such valuable information always exceed the time available. In thanking the team, I would also like to link this to thanking their colleagues in the supporting services in JNCC, not least for helping to navigate through the public service rules in which we have to work and which are not particularly closely fitted to survey work in such unusual circumstances.

We look forward to the present results proving at least as useful to the partners in nature conservation as were the earlier stages of the work.

Dr. Mike Pienkowski
Director Life Sciences
Joint Nature Conservation Committee

ACKNOWLEDGEMENTS

The Seabirds at Sea project has been in progress since 1979, and has relied on a very large amount of help and co-operation from many individuals and organisations. Without this help this investigation would have been impossible to undertake. As well as those listed in Tasker *et al.* (1987) and Webb *et al.* (1990), we thank all those below most sincerely.

The project has been sponsored in Britain both by the oil industry and Government and a number of project officers have served on the Steering Committee during the fourth phase with JNCC supervisors:

Department of Transport Marine Pollution Control Unit (now with the Coastguard Agency): B. Lynch, Dr. C. Goodman, K. Colcomb-Heiliger.
Department of Trade and Industry: M.J. Lummis.
Esso Petroleum Company Limited: M.J. Northover.
Shell U.K. Exploration and Production: Dr. A. Onder.
BP Exploration Operating Company Ltd.: Dr. S. McHugh, M. Heape.
Chevron UK Limited and Gulf Oil (Great Britain) Limited.: J.H. Allen, A. Duff, C. Lavington.
Elf Enterprise Caledonia Limited: A. Blake-Milton, M. Borwell, G. Nicholson.
British Gas: B. Hawker, S. Kallos, C. Pugh, J. Baker-Rogers.
Marathon: Dr. N. Ramsey.
Royal Society for the Protection of Birds: Dr. M. Avery, Dr. J. Sears, Dr. A. del Nevo.
Joint Nature Conservation Committee supervisors: Dr. M.W. Pienkowski, M.L. Tasker.

In addition to the above, Amerada Hess Ltd. and Amoco UK Exploration Company have joined the sponsors for the fifth phase of the project and as such have contributed towards the funding for this publication.

In Denmark, Ornis Consult were sponsored by the Commission of the European Union, the Nordic Council of Ministers, the National Forest and Nature Conservation Agency, the National Environmental Research Institute (Kalø), the National Environmental Research Institute (Roskilde), the Scientific Committee of the Danish Ornithological Society, the World Wide Fund for Nature, Sweden, and Stena Line.

In Germany, the project received financial support from Freunde und Förderer der Inselstation der Vogelwarte Helgoland e.V.

Observations used in this report were made by seabird workers from several countries:

SAST (UK): There have been over one hundred observers of the UK Seabirds at Sea Team. Those prior to 1990 are thanked in Webb *et al.* (1990) and Tasker *et al.* (1987). Observers of the UK Seabirds at Sea Team since 1990 include: C.J. Stone, T.R. Barton, I.C. Carter, B.J. Best, J.R.W. Gordon, C. Barton, A. Stronach, G.M. Leaper, A. Webb, N.M. Harrison, S.J. Aspinall, and D. Thomas.

NIOZ and IBN (Netherlands): C.J. Camphuysen, M. Leopold, A. Duiven, B. Knegtering, A. Sterk, B. Couperus, B. van de Geest, B. Knegtering, H. van Berkel, B. Loos, C. Mozes, C. van der Vliet, C. Winter, D. Schermer, E. Bos, E. Koopman, F. van de Ende, F. Hovenkamp, F. Oyen, G. Hogerwerf, G. Keyl, G. Wintermans, R. Hammer, H. van den Berg, H. Hin, H. Offringa, H. Witte, J. Apperloo, J. Hooijmeijer, J. Koerts, J. Mulder, J. Nijkamp, J. den Ouden, J. Seys, J. van der Voorn, K. Brass, K. Ensor, K. Philippart, L. Camps, L. Stegeman, L. Witte, L. Wessels, M. Argeloo, M. Hoekstein, M. Geertsma, M. Kok, M. Michiels, M. Poot, M. Talsma, M. Versluys, M. Werner, M. Laks, P. Wolf, P. Derks, H. Veldkamp, P. van der Wolf, Q. van Katwijk, R. Dijker, R. van Houwelingen, R. Kriek, R. Noordhuis, R. Witbaard, R. Witte, S. Groenewold, T. Eggenhuizen, T. Gras, T. Postma, T. Vanaght, W. Koomen.

Ornis Consult (Denmark): P. Andell, B. Bredesen, O.K. Bøhn, T. Bøhn, J. Christensen, R. Christensen, T.K. Christensen, H. Christophersen, J. Drachmann, J. Durink, K. Eie, T. Engebretsen, U. Ganning, O. Goldsmidt, R. Gustavsen, T. Gustavsen, L. Gustafsson, J.G. Hansen, J.L. Hansen, J.S. Hansen, K.A. Hansen, L.L. Hansen, P. Hjalmarson, A. Horneskøt, M. Hundeide, E.M. Jacobsen, L. Jakobsen, A. Jensen, B. Jensen, B.H. Jensen, E. Jirle, K.D. Johansen, M.F. Jørgensen, N. Kjellen, N.M. Kofoed, F.H. Kristensen, H. Kristensen, J. Kyed, X. Lambin, P. Lange, T. Larsen, V. Larsen, B. Laubek, K. Mouritsen, M. Nielsen, M. Nitske, M. Nord, I.B. Olsen, K. Olsen, J.S. Pedersen, S.Petersen, J.G. Poulsen, M.K. Poulsen, A. Rasmussen, H. Rinden, M. Ritman, F. Rost, E. Rugland, J.E. Røer, B. Sakseid, T. Sebro, T. Seidenfaden, H. Skov, H.P. Stange, J.O. Svendsen, R. Svensson, C. Wist and A. Østerby.

National Institute for Marine and Coastal Management/ RIKZ (Netherlands): H.J.M. Baptist.

NIOO-CEMO (Netherlands): P. Wolf.

Instituut voor Natuur Behoud (Belgium): H. Offringa, P. Meire.

NERI (Denmark): S. Pihl.

NINA (Norway): A. Follestad & T. Kasparsen.

Vogelwarte Helgoland (Germany): S. Garthe, O. Hüppop, A.M. Maul, M. Baatz, M. Renner, U. Nettelmann.

JNCC were helped greatly through access (often free) to various facilities and accommodation. Many of these organisations were thanked for their help to previous phases of the project (Benn *et al.* 1988, Webb *et al.* 1990, Tasker *et al.* 1987). We would like to thank the following for their assistance during the fourth phase of the project:

Shipping and ferry companies:
Sealink (UK) Ltd. (Capt. N.R. Pryke, B. Rees, C. Laming)
Stena Sealink (L. Marlow, S. Bulman)

P&O European Ferries (Portsmouth) Ltd. (Capt. T.C. Cairns, D. Price, A. Williams)
British Channel Island Ferries (P.J. Bowditch, J. Lewis)
Waverley Excursions Ltd. (T. Sylvester)
Brittany Ferries (D. Longden, M. Hammett, J. White)
Isles of Scilly Steamship Company Ltd. (G.W. Nicholls)
Irish Ferries (J. Riley, Capt. E. Keane)

Research Institutes:
Ministry of Agriculture, Fisheries and Food (J. Ramster)
Scottish Office Agriculture and Fisheries Department (J. Adams, J. Morrison)
Natural Environment Research Council, Research Vessel Services (Capt. P. Maw, Dr. J. Gordon, Dr. I. Joint)

Fisheries Protection:
Royal Navy Fisheries Protection (Lt. Cmdr. E. Fitzgerald, Lt. Cmdr. D. Wilson)
Scottish Office Agriculture and Fisheries Department

Oceanroutes (J. Thompson) for their free provision of long and short-range weather forecasts.

Ornis Consult were helped by the Swedish Institute of Marine Research (O. Hagström, J. Modin & P. Larson), the Danish Environmental Research Institute (G. Ærtebjerg), the Danish Institute of Marine and Fisheries Research (P. Lewy, H. Sparholt, V. Olsen, H. Degl, E. Kirkegaard & S. Munch-Petersen) and the Norwegian Institute of Marine Research (L. Føyn). In addition the shipping company Mærsk Olie and Gas A/S and the ferry companies Fred Olsen Lines, Color Line, Lion Ferry AS and Stena Line are thanked for their important co-operation.

Vogelwarte Helgoland were helped by the research institutes Biologische Anstalt Helgoland and Bundesforschungsanstalt für Fischerei (Hamburg) and by the following shipping and ferry companies: Reederei Caasen Eils, Wyker Dampfschiffs-Reederei, Bremer Seebäderdienst and Harle Express Seetouristik.

Observations by JNCC were made from the following ships (see also Tasker *et al.* 1987, Webb *et al.* 1990), whose captains and crews we thank for their friendliness and help:

Ferries: Hengist, Horsa, Parisian (formerly Champs Elysée), Londoner (formerly Versailles), Stena Normandy, Duc de Normandie, Pride of Winchester, Pride of Cherbourg, Pride of Le Havre, Pride of Hampshire, Corbière, Rozel, Havelet, Beauport, Norrona, Munster, Isle of Innisfree, Quiberon, Bretagne, St. Patrick II, St. Killian II, Scillonian III, Suilven, Waverley, Balmoral, Oldenburg.

Research Vessels: Cirolana, Corystes, Scotia, Challenger, Prince Madog, Dana, Agnich, Tridens III, Geolog Dimitrig Navilikin, Britannia Champion.

Royal Navy and Fishery Protection Vessels: HMS Orkney, HMS Lindisfarne, HMS Anglesey, HMS Shetland, HMS Jersey, HMS Alderney, HMS Leeds Castle, HMS Dumbarton Castle, FPV Norna, LE Emer.

Cargo vessel: Gry Maritha.

Tankers: Esso Clyde, Esso Milford Haven.

Other vessels: McGregor, Chalice, Sulaire, Anarkali.

Intensive surveys were carried out in June 1990 and June 1992 on board MV McGregor. We are indebted to Jamie Hambly, Stuart and Bron Farman, Tracey Joesbury and Jo Hender for the success of these cruises. Another intensive survey took place in August/September 1992 on board MV Chalice, and we would like to thank Keith Roberts, Pat, Steve and Barry for their help on this survey.

Aerial surveys took place in 1991; we thank Prospair Ltd. for the success of these surveys, particularly to the pilots John Farley, Alan Harbridge, Jeremy Norden and Mike Bunn.

Ornis Consult would like to thank the officers of the research vessels Argos, Dana, Eldjarn and Gunnar Thorson for their support and co-operation.

Vogelwarte Helgoland used the research vessels Heincke, Uthörn and Walther Herwig, and the ferries Seute Deern, Funny Girl, Wilhelmshaven, Helgoland, Pidder Lyng, First Lady.

The maps were plotted using DMAP for Windows. We would like to thank Dr. Alan Morton for modifying DMAP to plot latitude and longitude co-ordinates.

The following members of the European Seabirds at Sea Co-ordinating Group contributed to the introduction: Mardik Leopold, Henrik Skov, Henk Baptist, Henk Offringa, Stefan Pihl, Stefan Garthe, Claude Joiris and Leif Nilsson.

Andy Stronach helped produce the chapter on breeding populations. The following people kindly provided data for this chapter: Paul Walsh (Seabird Monitoring Programme, JNCC, UK), Stefan Garthe (Institut für Meereskunde, Univ. Kiel, Germany), Per Andell (Ornis Consult, Sweden), Bergur Olsen, (The Natural Museum, Faeroe Islands), Kees Camphuysen (Netherlands Institute for Sea Research, The Netherlands) and Guillemette Rolland (Société pour l'Étude et la Protection de la Nature en Bretagne -SEPNB- France).

A number of people reviewed the atlas and provided useful criticism of it: Jan Durinck and Henrik Skov (Ornis Consult, Denmark), Stefan Garthe (Institut für Meereskunde, Germany), Mardik Leopold (Instituut voor Bos- en Natuuronderzoek, The Netherlands), and Henk Baptist (National Institute for Coastal and Marine Management/RIKZ, The Netherlands). Nicky Fraser provided administrative support during its production.

1 SUMMARY

Area 1 - North-west oceanic

This area comprises deep water to the north and west of Scotland, and includes the continental shelf slope. The Faeroes are also included in this area. These waters were important for the more pelagic species such as fulmars, gannets, storm petrels and Leach's petrels. Other species were also often seen in this area: great skuas in early summer and autumn, kittiwakes and great black-backed gulls in winter, and sooty shearwaters in summer and autumn. Within this area, the shelf edge was of particular importance. Survey effort over deep waters was lower than over other areas - relatively few vessels used in the project covered these areas and poor weather often hampered attempts to survey deeper waters.

Area 2 - North-west shelf

This area contains many islands and sheltered sealochs, providing good breeding and wintering habitats. The island of Rum holds the largest breeding colony of Manx shearwaters in the world; this species was widespread throughout the area during the breeding season. The area was of some importance in winter for divers and eiders. The Minch was particularly important for its diversity of species including auks, fulmars, petrels, shearwaters, gulls, shags, cormorants and terns. High densities of guillemots and razorbills were found in the Minch in the summer and early autumn. Gannets were widespread throughout the area, although local concentrations were found around the gannetry at Ailsa Craig (Firth of Clyde) during the breeding season.

Area 3 - Shetland, Orkney and the Moray Firth

The Northern Isles hold large numbers of breeding birds; the surrounding waters are very important for seabirds during the breeding season, especially for auks, skuas and Arctic terns. The waters around the Northern Isles are important for some species throughout the year e.g. fulmar, great black-backed gull, kittiwake and shag. Guillemots remain in the area throughout the winter months, albeit at lower numbers than in the breeding season. The Moray Firth is locally important in winter for divers and seaducks, species which are vulnerable to pollution through prolonged periods of contact with the water surface. It is also important throughout the year for cormorants, shags, herring gulls, kittiwakes, guillemots and razorbills. A pollution incident anywhere in the Northern Isles/ Moray Firth area would have serious implications for seabirds, although species and numbers involved would depend on the time of year.

Area 4 - Western North Sea

This area also contains important breeding colonies, such as the Isle of May (Firth of Forth), Farne Islands and Flamborough Head. The area was important for auks at most times of the year. During the breeding season there were high densities around breeding sites in east Scotland and in the Firth of Forth. In late summer and early autumn there were concentrations of moulting auks throughout the area. In winter little auks arrived in the area. The area was also used in winter by eiders and gulls, particularly herring gull and great black-backed gull. Kittiwakes were abundant in the area throughout spring and summer, and terns (common, Arctic and sandwich) were found here in summer also. In late summer/ early autumn skuas (all species) passed through the area. Shags and cormorants were found in the Firth of Forth throughout the year.

Area 5 - Central and northern North Sea

This area was important for guillemots, although less so during the months of May and June when birds were tied to the colonies. Fulmars were widespread in the northern half of the area throughout the year, and extended into the southern half in late summer. Gannets and kittiwakes were also found in the area throughout the year, although the latter were more widespread during winter months, when herring gulls and great black-backed gulls were also widespread. The area was important in winter for little auks. Depth in this area is mostly shallow, with the exception of the Rinne. The southern and western edges of the Rinne, where depth increases sharply, were important for fulmars, and for little auks and guillemots in winter.

Area 6 - Southern and eastern North Sea, the Skagerrak, Kattegat and Belt Sea

This is a shallow area of low salinity which forms a distinct zone of distribution for many species. It was the most important area for divers, grebes and seaduck, especially during winter. Gulls were also common in the area: black-headed gulls, common gulls and great black-backed gulls in winter, lesser black-backed gulls in summer and herring gulls throughout the year. Little gulls were common during the peak of migration. The area was important in summer for terns (all species except roseate), in winter for guillemots, razorbills, black guillemots and little auks, and throughout the year for cormorants. An oil spill in this area would have serious consequences for seabirds, particularly in winter when many species which habitually sit on the water are found in large flocks.

Area 7 - Irish Sea

This area contains diverse habitats including estuaries and bays. Common scoter were found in large flocks in embayed areas in winter and spring. Skomer and Skokholm (Pembrokeshire Islands) hold large colonies of Manx shearwaters, reflected in the high densities of this species seen throughout the area in the breeding season. Grassholm (Pembrokeshire Islands) has a large gannetry; gannets were widespread in the area but concentrated locally around Grassholm. Guillemots and razorbills were seen throughout the year, although they were more numerous during the breeding season. Gulls and kittiwakes were widespread throughout the year, while common terns were seen in summer only. The area was important for roseate terns; although they were only seen in low numbers, the area contains Europe's largest breeding colony at Rockabill. The Irish Sea front, which runs south-west from the Isle of Man towards Ireland, is important for guillemots and razorbills from July until September; in the latter part of this period it is also important for fulmars, Manx shearwaters and kittiwakes, and to a lesser extent puffins and common terns.

Area 8 - South-west oceanic

This area contains the continental shelf edge to the west of Ireland and in the South-west Approaches and deep water of the Porcupine Seabight, although coverage in deep water was low. The area was typically inhabited by the more pelagic species. Gannets were present at the shelf edge throughout the year, although they were found in highest densities in March and April. Storm petrels were found at the shelf edge in summer. In late summer sooty shearwaters, great shearwaters and Cory's shearwaters were seen here. During winter months numbers of fulmars, great skuas, great black-backed gulls and kittiwakes at the shelf edge increased.

Area 9 - Celtic Sea

This is an extensive area of continental shelf, which again was typically inhabited by the more pelagic species. Gannets, lesser black-backed gulls and kittiwakes were widespread in the area throughout the year. In summer, Manx shearwaters and storm petrels, which have large colonies in or adjacent to the area, were also widespread. In late summer Cory's, great, sooty and Mediterranean shearwaters were seen in the area. Great skuas were concentrated in this area in winter, and guillemots were more widespread in the area in winter and spring than at other times of year.

Area 10 - English and Bristol Channels

Some species were widespread at low numbers throughout the year in this area e.g. fulmar, gannet, lesser black-backed gull, herring gull, great black-backed gull and kittiwake. The Solent supported black-headed gulls throughout the year, often in high densities. Shags were found around the Channel Islands and the Isles of Scilly throughout the year. In summer, Manx shearwaters were seen in the western half of the area. More species were found in the area in winter, including great skuas, common gulls and guillemots; low numbers of divers, Mediterranean gulls, little gulls and razorbills were seen in the eastern English Channel at this time.

Recommendations for future work

The maps and data presented here provide a baseline from which future work can proceed. Areas holding important seabird concentrations should be monitored to examine the continuing use of these areas. Examples of such areas are the Moray Firth in winter and the Irish Sea front in late summer. The general patterns of distribution of seabirds in all areas should also be monitored regularly, and the consistency of these patterns assessed.

Some areas would benefit from further coverage. Waters to the west of Norway have been incompletely surveyed between the months of October and April. There has been little survey in waters to the west of Ireland. Divers and seaduck are known to occur in the bays of west Ireland. Surveys to date have shown species such as razorbills and kittiwakes in this area. Further survey here would improve the quality of data available for this area.

Deep waters beyond the continental shelf edge to the south-west and north-west of Britain are also in need of further survey, particularly those to the south-west.

In addition to general survey and monitoring, further research on marine processes would enhance understanding of factors influencing the distribution of seabirds. The Irish Sea front is evidently important for a number of species, and further study may provide answers to some questions such as why this particular front is so important.

2 INTRODUCTION

There have been many incidents recorded of oil pollution killing seabirds. The wrecks of large oil tankers such as the Torrey Canyon in 1967 and the Amoco Cadiz in 1978 provoked much public anxiety. It was feared that the rapid development of the offshore oil industry in the North Sea in the 1970s would increase levels of oil pollution there, causing consequent harm to the seabird populations. In April 1977, a blowout occurred at the Ekofisk Bravo platform in the Norwegian sector of the central North Sea. Few birds were killed by this incident, in spite of the large quantities of oil spilled (Mehlum 1977, 1980). However, there were fears that if a similar incident were to occur in the period following the breeding season, when large numbers of auks from British colonies cross the North Sea, the damage would be greater. Throughout north-west Europe research institutions and nature conservation agencies began to realise that there was little information available on the distribution of seabirds away from the coasts. The only sources of information on the locations of seabird concentrations in the North Sea (e.g. Bourne 1982, Joiris 1972) were of little use for predicting numbers of birds at risk.

A number of organisations throughout north-west Europe began comprehensive studies of seabird distribution in offshore waters. Seabirds are truly international animals, particularly outside the breeding season, when they cross between the waters of states on a regular, even a daily, basis. Conservation of seabirds is thus a collective international responsibility, not just the isolated responsibility of individual states. Many of the organisations throughout north-west Europe recognised the need for collaboration and in recent years have joined forces to produce one common database for the waters of this area, the European Seabirds at Sea (ESAS) database.

This atlas has been published using data from the ESAS database. The following organisations have contributed data (in order of amount of survey effort): Joint Nature Conservation Committee (United Kingdom), Nederlands Instituut voor Onderzoek der Zee (The Netherlands), Ornis Consult (Denmark), National Institute for Coastal and Marine Management/RIKZ (The Netherlands), Nederlandse Zeevogelgroep (The Netherlands), Instituut voor Bos- en Natuuronderzoek (The Netherlands), Instituut voor Natuur Behoud (Belgium), National Environmental Research Institute (Denmark), Norsk Institutt for Naturforskning (Norway), and Vogelwarte Helgoland (Germany). In addition to these organisations, Vrije Universiteit Brussel (Belgium) and the University of Lund (Sweden) are part of the ESAS Co-ordinating Group. A brief history of the work of each of the contributing organisations and of the ESAS database follows.

2.1 Studies of seabird distribution at sea in north-west Europe

Joint Nature Conservation Committee, Seabirds at Sea Team (United Kingdom)

In 1979, following a one-year pilot study (Jones 1979), the Seabirds at Sea Team (SAST) was established by the Nature Conservancy Council (NCC) and a full research programme (SAST 1) started into the distribution of seabirds in the North Sea. Work in the North Sea continued in a second phase (SAST 2) between 1983 and 1986. Following this was a one-year project studying seabirds at sea north of Scotland (SAST NOS). In late 1986 NCC began a three-and-a-half-year project (SAST 3) concentrating on waters off western Scotland and in the Irish Sea. General surveys of the remaining sea areas in the English Channel and off south-west Britain were started in 1990 as part of the fourth phase of the Seabirds at Sea project (SAST 4). In April 1991, management of the Seabirds at Sea Team passed to the Joint Nature Conservation Committee (JNCC) as part of the re-organisation of the Nature Conservancy Council arising from the Environmental Protection Act 1990. The project has been funded at various times by the Department of Energy, the Department of Trade and Industry, the Department of the Environment, the Department of Transport, the Department of the Environment (Northern Ireland), the Marine Pollution Control Unit (MPCU, formerly with the Department of Trade and Industry, then with the Department of Transport and now with the Coastguard Agency), the United Kingdom Offshore Operators Association, BP, Esso, Shell, Chevron, British Gas, Hydrocarbons Great Britain, Occidental, Elf Enterprise and Amoco.

Throughout the project the aim has been to study distribution patterns of seabirds offshore throughout the year. Particular attention has been paid to: (i) the feeding range of auks from their colonies in the breeding season; (ii) the location of concentrations of moulting auks following the breeding season; (iii) wintering areas of birds; (iv) the frequency of occurrence of certain seabird concentrations; and (v) the relationship between seabird distribution and the marine environment. In addition to ship-based surveys offshore, aerial surveys covered the inshore zone of the entire British coastline. The results of previous phases of the project (SAST 1, 2, 3 and SAST NOS) have been reported in Blake *et al.* 1984, Tasker *et al.* 1987, Benn *et al.* 1987, 1988, 1989, Burton *et al.* 1987, and Webb *et al.* 1990. Companion reports summarise the location of vulnerable concentrations of seabirds in the North Sea and west of Britain (Tasker & Pienkowski 1987, Tasker *et al.* 1990). Data from all phases of the project up to and including SAST 4 are included in this atlas.

Two additional projects have been carried out to examine bird distribution in particularly sensitive nearshore areas off southern England. These projects covered Poole Bay in the winter of 1989/90 (funded by BP) and the Solent in 1991 (funded by BP and Esso) (Aspinall and Tasker 1990, 1992). Two further projects started in 1994: one is examining seabird and cetacean distribution between Durlston Head and Portland Bill in Dorset (funded by Amoco and British Gas), and the other is studying seabird distribution between the Shetland and Faeroe Islands (funded by BP and Shell). The Seabirds at Sea project is currently in its fifth phase, monitoring seabird distribution offshore around the UK.

Netherlands Institute for Sea Research (Nederlands Instituut voor Onderzoek der Zee, NIOZ) and Institute for Forestry and Nature Research (Instituut voor Bos- en Natuuronderzoek, IBN-DLO) (both at Texel, The Netherlands)

After several pilot studies on the distribution of seabirds in the Dutch sector of the North Sea in the 1970s (Engelsman & Hulsmann 1974, Swennen 1978) and the 1980s (Leopold 1987, van der Niet *unpubl.*), the Netherlands Institute for Sea Research (NIOZ) started observations on seabirds at sea in 1987. The surveys extended well beyond the Dutch sector, over the whole North Sea and waters beyond the English Channel, and the work has continued until the present. Standard SAST counting methods have been used since 1987, although in several specific studies the methods have been adapted, in order to get better estimates of numbers of divers (Skov *et al.* 1994), storm petrels (van der Meer & Leopold 1995, *in press*), and seaduck (Leopold *et al.* 1995, *in press*). The work was carried out by students and many volunteer observers, mainly of the Dutch Seabird Group (Nederlandse Zeevogelgroep, see below). Since 1993, the Institute for Forestry and Nature Research (IBN-DLO) took over the volunteer observers scheme, while NIOZ continued the work at sea by manning the Dutch Fisheries Research Vessel "Tridens" on its quarterly International Bottom Trawl Surveys. Recently, the data collected by all ESAS members over the Dutch sector of the North Sea from ships have been presented in an atlas (Camphuysen & Leopold 1994).

Ornis Consult (Denmark)

Between 1985 and 1987 surveys at sea around Denmark were initiated using ships of opportunity, with the focus on the previously unsurveyed waters suspected to support important concentrations of seabirds. From 1987 to 1989 a series of cruises on chartered ships were conducted by Ornis Consult as part of a national assessment of the location of vulnerable seabird areas and total numbers of seabirds in relation to the existing and planned development of offshore oil industries in Danish waters. The results of these surveys should form the basis for an evaluation of the existing international bird areas in Denmark, designated under the Ramsar Convention and the EC Bird Directive. These surveys were funded by the National Forest and Nature Agency (NFNA) and the National Environment Research Institute (NERI). NERI and Ornis Consult performed surveys from aeroplane and ship respectively. Further afield, between 1987 and 1990 Ornis Consult performed large scale surveys in the North Atlantic and the Davis Strait.

During the period from 1992 to 1994 Ornis Consult co-ordinated an international seabird conservation project entitled "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic Sea". This project aimed to identify areas of sea that could qualify for special protective measures, especially in relation to the EC Birds Directive and the EC Habitats Directive. The study area embraced the entire southern part of the Baltic Sea and, in the North Sea, the coastal waters of Belgium, the Netherlands, Germany and Denmark. Financial support was granted by the European Union, Netherlands Institute for Sea Research, the Nordic Council of Ministers and the National Environmental Research Institute. Along with this research dedicated to specific areas, Ornis Consult developed a survey scheme in offshore waters which was aimed at simultaneous bird and oceanographic data collection in order to relate patterns of abundance and seasonality to physical and biological characteristics. This work, which was carried out in collaboration with the Swedish Ornithological Society and the Scandinavian Seabird Group, involved repeated counts from marine research and monitoring ships as well as from ferries on fixed routes through specific areas of interest. The collection of new data and analyses of existing data from this scheme continues.

National Institute for Coastal and Marine Management / RIKZ (The Netherlands)

As part of the Ministry of Transport, Public Works and Water Management (RWS), the National Institute for Coastal and Marine Management / RIKZ provides information on the sustainable use of estuaries, coasts and seas and coastal flood protection. For this purpose RIKZ develops and maintains a knowledge and information infrastructure. RIKZ is the Netherlands' leading patron of applied coastal and marine research. As the knowledge bank for salt water systems, RIKZ also serves other parts of central government and it co-operates with various agencies and organisations at an international level. One of its tasks is to provide information on the sustainable use of estuaries, coasts and sea for advice and policy planning. Research provides the knowledge to allow us to use the sea responsibly, so as to preserve its natural values. Monitoring programmes offer an insight into the evolution and condition of salt water systems.

As part of the monitoring programme a series of counts of seabirds and mammals using aeroplanes was started in December 1984. The most important aim of the project has been to map the distribution of seabirds at the Dutch Continental Shelf and to quantify changes in numbers and distribution. From December 1984 until December 1987 seabirds were surveyed every month. Since January 1989 counts have been performed every two months, and this programme will be continued over the coming years. A small part of the information that has been gathered in the course of this project has been presented in "An atlas of birds on the Dutch Continental Shelf" (Baptist & Wolf 1993).

The accessibility of the databases will be improved to facilitate a wider use of the data. The information acquired during the monitoring programme is used for several governmental projects, especially the environmental zoning of the Dutch Continental Shelf and the Dutch Water Management Policy. The data are also used to analyse the effectiveness of oil clean-up operations by the North Sea Directorate.

Nederlandse Zeevogelgroep (The Netherlands)

In March 1987, volunteers of the "Club van Zeetrekwaarnemers" (CvZ, an organisation of seawatchers, currently a working group of the Dutch Seabird Group, NZG) were able to start regular systematic surveys on board RV Holland (Camphuysen & Platteeuw 1988). These surveys were carried out in close co-operation with and with the financial assistance of the Tidal Waters Division (DGW, currently named National Institute for Marine and Coastal Management, RIKZ) and the North Sea Directorate (DN) of the Ministry of Transport, Public Works and Water Management. The methods of the Seabirds at Sea Team were adopted and RV Holland was manned frequently between 1987 and 1990, when the project was discontinued. Surveys on board RV Holland followed fixed routes as part of a programme of Water Quality Monitoring, sailing from one sampling station to another within the Dutch sector of the North Sea. Observations of birds were made whilst sailing between these sampling stations, which were positioned at distances between two and 235 km away from the Dutch coast. Information from these surveys, together with data from other ship-based programmes for Dutch waters included in the ESAS database, were combined and published (Camphuysen & Leopold 1994).

Instituut voor Natuur Behoud (Institute for Nature Conservation) (Belgium)

The Institute for Nature Conservation was founded in 1986 by Prof. Eckhart Kuyken, one of the pioneers of seabird research in Belgium, who had conducted systematic beached bird surveys in the 1960s. The work of the Institute is focussed mainly on ecological studies, both for academic and management purposes. A major project has been a monitoring programme determining biologically important areas in Belgium, and the organisation of waterfowl counts has also been established here. Due to the intensive use of the Southern Bight and the Dover Straits by shipping, the need for gathering knowledge about the distribution and numbers of seabirds in these areas grew quickly. From 1986 onwards, systematic aerial surveys were conducted in Belgian coastal areas, but the gap in the knowledge of seabird distribution further offshore remained. The Institute for Nature Conservation in Hasselt commenced ship-based surveys offshore at the end of 1992, funded by the World Nature Fund and the Management Unit of the North Sea and Scheldt Estuary Mathematical Model (M.U.M.M.). Apart from the regular surveys on ferries and research vessels, special attention has been paid to the Flemmish Banks. The banks are widespread over the Southern Bight, but some are particularly important for common scoters and divers in coastal areas, and for gannets and guillemots further offshore. Since 1993 the Institute for Nature Conservation has been looking in more detail into the distribution of seabirds over different sandridges, in relation to hydrographic parameters and food abundance.

National Environmental Research Institute (Denmark)

The National Environment Research Institute (NERI) has carried out waterbird research since the beginning of the 1960s. NERI has worked almost exclusively with Anatidae. The monitoring has been based on total counts of the birds, particularly from aerial surveys. In the period 1987-1989 aerial transect counts were performed in the North Sea and the inner Danish waters where seabirds other than seaduck were included. Currently NERI is co-ordinating the decentralised IWRB Databases for Geese and Seaduck in the Western Palearctic. The databases collect results from the International Waterfowl Census (IWC) which takes place annually in the middle of January. The databases are expected to be used to publish population estimates and trends for seaduck and goose species.

Norsk Institutt for Naturforskning (Norway)

Offshore studies of seabird distribution have been carried out around Norway by a small number of organisations, but mainly by Norsk Institutt for Naturforskning (NINA). Most of these studies have been centred to the north of the study area, but two surveys were carried out by NINA in the North Sea in July 1986 and July 1987, with funding by Statoil a.s. and Norsk Hydro a.s., and with the assistance of the Norwegian Institute for Marine Research in Bergen.

Inselstation Helgoland des Instituts für Vogelforschung "Vogelwarte Helgoland" (Helgoland, Germany)

On the island of Helgoland seabirds have been studied by Vogelwarte Helgoland since 1909. Studies on seabirds at sea were started in July 1990. The main subjects of research are the relationships between seabird ecology and the biotic and abiotic environment. There have been studies on the short-term variation (temporal and spatial) in seabird abundance and communities in the coastal German Bight, involving more than 100 crossings between Helgoland and the mainland throughout the year. Links between the distribution of fulmar and other planktivorous birds and hydrography in the Skagerrak has been examined using simultaneous counting of birds and recording of hydrography (salinity and temperature profiles). This latter project involved co-operation with Ornis Consult and Anstalt Helgoland. Vogelwarte Helgoland also studies the reproductive success, food and condition of young, and feeding ranges of cliff-nesting seabirds around Helgoland. More recently projects have included the utilisation of fishery waste by seabirds using experimental discarding from research vessels on a large scale within the North Sea. Another project is looking at the relationship between fisheries, hydrography and seabird distribution in the German Bight.

Vrije Universiteit Brussel (Belgium)

From 1971 onwards, systematic counts of seabirds at sea were carried out, first in the southern North Sea (Joiris 1972) and later in the whole North Sea. These data were first expressed in numbers per unit time (half an hour), and later converted to densities by using specific correction factors evaluating the distance at which different species could be detected, taking into account their "conspicuousness" (size, colouration, etc.). The seabird data were integrated into the whole ecological structure of the North Sea ecosystem, where two basic types of water masses were defined on the basis of water temperature and salinity measurements: North Atlantic water with a classical food chain and North Sea water with a major proportion of the primary production being recycled by bacterioplankton (Joiris 1978). From 1973 onwards, attention turned to more northern waters, with more than 15 expeditions in the Greenland and Norwegian seas, and recently in the Barents Sea. Similar research was also conducted in the Antarctic.

University of Lund (Sweden)

Two sources of data are available for seabirds off the west coast of Sweden: counts from ships in offshore waters undertaken as a joint Danish-Swedish project (see section above on Ornis Consult) and the IWRB waterfowl counts. The latter are organised from the University of Lund with grants from the Swedish Environment Protection Agency. They include both inshore ground counts and, in some years, midwinter aerial surveys covering the entire area used by seaducks (early 1970s and 1987-1989). Midwinter ground counts in selected inshore areas to study long-term changes have been undertaken annually since 1967.

2.2 The European Seabirds at Sea Database

In 1991, with funding from the Department of Environment as part of its contribution to the North Sea Task Force, a project was undertaken to bring data sets from around Europe together. This project established common standards for combining data sets and combined all North Sea seabirds at sea databases into one that now contains over a million records of bird sightings and is the largest offshore bird and mammal database in existence. The project also devised a common method for assessing the vulnerability of offshore seabird concentrations to oil pollution. The database and these common standards were used to produce an updated and enhanced version of the 1987 North Sea vulnerability atlas (Carter *et al.* 1993).

The European Seabirds at Sea (ESAS) Co-ordinating Group was established also as a result of this project, currently under the chair of JNCC. It meets regularly to discuss potential co-operative surveys and analyses. As a follow-on from the project to produce the vulnerability atlas of seabirds in the North Sea, the ESAS Co-ordinating Group agreed to continue to update information in the joint database and use it to produce publications including a distribution atlas of seabirds in north-west Europe (this publication), an electronic atlas of seabird distribution in north-west Europe, and an atlas of bird concentrations vulnerable to oil and other surface pollutants south and west of Britain.

This publication is an atlas of the seasonal distribution of seabirds at sea in north-west Europe (see section 3.1 for a definition of the area). It contains a description of methods used by the different projects to collect bird distribution data at sea, the treatment of the data and the methods used to present the data. We provide brief descriptions of the numbers and distribution of breeding seabirds and a description of the marine environment. Each species account contains a set of seasonal distribution maps and a table of abundance in each of ten standard areas (see section 3.1). The text provides basic descriptions of the most important features shown in the maps and the tables, a brief summary for each species and a short bibliography of relevant literature. Interpretation of the distribution patterns is minimal; we consider this is best done in refereed scientific journals. A brief summary of the main features of each of the ten standard areas precedes this introduction.

Further reading

Aspinall, S. & Tasker, M.L. 1990. *Coastal birds of east Dorset.* Nature Conservancy Council, Peterborough.

Aspinall, S. & Tasker, M.L. 1992. *Birds of the Solent.* Joint Nature Conservation Committee, Aberdeen.

Baptist, H.J.M. & Wolf, P.A. 1993. *Atlas van de vogels van het Nederlands Continentaal Plat.* Rapport DGW-93.013, Rijkswaterstaat, Dienst Getijdewateren, Middelburg.

Benn, S., Webb, A., Burton, C.A., Tasker, M.L., Murray, S. & Tharme, A. 1987. Studies of seabirds at North Rona and Sula Sgeir, June 1986. *Nature Conservancy Council Chief Scientist Directorate Report* No.736.

Benn, S., Burton, C.A., Tasker, M.L., Webb, A. & Ward, R.M. 1988. Seabird distribution on the north-west Scottish shelf. *Nature Conservancy Council Chief Scientist Directorate Report* No. 803.

Benn, S., Murray, S. & Tasker, M.L. 1989. *The birds of North Rona and Sula Sgeir.* Nature Conservancy Council, Aberdeen.

Blake, B.F., Tasker, M.L., Jones, P.H., Dixon, T.J., Mitchell, R. & Langslow, D.R. 1984. *Seabird distribution in the North Sea.* Nature Conservancy Council, Huntingdon.

Bourne, W.R P. 1982. Concentrations of Scottish seabirds vulnerable to oil pollution. *Marine Pollution Bulletin 13:* 270-273.

Burton, C.A., Tasker, M.L., Benn, S., Webb, A. & Leaper, G.M. 1987. The distribution of seabirds off north-west Scotland, August 1986. *Nature Conservancy Council Chief Scientist Directorate Report* No. 758.

Camphuysen, C.J., Ensor, K., Furness, R.W., Garthe, S., Hüppop, O., Leaper, G., Offringa, H. & Tasker, M.L. 1993. *Seabirds feeding on discards in winter in the North Sea.* EC DG XIV research contract 92/3505. NIOZ Rapport 1993- 8, Netherlands Institute for Sea Research, Texel.

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Camphuysen, C.J. & Platteeuw, M. 1988. Voortgangsrapport Offshore Waarnemingen Nr. 1, 1987. *Sula 2(4):* 119-132.

Carter, I.C., Williams, J.M., Webb, A. & Tasker, M.L. 1993. *Seabird concentrations in the North Sea: an atlas of vulnerability to surface pollutants.* Joint Nature Conservation Committee, Aberdeen.

Danielsen, F., Skov, H. & Durinck, J. 1986. *Biological and environmental conditions of the North Sea - mapping of conditions in Danish sector and the Wadden Sea with reference to oil spill impact. Annex A: Atlas of birds. Preliminary determination of areas important to water birds with assessment of sensitivity to oil pollution.* Maersk Olie og Gas A/S, Copenhagen.

Durinck, J., Skov, H. & Andell, P. 1993. Seabird distribution and numbers in selected offshore parts of the Baltic Sea, winter 1992. *Ornis Svecica 3:* 11-26.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Engelsman, S. & Hulsmann, A. 1974. *Zeevogelproject Texel.* Int. Rep. NIOZ, Texel.

Joiris, C. 1972. Observations ornithologiques realisées dans le sud-est de la Mer du Nord, entre Juin 1971 et Janvier 1972 - I. Oiseaux marins. *Aves 9:* 85-103.

Joiris, C. 1978. Seabirds recorded in the northern North Sea in July: the ecological implications of their distribution. *Le Gerfaut 68:* 419-440.

Joiris, C. 1983. Winter distribution of seabirds in the North Sea: an oceanological interpretation. *Le Gerfaut 73:* 107-123.

Joiris, C.R. 1989. Seabirds in the North Sea: distribution and ecological role. *ICES Report C.M.1989/N:8 - ICES, Copenhagen.*

Jones, P.H. 1979. *Investigations of the distribution of seabirds at sea; short report on the feasibility study; October 1978 to March 1979 and suggestions for future work.* Nature Conservancy Council commissioned research report.

Leopold, M.F. 1987. *Zeevogels op zee: een onderzoek naar verspreiding en kwaliteitsverschillen van zeevogels binnen een deel van het Nederlandse Continentale Plat.* NIOZ Rapport 1987- 2, Netherlands Institute for Sea Research, Texel.

Leopold, M.F. 1991. Toppredatoren op het Friese Front: zeevogels en zeezoogdieren. In, Gee, A. de, Baars, M.A. & Veer, H.W. van der (eds.), *De Ecologie van het Friese Front*, NIOZ Rapport 1991-2, Texel, pp. 79-89.

Leopold, M.F., Baptist, H.J.M., Wolf, P.A. & Offringa, H. 1995. De Zwarte Zeeëend *Melanitta nigra* in Nederland. *Limosa,* in press.

Leopold, M.F., Grunsky, B., Hüppop, O. & Van Der Meer, J. 1994. How large an area of sea do Helgoland seabirds use for foraging during the breeding season? *Helgoländer Meeresunters 49,* in press.

Lorentsen, S.H., Anker-Nilssen, T., Kroglund, R.T., & Østnes, J.E. 1993. Konsekvensanalyse oljesjøfugl for petroleumsvirksomhet i norsk del av Skagerrak. *NINA forskningsrapp. 39:* 1-84.

Meer, J. & Leopold, M.F. 1995. Assessing the population size of the European Storm-Petrel (*Hydrobates pelagicus*) using spatial autocorrelation between counts from segments of criss-cross ship transects. *ICES J. Mar. Sci.,* in press.

Mehlum, F. 1977. Sjöfuglregistreringer i forbindelse med Bravoulykken, Ekofisk April 1977, Del I. *Mimeogr. report, Min. Environm., Norway,* 28pp.

Mehlum, F. 1980. Seabirds and the Bravo blow-out at Ekofisk North Sea. *Acta Orn. 17(10):* 119-126.

NCC 1980. *Important concentrations of seabirds requiring protection from oil pollution.* Nature Conservancy Council, Peterborough.

Skov, H., Andell, P., Danielsen, F. & Durinck, J. 1990. Hvordan kan man forebygge olieforureningsskader på havfugle i Kattegat og Skagerrak. *Fauna och Flora 85:* 153-160.

Skov, H., Danielsen, F. & Durinck, J. 1987. Kortægning af havfugle i danske farvande: Indledende undersøgelser 1986-87. *Dansk. Orn. Foren. Tidsskr. 81:* 174-176.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Swennen, C. 1978. Zeevogels en de ramp met de tanker "Pacific Colocotronis" in de Noordzee. *Veldorn. Tijdschr. 1:* 34-41.

Tasker, M.L. 1991. Conservation uses of information on the distribution of seabirds at sea. In, Camphuysen, C.J. & Franeker, J.A. (eds.), *Oil pollution, beached bird surveys and policy: towards a more effective approach to an old problem.* Proc. int. NZG/NSO workshop, Rijswijk, 19 April 1991, *Sula 5 (special issue):* 28-29.

Tasker, M.L. & Pienkowski, M.W. 1987. *Vulnerable concentrations of birds in the North Sea.* Nature Conservancy Council, Peterborough.

Tasker, M.L., Webb, A., Hall, A.J., Pienkowski, M.W. & Langslow, D.R. 1987. *Seabirds in the North Sea.* Nature Conservancy Council, Peterborough.

Tasker, M.L., Webb, A., Harrison, N.M. & Pienkowski, M.W. 1990. *Vulnerable concentrations of marine birds west of Britain.* Nature Conservancy Council, Peterborough.

Webb, A., Harrison, N.M., Leaper, G.M., Steele, R.D., Tasker, M.L. & Pienkowski, M.W. 1990. *Seabird distribution west of Britain.* Nature Conservancy Council, Peterborough.

3 METHODS

3.1 The study area

For the purposes of this publication the waters of north-west Europe are defined as those lying within the latitudes 48°N and 63°N and within the longitudes 15°W and 14°E. This atlas is concerned primarily with offshore waters and does not pretend to cover adequately coastal concentrations of birds. The waters were divided into ten standard areas for analysis of bird distributions (Figure 3.1). The divisions are based mostly on major geographic, hydrographic and physical differences between the areas (see section 4.2). The location of places and areas mentioned throughout the text are shown in Figure 3.2.

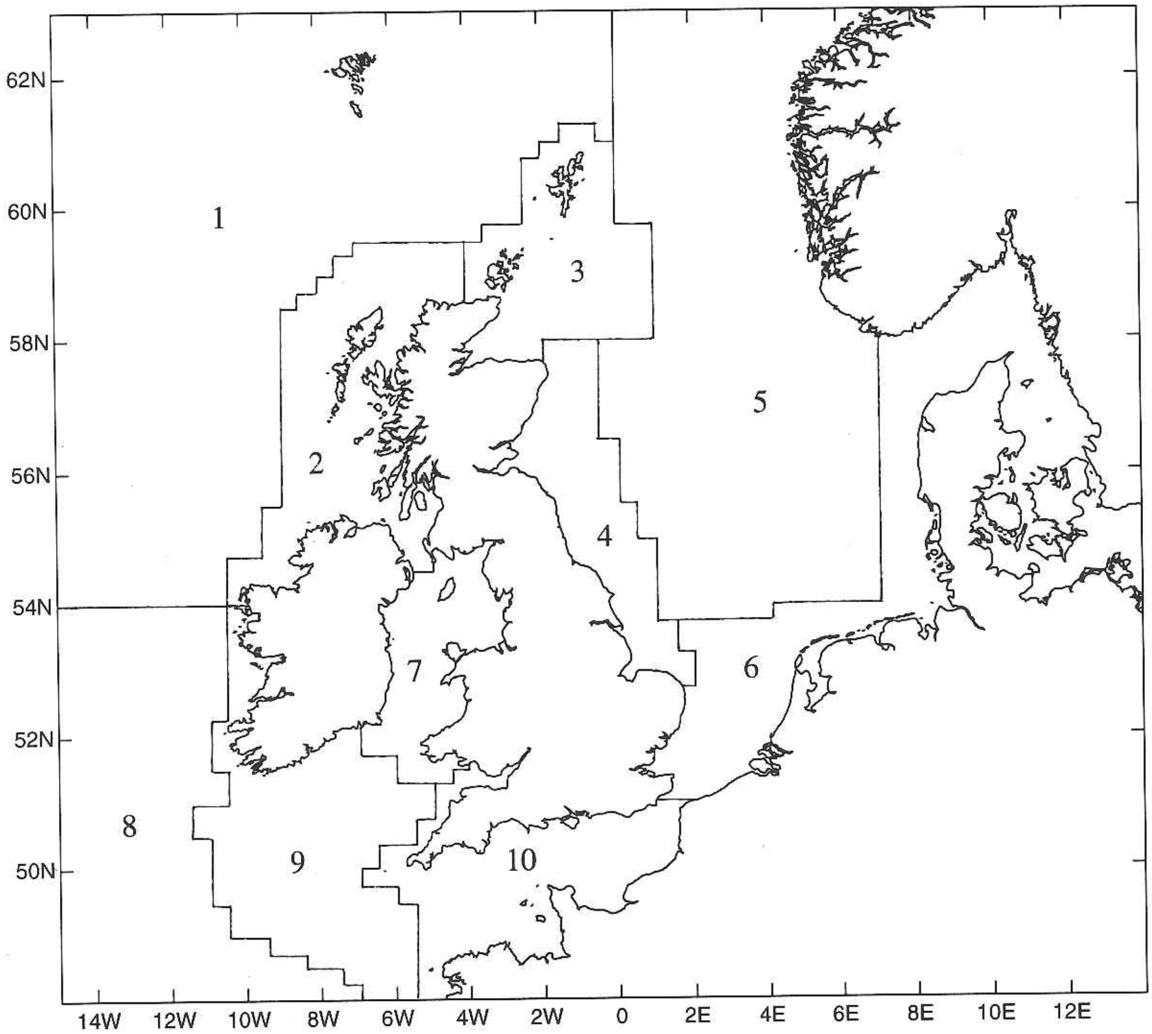

Figure 3.1 Areas for analysis of seabird distribution

1 North-west oceanic
2 North-west shelf
3 Shetland, Orkney & Moray Firth
4 Western North Sea
5 Central & northern North Sea
6 Southern & eastern North Sea
7 Irish Sea
8 South-west oceanic
9 Celtic Sea
10 English & Bristol Channels

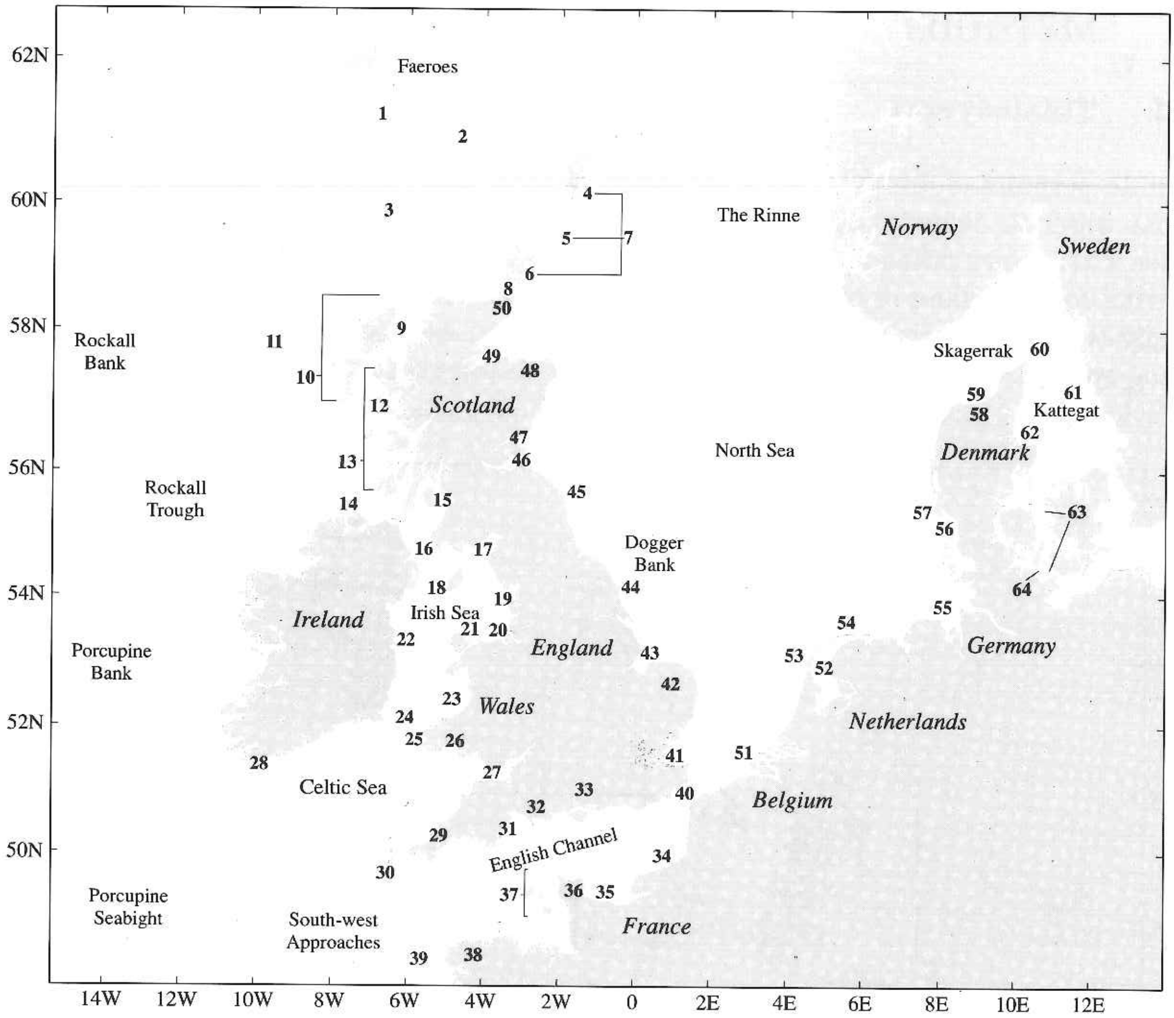

Figure 3.2 Location of places named in the text

1. Faeroe Bank
2. Faeroe-Shetland Channel
3. Scotland-Faeroe Iceland Ridge
4. Shetland
5. Fair Isle
6. Orkney
7. Northern Isles
8. Pentland Firth
9. The Minch
10. Outer Hebrides
11. St Kilda
12. Rum
13. Inner Hebrides
14. Malin Head
15. Firth of Clyde
16. North Channel
17. Solway Firth
18. Isle of Man
19. Morecambe Bay
20. Liverpool Bay
21. Anglesey
22. Rockabill
23. Cardigan Bay
24. St. George's Channel
25. Pembrokeshire Islands
26. Carmarthen Bay
27. Bristol Channel
28. Cape Clear
29. Cornwall
30. Isles of Scilly
31. Lyme Bay
32. Dorset
33. The Solent
34. Baie de la Somme
35. Baie de la Seine
36. Cherbourg Peninsula
37. Channel Islands
38. Brittany
39. Ushant
40. Dover Straits
41. Thames Estuary
42. East Anglia
43. The Wash
44. Flamborough Head
45. Farne Islands
46. Firth of Forth
47. Firth of Tay
48. Grampian
49. Moray Firth
50. Caithness
51. Delta Region
52. Wadden Sea - Dutch
53. Texel
54. Frisian Islands
55. German Bight
56. Wadden Sea - Danish
57. Blåvandshuk
58. Limfjorden
59. Jammerbugten
60. Skagen
61. Middelgrundene
62. Ålborg Bight
63. Belt Sea
64. Kiel Bay

3.2 Survey methods

Two types of observation platform were used to survey seabird distribution: ships and aircraft. The basis of recording from both platforms is a strip transect, in which all birds are counted within a specific lateral distance from a moving platform.

3.2.1 Ships.

Methods used for counting birds from ships have been described by Tasker *et al.* (1984) and Webb & Durinck (1992). Birds were counted within a strip transect up to 300 m wide on one side of the ship. There was some variation in the transect width; most transects were 300 m wide, but a small proportion of transects were narrower than this (Table 3.1). Birds on the water were categorised according to distance from the observer (0-50 m, 51-100 m, 101-200 m and 201-300 m). Distances were judged by eye with regular verification using a rangefinder (Heinemann 1981). To avoid overestimating abundance, flying birds within the transect were counted instantaneously at intervals depending on the ship's speed. In addition to the strip transect, all other birds within a 90° (bow-to-beam) or 180° (forward of the ship) scan were recorded, but these birds were noted as being out of transect. The choice of angle depended on viewing conditions; the 180° scan provides a larger sample and is considered more appropriate for abundance of rarer birds.

Table 3.1 Ship-based survey effort using transects of different widths

Transect width (m)	Survey effort (km^2) and percentage in brackets
50	2 (0.002%)
100	277 (0.2%)
150	3015 (2.3%)
200	4800 (3.6%)
250	71 (0.1%)
300	124,421 (93.8%)

3.2.2 Aircraft

A strip transect was operated on one or both sides of the aircraft using methods described by Pihl & Frikke (1992). The high speed of the aircraft eliminates the danger of overestimating abundance of flying birds, so these were counted continuously within the transect along with birds on the water. Aerial surveys were used by three European research programmes, each using slightly different techniques (Table 3.2). Briggs, Tyler & Lewis (1985b) have compared different aerial survey techniques. We have not controlled for differences between survey methods and have included all aerial survey data together.

Table 3.2 Method used for aerial surveys by different institutes.

Research institute	Transect width	Height above sea
Joint Nature Conservation Committee (UK)	180m on one side of aircraft	60m; some at 30m
Natural Environment Research Institute (DK)	90m on both sides	60m
Tidal Waters Division (NL)	150m on both sides	120 - 150m

3.2.3 Treatment of ship and aerial survey data.

The similarities and differences between ship and aerial survey methods for assessing the abundance of seabird species are discussed by Pihl *et al.* 1992 and by Briggs, Tyler & Lewis 1985a. There have been few if any good comparisons of seabird densities derived from the two platforms. However, in general, it is believed that aerial surveys underestimate densities of small inconspicuous species, whereas ship surveys usually overestimate densities of scavenging species (e.g. Blake *et al.* 1984). Aerial surveys require rapid identification of birds; often it is not possible to determine identity of birds to species level, especially those which are similar to each other, such as the auks, divers, terns and some gulls (Briggs, Tyler & Lewis 1985a). We have presented data from both ship and aerial surveys only for conspicuous species which can easily be identified from the air or where the density of whole species groups are presented (Table 3.3).

Table 3.3 Source of data used in analysis of distribution of each species or species group

Species	Ship/aerial data used
Divers (all species combined)	Ship & aerial
Identified diver species	Ship only
Grebes	Ship only
Fulmar	Ship & aerial
Shearwaters (except Manx shearwaters)	Ship only
Manx shearwater	Ship & aerial
Storm petrels	Ship only
Gannet	Ship & aerial
Cormorant and shag	Ship only
Seaduck	Ship & aerial
Skuas	Ship only
Gulls (excluding kittiwake)	Ship only
Kittiwake	Ship & aerial
Terns	Ship only
Auks	Ship only

3.3 Data processing

All data collected on ships were initially recorded on paper and later coded for computer analysis. Three types of information were coded: bird data (information on species, number, behaviour, plumage, age, etc.), base data (information on the type of observation base, method used, position, speed and course, activity, etc.), and environmental data (wind direction, sea state, swell height and visibility).

A number of different coding systems operate amongst the European Seabirds at Sea schemes; all are PC-based. In all schemes data are validated by a computer program to check for extraneous values and other logical errors, and in most schemes there is additional manual checking of data. After validation the different systems are translated into an agreed common format stored in a relational Paradox database package.

3.4 Interpretation of data

3.4.1 Distribution maps

The distribution of each species within this atlas has been mapped in one of three ways (Table 3.4): as birds.km^{-2}, birds.km^{-1} or as sightings. Monthly maps showing the effort within the study area (km^2 surveyed and km travelled from both ships and aircraft combined and from ships only) are presented in Figures 3.3 to 3.50.

Table 3.4 Type of analysis and mapping for all species considered in this atlas

Common species where numbers of birds are expressed as densities (birds.km^{-2}) (Method 1)	Less common species where numbers of birds are expressed as abundance (birds.km^{-1}) (Method 2)	Rare species where all sightings of individuals are recorded (Method 3)
Divers (all species combined)	Red-throated diver	Mediterranean shearwater
Fulmar	Black-throated diver	Wilson's petrel
Sooty shearwater	Great northern diver	Grey phalarope
Manx shearwater	Great crested grebe	Pomarine skua
Storm petrel	Red-necked grebe	Long-tailed skua
Gannet	Cory's shearwater	Mediterranean gull
Cormorant	Great shearwater	Sabine's gull
Shag	Leach's petrel	Iceland gull
Eider	Long-tailed duck	Glaucous gull
Common scoter	Velvet scoter	Little tern
Arctic skua	Red-breasted merganser	Black tern
Great skua	Black guillemot	
Unidentified gulls		
Little gull		
Black-headed gull		
Common gull		
Lesser black-backed gull		
Herring gull		
Great black-backed gull		
Kittiwake		
Terns (all species combined)		
Sandwich tern		
Commic terns		
Unidentified auks		
Guillemot		
Razorbill		
Little auk		
Puffin		

Method 1. Common species are plotted as densities (birds.km^{-2}), by summing the number of birds recorded in transect both on the water and flying in each ¼ ICES rectangle (15' latitude x 30' longitude), and dividing it by the area surveyed in that rectangle. For these species, only birds seen in strip transects were analysed.

To account for variations in detection of birds on the water at different distances from the ship, numbers of these birds were multiplied by a factor according to species and the width of the strip transect (Table 3.5). These factors were used only for birds on the water and not for flying birds. The factors were calculated by comparing the numbers of each species seen at different distances from the ship. Birds were allocated to one of four divisions of the transect (0-50 m, 51-100 m, 101-200 m, 201-300 m). The numbers of birds in each band were examined on the assumption that the ratio of the totals would equal the ratio of the band widths. This calculation was done for all species for transect widths of 200 m and of 300 m. It was not possible to carry out the calculation on band widths of 150 m; it was assumed that 100% efficiency was achieved in transect widths of less than 200 m.

It was found that 200 m transects were almost always more efficient than 300 m transects. The degree of efficiency varied with conspicuousness of the species. Gannets could be detected with equal efficiency at all distances to 300 m, as could eider and common scoter which normally occur in large flocks. Little auks and tern species are small and highly inconspicuous when resting on the water and had the highest multiplication factors applied. It is not possible to measure the relative efficiency of observations for flying birds.

Table 3.5 Factors used when calculating densities to compensate for decreasing ability to detect birds on the sea with increasing distance from the ship.

Species	Factor for strip transects of 200 m	Factor for strip transects of 300 m
Diver species	1.2	1.3
Fulmar	1.1	1.1
Sooty shearwater	1.1	1.3
Manx shearwater	1.1	1.3
Storm petrel	1.2	1.5
Gannet	1.0	1.0
Cormorant	1.1	1.1
Shag	1.1	1.1
Eider	1.0	1.0
Common scoter	1.0	1.0
Arctic skua	1.1	1.3
Great skua	1.1	1.3
Unidentified gulls	1.2	1.4
Little gull	1.2	1.4
Black-headed gull	1.2	1.4
Common gull	1.2	1.4
Lesser black-backed gull	1.2	1.4
Herring gull	1.2	1.4
Great black-backed gull	1.2	1.4
Kittiwake	1.2	1.4
Tern species	1.3	1.7
Sandwich tern	1.3	1.7
Commic terns	1.3	1.7
Unidentified auks	1.2	1.5
Guillemot	1.2	1.4
Razorbill	1.2	1.5
Little auk	1.5	1.9
Puffin	1.2	1.5

Method 2. Less common species are plotted as abundance of birds per km travelled (birds.km^{-1}); these species were analysed including birds both in and out of the strip transect. Coverage using the scan method differed from that using the transect, mainly due to the inclusion of records from UK volunteer observers.

Method 3. For species that were seen only occasionally, the number of birds seen in each ¼ ICES rectangle is plotted using all records of sightings.

Some rare species were seen which are rare in the whole or part of the study area - not all of these records have been verified by the appropriate rarities committee. A list of species rare in the whole study area (fewer than fifteen birds) is contained in section 5.52.

Maps for each month of the year were produced for each species. The data were then compared for changes between each month; where changes in distribution and/or numbers were relatively small, the months have been amalgamated for this report.

All maps have been plotted using a computer program called DMAP for windows, which was modified specially by Dr. Alan Morton to allow plotting of positions using latitude and longitude. The maps use a projection of equidistant meridians and equidistant parallels. The aspect ratio (N/S:E/W) between these two projections is set at 1.7:1 i.e. a degree of latitude on the map meausures the same as 1.7 degrees of longitude.

3.4.2 Monthly statistics

For all species the monthly abundance is presented for each of the ten standard areas (Figure 3.1). The unit of measurement (birds.km^{-2} or birds.km^{-1}) is the same as that used for presentation in the distribution maps (Table 3.4). The summary statistics presented are the overall density or abundance of birds and the effort (km^2 surveyed or km travelled).

3.4.3 Uncertain identifications

It is not always possible to identify specifically every bird seen at sea. There are four main groups where identification may be difficult: the auks (especially guillemot and razorbill), large gulls (especially immatures and when in large mixed flocks), divers and terns. In our surveys, if the observer was uncertain of the precise identity of a bird, it was categorised to a pair or group of species. For most species groups, the incidence of uncertain identifications is low (less than 5%). For auks and gulls, some categories of identification (all gull species, large gull species, all auk species, and guillemot/ razorbill) are included separately as tables of densities. Data from other uncertain identifications are presented only in composite maps for two species groups (divers and terns), thus in some cases true densities of identified species may be slightly higher than shown by the maps and tables.

3.5 Survey difficulties

3.5.1 Effects of survey ships

Several unquantified biases probably exist within the data used in this document. One bias may be caused by the variety of ships used to gather the data. Most observations to the west of the Outer Hebrides at the continental shelf edge or beyond were made from fishery protection vessels; most of those in the eastern North Sea were from research vessels or chartered ships. These former vessels actively seek fishing vessels in order to check on their activities. Since many species of seabirds are attracted to fishing vessels, it is likely that more of these species will be recorded from fishery protection vessels than from those vessels that move independently of fishing vessels. The densities of these scavenging birds may therefore be inflated in the area west of the Hebrides. Observations were made from fishery protection vessels in this area in all months except June, September and November.

Many different types of ships have been used, often for reasons of cost and practicality. Several biases may be present because of variety of ships used. Some data are collected from ferries; they follow fixed routes which are more or less independent of the marine environment, but ferries are larger and faster than most other vessels used in the different projects and may have their own survey biases. Small ships are much more affected by waves and seastate than large ships, but being generally slower, may give a greater chance of detecting individual birds. Observation positions on larger ships are generally higher, potentially giving increased visibility. No tests have been made to quantify these potential biases.

3.5.2 Variation of data with time

Seabird distributions are not constant, and vary in both time and location. Tasker *et al.* (1987) discuss variation of seabird distribution on year-to-year, day-to-day and diurnal timescales. Further analysis of annual variation in seabird distribution patterns in north-west Europe is being carried out. In this document, data from all years, all days of the month and all times of day are combined for analysis. This approach may conceal some important features of seabird biology and distribution at sea. A summary of the variation in annual effort in each of the ten standard areas (Figure 3.1) is presented in Table 3.6.

Further reading

Baptist, H.J.M. 1990. Errors of sampling, analysis of distribution and sampling methods. *Meeting of IWRB's Western Palearctic Seaduck Database, Knebel, Denmark.*

Blake, B.F., Tasker, M.L., Jones, P.H., Dixon, T.J., Mitchell, R. & Langslow, D.R. 1984. *Seabird distribution in the North Sea.* Nature Conservancy Council, Huntingdon.

Briggs, K.T., Tyler, W.B. & Lewis, D.B. 1985a. Comparison of ship and aerial surveys of birds at sea. *Journal of Wildlife Management 49:* 405-411.

Briggs, K.T., Tyler, W.B. & Lewis, D.B. 1985b. Aerial surveys for seabirds: methodological experiments. *Journal of Wildlife Management 49:* 412-417.

Diamond, A.W., Gaston, A.J. & Brown, R.G.B. 1986. Converting counts of seabirds at sea to absolute densities. *Can. J. Wildl. Serv. Prog. Note No. 164,* 21pp.

Franeker, J.A. van 1990. Methodes voor het tellen van zeevogels op zee: een pleidooi voor vergelijkend onderzoek. *Sula 4:* 85-89.

Franeker, J.A. van 1994. A comparison of methods for counting seabirds at sea in the southern ocean. *J. Field Orn. 65:* 96-108.

Gaston, A.J., Collins, B.L. & Diamond, A.W. 1987. The "snapshot" count for estimating densities of flying seabirds during boat transects: a cautionary comment. *Auk 104:* 336-338.

Haldin, M. & Ulfrens, J. 1987. On the efficiency of censusing waterbirds by boat. *Orn. Fenn. 64:* 74-75.

Heinemann, D. 1981. A range finder for pelagic bird censusing. *Journal of Wildlife Management 45:* 489-493.

Offringa, H. & Leopold, M.F. 1991. Het tellen van Zwarte Zeeëenden *Melanitta nigra* voor de Nederlandse kust. *Sula 5:* 154-157.

Pihl, S. & Frikke, J. 1992. Counting birds from aeroplane. In, Komdeur, J., Bertelsen, J. & Cracknell G, (eds.), *Manual for aeroplane and ship surveys of waterfowl and seabirds*, IWRB Special Publication No. 19, Slimbridge, pp. 8-23.

Pihl, S., Webb, A., Frikke, J. & Durinck, J. 1992. The importance of monitoring waterfowl and seabirds. In, Komdeur, J., Bertelsen, J. & Cracknell, G., (eds.), *Manual for aeroplane and ship surveys of waterfowl and seabirds*, IWRB Special Publication No. 19, Slimbridge, pp. 6-8.

Tasker, M.L., Jones, P.H., Dixon, T.J. & Blake, B.F. 1984. Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach. *Auk 101:* 567-577.

Tasker, M.L., Webb, A., Hall, A.J., Pienkowski, M.W. & Langslow, D.R. 1987. *Seabirds in the North Sea.* Nature Conservancy Council, Peterborough.

Webb, A. & Durinck, J. 1992. Counting birds from ship. In, Komdeur, J., Bertelsen, J. & Cracknell, G., (eds.), *Manual for aeroplane and ship surveys of waterfowl and seabirds*, IWRB Special Publication No. 19, Slimbridge, pp. 24-37.

Table 3.6 Annual survey effort (km^2) in each of ten standard areas (see Figure 3.1).

a) Effort from ships and aircraft.

Area \ Year	80	81	82	83	84	85	86	87	88	89	90	91	92	93
1	383.8	389.6	178.8	119.9	147.9	157.7	1539.3	754.3	339.8	212.6	276.9	235.6	52.8	56.2
2	558.4	61.6	39.8	381.0	18.3	437.8	5037.5	3623.6	2592.8	1777.6	95.1	337.7	59.1	266.6
3	1089.5	2479.8	3406.1	3246.5	647.6	533.7	1180.3	1005.4	270.8	123.2	818.7	871.2	452.6	535.9
4	952.0	2056.1	831.4	272.9	3881.9	2090.6	197.7	1086.1	529.4	1102.1	348.2	1260.7	310.1	969.9
5	1144.1	3405.1	1470.5	430.1	2110.1	3351.3	2108.1	4736.9	2441.6	1252.2	963.0	1651.4	747.2	1896.9
6	0	3015.4	1418.6	199.5	2432.3	4223.9	4352.7	8221.2	7496.9	3672.1	2343.7	2463.0	2377.5	3491.9
7	92.9	209.7	0	781.4	0	52.9	0	2044.9	1892.0	1089.9	636.7	1205.2	1261.6	454.3
8	114	0	0	0	0	0	0	0	0	252.3	104.9	172.3	452.0	227.4
9	459.9	0	0	3.8	0	0	0	235.9	0	653.6	588.0	1296.8	1878.8	455.9
10	94.5	159.0	120.4	15.1	2.1	9.0	0	264.8	216.1	383.4	1488.1	5335.1	2629.0	110.4

b) Effort from ships.

Area \ Year	80	81	82	83	84	85	86	87	88	89	90	91	92	93
1	383.8	389.6	178.8	119.9	147.9	157.7	1539.3	754.3	339.8	212.6	276.9	235.6	52.8	56.2
2	558.4	61.6	39.8	381.0	18.3	437.8	5037.5	1548.8	2174.4	1372.3	95.1	337.7	59.1	266.6
3	1089.5	2479.8	3166.6	2556.1	647.0	533.7	1180.3	912.3	270.8	123.2	818.7	871.2	452.6	535.9
4	952.0	2056.1	831.4	212.3	2649.8	1882.5	197.7	1086.1	529.4	491.2	348.2	1124.4	310.1	969.9
5	1144.1	3405.1	1470.5	430.1	2028.5	2584.6	1293.6	4323.2	2107.2	1252.2	963.0	1571.6	747.2	1896.9
6	0	3015.4	1418.6	199.5	2077.4	1756.9	1187.5	6732.7	6745.9	2605.8	2343.8	2239.8	2377.5	3491.9
7	92.9	209.7	0	781.4	0	52.9	0	2044.9	921.7	277.6	636.7	796.3	1261.6	454.3
8	114.0	0	0	0	0	0	0	0	0	252.3	104.9	172.3	452.0	227.4
9	459.9	0	0	3.8	0	0	0	235.9	0	653.6	588.0	1275.2	1878.8	455.9
10	94.5	159.0	120.3	15.1	0	9.0	0	264.8	216.1	363.5	1488.1	3192.0	2629.0	110.4

Table 3.6 cont. Annual survey effort (km^2) in each of ten standard areas (see Figure 3.1).

c) Effort from aircraft

Area \ Year	80	81	82	83	84	85	86	87	88	89	90	91	92	93
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	2074.8	418.4	405.4	0	0	0	0
3	0	0	239.6	690.4	0.6	0	0	93.1	0	0	0	0	0	0
4	0	0	0	60.6	1232.2	208.2	0	0	0	610.9	0	136.3	0	0
5	0	0	0	0	81.6	766.7	814.5	413.7	334.4	0	0	79.8	0	0
6	0	0	0	0	354.9	2467.0	3165.2	1488.5	751.0	1066.3	0	223.3	0	0
7	0	0	0	0	0	0	0	0	970.3	812.3	0	408.9	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	21.6	0	0
10	0	0	0	0	2.1	0	0	0	0	19.9	0	2143.1	0	0

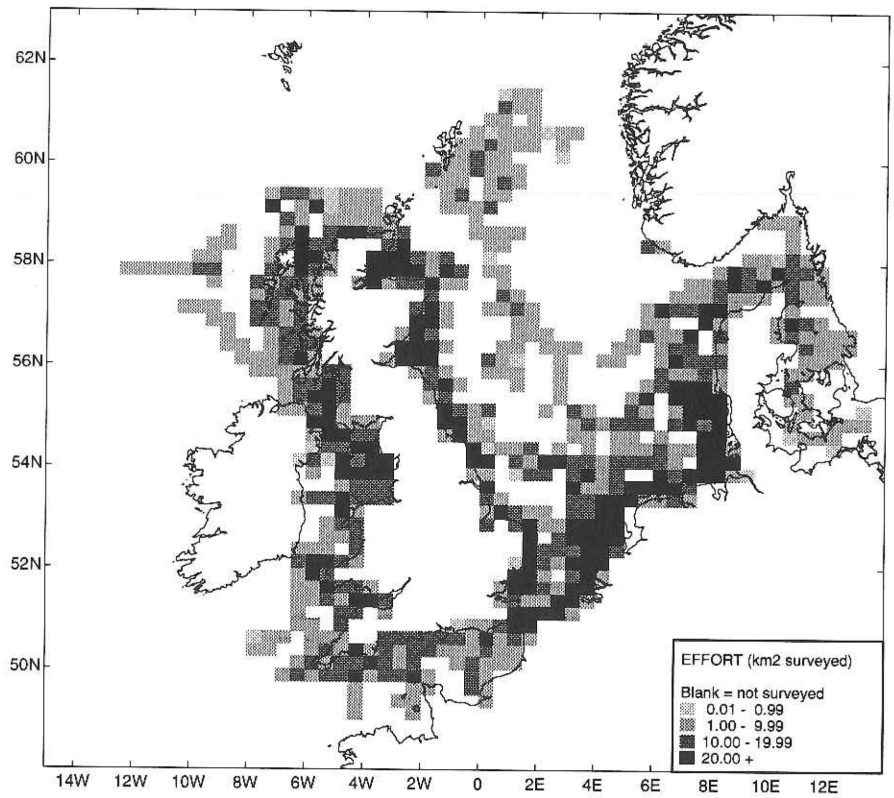

Figure 3.3 Coverage in January from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

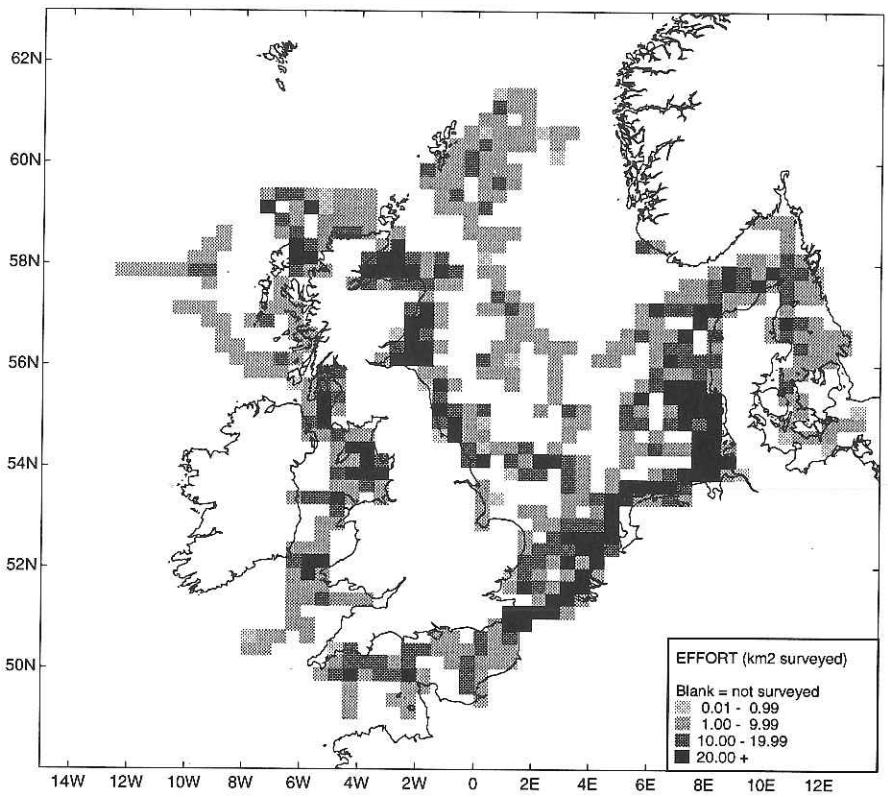

Figure 3.4 Coverage in January using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

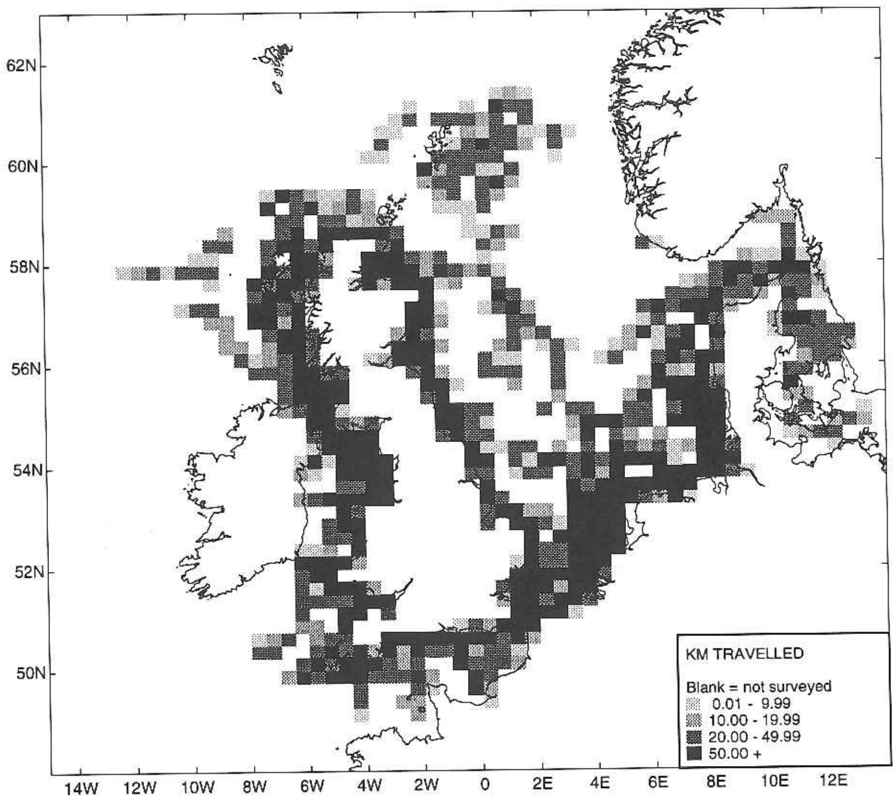

Figure 3.5 Coverage in January using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

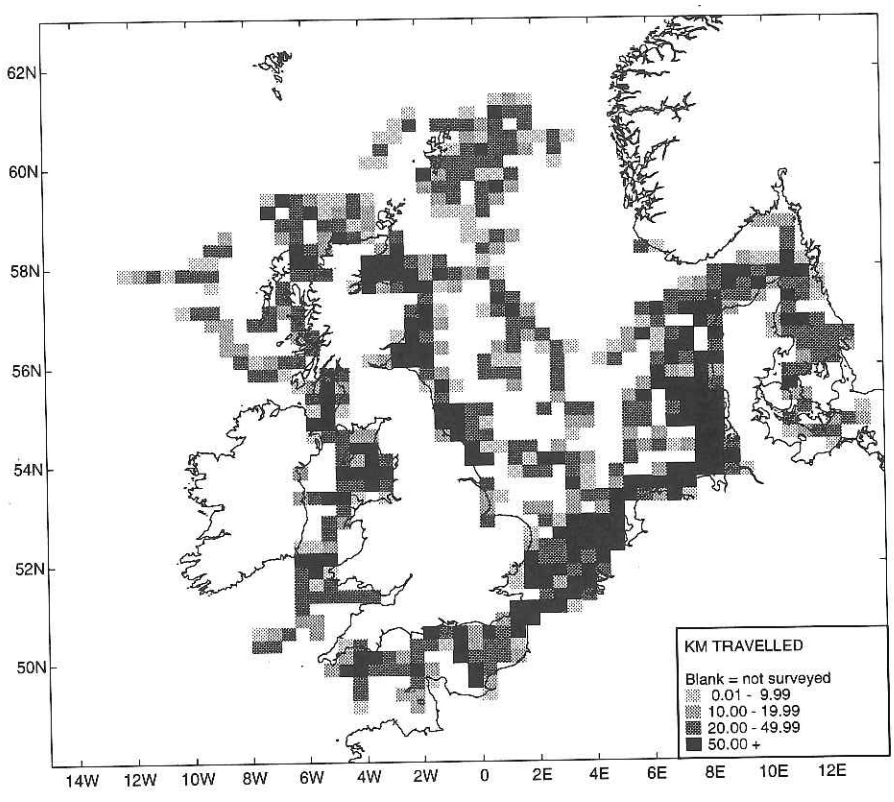

Figure 3.6 Coverage in January using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

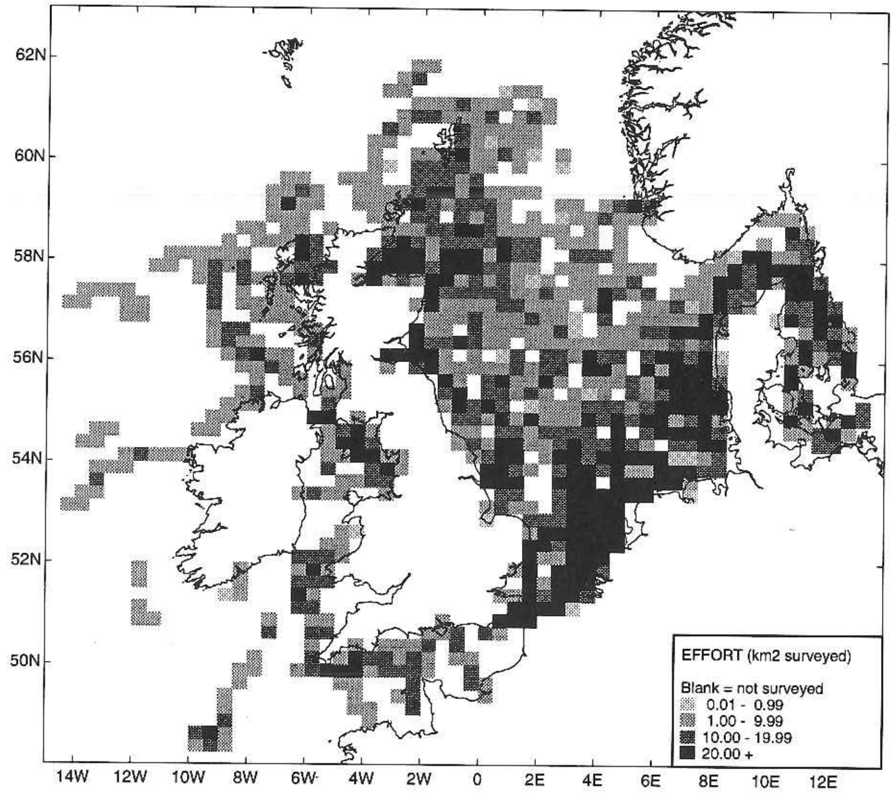

Figure 3.7 Coverage in February from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

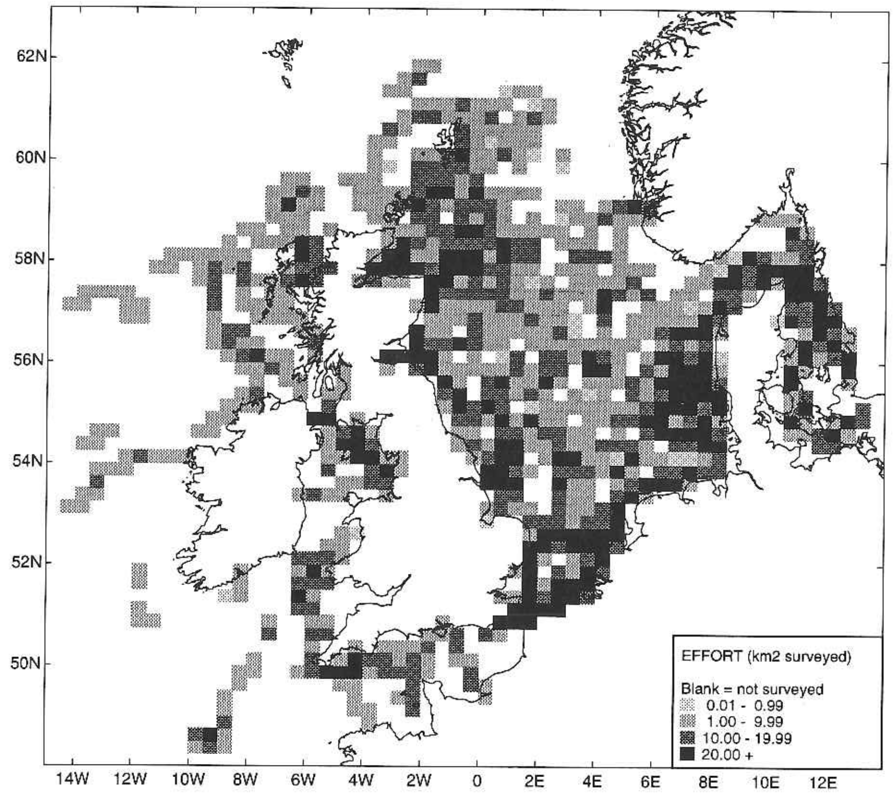

Figure 3.8 Coverage in February using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

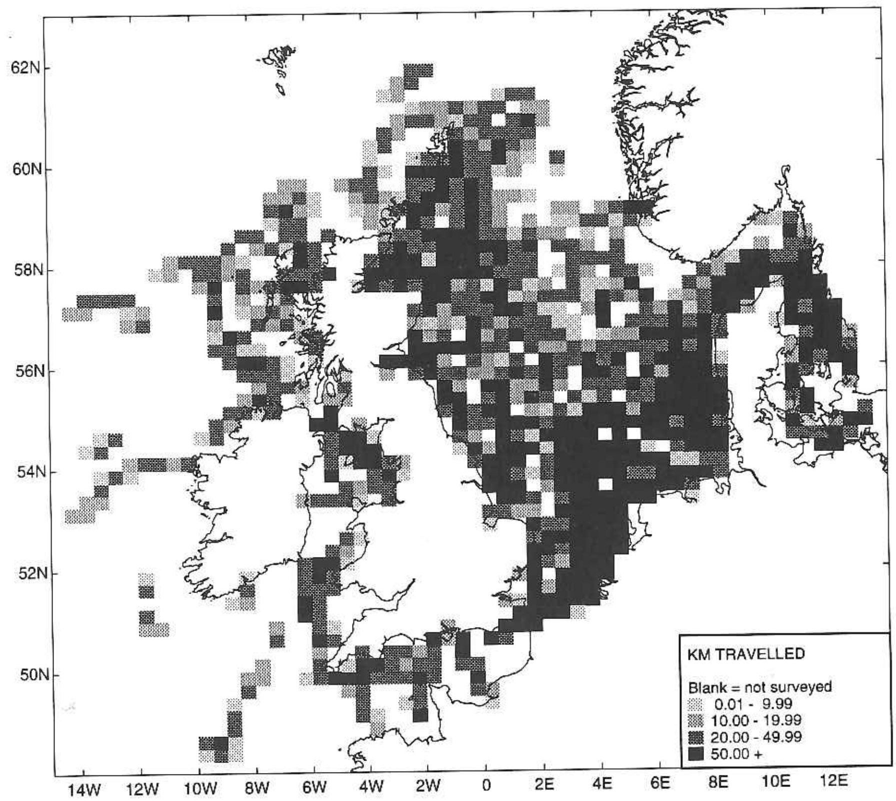

Figure 3.9 Coverage in February using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

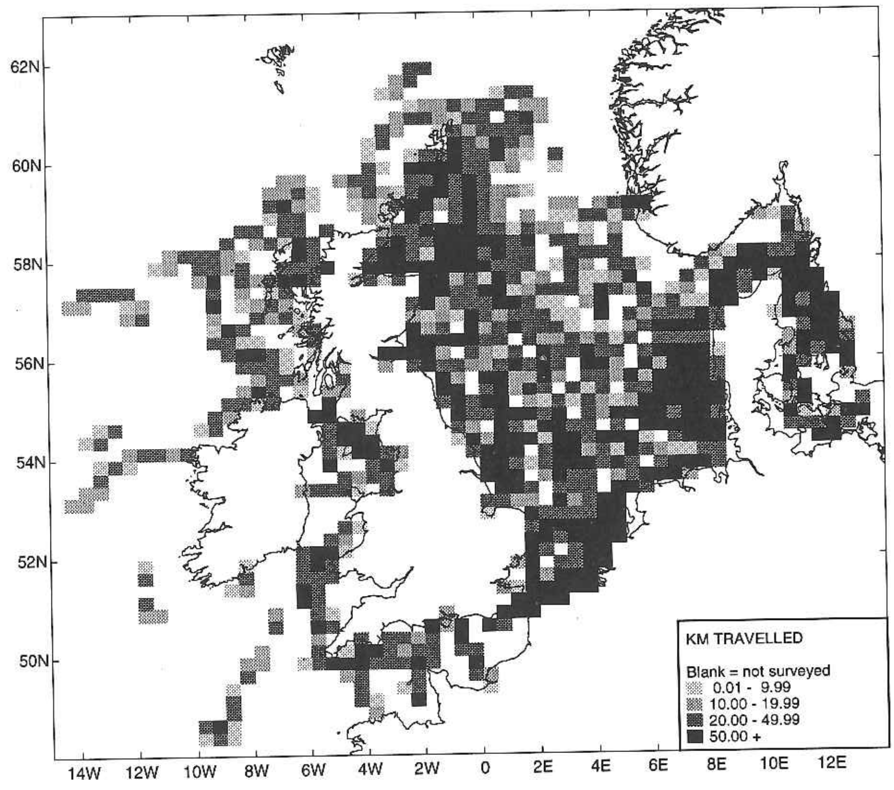

Figure 3.10 Coverage in February using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

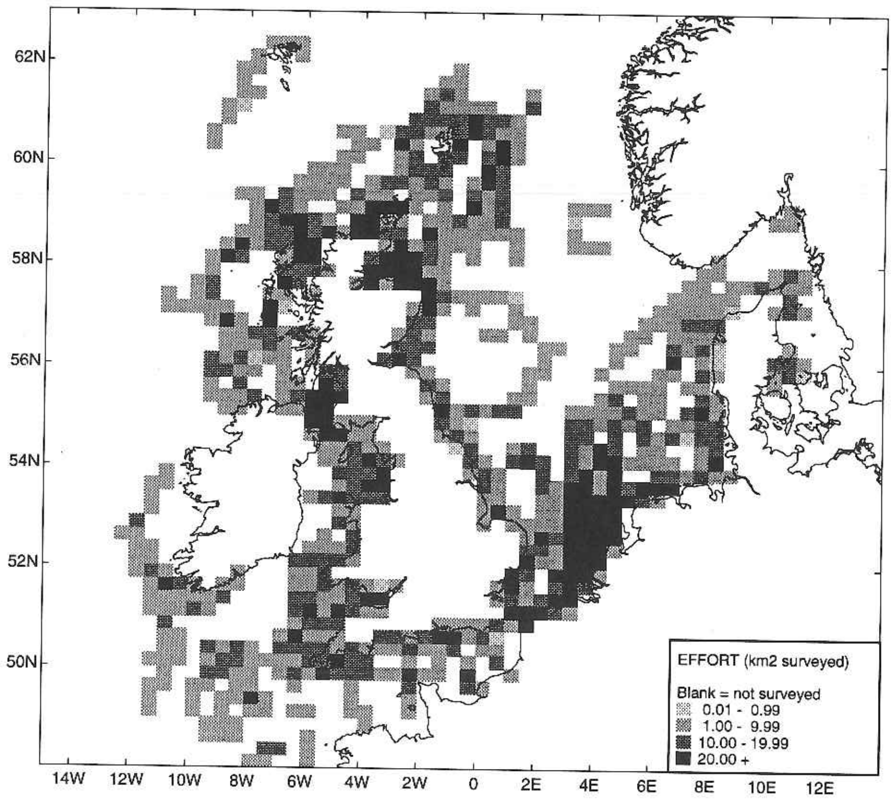

Figure 3.11 Coverage in March from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

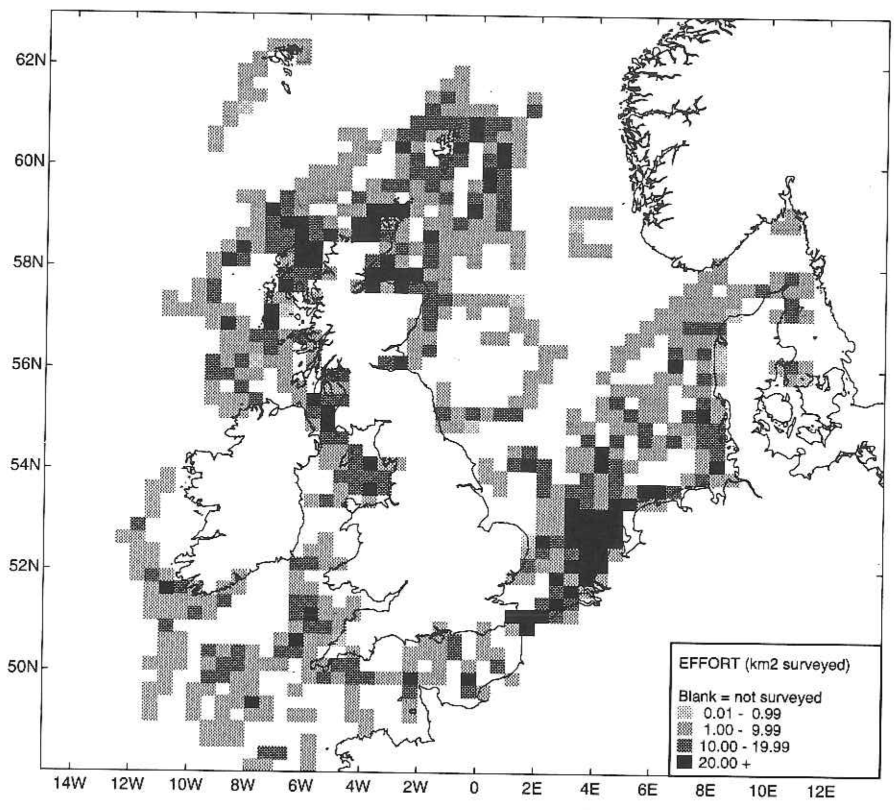

Figure 3.12 Coverage in March using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

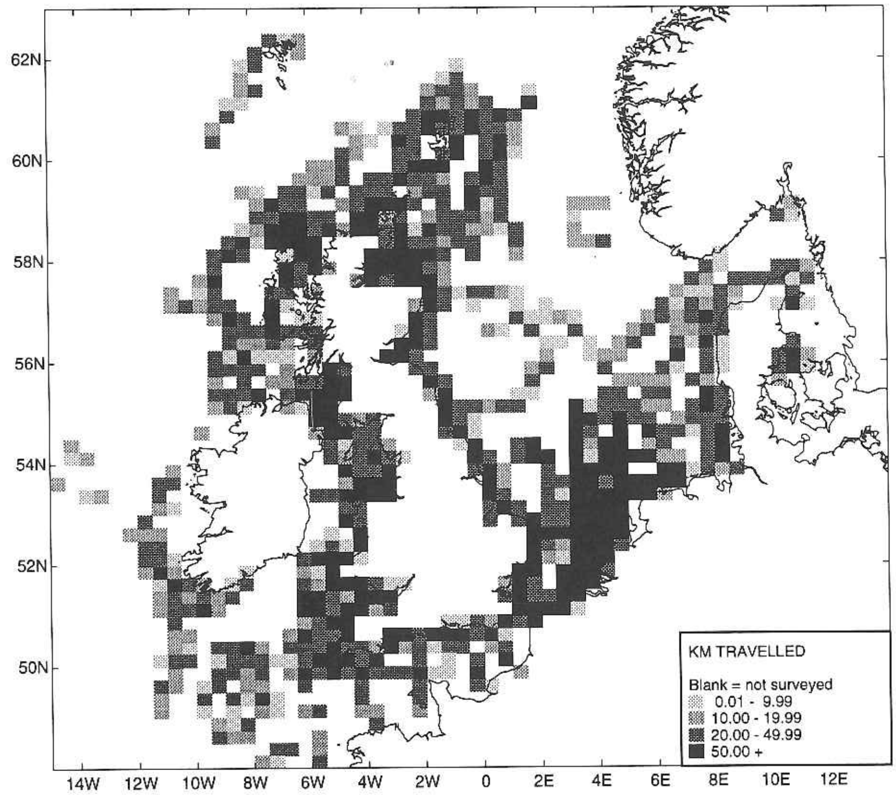

Figure 3.13 Coverage in March using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

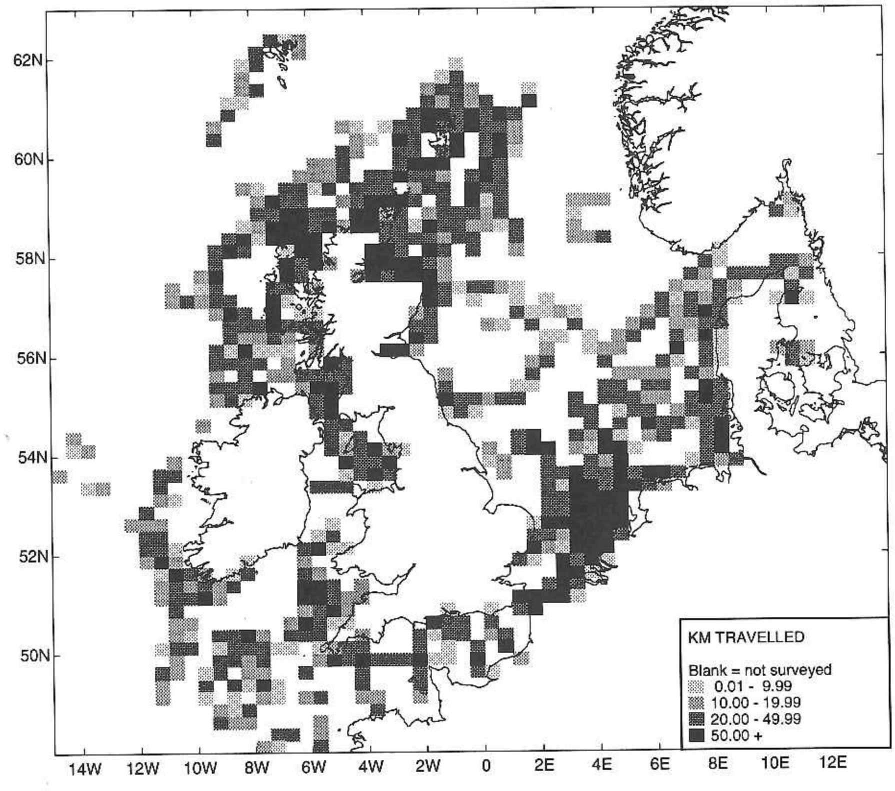

Figure 3.14 Coverage in March using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

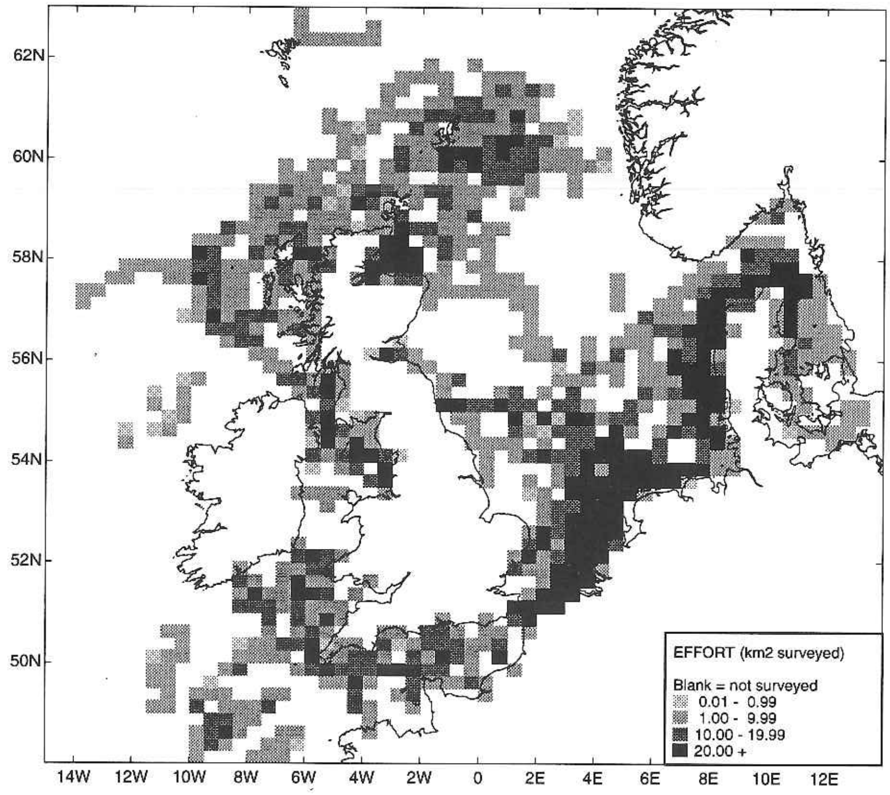

Figure 3.15 Coverage in April from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

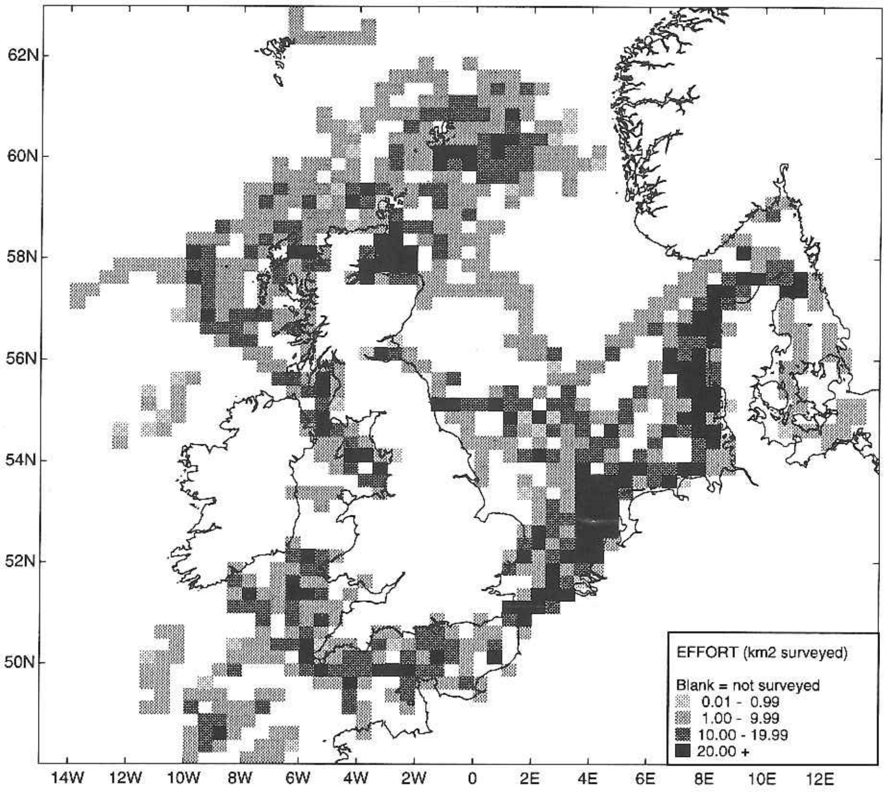

Figure 3.16 Coverage in April using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

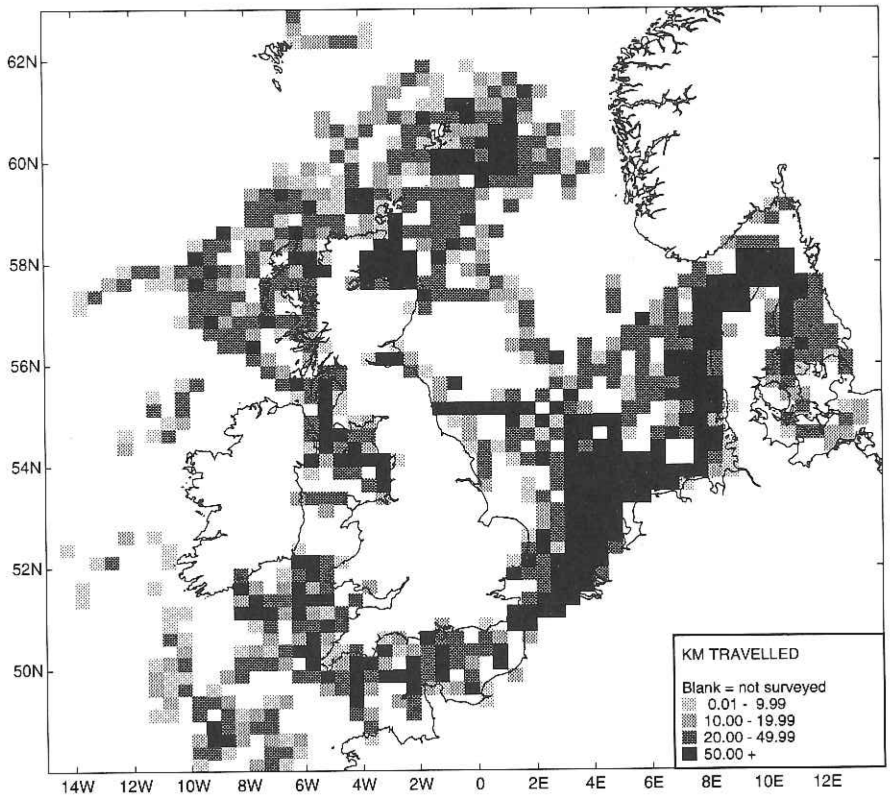

Figure 3.17 Coverage in April using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

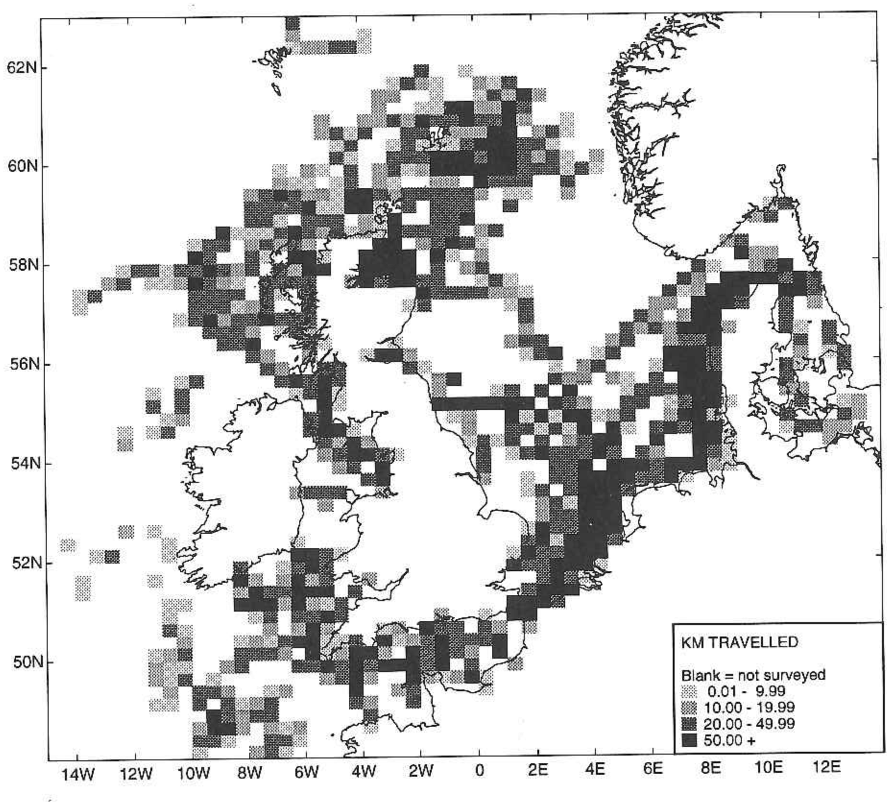

Figure 3.18 Coverage in April using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

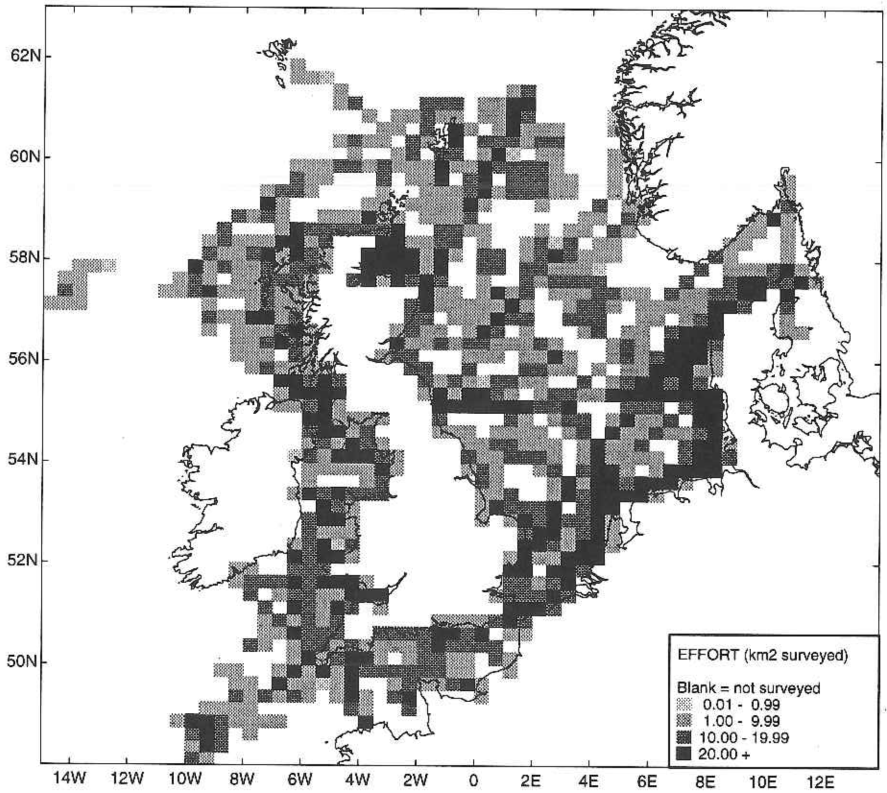

Figure 3.19 Coverage in May from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

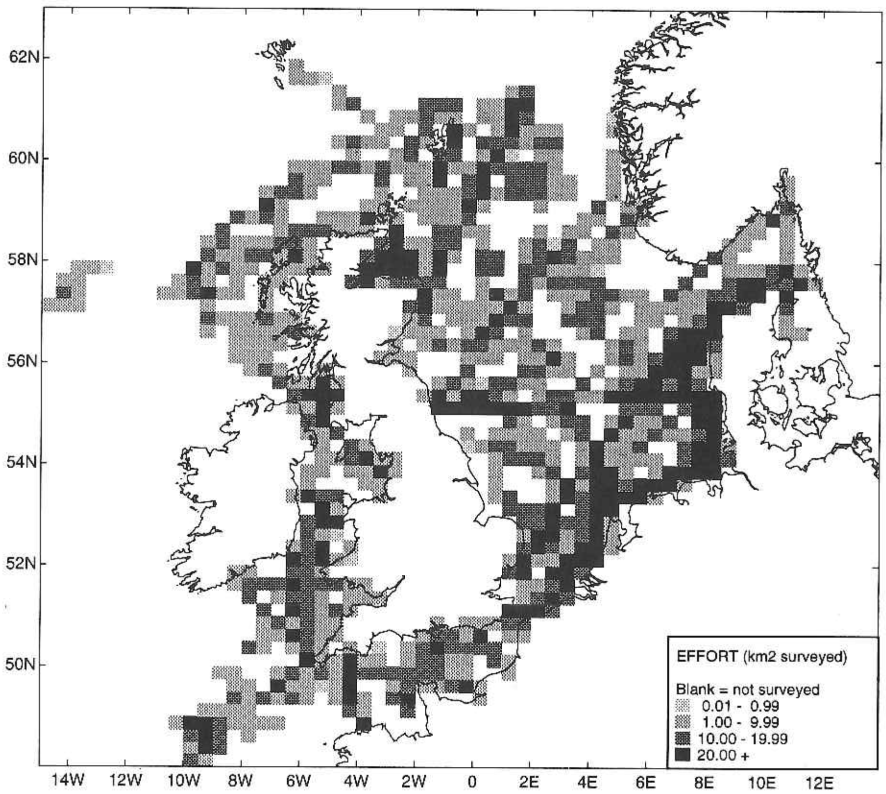

Figure 3.20 Coverage in May using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

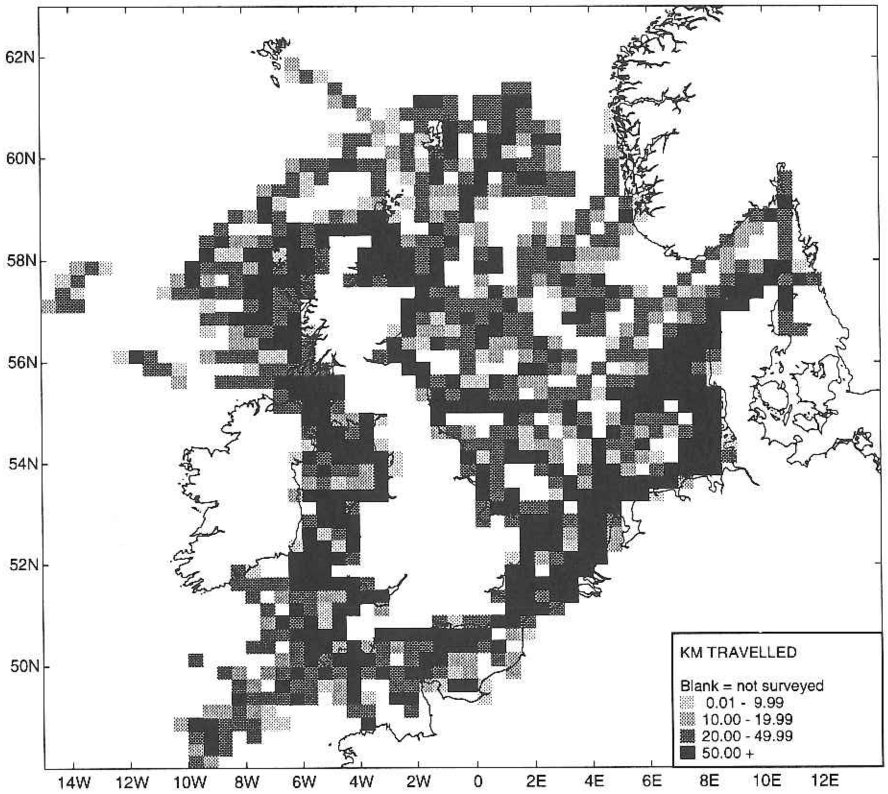

Figure 3.21 Coverage in May using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

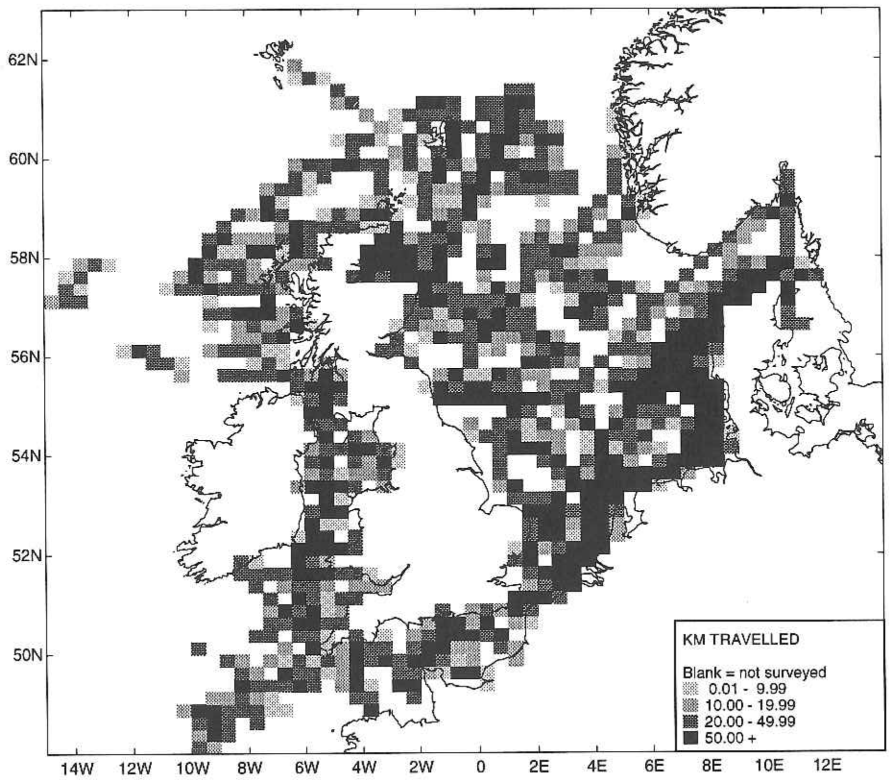

Figure 3.22 Coverage in May using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

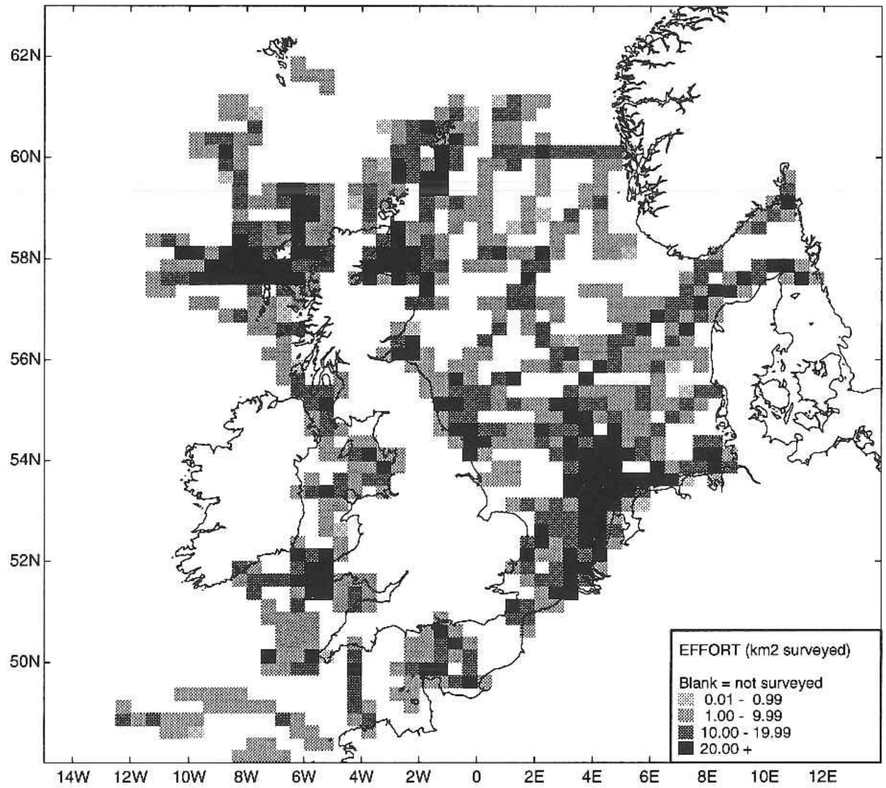

Figure 3.23 Coverage in June from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

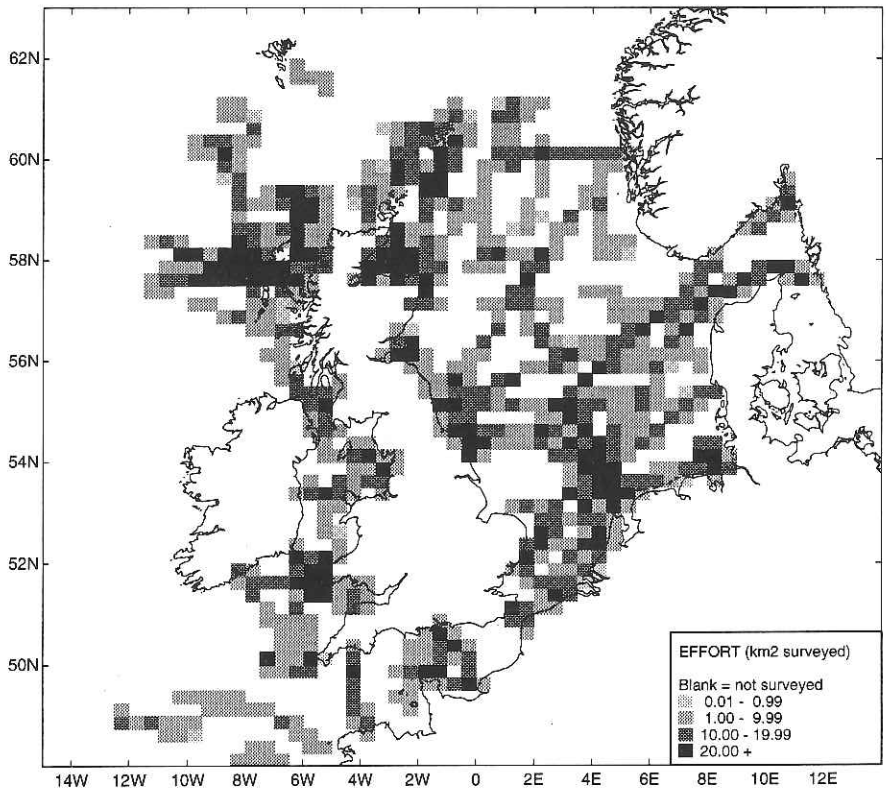

Figure 3.24 Coverage in June using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

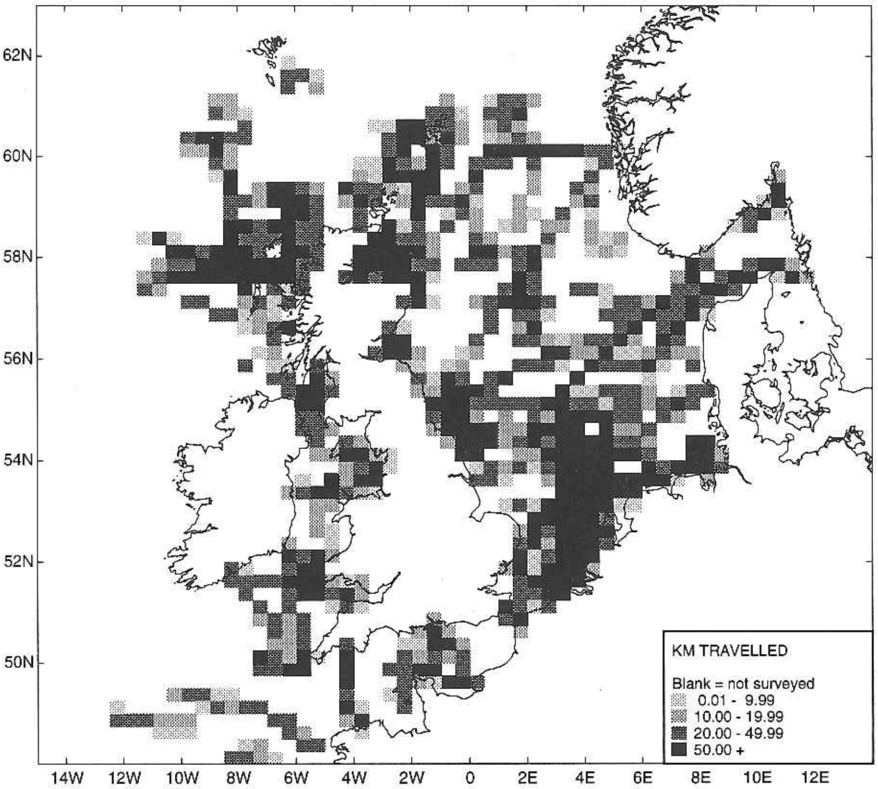

Figure 3.25 Coverage in June using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

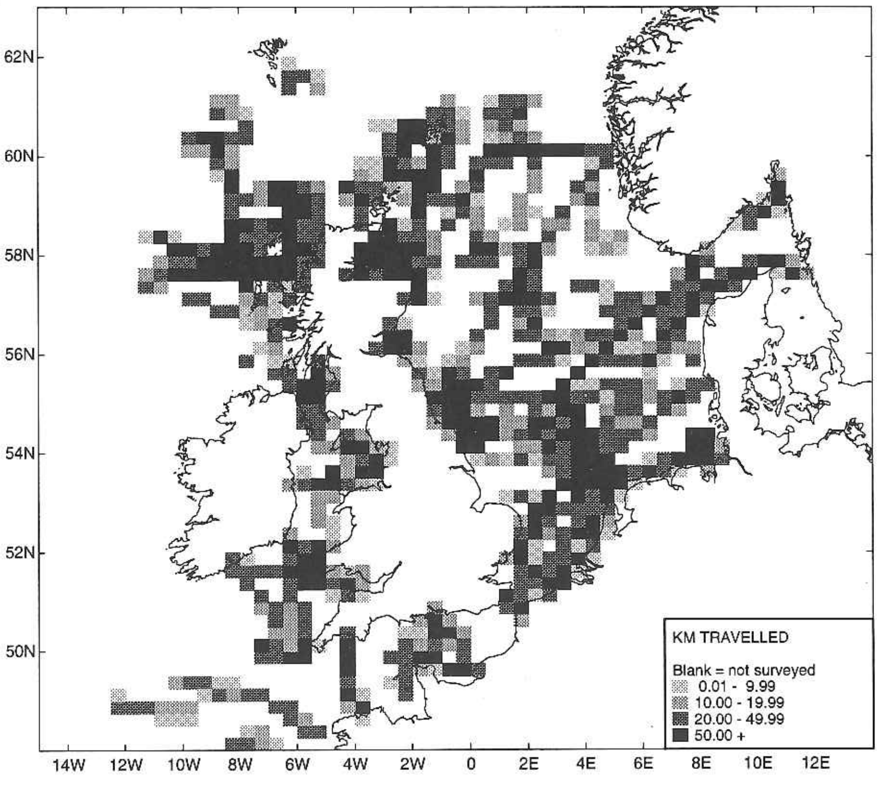

Figure 3.26 Coverage in June using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

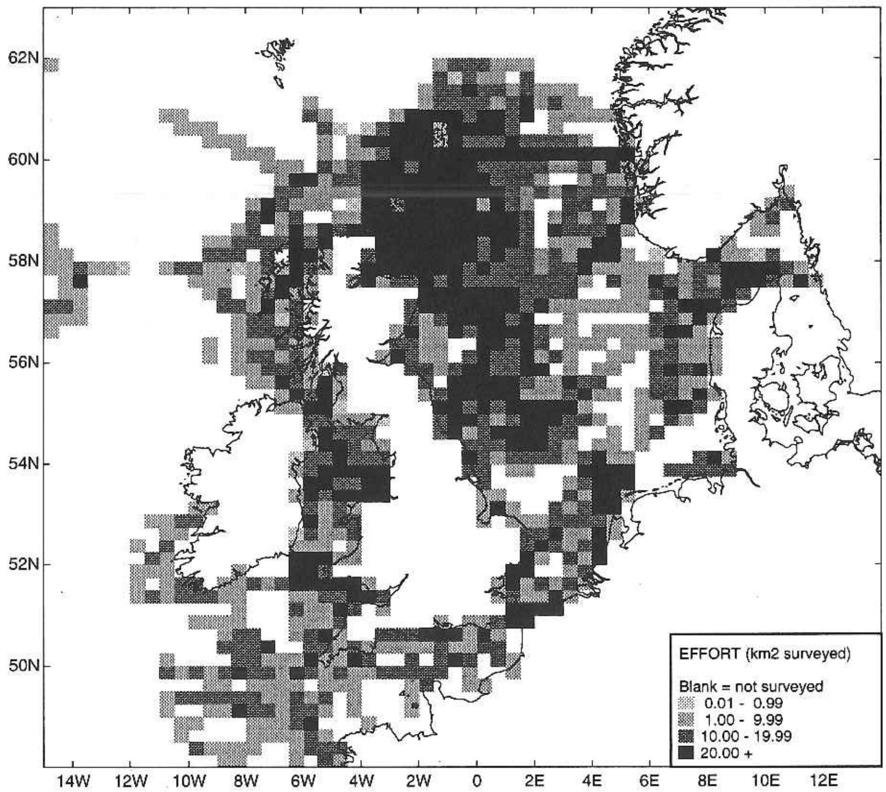

Figure 3.27 Coverage in July from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

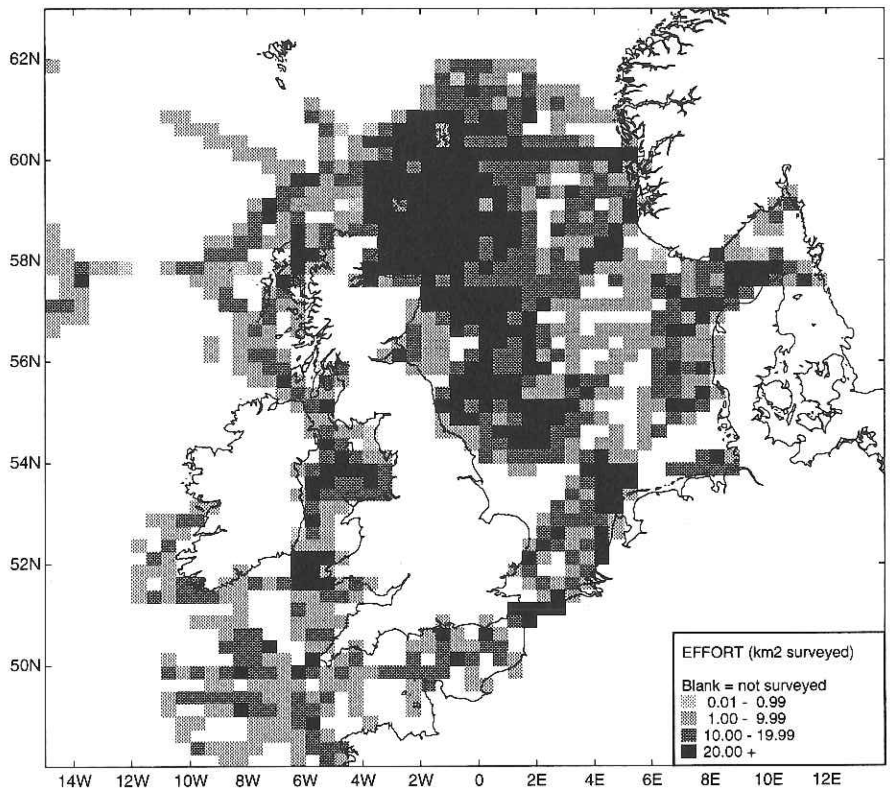

Figure 3.28 Coverage in July using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

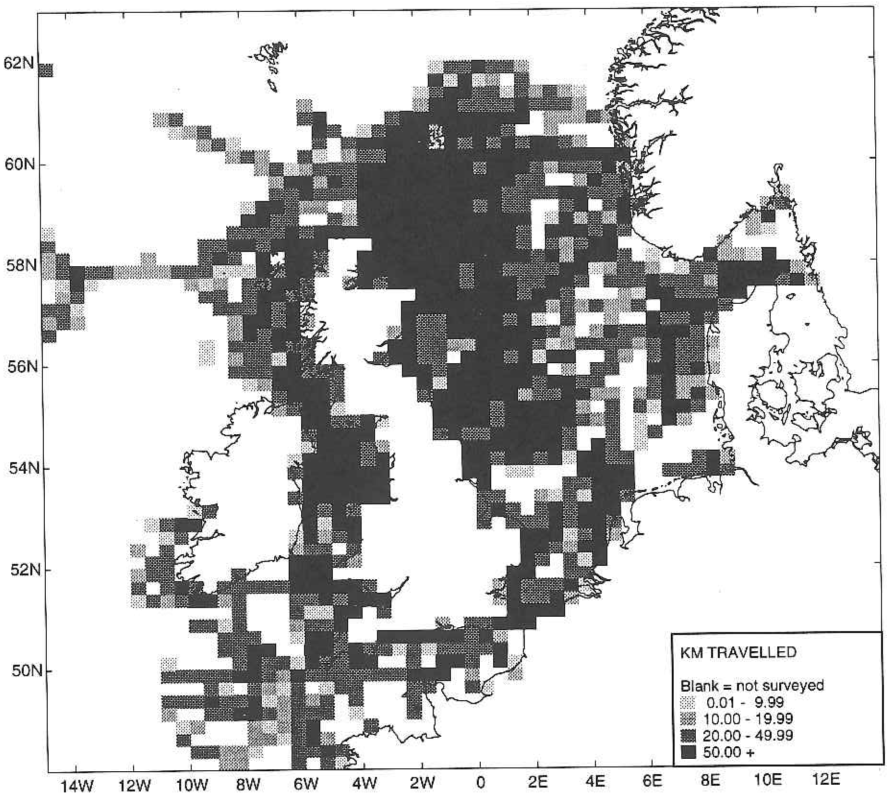

Figure 3.29 Coverage in July using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

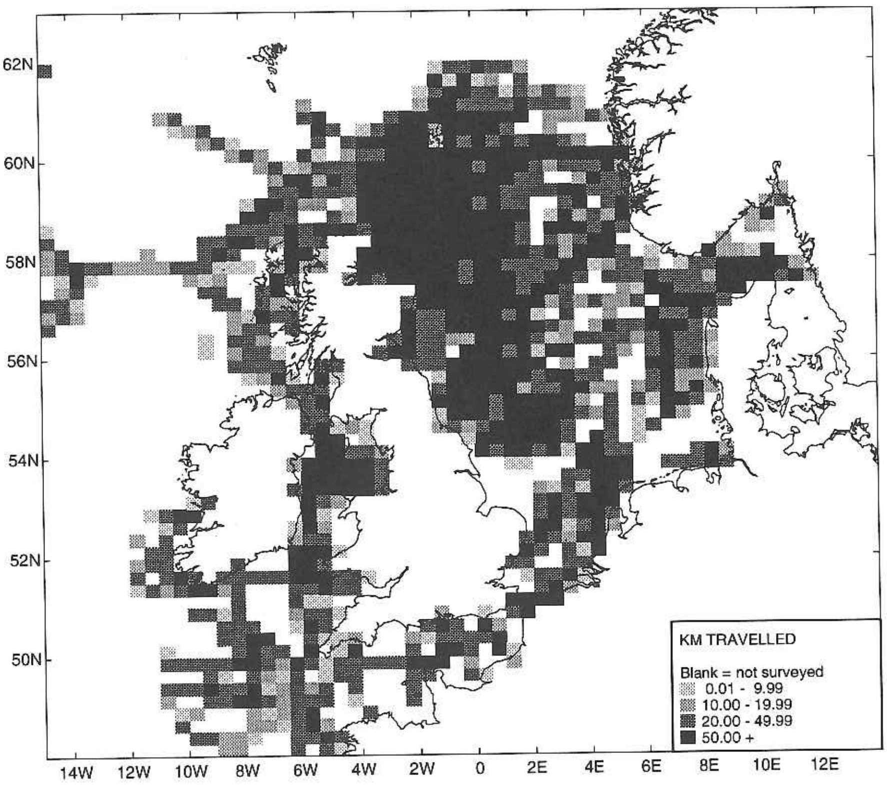

Figure 3.30 Coverage in July using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

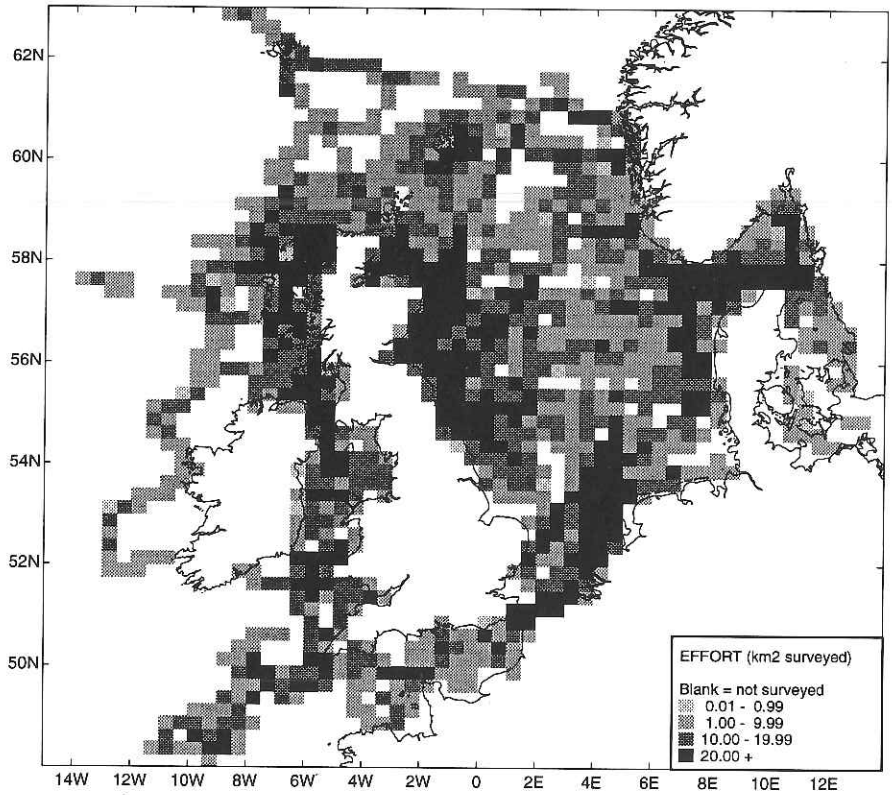

Figure 3.31 Coverage in August from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

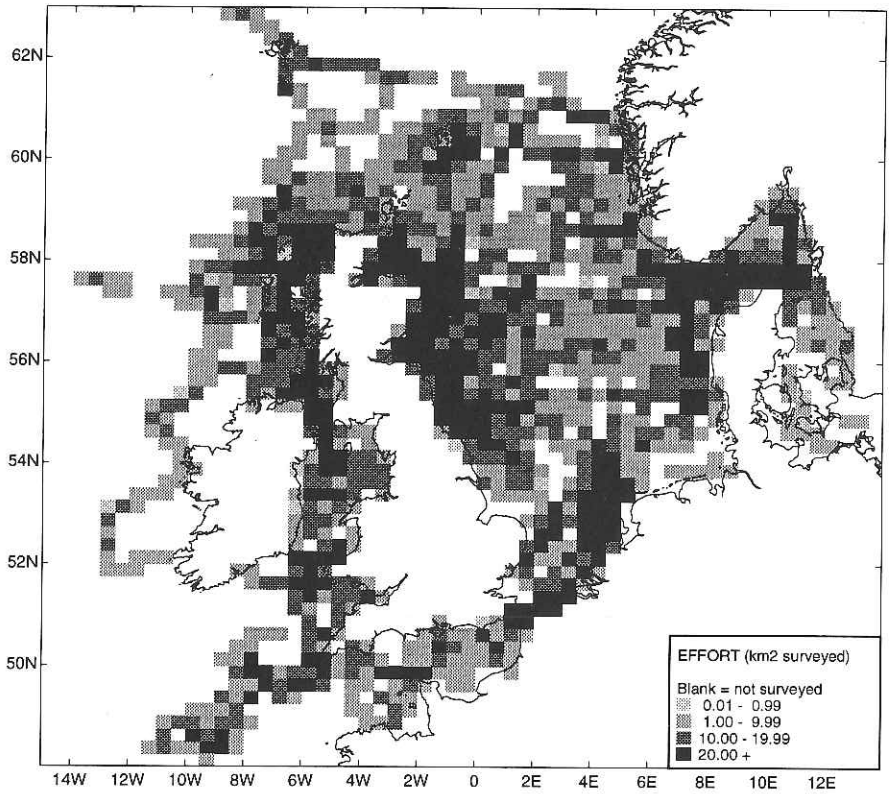

Figure 3.32 Coverage in August using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

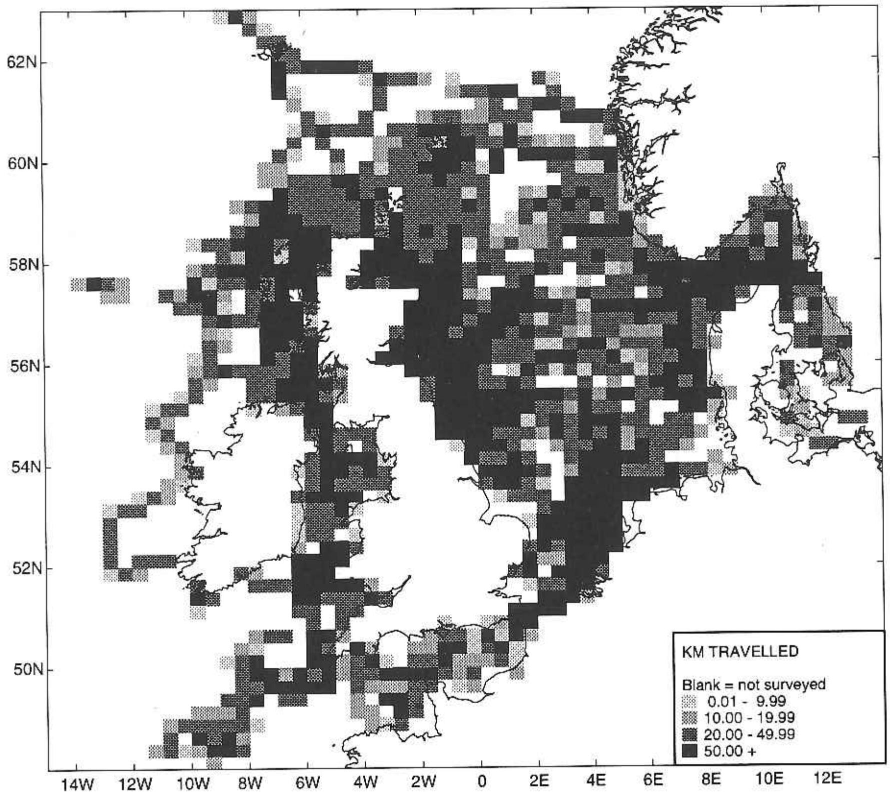

Figure 3.33 Coverage in August using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

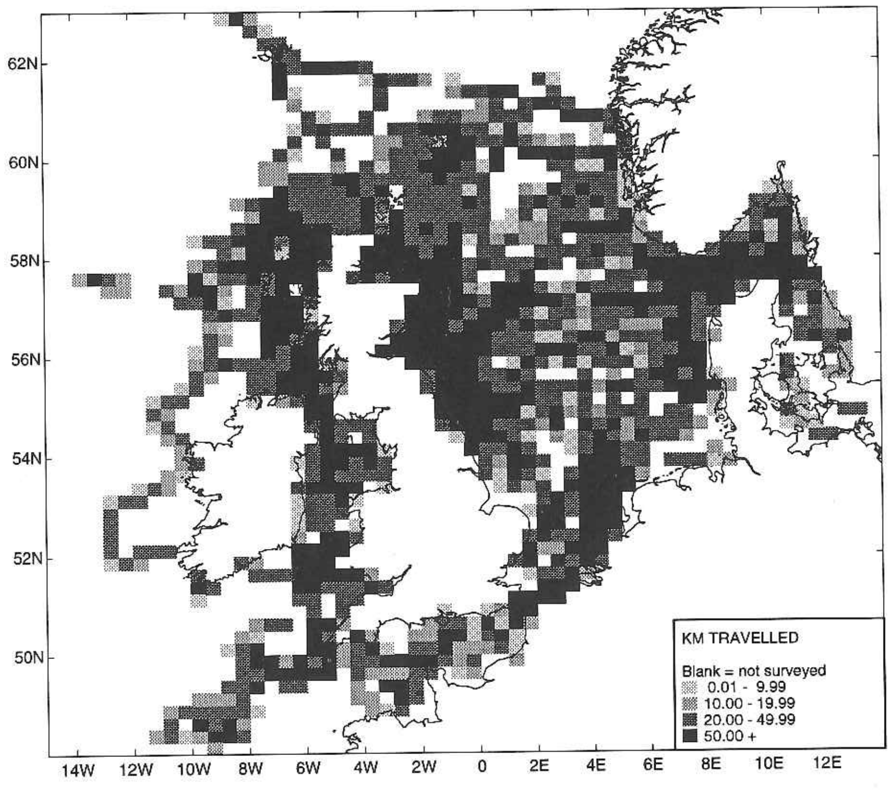

Figure 3.34 Coverage in August using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

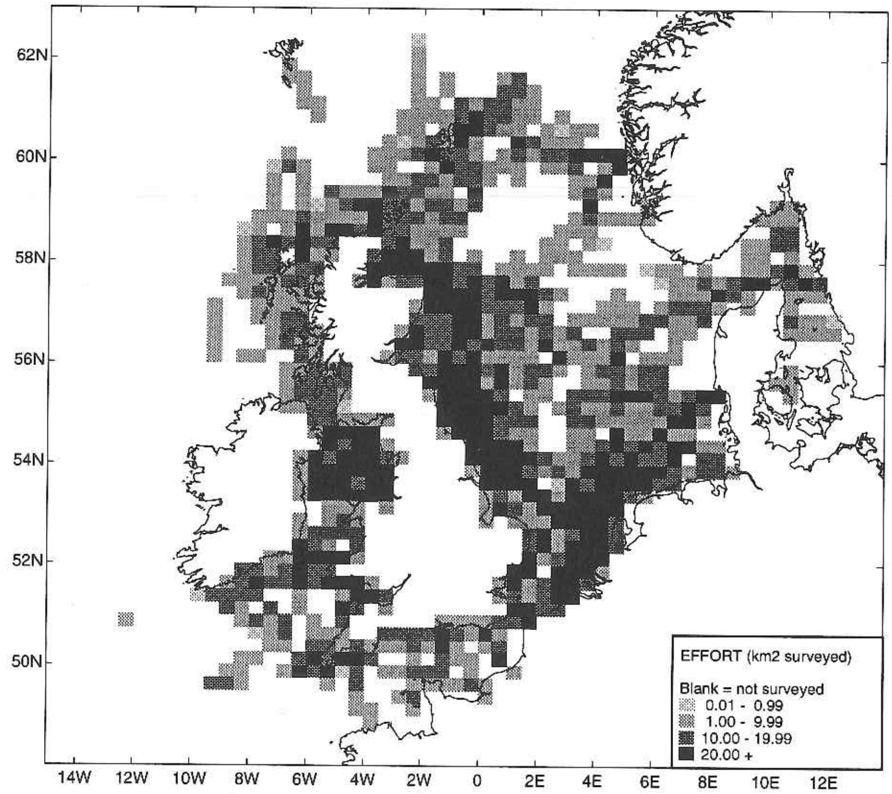

Figure 3.35 Coverage in September from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

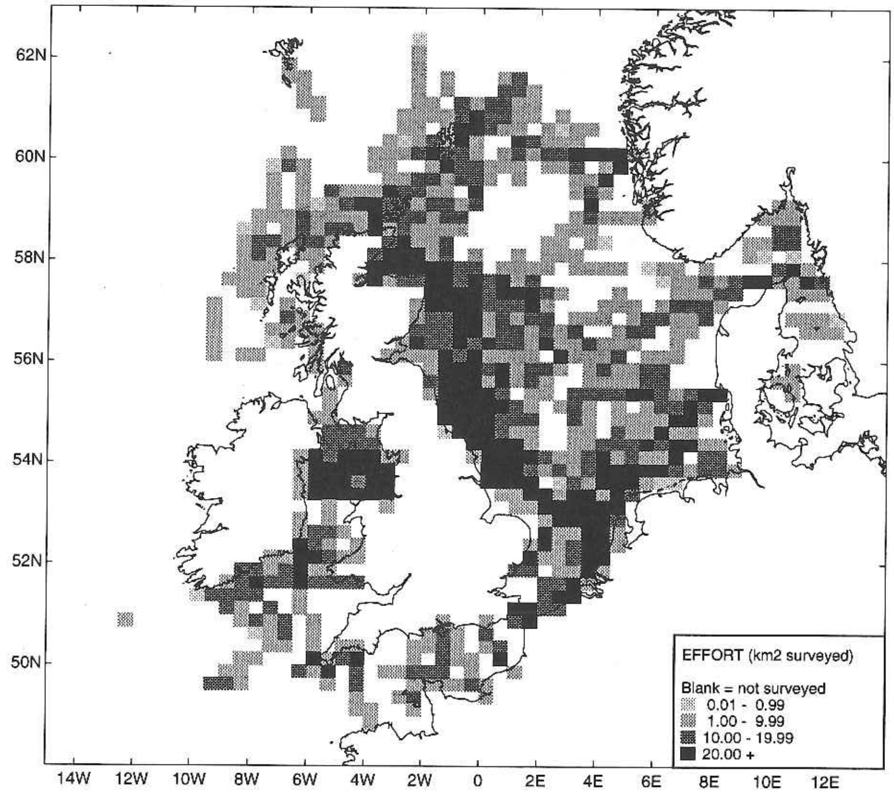

Figure 3.36 Coverage in September using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

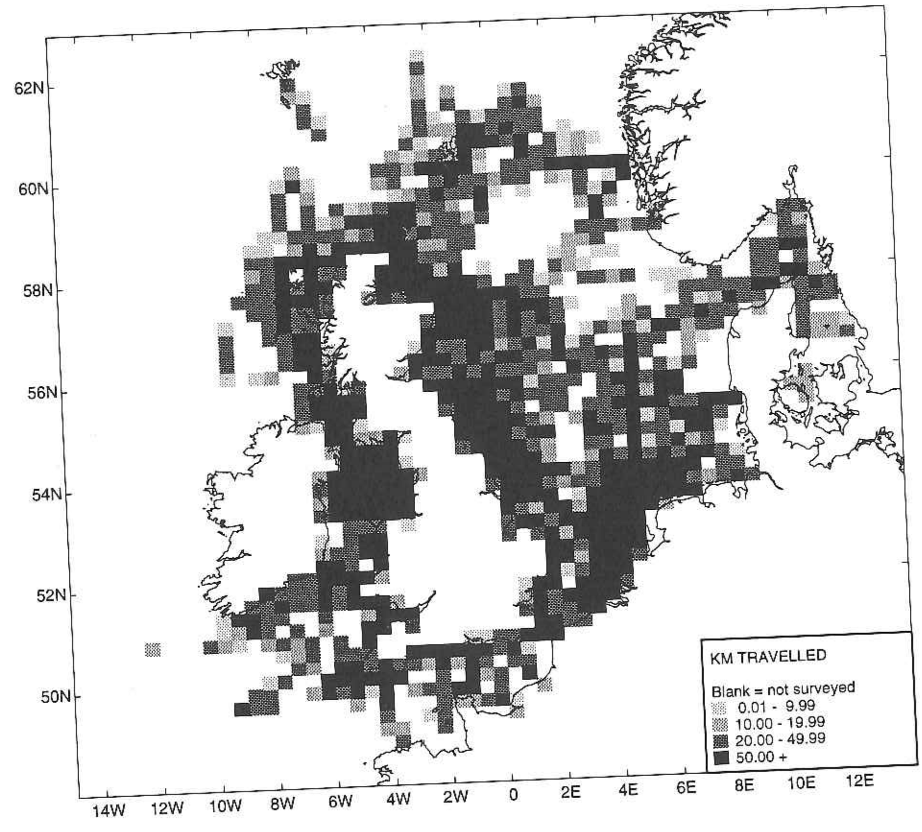

Figure 3.37 Coverage in September using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

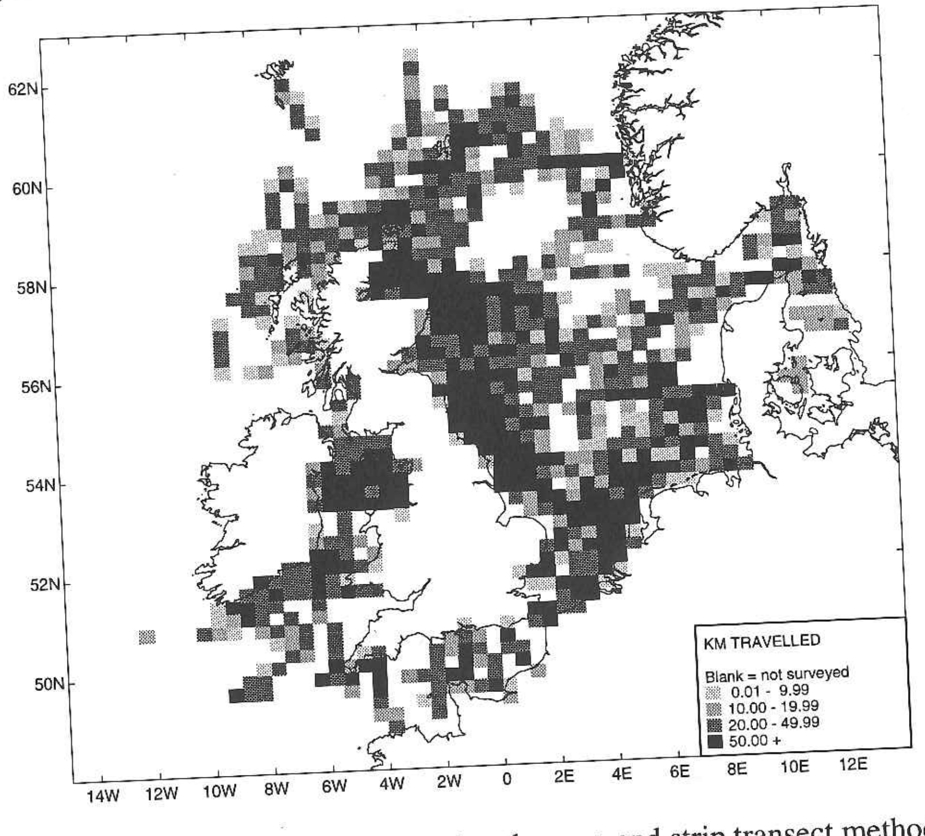

Figure 3.38 Coverage in September using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

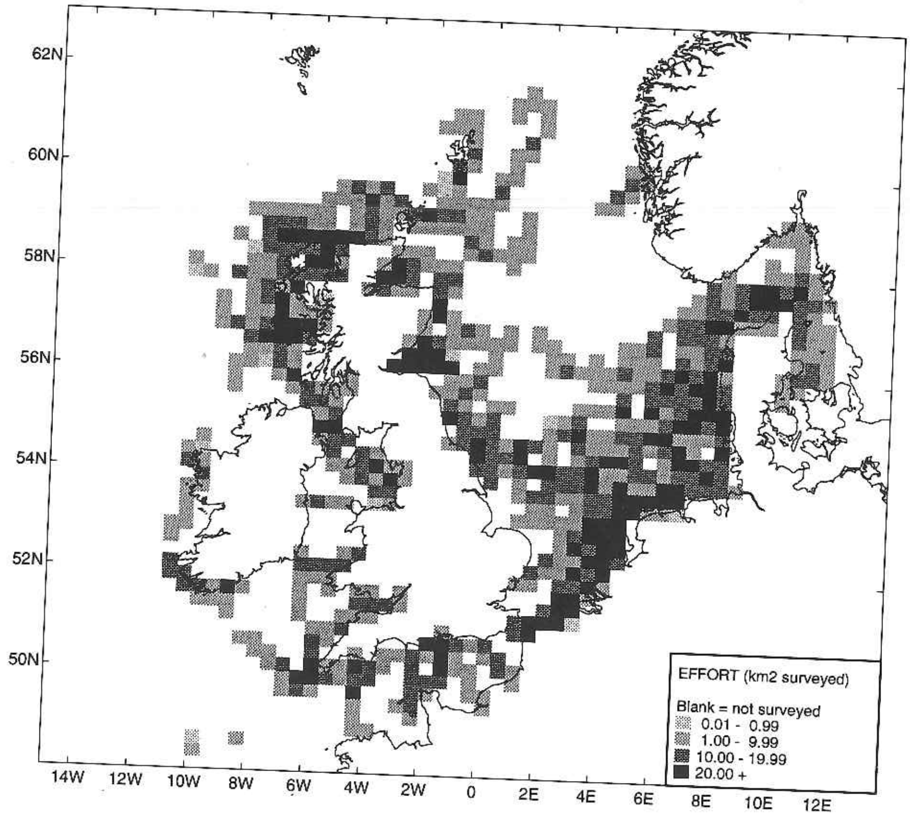

Figure 3.39 Coverage in October from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

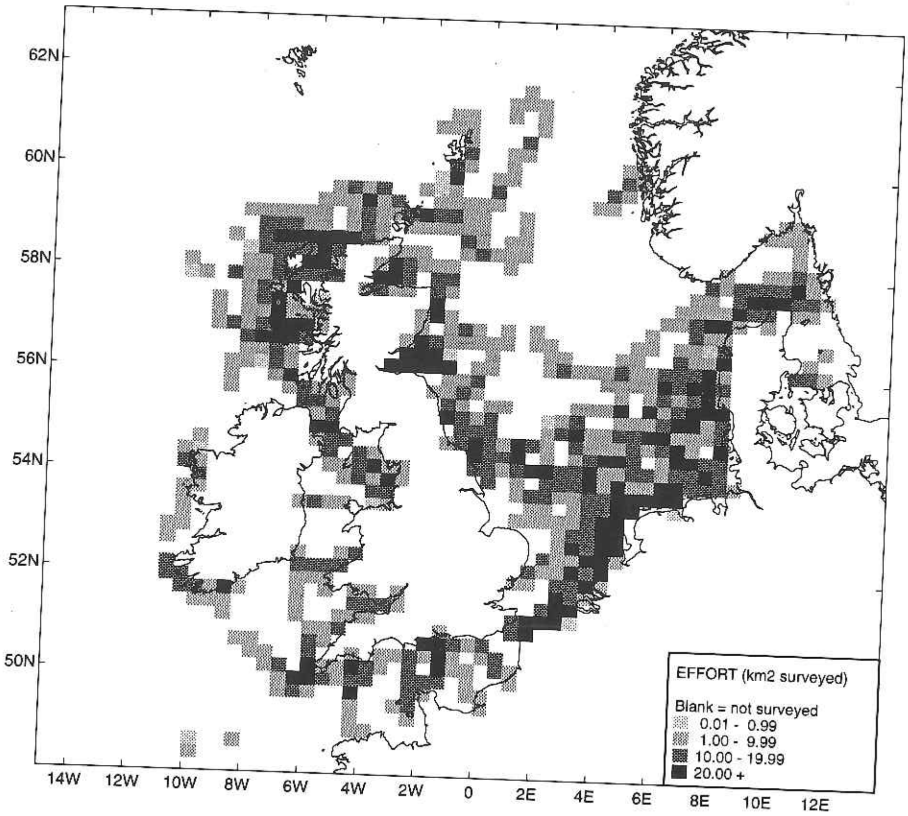

Figure 3.40 Coverage in October using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

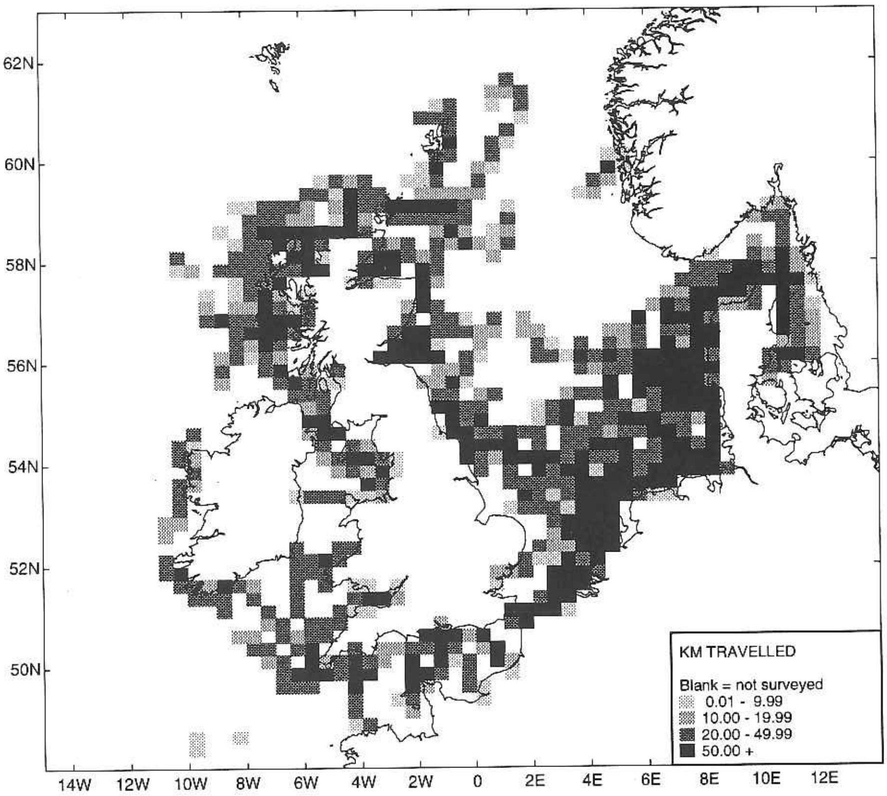

Figure 3.41 Coverage in October using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

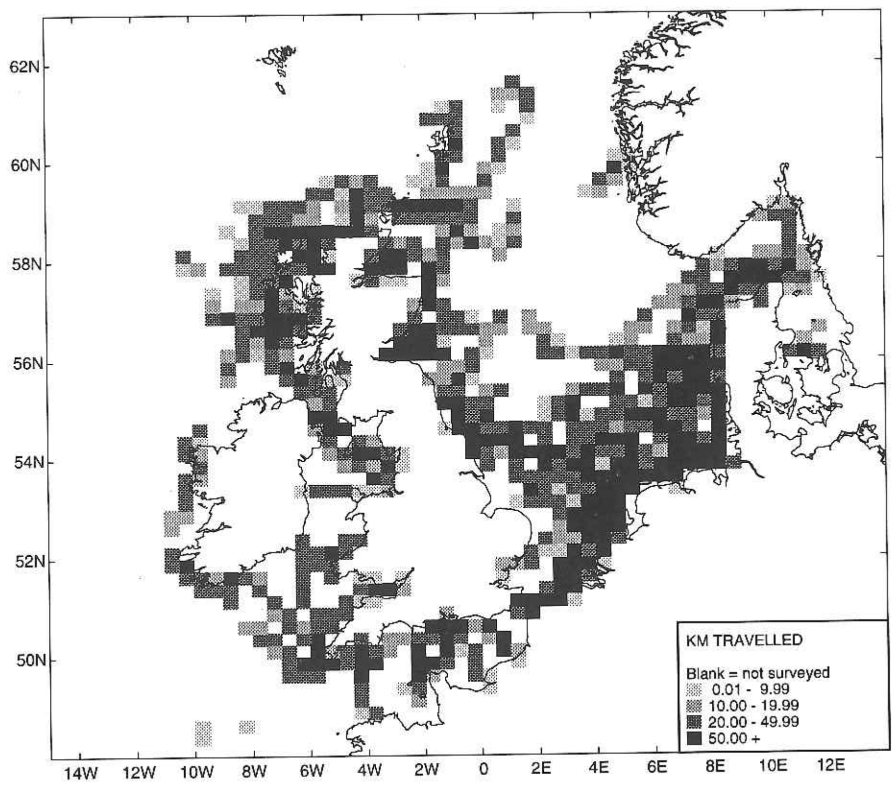

Figure 3.42 Coverage in October using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

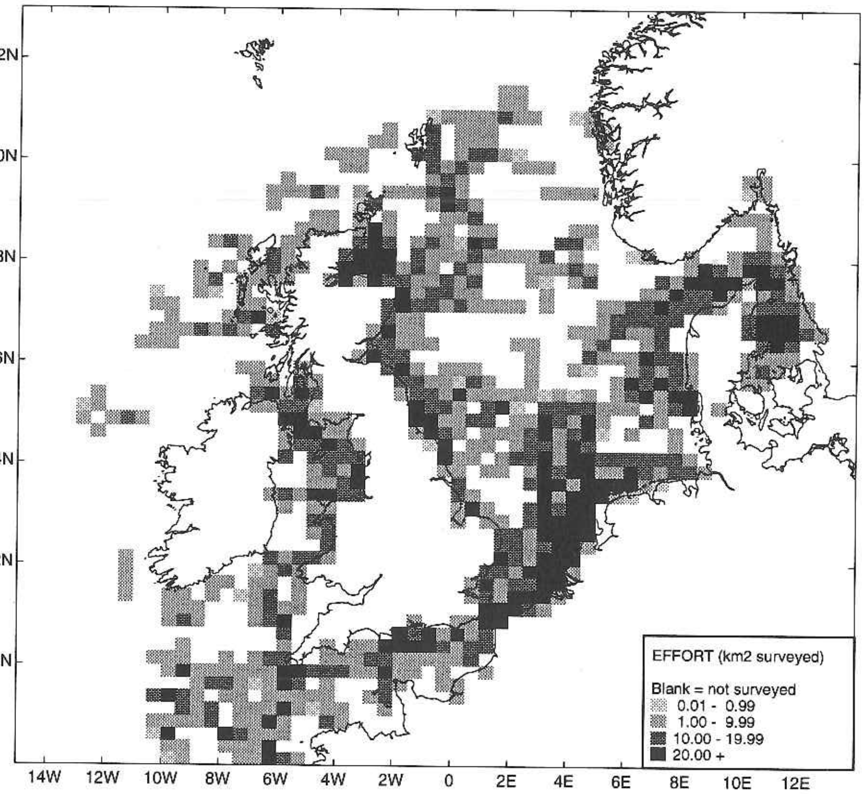

Figure 3.43 Coverage in November from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

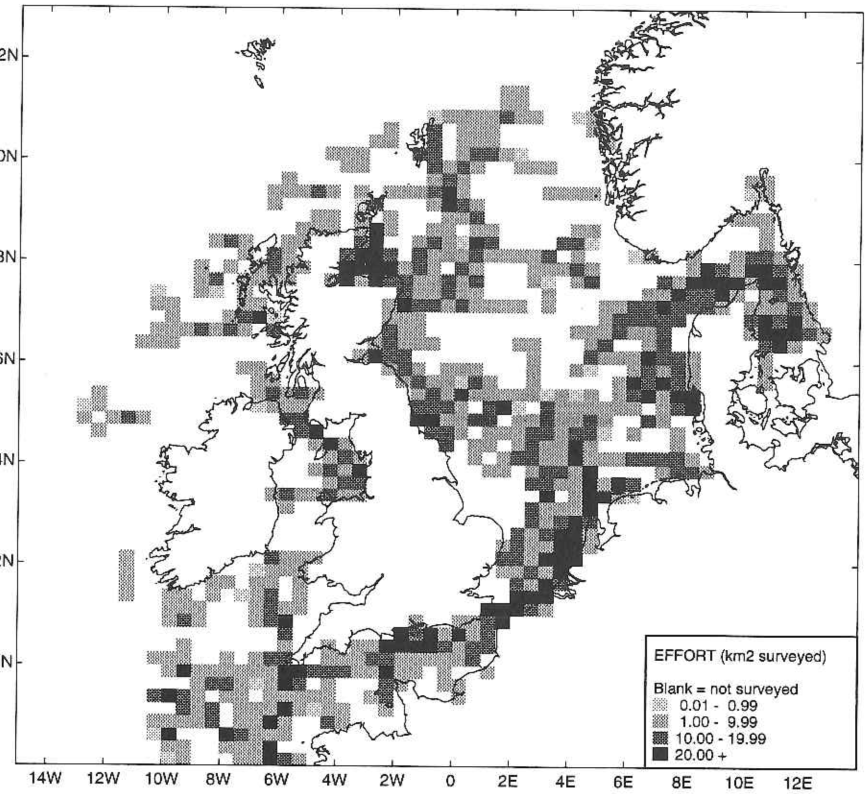

Figure 3.44 Coverage in November using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

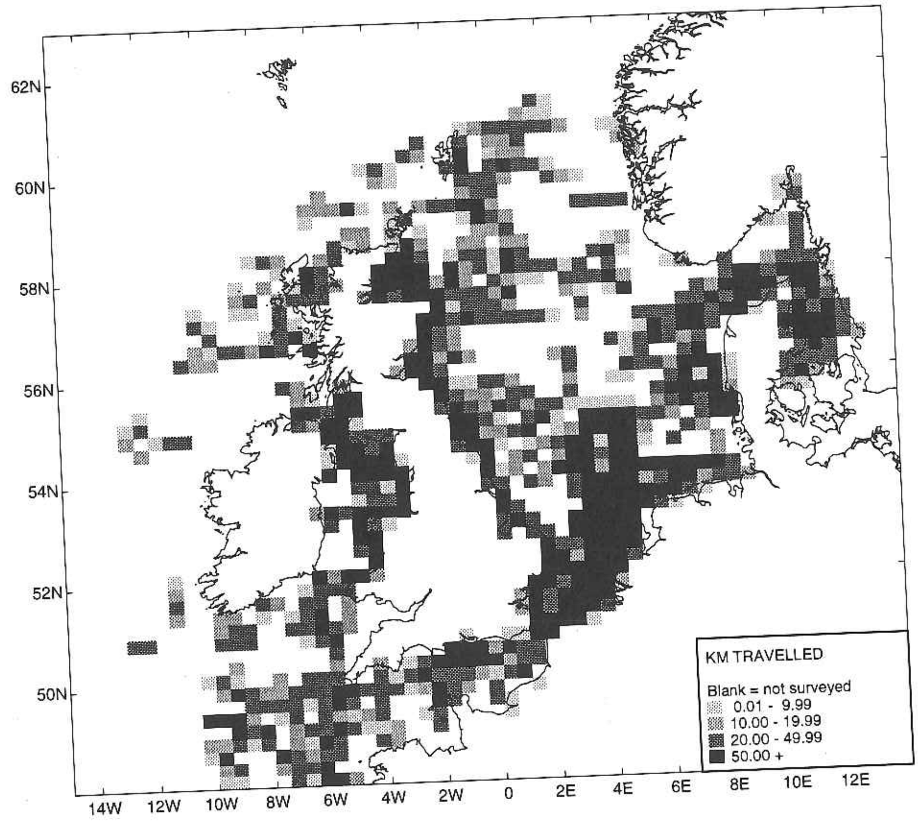

Figure 3.45 Coverage in November using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

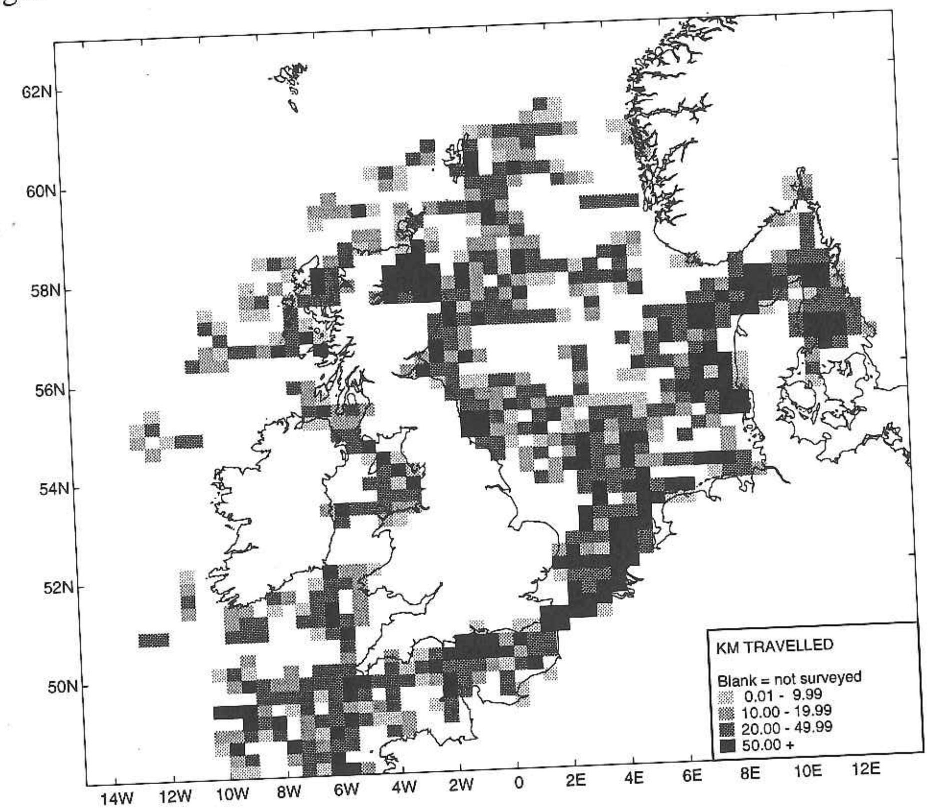

Figure 3.46 Coverage in November using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

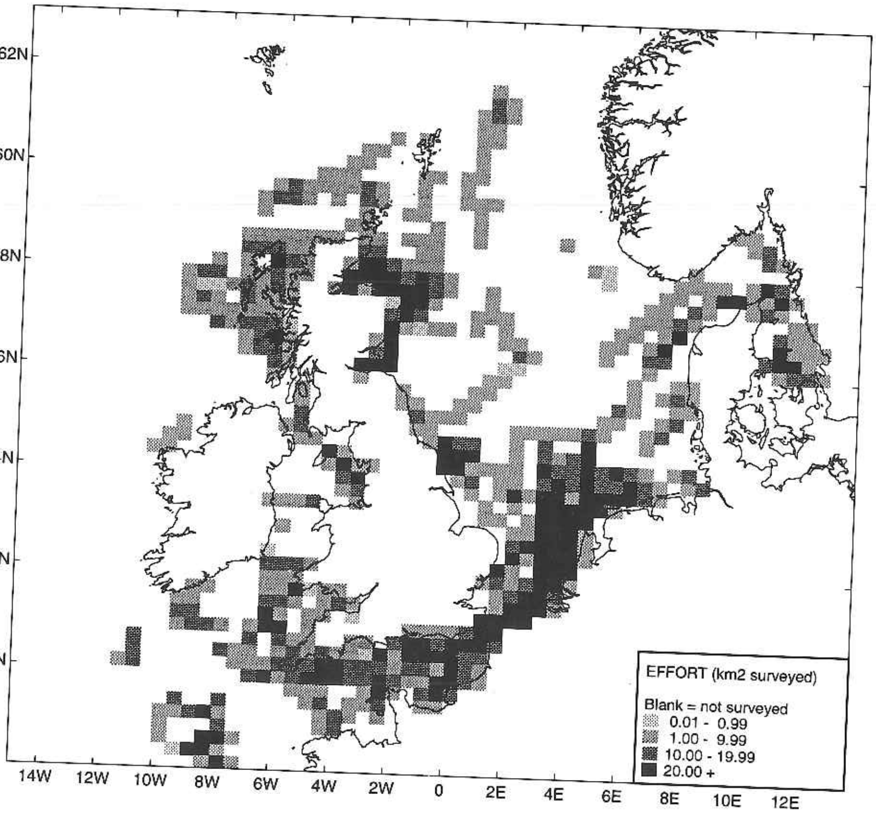

Figure 3.47 Coverage in December from ships and aircraft using the strip transect. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

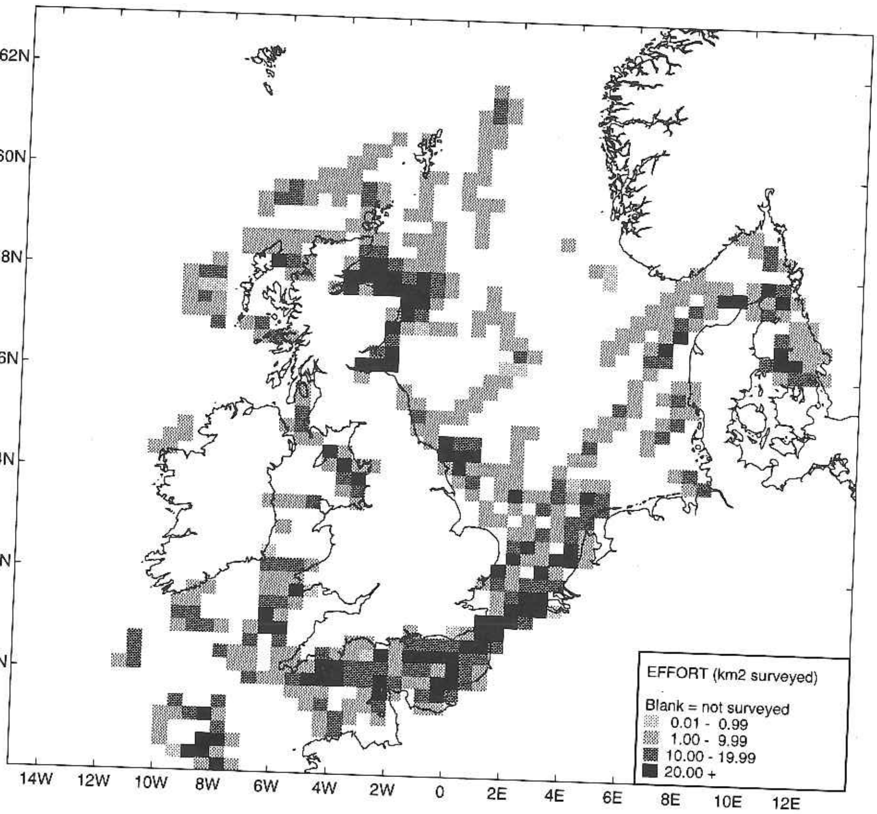

Figure 3.48 Coverage in December using the strip transect from ships only. Shading represents km^2 surveyed within the transect in each ¼ ICES rectangle.

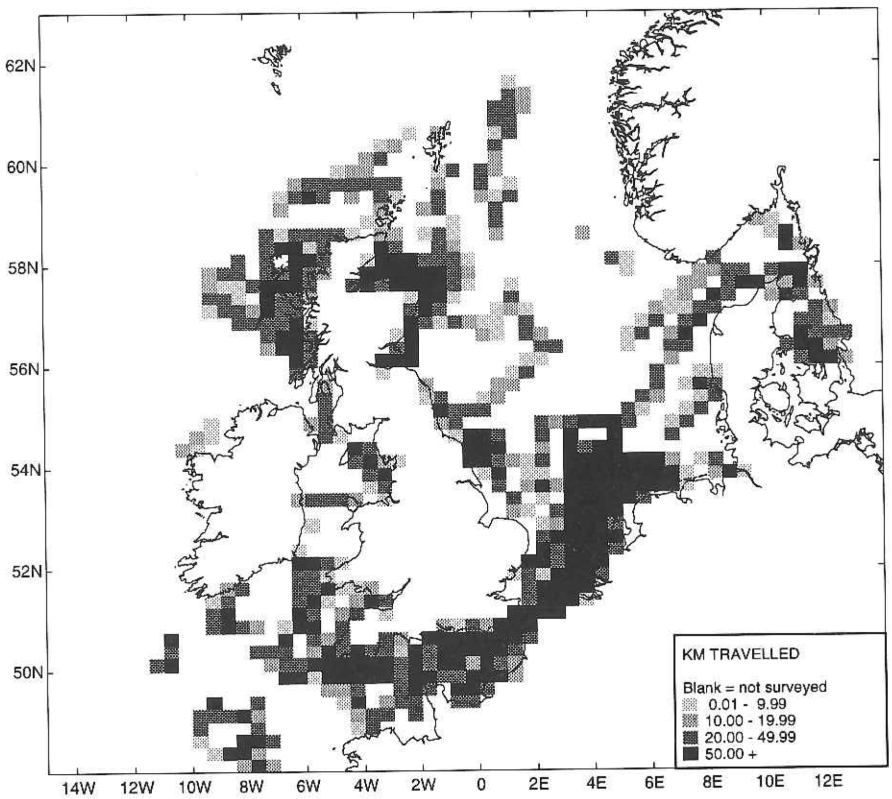

Figure 3.49 Coverage in December using the scan and strip transect methods from ships and aircraft. Shading represents distance travelled (km) in each ¼ ICES rectangle.

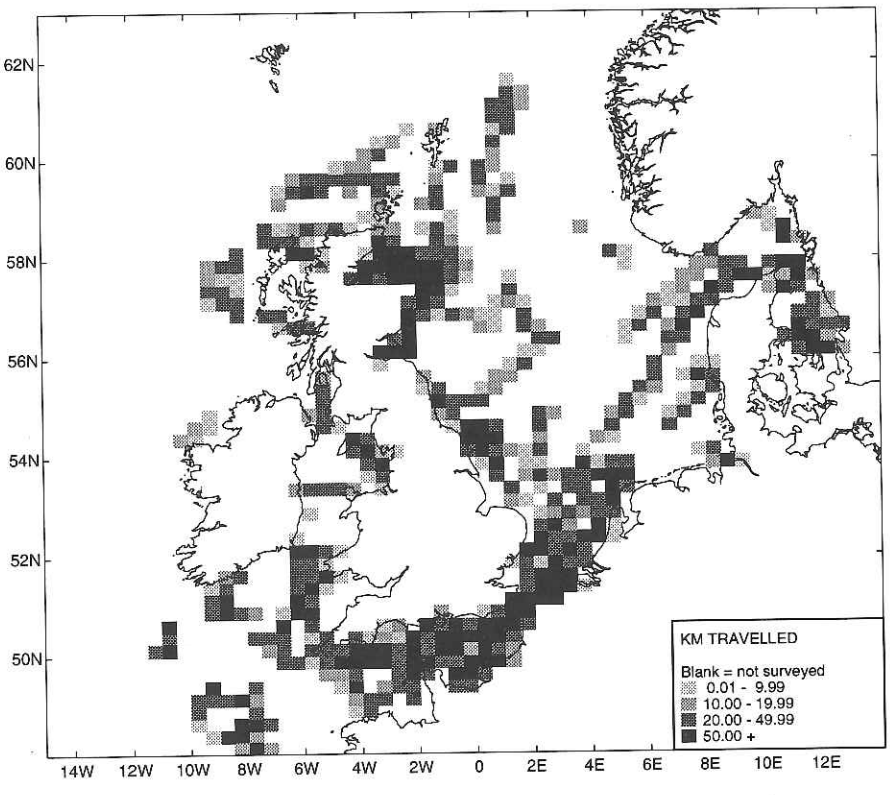

Figure 3.50 Coverage in December using the scan and strip transect methods from ships only. Shading represents distance travelled (km) in each ¼ ICES rectangle.

4 BACKGROUND

4.1 BREEDING POPULATIONS OF SEABIRDS

Introduction And Sources

Seabirds depend on two types of habitat: the coasts for breeding and the seas for feeding. The distribution of seabirds at sea during the breeding season will be strongly influenced by the location of breeding colonies. This section gives an overview of breeding populations in the study area. Data were obtained from a number of sources, including Møller 1978, Paulussen 1982, Bloch & Sørensen 1984, Wanless 1987, Asbirk 1988, Groupe Ornithologique Normand (GONm) 1989, Grimmet & Jones 1989, Kempf *et al.*, 1989, Rooth 1989, De Putter & Orbie 1990, Lloyd, Tasker & Partridge 1991, Orbie 1991, Arts 1993, Südbeck & Hälterlin 1994 and the relevant national agencies. In 1984, the then Nature Conservancy Council and the Seabird Group initiated the Seabird Colony Register; this provides the British data that follow (Walsh, Avery & Heubeck 1990, Walsh, Sears & Heubeck 1991, Walsh, Sim & Heubeck 1992).

All counts shown are of breeding pairs including the auks (guillemot, razorbill, black guillemot and puffin). To obtain pair equivalents for these species for the totals in each area, the number of individuals of guillemots and razorbills has been multiplied by 0.67 (Harris 1989), and the number of individuals of puffins and black guillemots multiplied by 0.5 (Cramp, Bourne & Saunders 1974, Lloyd, Tasker & Partridge 1991). Substantial numbers of some seabird species, particularly cormorants, gulls and terns, breed inland; these are not included in the numbers shown here. However, individuals of these species breeding inland but close to the coast may use the marine environment. For some areas recent information was not available or estimates are crude. Estimates in Table 4.1.1 which are based on inadequate material are given in brackets.

Results

Important breeding areas for fulmars, kittiwakes and auks are the Scottish mainland, the Scottish islands and the Faeroes. The largest colonies of Manx shearwaters in the world are found on Rum and on Skomer and Skokholm (Pembrokeshire Islands), and they are also found in large numbers on the Faeroes. Storm petrels and Leach's petrels breed in large numbers on the Outer Hebrides and on the Faeroes, but colony censuses are traditionally inaccurate. Gannets occur in scattered gannetries in the study area, the largest of which are found on St Kilda, Bass Rock (Firth of Forth), Ailsa Craig (Firth of Clyde), Grassholm (Pembrokeshire Islands) and Little Skellig (off south-west Ireland). Continental populations of cormorants have rapidly increased in Denmark, Germany and the Netherlands. Whereas most of these birds breed in inland colonies, recent colonisations in the Wadden Sea district took place. There are also large continental populations of eiders. Great and Arctic skuas breed primarily on Shetland, Orkney and the Faeroes. Black-headed gulls and common gulls commonly breed inland. Substantial coastal populations of the former species occur in south-east England, around the Irish Sea, in the Netherlands, Germany and Denmark. Coastal colonies of common gulls are mainly found on Orkney, Shetland and the Outer Hebrides, the Netherlands, Denmark and Norway. Lesser black-backed gulls are widespread in scattered small colonies, with substantial populations in the Irish Sea and the Netherlands. Herring gulls breed throughout the study area in large numbers. Most Arctic terns breed on Orkney, Shetland and the Faeroes. Common terns are very numerous in the Netherlands and Germany, but many terns breed inland. Sandwich terns are common in the Netherlands, along the east coast of Britain and in Northern Ireland.

References

Arts, F. 1993. Kustbroedvogel Database DGW/SOVON. Voorlopig Rapport. *SOVON Rapport 93/08, Beek-Ubbergen.*

Asbirk, S. 1988. Ynglebestanden af Tejst *Cepphus grylle* i Danmark 1978-87. *Dansk. Orn. Foren. Tidsskr. 82:* 131-134.

Bloch, D. & Sørensen, S. 1984. *Yvirlit yvir Føroya fuglar.* Føroya Skúlabókagrunnur. Tórshaven.

Cramp, S., Bourne, W.R.P. & Saunders, D. 1974. *The seabirds of Britain and Ireland.* Collins, London.

Gibbons, D.W., Reid, J.B. & Chapman, R.A. 1993. *The new atlas of breeding birds in Britain and Ireland: 1988-1991.* T. & A.D. Poyser, London.

Gregersen, J. 1991. The development of the Danish Cormorant population 1980-1988 and some comments on the breeding success. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 36-38.

Groupe Ornithologique Normand (GONm). 1989. Atlas des oiseaux nicheurs de Normandie et des îles Anglo-Normandes. *Le Cormoran 7:* 247pp.

Grimmet, R.F.A. & Jones, T.A. 1989. Important Bird Areas in Europe. *ICBP Technical Publication No. 9, Cambridge.*

Harris, M.P. 1989. Variations in the correction factor used for converting counts of individual Guillemots *Uria aalge* into breeding pairs. *Ibis 131:* 85-93.

Kempf, N., Fleet, D.M.F., Rösner, H.U. & Prokosch, P. 1989. Brut- und Rastvogelzählungen im Schleswig-Holsteinischen Wattenmeer 1987-1988. *Landesamt für den Nationalpark Schleswig-Holsteinisches Wattenmeer.*

Lloyd, C., Tasker, M.L. & Partridge, K. 1991. *The status of seabirds in Britain and Ireland.* T. & A.D. Poyser, London.

Meininger, P.L., Berrevoets, C.M., Schekkerman, H., Strucker, R.C.W. & Wolf, P.A. 1991. Vodesel en fourageergebieden van broedende Zwartkopmeeuwen *Larus melanocephalus* in Zuidwest-Nederland. *Sula 5:* 138-145.

Menke, T. 1991. Recent population development of the cormorant *Phalacrocorax carbo sinensis* in the Federal Republic of Germany. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 49-52.

Møller, A.P. 1978. Magernes Larinae yngleudbredelse, bestands-storrelse og -aendringer i Danmark, med supplerende oplysninger om forholdene i det overige Europa. *Dansk. Orn. Foren. Tidsskr. 72:* 15-39.

Orbie, G. 1991. De grote stern *Sterna sandvicensis* nieuwe broedvogel voor Belgie. *Mergus 5:* 3-12.

Paulussen, J.A. 1982. Breeding status of the black-headed gull (*Larus ridibundus* L.) in Belgium. *Gull Study Group Bulletin 4:* 11-12.

Putter, G. De & Orbie, G. 1990. Het voorkomen van de dwergstern *Sterna albifrons* als broedvogel aan de Vlaamse kust. *Mergus 4:* 14-22.

Rooth, J. 1989. De Nederlandse broedpopulatie van de grote stern *Sterna sandvicensis* in 1961-88. *Limosa 62:* 121-124.

Sellers, R.M. 1991. Breeding and wintering status of the cormorant in the British Isles. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 30-35.

Südbeck, P. & Hälterlein, B. 1994. Brutvogelbestände an der deutschen Nordseeküste im Jahre 1992 - Sechste Erfassung durch die Arbeitsgemeinschaft Seevogelschutz. *Seevogel 15:* 11-15.

Walsh, P.M., Avery, M. & Heubeck, M. 1990. Seabird numbers and breeding success in 1989. *Nature Conservancy Council CSD Report* No. 1071.

Walsh, P.M., Sears, J. & Heubeck, M. 1991. Seabird numbers and breeding success in 1990. *Nature Conservancy Council CSD Report* No. 1235.

Walsh, P.M., Sim, I. & Heubeck, M. 1992. Seabird numbers and breeding success in Britain and Ireland, 1991. *JNCC Report* No. 6.

Wanless, S. 1987. A survey of the numbers and breeding distribution of the North Atlantic gannet *Sula bassana* and an assessment of the changes which have occured since Operation Seafarer 1969/70. *Research & survey in nature conservation,* No.4.

Zijlstra, M. & Eerden, M.R. van 1991. Development of the breeding population of cormorants *Phalacrocorax carbo* in the Netherlands till 1989. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 53-60.

Zimmerman, H. & Rutschke, E. 1991. Population and population development of the cormorant *Phalacrocorax carbo sinensis* in the German Democratic Republic. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 45-48.

Table 4.1.1 Numbers of breeding seabirds around the coasts of north-west Europe, total around 6.5 million pairs. p = present but no further information. Where orders of magnitude have been used, totals are calculated from the logarithmic mid points. Bracketed numbers are those from an uncertain or incomplete source. Note: order = order of magnitude: 1 = 1-10, 2 = 11-100, 3 = 101-1000, 4 = 1001-10,000, 5 = 10,001-100,000, 6 = 100,001-1,000,000 (see Figure 3.1 for definition of areas).

Species	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 9	Area 10	Species totals
Fulmar	(600000)	170000	358000	14900			7000	16200	3100	1169000
Manx Shearwater	order 5	order 6	order 2-3				order 6	order 5	order 3	order 6
Storm Petrel	order 5-6	order 5	order 4				order 4	order 6	order 4	order 6
Leach's Petrel	order 3	order 5	order 2							order 5
Gannet	2000	88300	17000	22900	(1400)		30400	23400	9400	195000
Cormorant	10	2100	1500	1000		(18900)	4200	1200	(2600)	31500
Shag	(1500)	22200	11600	6100	(2000)		4000	1700	2400	51500
Eider	1000	p	p	p		(39600)			10	40600
Arctic Skua	1400	210	3100			(50)				4800
Great Skua	250	200	7700		(8)					8200
Mediterranean Gull						(110)			10	120
Little Gull						(2)				2
Black-headed Gull	190	4000	3800	16100		(374000)	27400	870	27600	454000
Common Gull	850	5400	6400	80		(58700)	110	170	8	71700
Lesser Black-backed Gull	9000	11200	1800	6200		(37200)	35100	1300	3000	105000
Herring Gull	1400	54400	22100	37900		(217000)	51900	7500	18500	411000
Great Black-backed Gull	1100	8500	5100	40		(6600)	1800	2100	1700	26900
Kittiwake	230000	94600	197000	261000	(50000)	(400)	24700	17700	9700	885000
Sandwich Tern		610	60	8100		27600	4600	410	900	42300
Roseate Tern		30		20		1	510	7	20	590
Common Tern		3500	700	3400		23200	2900	800	3600	38100
Arctic Tern	(5000)	7000	65900	3400		11400	1200	1240	5	95100
Commic Tern		690	40			3000	90			3800
Little Tern		300	8	480		1900	370	120	390	3600
Black Tern						1600				1600
Guillemot	175000	231300	338000	120700	(10000)	4010	74700	23900	4200	982000
Razorbill	(4500)	56500	29400	10800	(3500)	290	14100	5200	1480	126000
Black Guillemot	(3500)	7600	10500	5		1300	440	120		23400
Puffin	(550000)	264000	142000	42800	(75000)		8400	15500	700	1098000
Area totals (pairs)	1719000	1153000	1232000	556000	142000	828000	611000	129000	89600	6459000

4.2 THE MARINE ENVIRONMENT OF NORTH-WEST EUROPE

Seabird distribution in relation to the marine environment

Seabird distribution is patchy (Schneider & Duffy 1985), influenced by various factors. Prey distribution is important (e.g. Hunt & Schneider 1987), probably more so than physical factors (McClatchie, Hutchinson & Nordin 1989). The proximity of available nesting sites also limits distribution in the breeding season (e.g. Fraser & Ainley 1986, Skov *et al.* 1994). Other biological factors influencing seabird distribution include social interactions (Hunt & Schneider 1987). Seabirds may use physical characteristics to locate suitable habitats, then search for food (Fraser & Ainley 1986). Hunt & Schneider (1987) suggest that large scale patches (>100 km) of seabird distribution are a response to physical features, whereas smaller scale patches (<100 km) are controlled by biological processes, e.g. foraging behaviour. Physical features have greater longevity, hence larger scale patterns of seabird distribution are more stable than small scale patterns.

Many physical factors influence seabird distribution, often indirectly via prey distribution. Wind (e.g. Schneider & Duffy 1985) and weather (e.g. Hunt & Schneider 1987) may have a seasonal effect. Water movement may also have an effect; Barstow (1983) has recorded birds feeding on prey concentrated by Langmuir circulations along drift lines, while in the open ocean shearwaters and petrels have been found over internal wave crests where prey may accumulate (Haney 1987).

Water types are also influential (e.g. Elphick & Hunt 1993). In the North Sea, Joiris (1978) identified two zones of distribution in July. A north-western zone of Atlantic water held the majority of alcids, skuas and gannets and large numbers of fulmars. Typical North Sea water further south held fewer fulmars and lower numbers of birds; Joiris suggests that recycling here is via heterotrophic bacteria, providing less food for birds than the classic food web. Water types may be defined by temperature and salinity, therefore bird distribution may correlate with these parameters (e.g. Pocklington 1979, Durinck, Skov & Danielsen 1993).

Mixing brings nutrients to the surface, encouraging phytoplankton growth which attracts zooplankton and fish. The increased prey density attracts birds (e.g. Bourne 1982). Mixing is caused by turbulence around topographic features aswell as at fronts between water masses with different properties. Fronts are highly productive, with increased concentrations of plankton and fish; increased bird densities have been found at fronts (e.g. Kinder *et al.* 1983, Follestad 1990, Harrison, Hunt & Cooney 1990, Schneider 1990).

Fronts can occur at characteristic depths, hence bird distribution may relate to depth. Schneider (1982) found increased concentrations of fulmars and petrels at a shelf break front, and murres and shearwaters at a front at the 50 m isobath. Brown (1988a,b) found little auks associated with a shelf break front and Leach's and Wilson's petrels at the shelf break and at upwellings and convergences with zooplankton concentrations. Upwellings, common at the shelf break and elsewhere, have increased bird densities (e.g. Summerhayes, Hofmyer & Rioux 1974). Auks and Manx shearwaters have been found to remain mostly within continental shelf waters, while fulmars and storm petrels are commonest at the outer shelf, shelf edge and over deep waters (Stone, Webb & Tasker 1995).

Fishing activity influences the distribution of species feeding behind trawlers. Fulmars, gannets, common gulls, herring gulls, great black-backed gulls and kittiwakes have been found to obtain a substantial proportion of their food from fishing vessels (Camphuysen *et al.* 1993). During the period 1985-1992 an estimated 83,700 tonnes of offal, 146,000 tonnes of roundfish, 148,000 tonnes of flatfish and 100,000 tonnes of benthic invertebrates were discarded in the entire North Sea. Roundfish and offal were the most important for seabirds; it has been suggested that around two million seabirds may be supported by these discards (Camphuysen *et al.* 1993). However, Summerhayes, Hofmyer & Rioux (1974) found that birds associated with fishing vessels at the shelf edge did not follow them elsewhere, suggesting that regional differences have a stronger influence on bird distribution, but within a region distribution may be modified by fishing activity.

A basic description of the oceanography of north-west European waters follows, with particular reference to those factors mentioned above which may influence seabird distribution.

Bathymetry (Figure 4.2.1, Table 4.2.1)

The North Sea is mostly shallow (< 100 m), although not uniformly so; the southern half is shallowest (< 50 m). A shallow tongue extends northwards around Orkney and Shetland. The Kattegat, Belt Sea, English Channel, Irish Sea and St. George's Channel are shallow, although deeper areas (100-200 m) lie within the latter two regions. Other shallow areas are the Faeroe and Rockall Banks, and banks south-west of the Faeroes.

The continental shelf (<200 m) is extensive to the south-west of the area, in the Celtic Sea. It is narrower to the west of Ireland and Scotland. The Porcupine Bank, west of Ireland, is also less than 200 m deep. The shelf in the north-east of the area extends almost to Norway. Shelf waters are generally productive, with populations of fish and invertebrates which are potentially available as prey for seabirds.

The continental slope (200-1000 m) is steeper at the edge of the Celtic Sea and west of Scotland than to the west of Ireland. Upwelling at the shelf edge may concentrate fish and plankton, which may increase the value of these areas for seabirds. A deep (200-1000 m) trench, the Rinne, runs parallel to the west coast of Norway and into the Skagerrak. Deep waters (>1000 m) beyond the shelf edge are divided by the Scotland-Faeroe-Iceland Ridge. East of the Faeroes is the Faeroe-Shetland Channel, a narrow deep area that expands northwards. The Rockall Trough lies to the west of Scotland and the Porcupine Seabight to the south-west of Ireland.

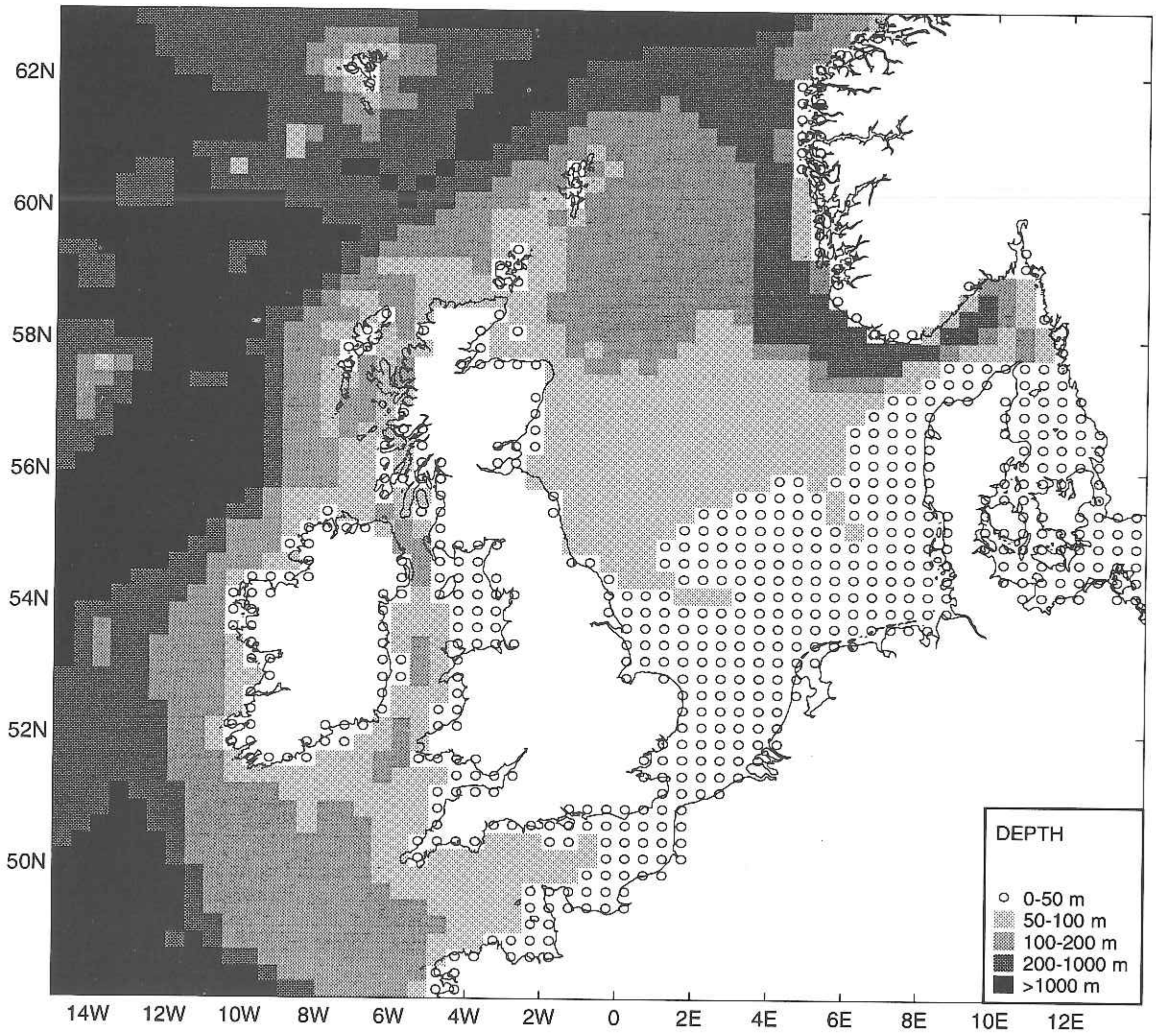

Figure 4.2.1 Bathymetry of north-west European waters

Table 4.2.1 Depth composition of each area used for analysis of seabird distribution (see Figure 3.1 for definition of areas).

Area	Depth (metres)				
	0-50	50-100	100-200	200-1000	1000+
1 North-west oceanic	0.56%	1.86%	8.36%	42.57%	46.65%
2 North-west shelf	23.64%	36.36%	36.97%	3.03%	0.00%
3 Shetland, Orkney & Moray Firth	16.50%	30.10%	53.40%	0.00%	0.00%
4 Western North Sea	41.11%	56.67%	2.22%	0.00%	0.00%
5 Central & north North Sea	32.03%	10.86%	28.69%	23.68%	4.74%
6 South & east North Sea	86.25%	7.50%	2.50%	3.75%	0.00%
7 Irish Sea	62.96%	28.40%	8.64%	0.00%	0.00%
8 South-west oceanic	0.00%	0.00%	22.77%	37.95%	39.28%
9 Celtic Sea	14.29%	23.60%	62.11%	0.00%	0.00%
10 English & Bristol Channels	59.70%	35.08%	5.22%	0.00%	0.00%

Bottom deposits

Muddy substrates, sometimes mixed with sand, are found in sedimentation areas in deep water (Table 4.2.1). Mud and sand are also found in shallow areas of the central North Sea and the northern Irish Sea, mixed with gravel in the latter. Shallow waters, such as those in the English Channel and the Kattegat, have sandy substrates or sand/gravel mixtures. Sandy substrates provide an ideal habitat for sandeels, a component of the diet of many seabird species. Gravel dominates the central English Channel. In the North Sea sand is mixed with gravel towards land.

Rocky outcrops are widespread around British mainland and island coasts except in the south-east and at Irish Sea borders. In shallow waters these rocky substrates provide a habitat for molluscs, echinoderms and some shallow-water fish such as blennies, all of which are important in the diet of some seabirds such as seaduck, cormorants, shags and black guillemots. Stone reefs in the Kattegat, Belt Sea and Kiel Bay support high densities of mussels *Mytilus edulis*, an important constituent in the diet of seaducks such as eider and scoter. Rocky substrates extend to the shelf edge west of Scotland. Continental North Sea coasts have little exposed rock, excepting Norway.

Surface temperature and salinity

In winter, surface waters are warmer offshore than inshore, and warmer in Atlantic regions than in the North Sea or the Baltic (Lee & Ramster 1981). Warm water masses enter the Irish Sea and English Channel from the south-west, and pass into the southern North Sea. Warm water also enters the North Sea from the north and north-west. Coastal waters are cooler, particularly where enclosed or where there is a large river input e.g. Liverpool Bay, the upper Bristol Channel, the Moray Firth and the German coast. In summer, surface temperature increases in shallow coastal waters and further offshore to the south-west.

Surface salinity is lower near coasts than offshore throughout the year (Lee & Ramster 1981). High salinity (>35‰) North Atlantic water enters the English Channel from the south-west and the North Sea from the north-west, reaching further in winter than in summer. This high salinity oceanic water to the west of the area contrasts with low salinity water along continental coasts of the southern North Sea. These two contrasting water types may lead to different avifaunas selecting different areas (Ratcliffe *et al.* 1995 *in prep.*). Run-off from rivers lowers salinity along German and Dutch coasts while the Baltic outflow lowers salinity in the Kattegat and Skagerrak (Svansson 1975); salinity in the Kattegat ranges from 15‰ to 30‰.

Tides and circulation

Tidal ranges are greater in the west of the area, and highest in estuaries and bays. Ranges are large in the upper Bristol Channel, the east English Channel, along the Lancashire coast, the Brittany coast, and in the Wash. In the North Sea tidal range increases in the west. Tidal streams in the central North Sea are less than one knot. Local topography in narrow channels or by headlands strengthens tidal streams in the Pentland Firth, Dover Straits and St. George's Channel, and around Dorset, the Cherbourg Peninsula, Malin Head and East Anglia. Resonance in the Bristol Channel and Solway Firth enhances tidal streams, which exceed seven knots at spring tides in the upper Bristol Channel. Eddies may form downstream of headlands and islands (Pattiaratchi, James & Collins 1986). Turbulence caused by strong tidal streams may enhance food availability for seabirds.

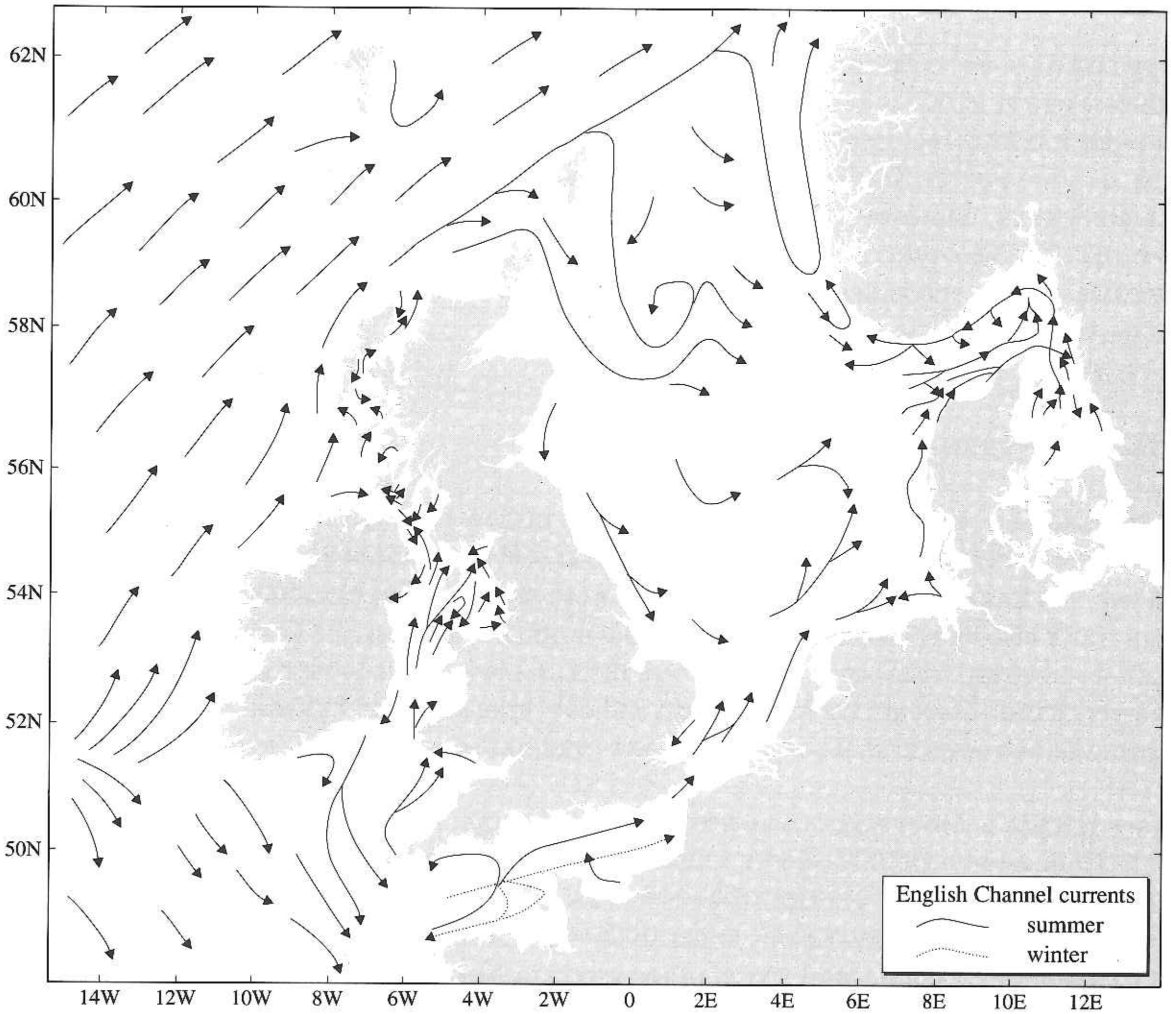

Figure 4.2.2 Surface circulation in the seas of north-west Europe (adapted from Lee 1980, Turrell 1992, Turrell *et al.* 1992)

Internal waves occur in deep water; along the shelf edge these may facilitate exchange of water, heat and nutrients from the deep ocean to shelf waters (Huthnance 1985), resulting in phytoplankton growth (Pingree & Mardell 1981) and increased production.

Oceanic North Atlantic water dominates the Norwegian coast and enters the central North Sea via the Norwegian Trench Atlantic Inflow, the East Shetland Atlantic Inflow and the Fair Isle Current (Turrell 1992, Turrell *et al.* 1992) (Figure 4.2.2). Channel water passing the Dover Straits occupies the central southern North Sea (Lee 1980), mixing with fresh river water towards the Skagerrak. There is a specific river-influenced water mass along the coasts of the Netherlands, Denmark and Germany. The Atlantic Inflow, Channel water and Baltic Outflow combine to leave the North Sea via the Norwegian Coastal Current. Again, these different water masses may lead to different avifaunas inhabiting different areas.

English Channel circulation varies with the season (Lee 1980). A western inflow runs along the north side in winter and through the southern half in summer. It diverges at about 3°W: some water continues eastwards and some loops back out of the Channel.

Irish Sea circulation is northerly, with a southwards element along the Irish coast and an anticlockwise flow east of the Isle of Man. The flow continues through the North Channel. West of Ireland the North Atlantic Drift flows north-east; some water enters the Irish Sea around Northern Ireland. Atlantic water, mixed with Irish Sea and Clyde waters, flows north through the Minch; some branches south of the Outer Hebrides (Ellett 1979). Atlantic water passes west Scotland and Norway; the Atlantic Inflow to the North Sea breaks off this.

Fronts

Fronts occur at boundaries between water types. Thermal stratification develops offshore in summer; a thermocline divides warm surface layers and cooler deeper water. Stratification develops in April and is well established by June (Simpson, Hughes & Morris 1977), then breaks down between September and November. In shallow coastal water wind and tide ensure that the water column is mixed throughout the year. Fronts may occur in summer where mixed and stratified waters meet; nutrient renewal at fronts promotes phytoplankton growth (e.g. Pingree, Holligan & Mardell 1978). Cyclonic eddies may provide a cross-frontal exchange mechanism, increasing phytoplankton concentrations (Pingree 1978). Increased production in frontal areas attracts fish and birds.

Seasonal fronts occur in the Celtic Sea (Simpson 1976), between the Channel Islands (Pingree, Forster & Morrison 1974), in Lyme Bay (Pingree, Mardell & Maddock 1983), off west Brittany at Ushant, around the Isles of Scilly and in the North Sea (Pingree & Griffiths 1978) (Figure 4.2.3). The Irish Sea front (Simpson 1971) runs between areas of weak and strong tides south-west of the Isle of Man. The Islay front (Simpson *et al.* 1979), between Ireland and Islay, has haline and thermal elements (Hill & Simpson 1989); the haline front is permanent and the thermal front seasonal. The Islay and Irish Sea fronts have a consistent position (Simpson & Bowers 1979), which may enhance their value as a food source for seabirds. Low salinity Baltic water meeting high salinity North Sea water causes a permanent front in the Skagerrak and Kattegat (Svansson 1975). Local headland fronts also occur (Pingree, Bowman & Esaias 1978) and there is a front around the Frisian Islands (de Gee, Baars & van der Veer 1991). The German Bight has many short-lived plume fronts (Krause *et al.* 1986). Plume fronts are also found at the outflow of many rivers, such as those in the southern North Sea and the Thames.

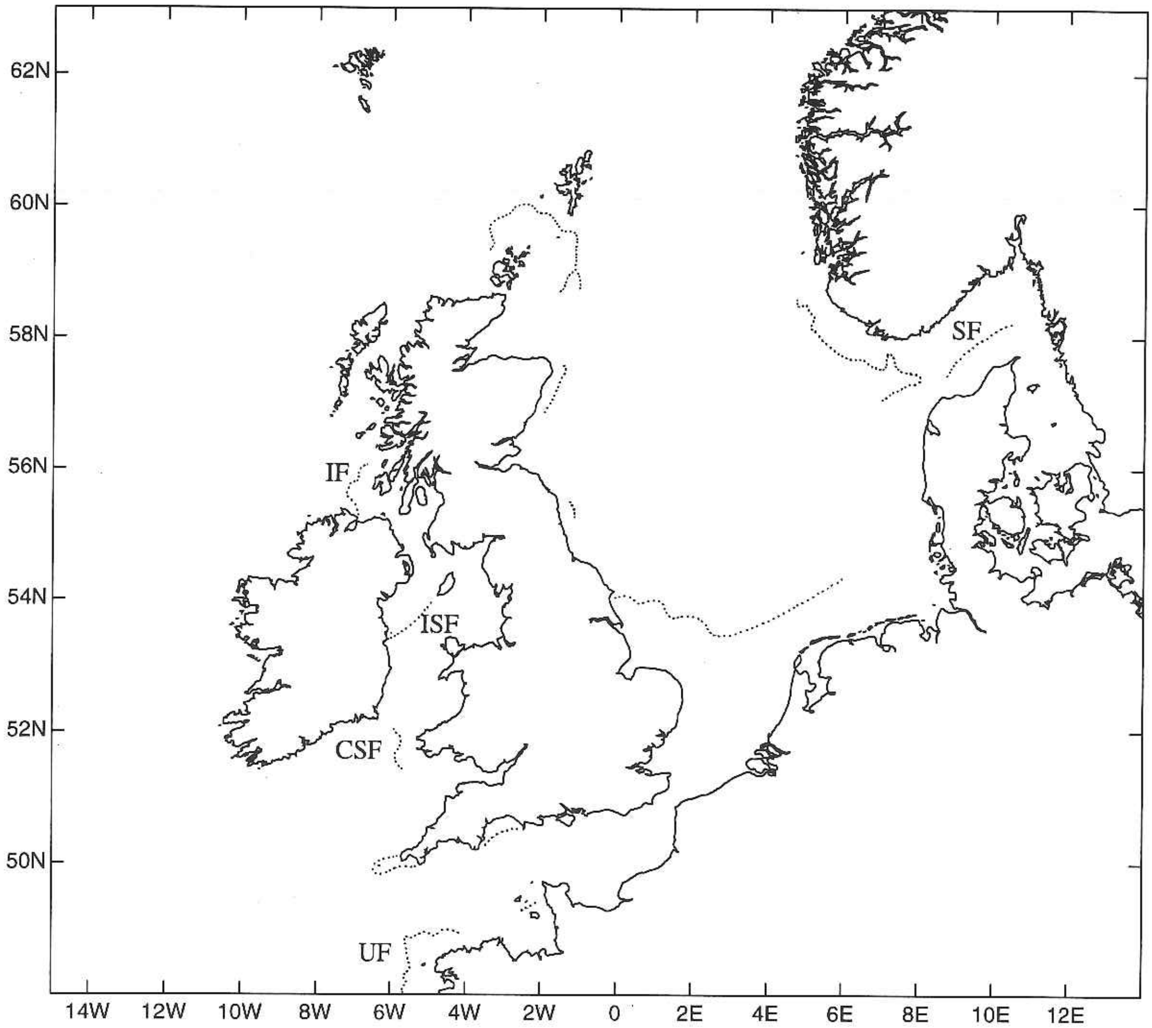

Figure 4.2.3 The position of fronts (excluding plume fronts) in north-west European waters
(CSF = Celtic Sea front; IF = Islay front; ISF = Irish Sea front; SF = Skagerrak front; UF = Ushant front)

Fish and fisheries

Most species of seabirds feed on fish, either directly or as discards from fishing vessels. Many species (e.g. Manx shearwater, gannet, shag, terns, guillemot, razorbill, puffin) feed on sandeels, clupeids (herring, sprat) and gadoids (cod, whiting, haddock, saithe, Norway pout, blue whiting). Cormorants feed on flatfish such as plaice and sole.

The concentration of fish at spawning or nursery areas may be advantageous to seabirds. The importance of each of the ten areas used for analysis of seabird distribution as spawning or nursery areas is presented below (Table 4.2.2). Some species of gulls, together with fulmars, great skuas and gannets, scavenge at fishing vessels; fishing activity in each of the ten areas is also presented in Table 4.2.2. Shelf seas hold many species of fish, but deeper waters (Areas 1 and 8) are important mainly for blue whiting, with south-west oceanic waters (Area 8) also being important for mackerel which spawn along the shelf edge in this area. Deep waters are diverse in deep-water fish, but these would be unavailable to seabirds.

Some species (divers, black-headed gull, little gull, common gull and black guillemot), feed on shallow water fish such as blennies, gobies and butterfish. These fish are found around coasts. Similarly seaduck feed on marine molluscs, also found in shallow coastal regions, particularly in the Kattegat and Belt Sea.

Fishing concentrates on the shelf and shelf edge, therefore the opportunity for scavenging on discards is greater there than in deep waters. Intensity is highest in the North Sea, especially close to Dutch and German coasts. There is little fishing in deep waters; fishing in Areas 1 and 8 concentrates mainly on blue whiting.

Table 4.2.2 Spawning areas, nursery areas and commercial exploitation of fish in north-west Europe (see Figure 3.1 for definition of areas).
(s = spawning area, n = nursery area, f = fishing area; capital letter denotes major importance, lower case letter denotes moderate importance, parentheses denotes minor importance.)

Species	Area 1 North-west oceanic	Area 2 North-west shelf	Area 3 Shetland, Orkney & Moray Firth	Area 4 Western North Sea	Area 5 Central & north North Sea	Area 6 South & east North Sea	Area 7 Irish Sea	Area 8 South-west oceanic	Area 9 Celtic Sea	Area 10 English & Bristol Channels
Plaice		f	(s),f	S,f	S,F	S,F	(s),f		(s),f	S,f
Sole				(s),(n),f	f	S,N,F	(s),N,f		(s)	S,N,f
Cod	(f)	s,F	(s),F	(s),F	S,f	S,f	s,f		(s),f	f
Haddock	(s),f	(s),F	s,f	F	s,F		(f)		(f)	(f)
Saithe	(s),(f)	S,f	(s),F	(f)	S,f		(f)			f
Whiting	(s)	s,F	(s),F	s,F	s,F	s,(f)	s,f		(s)	f
Sprat		s,f	s,(f)	S,F	S,F	S,f	S,f		(s)	S,f
Norway Pout	s	s,(f)	s,(f)	(s),(f)	S,f	(f)				
Blue Whiting	S,N,F	(n),(f)	(n)		N,F			S,f		
Sandeel			s,n,(f)	s,n,f	s,n,F					
Herring		s,F	S,n,F	s,n,f	(n),(f)	(s),N,(f)	(s),n,f		(s),(n)	(s),(f)
Mackerel		f	s,(f)	s,(f)	S,(f)	s		S	S,(f)	s,f
Nephrops		F	F	f			f			
Shrimps		(f)	(f)	(f)	f	f				

References

Barstow, S.F. 1983. The ecology of Langmuir circulation: a review. *Marine Environmental Research 9:* 211-236.

Bourne, W.R.P. 1982. Concentrations of Scottish seabirds vulnerable to oil pollution. *Marine Pollution Bulletin 13:* 270-273.

Brown, R.G.B. 1988a. The influence of oceanographic anomalies on the distributions of storm-petrels (Hydrobatidae) in Nova Scotian waters. *Colonial Waterbirds 11:* 1-8.

Brown, R.G.B. 1988b. Oceanographic factors as determinants of the winter range of the dovekie (*Alle alle*) off Atlantic Canada. *Colonial Waterbirds 11:* 176-180.

Camphuysen, C.J., Ensor. K., Furness, R.W., Garthe, S., Hüppop, O., Leaper, G., Offringa, H. & Tasker, M.L. 1993. *Seabirds feeding on discards in winter in the north North Sea.* EC DG XIV research contract 92/3505. NIOZ Rapport 1993- 8, Netherlands Institute for Sea Research, Texel.

Durinck, J., Skov, H. & Danielsen, F. 1993. Some factors determining seabird distribution in the North Sea. *Proceedings of the Seventh Nordic Congress of Ornithology, 1990:* 9-17

Ellett, D.J. 1979. Some oceanographic features of Hebridean waters. *Proceedings of the Royal Society of Edinburgh 77B:* 61-74.

Elphick, C.S. & Hunt, G.L. Jr. 1993. Variations in the distributions of marine birds with water mass in the northern Baring Sea. *Condor 95:* 33-44.

Follestad, A. 1990. The pelagic distribution of little auk *Alle alle* in relation to a frontal system off central Norway, March/April 1988. *Polar Research 8:* 23-28.

Fraser, W.R. & Ainley, D.G. 1986. Ice edges and seabird occurrence in Antarctica. *Bioscience 36:* 258-263.

Gee, A. de, Baars, M.A. & Veer, H.W. van der 1991. *De ecologie van het friese front. Waamemigen aan een biologisch-rijke zone in de Noordzee, gelegen tussen de Zuidelijke Bocht en de Oestergronden.* NIOZ-rapport 1991-2, Neth. Inst. Sea Res., Texel.

Haney, J.C. 1987. Ocean internal waves as sources of small-scale patchiness in seabird distribution on the Blake Plateau. *Auk 104:* 129-133.

Harrison, N.M., Hunt, G.,L., Jr. & Cooney, R.T. 1990. Front affecting the distribution of seabirds in the northern Bering Sea. *Polar Research 8:* 29-31.

Hill, A.E. & Simpson, J.H. 1989. On the interaction of thermal and haline fronts: the Islay front revisited. *Estuarine, Coastal and Shelf Science 28:* 495-505.

Hunt, G.L. Jr. & Schneider, D.C. 1987. Scale-dependent processes in the physical and biological environment of marine birds. In, Croxall, J.P. (ed.), *Seabirds: feeding biology and role in marine ecosystems*, Cambridge University Press, pp. 7-41.

Huthnance, J. 1985. Oceanography of the continental shelf margin. *NERC Newsletter, Dec. 1985, pp.8-11.*

Joiris, C. 1978. Seabirds recorded in the northern North Sea in July: the ecological implications of their distribution. *Le Gerfaut 68:* 419-440.

Kinder, T.H., Hunt, G.L. Jr., Schneider, D. & Schumacher, J.D. 1983. Correlations between seabirds and oceanic fronts around the Pribilof Islands, Alaska. *Estuarine, Coastal and Shelf Science 16:* 309-319.

Krause, G., Budeus, G., Gerdes, D., Schaumann, K. & Hesse, K. 1986. Frontal systems in the German Bight and their physical and biological effects. In, Nihoul, J.C.J. (ed.), *Marine interfaces and ecohydrodynamics*, Elsevier, Amsterdam, pp. 119-140.

Lee, A.J. 1980. North Sea: physical oceanography. In, Banner, F.T., Collins, M.B., Massie, K.S. (eds.), *The North-West European shelf seas: the sea bed and the sea in motion, II, Physical and chemical oceanography, and physical resources.* Elsevier Oceanography Series 24B, Amsterdam, pp. 467-493.

Lee, A.J. & Ramster, J.W. (eds.) 1981. *Atlas of the seas around the British Isles.* MAFF Directorate of Fisheries Research, Lowestoft.

McClatchie, S., Hutchinson, D. & Nordin, K. 1989. Aggregation of avian predators and zooplankton prey in Otago shelf waters, New Zealand. *Journal of Plankton Research 11:* 361-374.

Pattiaratchi, C., James, A. & Collins, M. 1986. Island wakes and headland eddies: a comparison between remotely sensed data and laboratory experiments. *Journal of Geophysical Research 92(C1):* 783-794.

Pingree, R.D. 1978. Cyclonic eddies and cross-frontal mixing. *Journal of the marine biological association of the U.K. 58:* 955-963.

Pingree, R.D., Bowman, M.J. & Esaias, W.E. 1978. Headland fronts. In, Bowman, M.J. & Esaias, W.E. (eds.), *Oceanic fronts in coastal processes*, Proceedings of a workshop held at the Marine Sciences Research Centre, May 25-27, 1977. Springer-Verlag, pp. 78-86.

Pingree, R.D., Forster, G.R. & Morrison, G.K. 1974. Turbulent convergent tidal fronts. *Journal of the marine biological association of the U.K. 54:* 469-479.

Pingree, R.D. & Griffiths, D.K. 1978. Tidal fronts on the shelf seas around the British Isles. *Journal of Geophysical Research 83(C9):* 4615-4622.

Pingree, R.D., Holligan, P.M. & Mardell, G.T. 1978. The effects of vertical stability on phytoplankton distributions in the summer on the northwest European shelf. *Deep-Sea Research 25:* 1011-1028.

Pingree, R.D. & Mardell, G.T. 1981. Slope turbulence, internal waves and phytoplankton growth at the Celtic Sea shelf-break. *Philosophical Transactions of the Royal Society London A 302:* 663-682

Pingree, R.D., Mardell, G.T. & Maddock, L. 1983. A marginal front in Lyme Bay. *Journal of the marine biological association of the U.K. 63:* 9-15.

Pocklington, R. 1979. An oceanographic interpretation of seabird distributions in the Indian Ocean. *Marine Biology 51:* 9-21.

Ratcliffe, N., Stone, C.J., Webb, A. & Tasker, M.L. 1995 *in prep.* Habitat use and community interactions of seabirds in the seas of north-west Europe.

Schneider, D. 1982. Fronts and seabird aggregations in the southeastern Bering Sea. *Marine Ecology Progress Series 10:* 101-103.

Schneider, D.C. 1990. Seabirds and fronts: a brief overview. *Polar Research 8:* 17-21.

Schneider, D.C. & Duffy, D.C. 1985. Scale-dependent variability in seabird abundance. *Marine Ecology Progress Series 25:* 211-218.

Simpson, J.H. 1971. Density stratification and microstructure in the western Irish Sea. *Deep-Sea Research 18:* 309-319.

Simpson, J.H. 1976. A boundary front in the summer regime of the Celtic Sea. *Estuarine and Coastal Marine Science 4:* 71-81.

Simpson, J.H. & Bowers, D. 1979. Shelf sea fronts' adjustments revealed by satellite IR imagery. *Nature 280:* 648-651.

Simpson, J.H., Edelsten, D.J., Edwards, A., Morris, N.C.G. & Tett, P.B. 1979. The Islay front: physical structure and phytoplankton distribution. *Estuarine and Coastal Marine Science 9:* 713-726.

Simpson, J.H., Hughes, D.G. & Morris, N.C.G. 1977. The relation of seasonal stratification to tidal mixing on the continental shelf. In, Angel, M. (ed.), *A voyage of discovery*, Pergamon Press, Oxford and New York, pp. 327-340.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Summerhayes, C.P., Hofmyer, P.K. & Rioux, R.H. 1974. Seabirds off the southwestern coast of Africa. *Ostrich 45:* 83-109.

Svansson, A. 1975. Physical and chemical oceanography of the Skagerrak and the Kattegat. I. Open sea conditions. *Fishery Board of Sweden, Institute of Marine Research,* Report no. 1.

Turrell, W.R. 1992. New hypotheses concerning the circulation of the northern North Sea and its relation to North Sea fish stock recruitment. *ICES Journal of Marine Science 49:* 107-123.

Turrell, W.R., Henderson, E.W., Slesser,. G., Payne, R. & Adams, R.D. 1992. Seasonal changes in the circulation of the northern North Sea. *Continental Shelf Research 12:* 257-286.

5 SPECIES ACCOUNTS

5.1 DIVERS

Four species of diver were seen in this study, of which three (red-throated diver *Gavia stellata*, black-throated diver *G. arctica* and great northern diver *G. immer*) were recorded regularly. Two white-billed divers *G. adamsii* were seen (see section 5.52). In order to examine diver distribution in the study area it was decided to consider densities (birds.km^{-2}) for all diver species together (identified and unidentified) and also to consider abundance (birds.km^{-1}) of individual species (sections 5.2 - 5.4). In this section, density figures are made up from both ship-based survey data and aerial survey data. Since identifying divers to species during aerial surveys proved difficult, the data for individual diver species comes from ship-based surveys only. Surveys of west Scottish sealochs have been reported previously and are not included here (Webb *et al.* 1990).

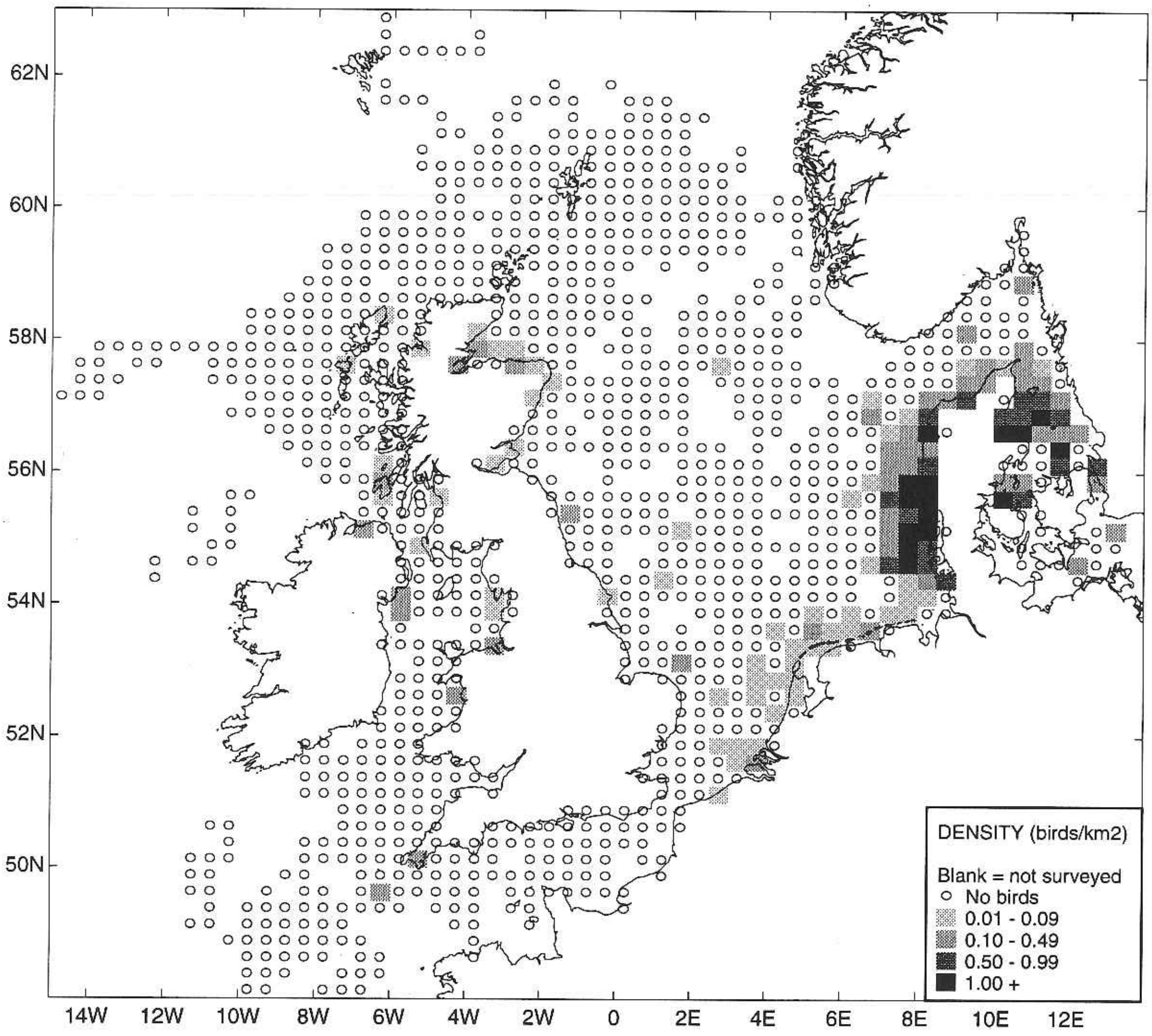

Figure 5.1.1 Distribution of divers in April and May

April to May (Figure 5.1.1)

The distribution of divers at this time of year was predominantly coastal. The highest densities were found in the main wintering area in the northern German Bight, aswell as along the Danish coasts of the Skagerrak and Kattegat, with lower densities in the southern German Bight and along the coasts of the Netherlands. There were low densities along the west coast of Scotland and in the Moray Firth, and some were seen on Irish Sea coasts. Few birds were noted far offshore.

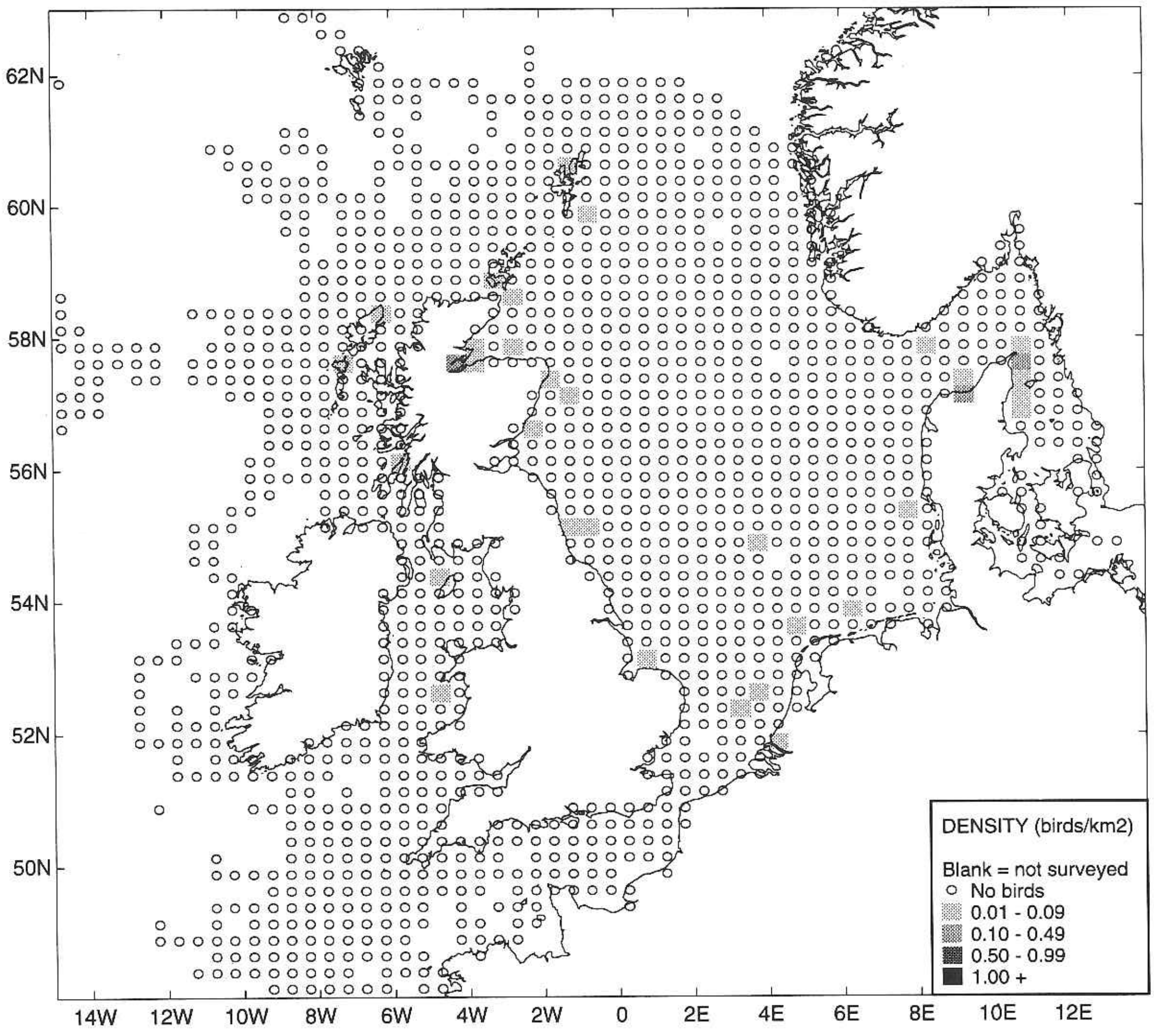

Figure 5.1.2 Distribution of divers from June to September

June to September (Figure 5.1.2)

Diver density was much lower at this time of year (Table 5.1.1), since most birds would be outside the study area in order to breed. Again the majority of records were close to land, around Denmark, the Netherlands and the United Kingdom, with concentrations at Jammerbugten, Skagen and in the Moray Firth.

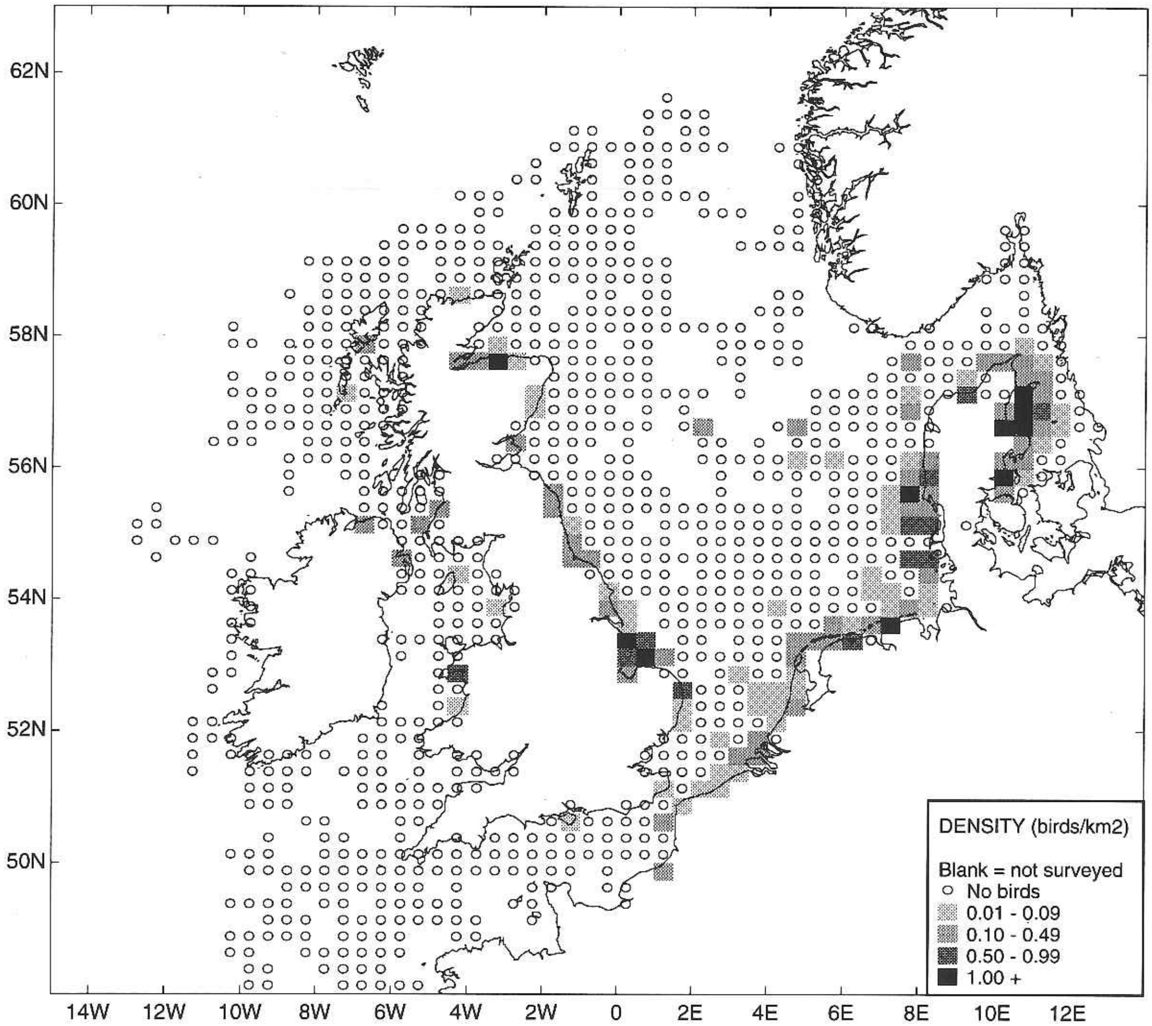

Figure 5.1.3 Distribution of divers in October and November

October to November (Figure 5.1.3)

The density of divers began to increase again following the breeding season. This increase occurred around the coasts of Denmark, the Kattegat, Germany, the Netherlands and Belgium. Birds were also recorded along the east coast of Britain, particularly in the Wash, and to a lesser extent on the west coast.

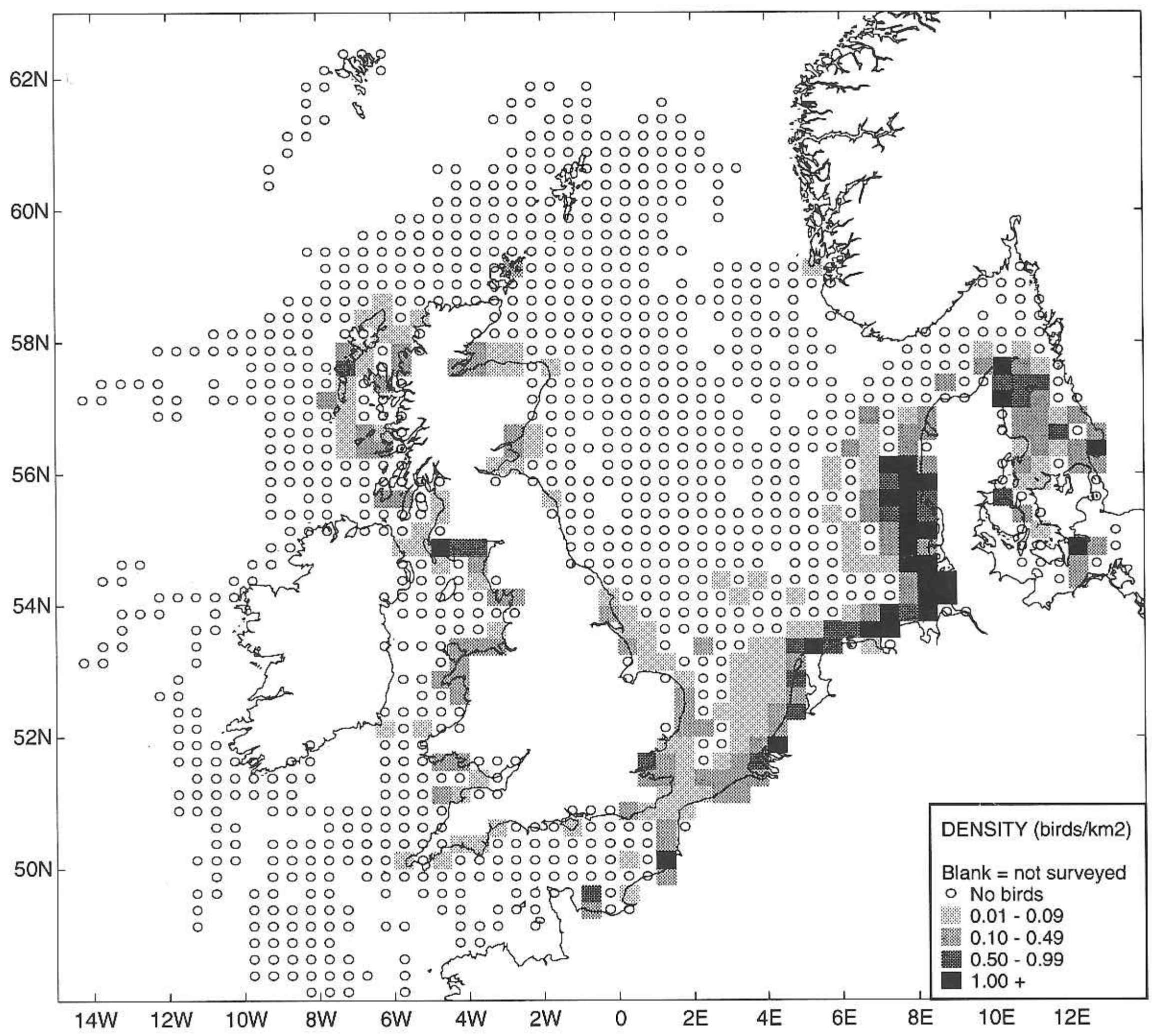

Figure 5.1.4 Distribution of divers from December to March

December to March (Figure 5.1.4)

At this time of year densities were at their highest and divers were more widespread than in other months throughout the whole study area (Table 5.1.1). Birds were found in high densities to the west of Denmark, along the coasts of Germany and the Netherlands and also in the Kattegat, where densities were slightly lower. Other studies (Durinck *et al.* 1994) have shown mean densities of red-throated and black-throated divers in the Belt Sea to be as high as 4.1 birds.km^{-2}. Divers also occurred in lower densities around the east and west coasts of Scotland, the west and south-east coasts of England and the coastal waters of Belgium and northern France.

Summary and conservation implications

The coasts of Denmark, Germany and the Kattegat were the most important areas for divers, which occurred here in high densities from October to May. The Netherlands and Belgian coasts were also important areas for these species. Wintering numbers of small divers in the south-eastern North Sea have increased markedly in the 1980s (Meininger 1978, Camphuysen & Van Dijk 1983, Platteeuw *et al.* 1994). Around British coasts, divers were only present in reasonable densities in winter months. Few divers were present in the study area in summer months. Divers spend a large part of their lives on the sea, including time spent asleep, and thus are likely to come into contact with oil on the water surface. They would be seriously affected by a large oil spillage in the region of any major concentration. A large number of divers could therefore be at risk if a major oil spillage were to occur in the German Bight or Kattegat during the winter. Divers are especially vulnerable to oil pollution during moult periods, when they become flightless. Along the coast of the Dutch Wadden Sea and in the Delta Region shipping can cause disturbance to divers.

Further reading

Camphuysen, C.J. 1989. Beached bird surveys in the Netherlands 1915-1988. *Techn. Rapp. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam.*

Camphuysen, C.J. & Dijk, J. van 1983. Zee - en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Clausager, I. 1979. *Olieudslippet efter Thun Tank III's grundstødning 1979.* Vildtbiol. Stat., Kalø.

Danielsen, F., Skov, H. & Durinck, J. 1993. Estimates of the wintering population of Red-throated Diver *Gavia stellata* and Black-throated Diver *Gavia arctica* in northwest Europe. *Proceedings of the Seventh Nordic Congress of Ornithology, 1990:* 18-25.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H., Danielsen, F. & Christensen, K.D. 1994. Vinterføden hos Rødstrubet Lom *Gavia stellata* i Skagerrak. *Dansk. Orn. Foren. Tidsskr. 88:* 39-41.

Greenwood, J.J.D., Donally, R.J., Feare, C.J., Gordon, N.J. & Waterston, G. 1971. A massive wreck of oiled birds: northeast Britain, winter 1970. *Scot Birds 6:* 235-250.

Heubeck, M. 1979. Seabirds and Oil Pollution in Shetland 1979. *Seabird Group Newsletter No 27:* 6-8.

Joensen, A.H. 1972. Oil pollution and seabirds in Denmark 1935-1968. *Dan. Rev. Game. Biol. 6 No 8:* 1-24.

Jones, P.H., Monnat, J.-Y., Cadbury, C.J. & Stowe, T.J.S. 1978. Birds oiled during the Amoco Cadiz incident: An interim report. *Mar. Poll. Bull. 9(11):* 307-310.

Laursen, K. & Frikke, J. 1987. Vinterforekomst af dykænder, lommer og alkefugle i den sydøstlige del af Vesterhavet. *Dansk Orn. Foren. Tidsskr. 81:* 167-172.

Meininger, P.L. 1978. Het voorkomen van Duikers (Gaviidae) langs de Nederlandse kust in de periode juli 1972 - juni 1976. *Watervogels 3(4):* 199-209.

Meltofte, H. & Kiørboe, T. 1973. Forekomsten af lommer Gaviidae ved Blåvandshuk 1963-1971. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfågelräkning från färjor i Kattegatt. *Pelagicus 3:* 17-39.

Platteeuw, M. Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Storstein, B. 1987. Høsttrekket ved Haugesund 1979-84: Trekkforløp og antall Del 1: Lomer-riksefugler. *Vår Fuglefauna 10(1):* 25-36.

Temme, M. 1989. Über das Vorkommen von See- und Hochseevogelarten vor der Insel Norderney nach Planbeobachtungen. *Vogelk. Ber. Nieders. 21(2): 54-63.*

Webb, A., Harrison, N.M., Leaper, G.M., Steele, R.D., Tasker, M.L. & Pienkowski, M.W. 1990. *Seabird distribution west of Britain.* Nature Conservancy Council, Peterborough.

Table 5.1.1 Overall density of divers (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.04	0.01	0.03	0.00	0.93	0.01	-	0.00	0.03
	km^2	96.0	1292.1	774.8	1145.1	1093.4	4048.0	896.7	0.0	71.2	899.0
Feb	Density	0.00	0.00	0.01	0.00	0.02	0.4	0.01	0.00	0.00	0.00
	km^2	352.0	778.9	1415.8	1271.7	3006.9	5775.9	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.03	0.02	0.00	0.24	0.17	0.00	0.00	0.01
	km^2	374.7	1385.1	1388.4	597.0	1015.4	3101.8	581.6	148.9	609.3	780.0
Apr	Density	0.0	0.01	0.05	0.00	0.00	0.39	0.00	0.00	0.00	0.00
	km^2	576.0	944.6	1243.0	269.6	1743.2	4940.1	483.9	98.9	550.9	787.8
May	Density	0.00	0.01	0.02	0.01	0.00	0.16	0.01	0.00	0.00	0.00
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4025.4	978.9	253.2	501.1	1242.0
Jun	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	2114.0	2662.2	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	1002.1	1512.4	3689.2	1798.9	4787.4	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	867.9	2468.6	1377.9	2097.8	4052.5	4954.6	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	208.9	1059.6	1396.9	3171.9	3080.7	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	0.00	0.00	0.00	0.01	0.00	0.12	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	753.5	1427.6	3410.4	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.01	0.03	0.09	0.00	0.14	0.02	0.00	0.00	0.01
	km^2	116.3	561.5	1013.7	869.8	1592.0	3655.4	587.7	76.3	710.4	859.0
Dec	Density	0.00	0.09	0.02	0.00	0.00	0.07	0.01	0.00	0.00	0.03
	km^2	102.2	620.5	609.0	847.5	736.5	2873.1	280.7	97.9	460.5	1476.1

5.2 RED-THROATED DIVER *Gavia stellata*

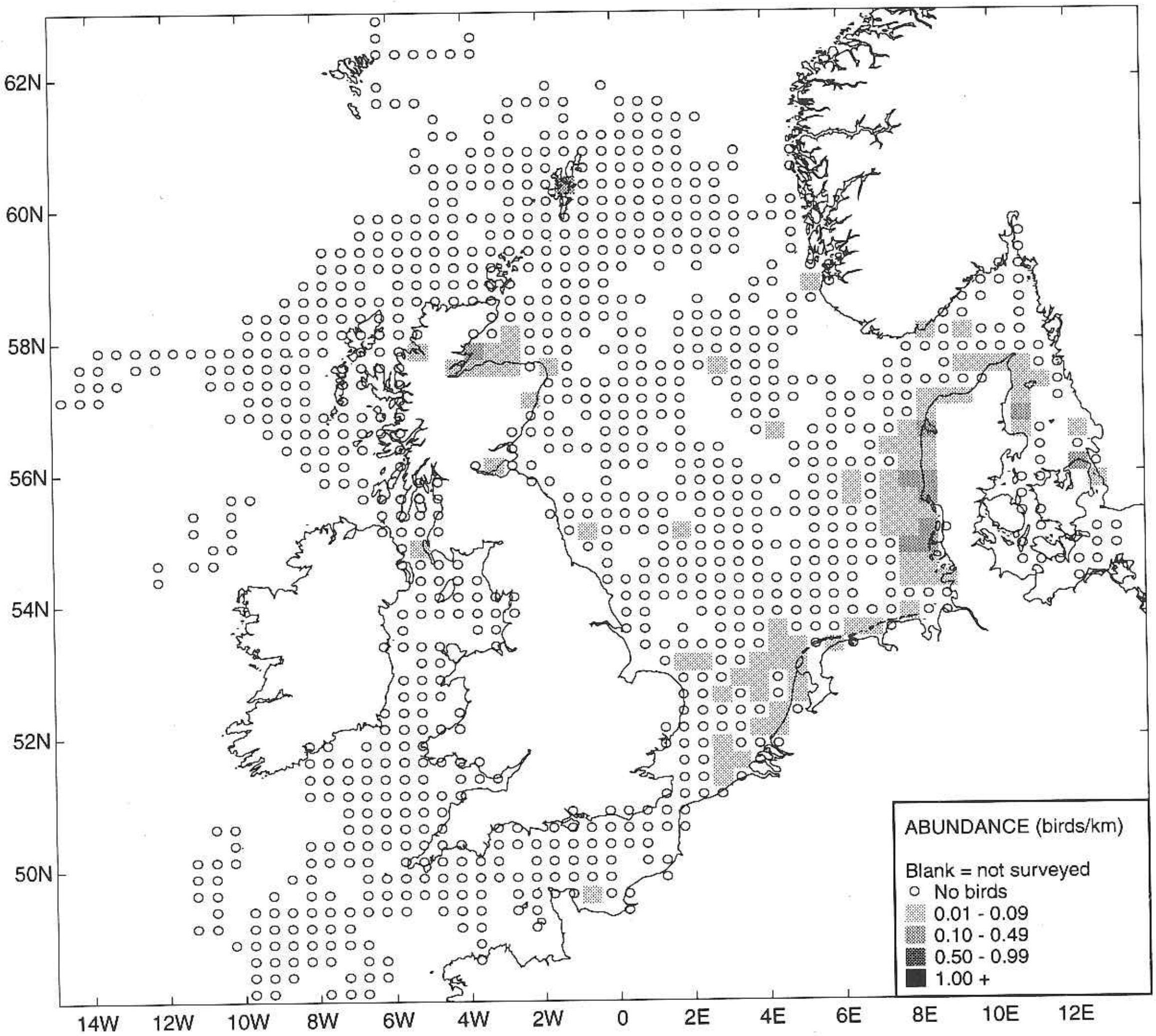

Figure 5.2.1 Distribution of red-throated divers in April and May

April to May (Figure 5.2.1)

Distribution of red-throated divers was mainly along continental coasts of the southern North Sea (Table 5.2.1). Most birds were concentrated along the west coast of Denmark, particularly around Blåvandshuk and the Danish Wadden Sea, with some found along the Netherlands coast. Birds were also recorded in low numbers in the Moray Firth.

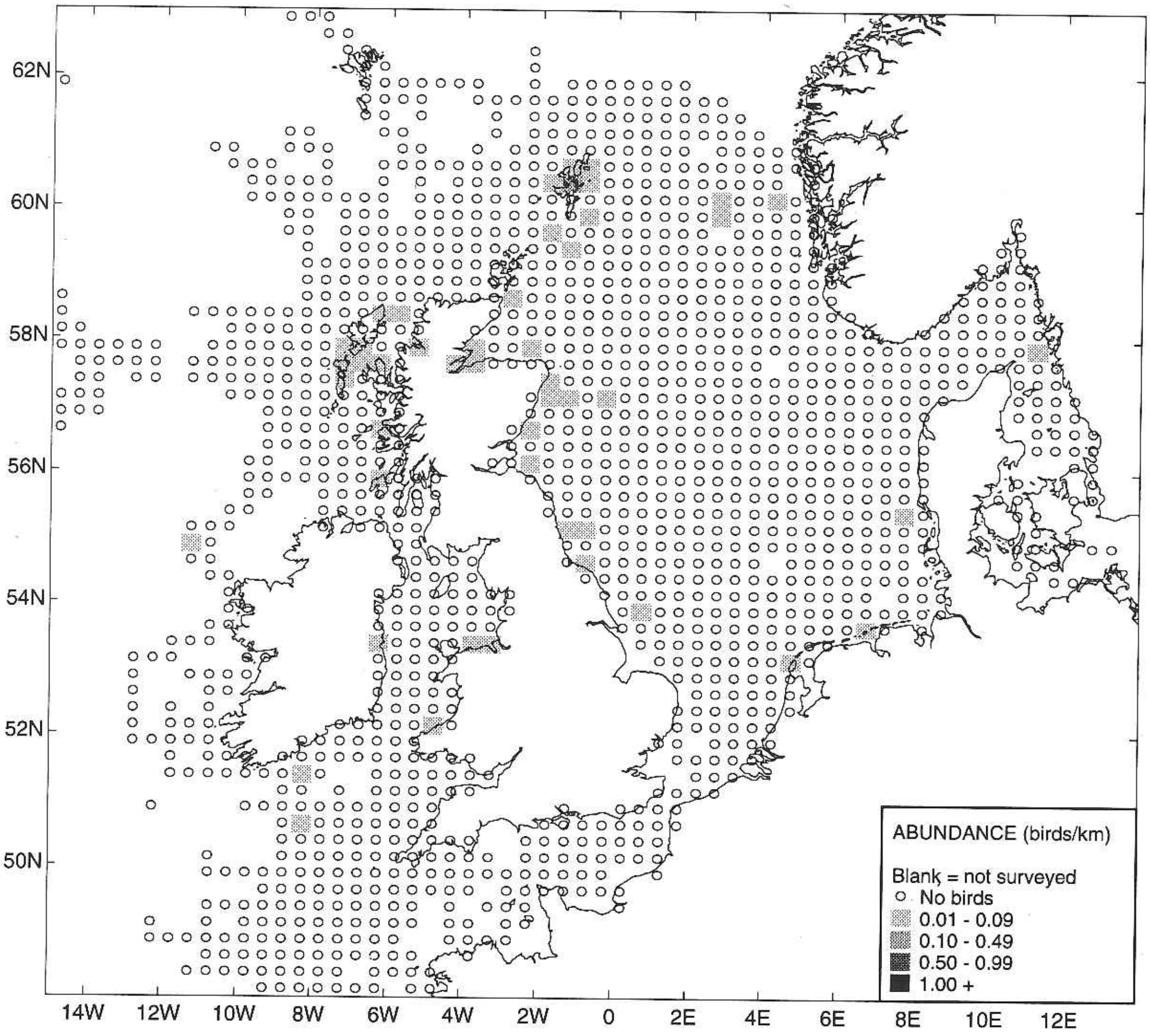

Figure 5.2.2 Distribution of red-throated divers from June to September

June to September (Figure 5.2.2)

The abundance of red-throated divers decreased at this time of year, with low numbers recorded around Orkney, Shetland, and the Hebrides, where breeding occurs, and along the east coast of Britain. A few birds were seen elsewhere.

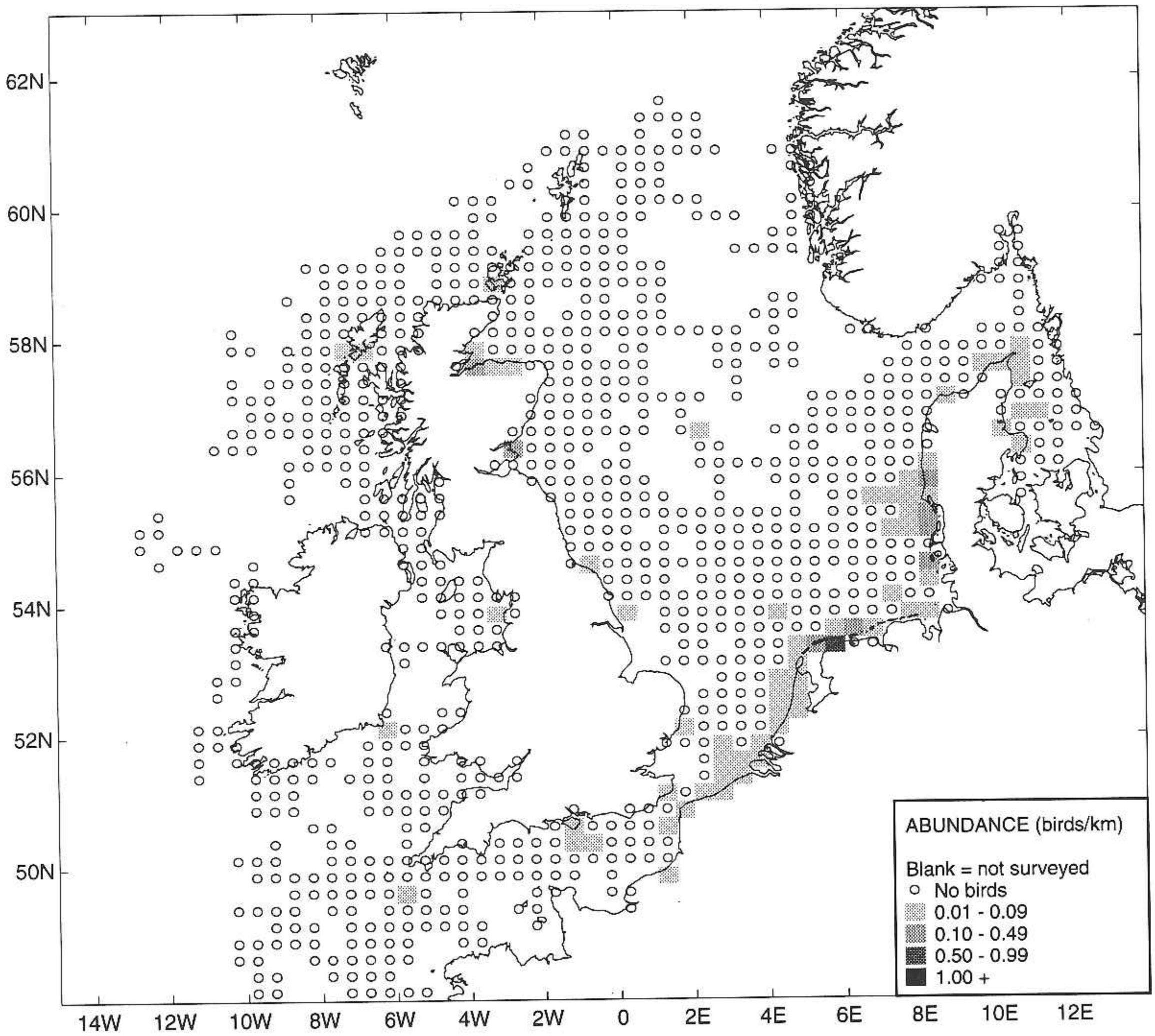

Figure 5.2.3 Distribution of red-throated divers from October to November

October to November (Figure 5.2.3)

At this time red-throated divers are moulting their flight feathers and their distribution had changed considerably. Most birds were seen along the coasts of Denmark, Germany, the Netherlands and Belgium, with a few birds along the east coast of Britain.

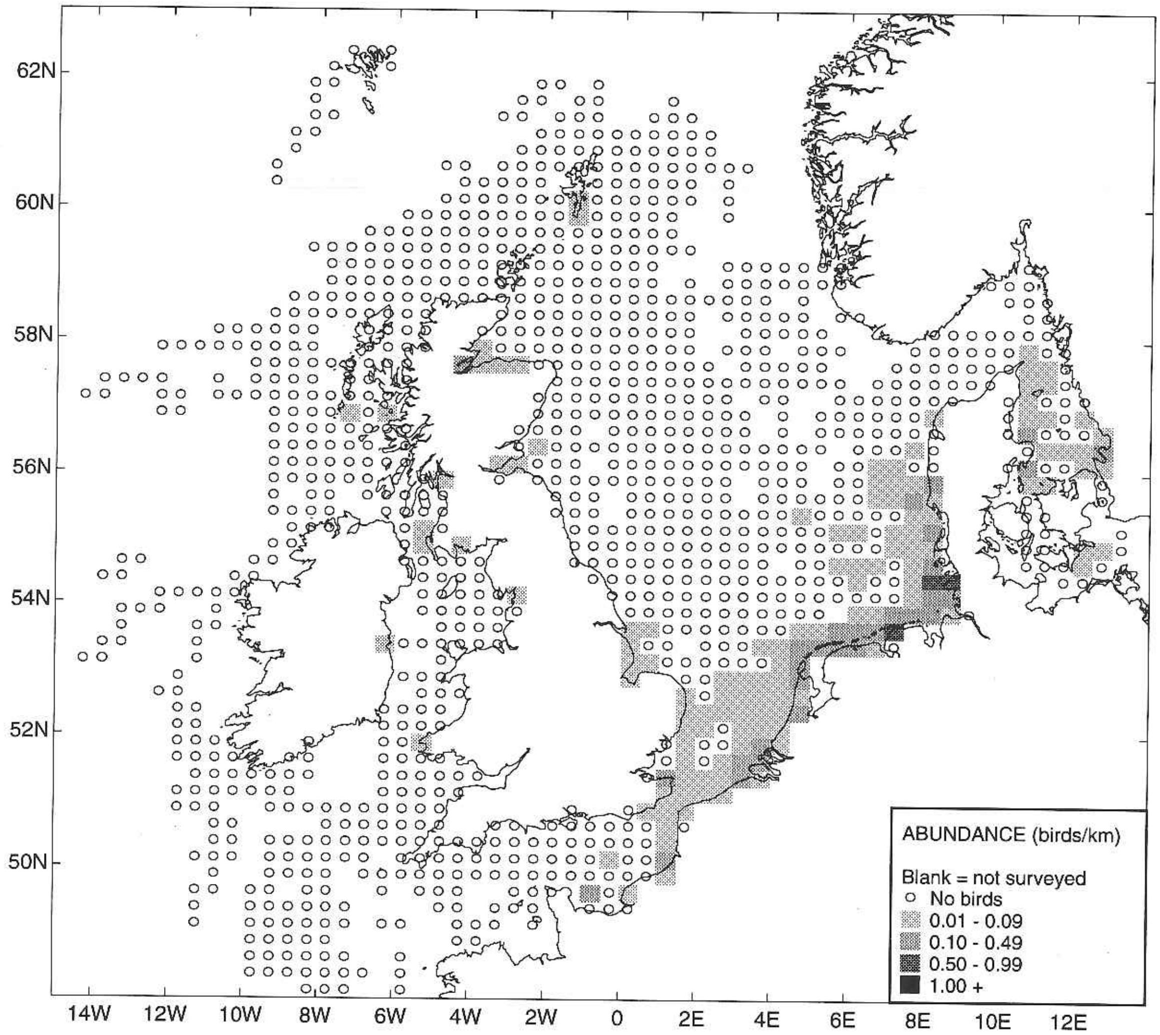

Figure 5.2.4 Distribution of red-throated divers from December to March

December to March (Figure 5.2.4)

The distribution of birds from December to March was similar to that of October and November, although it extended slightly further out to sea. The main areas of distribution were in the Kattegat and in the south-eastern North Sea from the Danish west coast to Belgium and northern France, with highest concentrations along the north coast of the Netherlands and in the German Bight. Low numbers were noted in the Wash, the Firth of Forth, the Moray Firth, and along the west coast of Scotland. Other studies (Durinck *et al.* 1994) have shown mean densities of red-throated and black-throated divers in the Belt Sea to be as high as 4.1 birds.km^{-2}.

Summary and conservation implications

Like all divers, red-throated divers are extremely vulnerable to oil pollution. A large proportion of the North Atlantic population of red-throated divers spend the non-breeding seasons in the North Sea, although their main wintering grounds are in the Baltic (Durinck *et al.* 1994). A large oil spill in the most important inshore waters at these times could cause significant mortality in this population.

Further reading

Danielsen, F., Skov, H. & Durinck, J. 1993. Estimates of the wintering population of Red-throated Diver *Gavia stellata* and Black-throated Diver *Gavia arctica* in northwest Europe. *Proceedings of the Seventh Nordic Congress of Ornithology, 1990:* 18-25.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H., Danielsen, F. & Christensen, K.D. 1994. Vinterføden hos Rødstrubet Lom *Gavia stellata* i Skagerrak. *Dansk. Orn. Foren. Tidsskr. 88:* 39-41.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Meltofte, H. & Kiørboe, T. 1973. The occurrence of divers (Gaviidae) at Blåvandshuk 1963-71. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Ouweneel, G.L. 1993. Roodkeelduikers *Gavia stellata* in het Brouwershavense Gat. *Limosa 66:* 164-166.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfågelräkning från färjor i Kattegatt. *Pelagicus 3:* 17-39.

Table 5.2.1 Overall abundance of red-throated divers (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.01	0.00	0.00	0.14	0.00	-	0.00	0.00
	km	319.8	2302.8	1802.6	2839.2	3364.3	14258.1	1755.0	0.0	223.8	1644.7
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4199.1	4328.1	9577.2	16543.9	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
	km	1249.2	4181.7	3929.2	926.8	2967.4	8348.4	1074.7	496.2	2019.2	1357.7
Apr	Abundance	0.00	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00
	km	1920.0	3133.2	4143.3	898.7	4764.0	11862.2	1316.7	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	km	1505.2	3068.3	4143.3	3127.1	10173.7	14239.6	2066.0	844.0	1662.0	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	6461.6	7195.5	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	3123.3	12227.0	5022.7	16371.3	8663.4	3462.7	514.0	3132.1	2146.8
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	6818.3	13207.3	15561.0	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4626.1	9937.2	9838.7	9986.4	4513.6	13.3	1276.7	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	4761.4	11121.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2909.0	1845.7	5346.1	9832.2	889.1	277.2	2522.6	2958.0
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	km	340.5	1094.0	2030.0	2380.8	1316.8	5748.9	930.5	335.6	1553.8	4508.2

5.3 BLACK-THROATED DIVER *Gavia arctica*

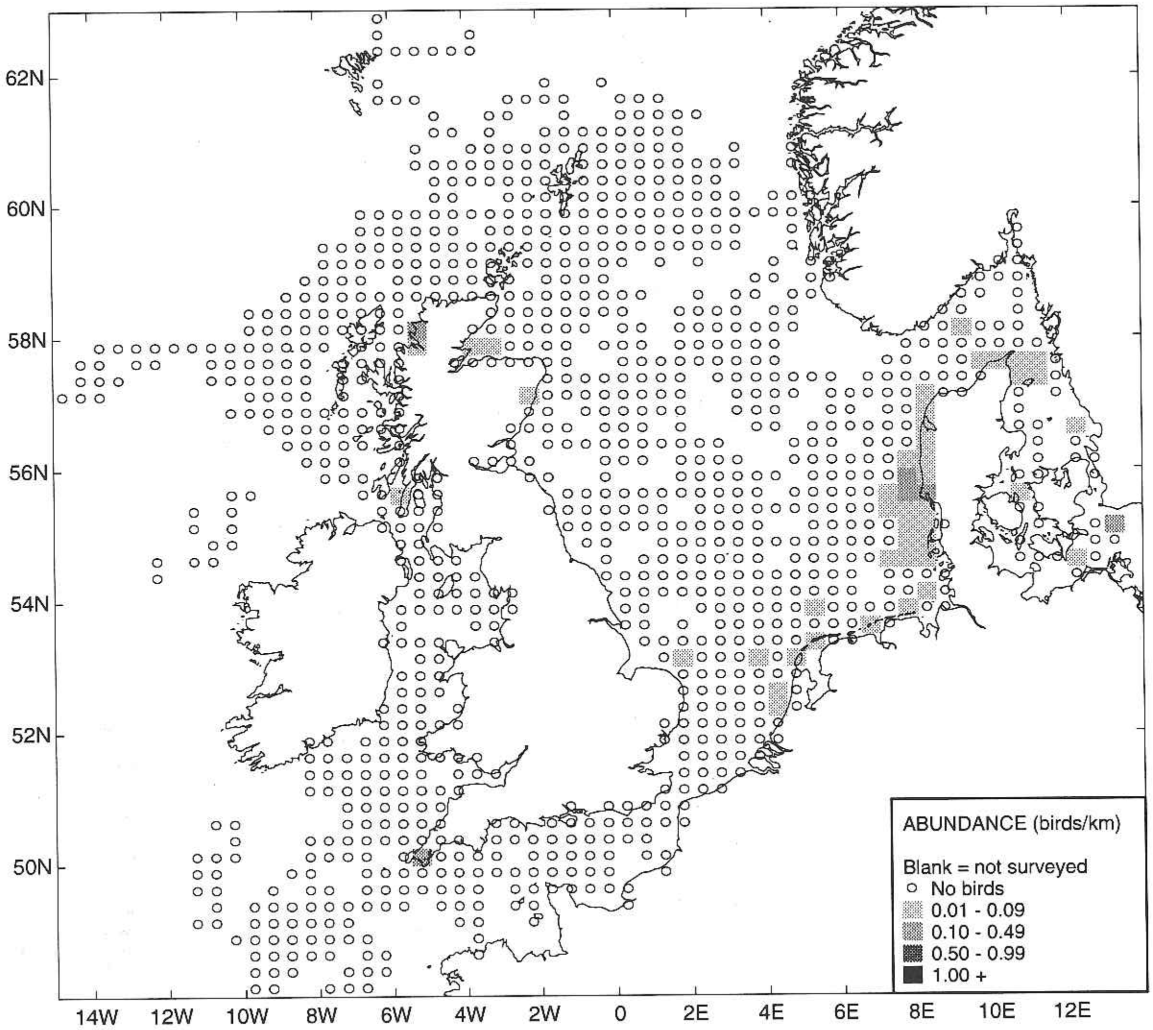

Figure 5.3.1 Distribution of black-throated divers in April and May

April to May (Figure 5.3.1)

The distribution pattern was more contracted than that of red-throated divers at this time of year. Most birds were found along the west coast of Denmark, particularly at Blåvandshuk; numbers of black-throated divers in Danish waters increase at this time due to birds arriving from more southerly wintering areas. Fewer black-throated divers were spread along the coastline of the southern North Sea than red-throated divers. A few birds were noted in the Moray Firth and in the Kattegat and Belt Sea.

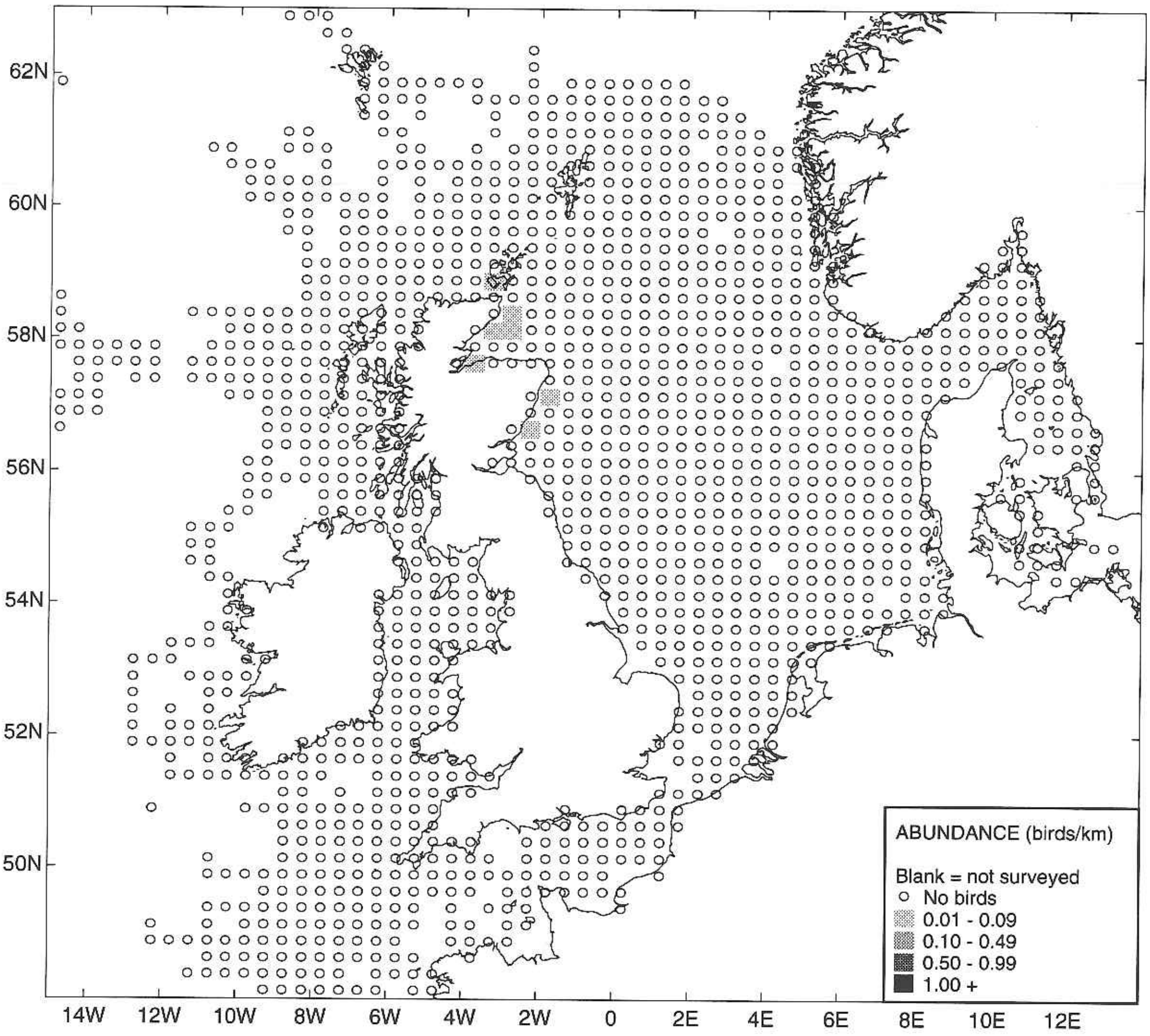

Figure 5.3.2 Distribution of black-throated divers from June to September

June to September (Figure 5.3.2)

The distribution of black-throated divers was limited to the east coast of Scotland for these months. The numbers of birds were low (Table 5.3.1), since the majority of birds would be in their breeding grounds outside the study area, at this time of year.

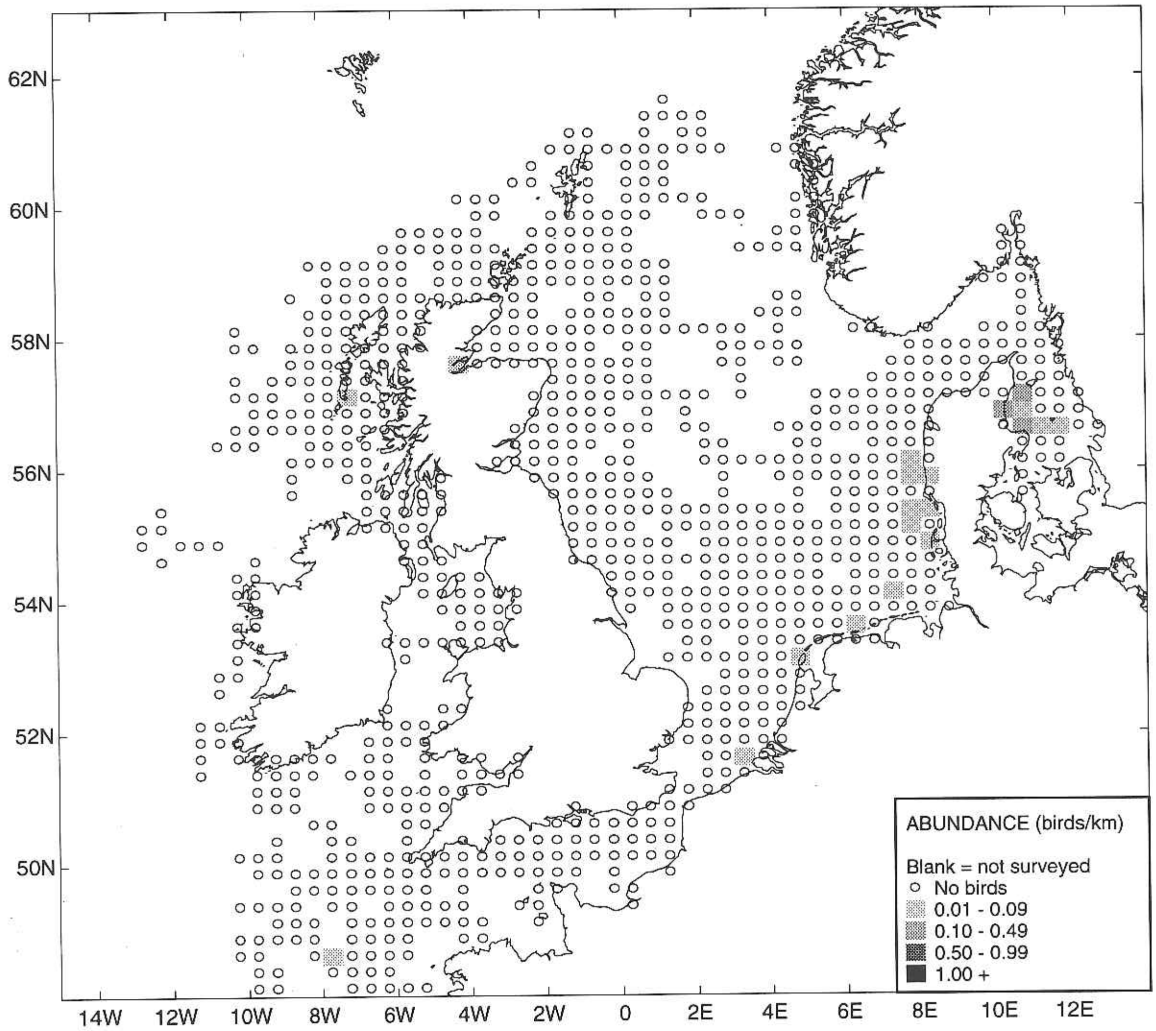

Figure 5.3.3 Distribution of black-throated divers in October and November

October to November (Figure 5.3.3)

Numbers of black-throated divers were low at this time of year. Birds were present in the Ålborg Bight, to the west of Denmark, and a few occurred close to land in the southern North Sea close to Texel, the Frisian Islands and the Delta Region. Their distribution did not extend as far south as that of red-throated divers.

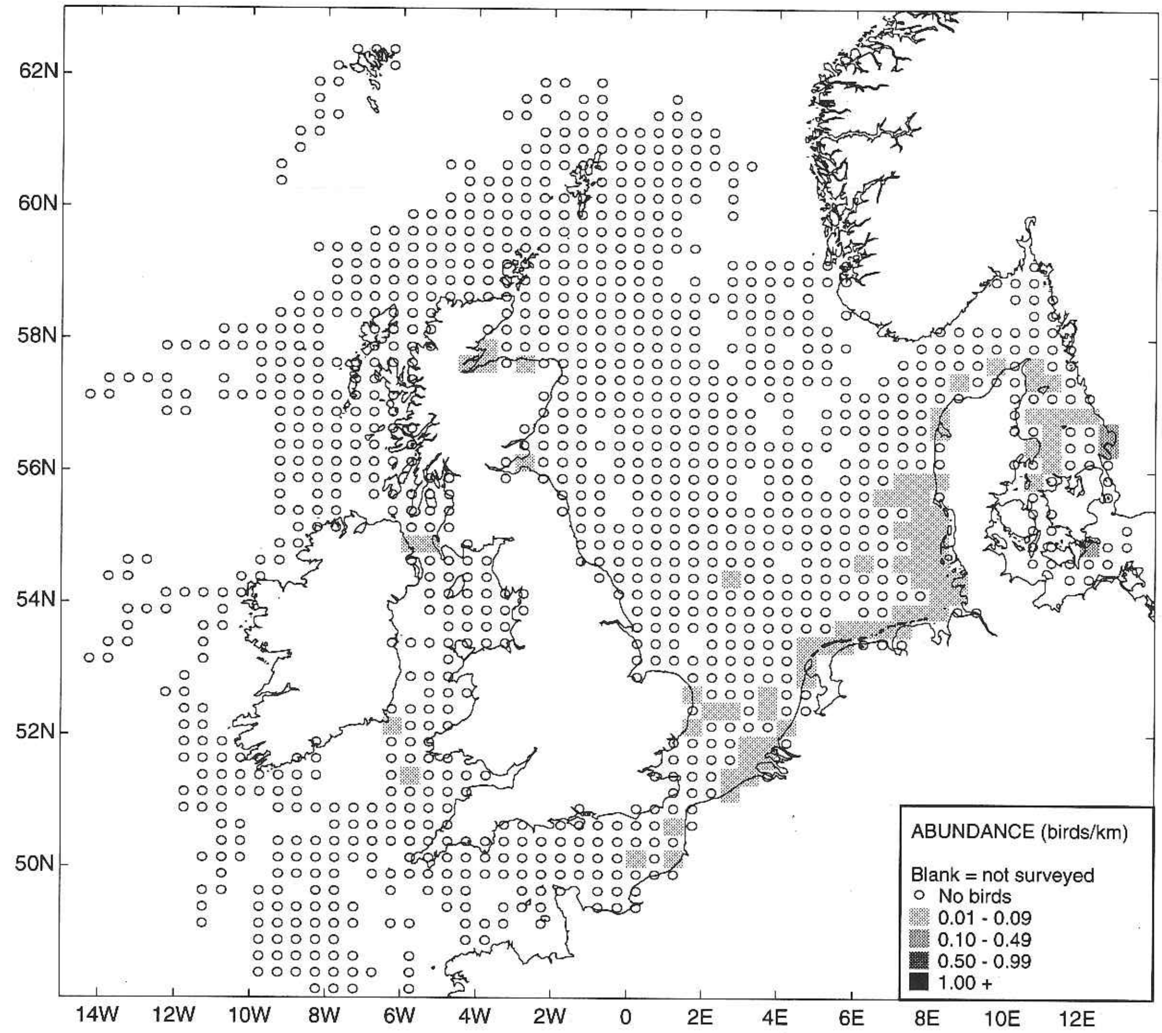

Figure 5.3.4 Distribution of black-throated divers from December to March

December to March (Figure 5.3.4)

Black-throated divers were most widespread during this period, although numbers were still low. Birds were present in the Kattegat and along the coasts of Denmark, Germany, the Netherlands and Belgium, and a few were found around the coast of Britain, in places such as the Moray Firth, the Firth of Forth, and the North Channel.

Summary and conservation implications

The low numbers of black-throated divers when compared to red-throated divers (section 5.2) may be partly due to black-throated divers having been under-recorded as a result of their similarity to other divers. Black-throated divers, like all divers, are at risk from oil pollution.

Further reading

Danielsen, F., Skov, H. & Durinck, J. 1993. Estimates of the wintering population of Red-throated Diver *Gavia stellata* and Black-throated Diver *Gavia arctica* in northwest Europe. *Proceedings of the Seventh Nordic Congress of Ornithology, 1990:* 18-25.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Ham, N.F. van der 1987. Zomerkleed Parelduikers *Gavia arctica* voor de Noordhollandse kust. *Sula 1(2):* 47-48.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfågelräkning från färjor i Kattegatt. *Pelagicus 3:* 17-39.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Table 5.3.1 Overall abundance of black-throated divers (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	-	0.00	0.00
	km	319.8	2302.8	1802.6	2839.2	3364.3	14258.1	1755.0	0.0	223.8	1644.7
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4199.1	4328.1	9577.2	16543.9	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1249.2	4181.7	3929.2	926.8	2967.4	8348.4	1074.7	496.2	2019.2	1357.7
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km	1920.0	3133.2	4143.3	898.7	4764.0	11862.2	1316.7	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	3068.3	4143.3	3127.1	10173.7	14239.6	2066.0	844.0	1662.0	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	6461.6	7195.5	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	3123.3	12227.0	5022.7	16371.3	8663.4	3462.7	514.0	3132.1	2146.8
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	6818.3	13207.3	15561.0	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4626.1	9937.2	9838.7	9986.4	4513.6	13.3	1276.7	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	4761.4	11121.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2909.0	1845.7	5346.1	9832.2	889.1	277.2	2522.6	2958.0
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
	km	340.5	1094.0	2030.0	2380.8	1316.8	5748.9	930.5	335.6	1553.8	4508.2

5.4 GREAT NORTHERN DIVER *Gavia immer*

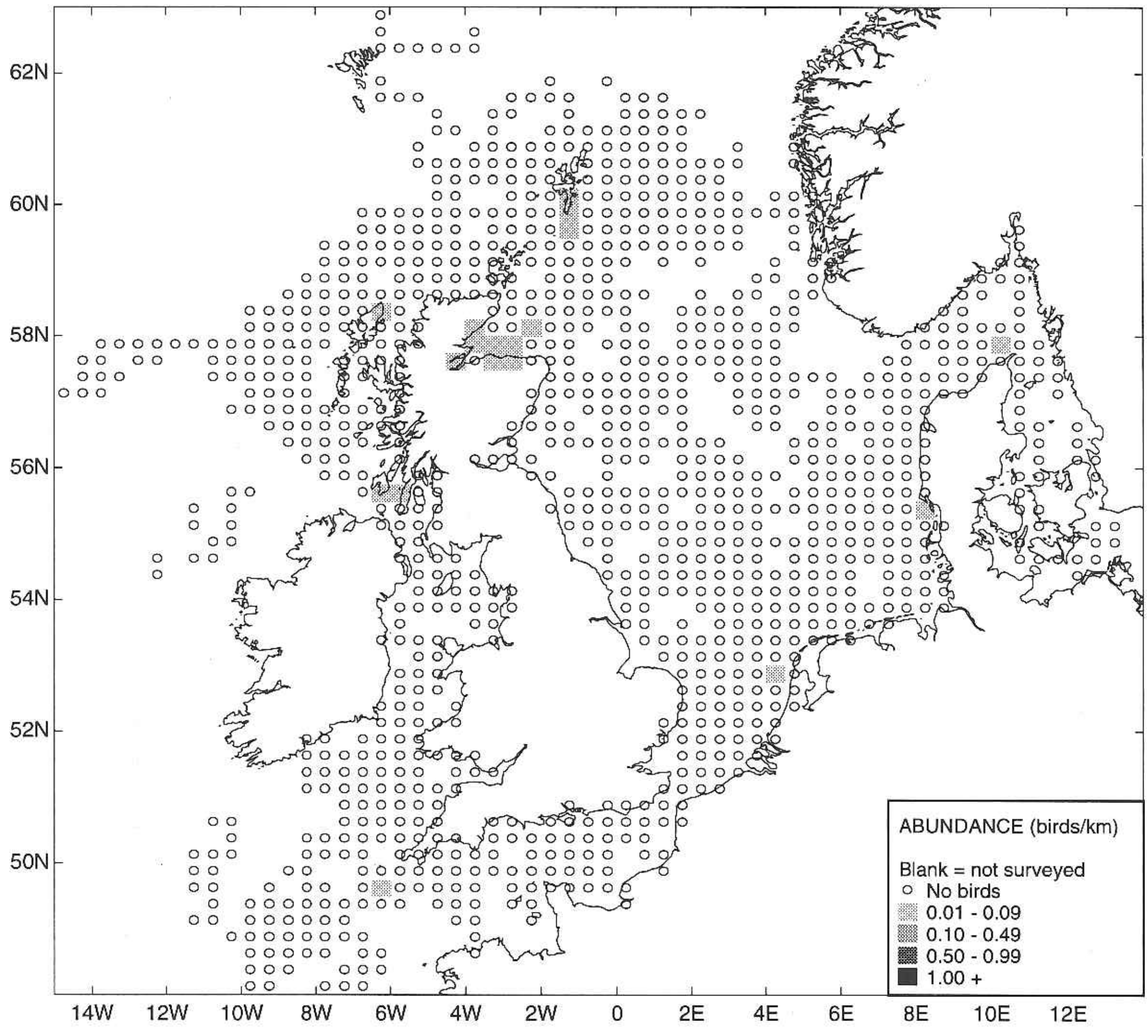

Figure 5.4.1 Distribution of great northern divers in April and May

April to May (Figure 5.4.1)

Great northern divers were present in the Moray Firth and around Shetland, with a few records from the coastal waters of the southern North Sea. Numbers were low throughout these areas (Table 5.4.1). The important wintering areas in the Outer Hebrides and Brittany were missed by these surveys.

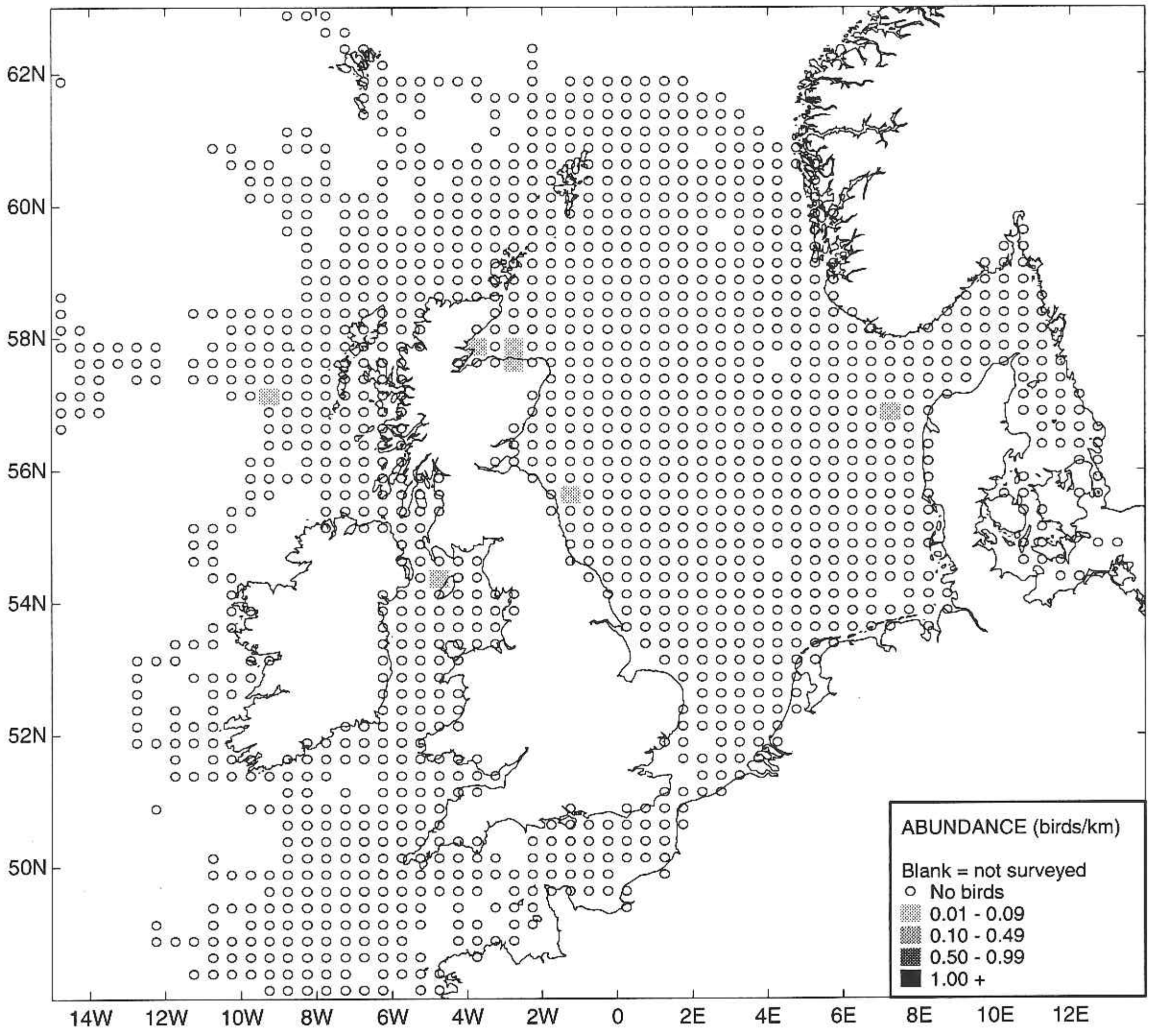

Figure 5.4.2 Distribution of great northern divers from June to September

June to September (Figure 5.4.2)

Few great northern divers were seen throughout these months, these being in the Moray Firth, off the Isle of Man, to the west of Scotland and off the south-east coast of Scotland, and to the west of Denmark.

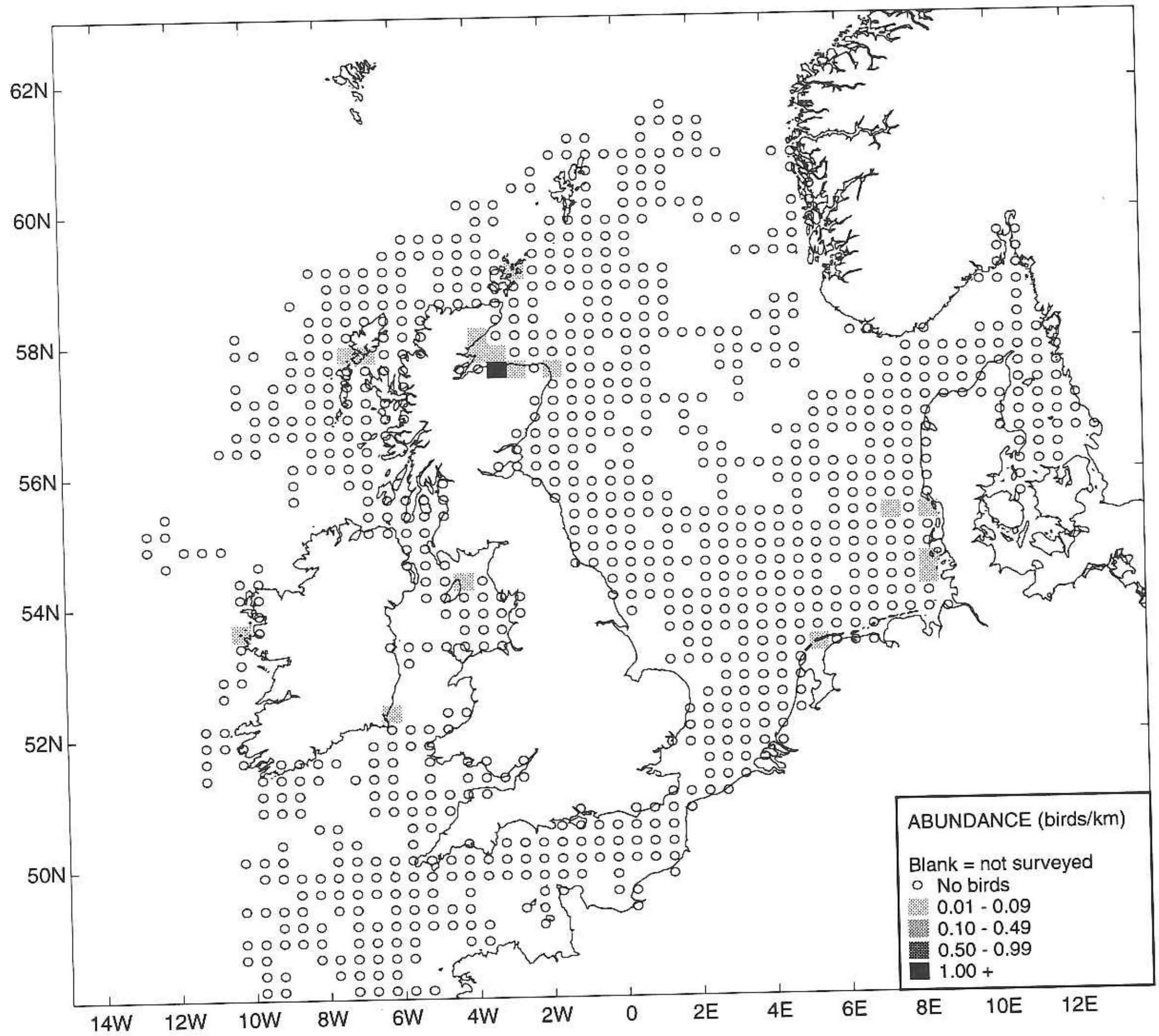

Figure 5.4.3 Distribution of great northern divers in October and November

October to November (Figure 5.4.3)

Great northern divers return from their breeding grounds in these months. Birds were seen in the Moray Firth, around the Outer Hebrides, off the Isle of Man, and along the west coast of Denmark. The distribution spread further south than in the summer months, with birds observed near the north coast of the Netherlands and off south-east Ireland. Numbers were still low.

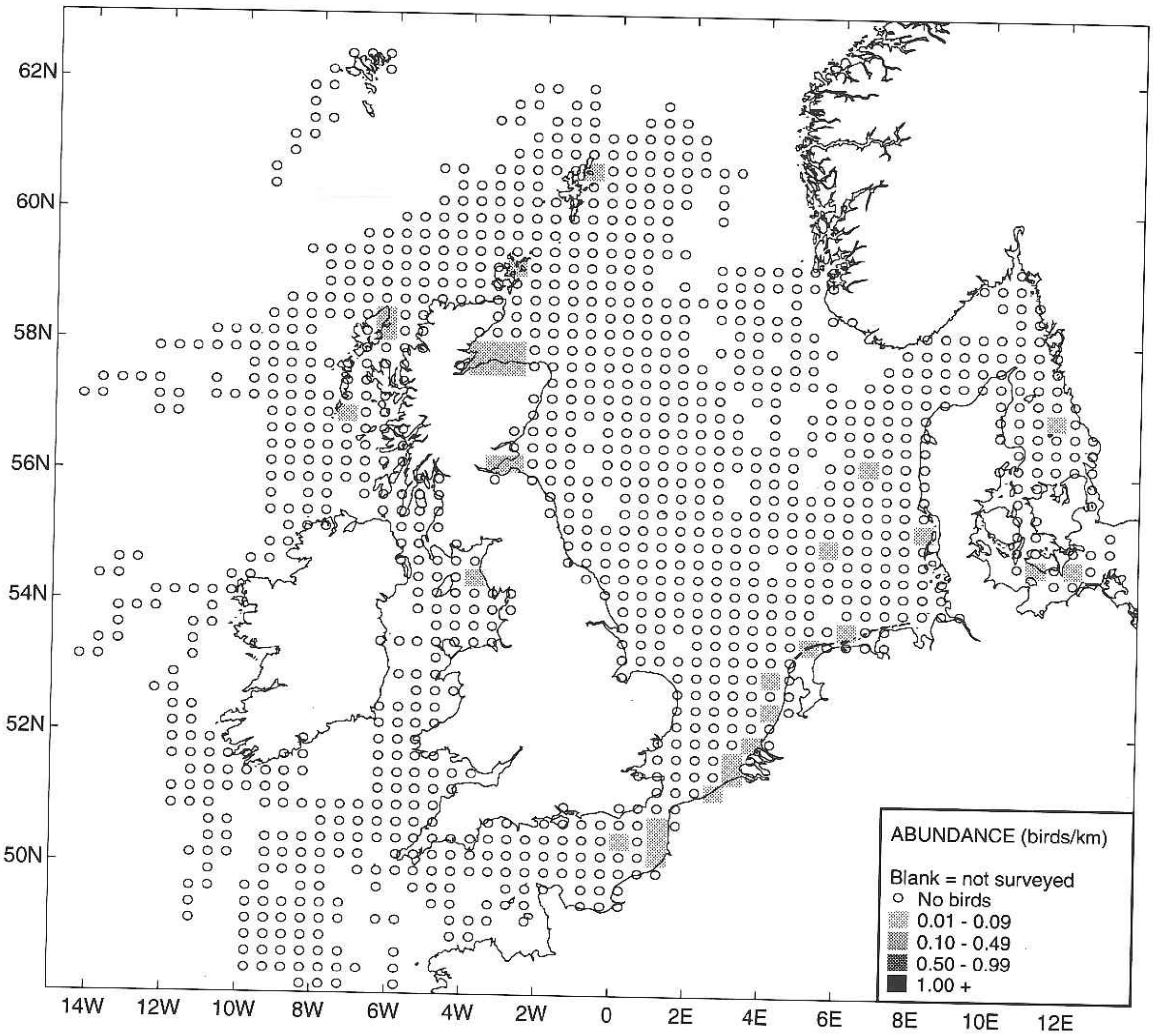

Figure 5.4.4 Distribution of great northern divers from December to March

December to March (Figure 5.4.4)

This was the peak time for great northern divers, although numbers remained low. Birds were present in the Moray Firth, Shetland, the Outer Hebrides (although these were not well surveyed in these months), off the Solway Firth and along the coasts of northern France. Apparently equal numbers of birds along the coasts of Belgium, the Netherlands and Denmark may be an artefact of extensive surveys in these areas compared to other areas. Birds were also noted in the Kattegat and Belt Sea.

Summary and conservation implications

Great northern divers were the rarest of the three common species of diver recorded in the study area. Birds were most widespread from December to March. Like other divers, great northern divers spend much time on the surface of the water and are therefore very susceptible to oil pollution; they would be at risk from a major oil spill, depending on the timing and location of the spill.

Further reading

Alerstam, T., Hjort, C., Högstedt, G., Jönsson, P.E., Karlsson, J. & Larsson, B. 1986. Spring migration of birds across the Greenland Inland ice. *Meddelelser om Gronland, Bioscience 21:* 1-38.

Karlsen, T. 1985. Forekomsten av islom *Gavia immer* og gulnebblom *Gavia adamsii* på kyststrekningen Lindesnes-svenskegrensa fram t.o.m. 1984. *Vår Fuglefauna 8(3):* 179-182.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfågelräkning från färjor i Kattegatt. *Pelagicus 3:* 17-39.

Vandenbulcke, P. 1979. Een analyse van tien jaar zeevogelwaarnemingen langs de Belgische kust en in het binnenland, gebaseerd op de BAHC verslagan. *Veldorn. Tijdschr. 2:* 35-57.

Vielliard, J. 1968. La migration prénuptiale des Plongeons en Bretagne. *Alauda 36(4):* 286-287.

Table 5.4.1 Overall abundance of great northern divers (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km	319.8	2302.8	1802.6	2839.2	3364.3	14258.1	1755.0	0.0	223.8	1644.7
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4199.1	4328.1	9577.2	16543.9	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1249.2	4181.7	3929.2	926.8	2967.4	8348.4	1074.7	496.2	2019.2	1357.7
Apr	Abundance	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1920.0	3133.2	4143.3	898.7	4764.0	11862.2	1316.7	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	3068.3	4143.3	3127.1	10173.7	14239.6	2066.0	844.0	1662.0	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	6461.6	7195.5	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	3123.3	12227.0	5022.7	16371.3	8663.4	3462.7	514.0	3132.1	2146.8
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	6818.3	13207.3	15561.0	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4626.1	9937.2	9838.7	9986.4	4513.6	13.3	1276.7	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	4761.4	11121.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2909.0	1845.7	5346.1	9832.2	889.1	277.2	2522.6	2958.0
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	340.5	1094.0	2030.0	2380.8	1316.8	5748.9	930.5	335.6	1553.8	4508.2

5.5 GREAT CRESTED GREBE *Podiceps cristatus*

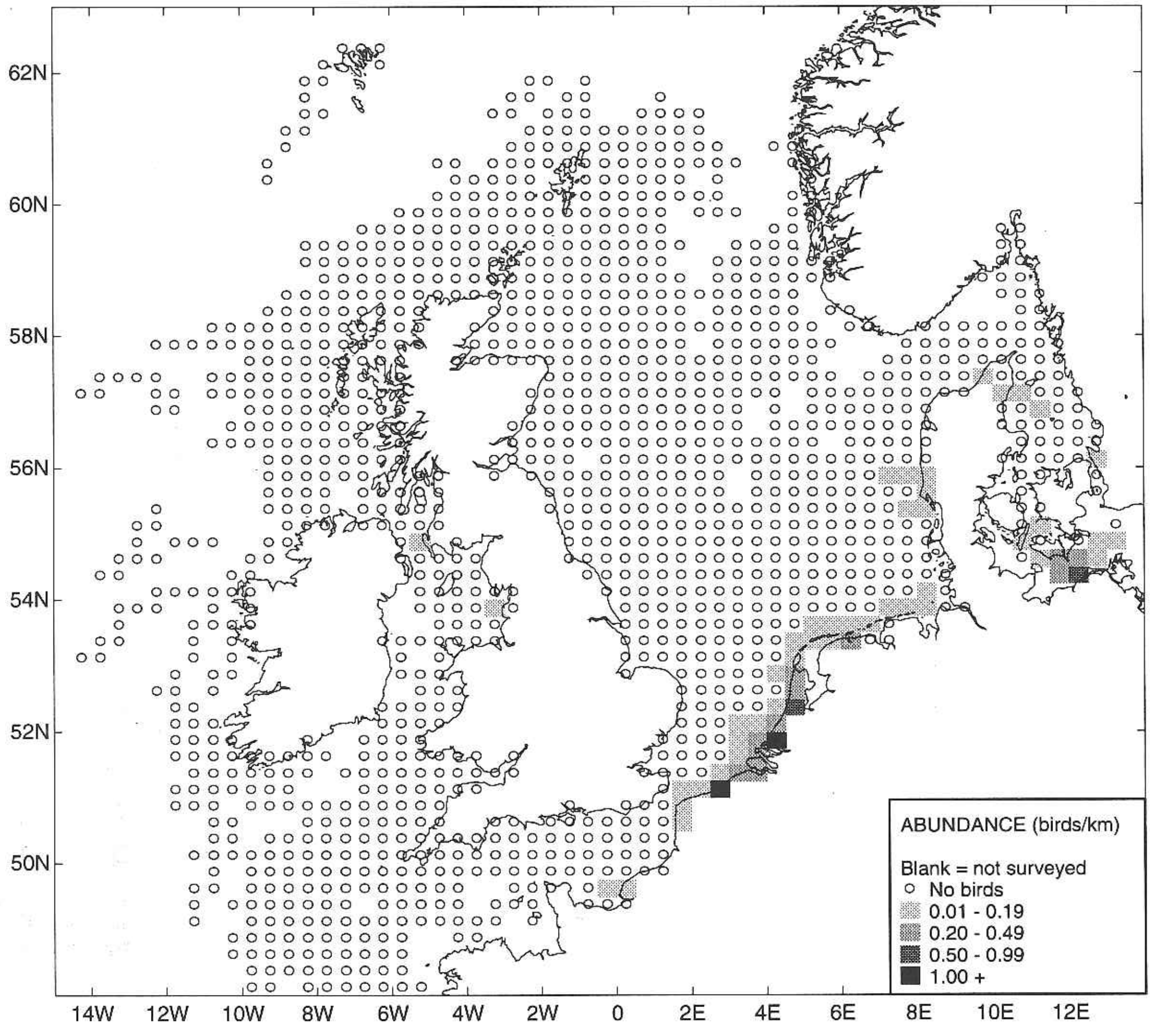

Figure 5.5.1 Distribution of great crested grebes from October to March

October to March (Figure 5.5.1)

Great crested grebes are a typically inshore species of which high numbers occurred only close to the coast. Most grebes were found along the continental coast between Belgium and Denmark. Highest numbers occurred in areas of low salinity, such as the Delta Region and the Belt Sea. Substantial differences occurred between years, because severe winters have forced tens of thousands of grebes to move to sea, whereas most birds stayed on fresh water in mild seasons (Camphuysen & Derks 1989).

Great crested grebes occurred at sea throughout the year, but very small numbers were seen from April to September (Table 5.5.1).

Summary and conservation implications

Great crested grebes were mainly present in the study area in the non-breeding season, from October through to March. They spend most of their time on the water, and would be vulnerable to oil pollution in coastal waters at this time. Starvation may also be a problem for great crested grebes in severe winters (Camphuysen & Derks 1989).

Further reading

Adriaensen, F., Ulenaers, P. & Dhondt, A.A. 1993. Ringing recoveries and the increase in numbers of European Great Crested Grebes *Podiceps cristatus*. *Ardea 81:* 59-70.

Andersson, T. 1954. Simflyttning hos skäggdopping *(Podiceps cristatus)* och gråhakedopping *(P. grisegena)*. *Vår Fågelvärld 13:* 133-142.

Baptist, H.J.M. 1988. Vogelconcentraties in de voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Baptist, H.J.M. & Wolf, P.A. 1993. *Atlas van de vogels van het Nederlands Continentaal Plat.* Rapport DGW-93.013, Rijkswaterstaat, Dienst Getijdewateren, Middelburg.

Benn, S. 1985. Seafowl off North East Scotland and in Orkney. *Nature Conservancy Council, unpublished report, Aberdeen.*

Camphuysen, C.J. 1989. Beached bird surveys in the Netherlands 1915-1988. *Techn. Rapp. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam.*

Camphuysen, C.J. & Derks, P.J.T. 1989. Voorkomen en sterfte van de Fuut *Podiceps cristatus* voor de Nederlandse kust, 1974-86. *Limosa 62:* 57-62.

Camphuysen, C.J. & Dijk, J.van 1983. Zee- en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Durinck, J., Skov, H. & Andell, P. 1993. Seabird distribution and numbers in selected offshore parts of the Baltic Sea, winter 1992. *Ornis Svecica 3:* 11-26.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Poel, A.M. van der 1984. Overwinteringsgebieden, plaatstrouw en levensverwachting van Nederlandse Futen *Podiceps cristatus*. *Limosa 57:* 43-46.

Storstein, B. 1987. Høsttrekket ved Haugesund 1979-84: Trekkforløp og antall Del 1: Lomer-riksefugler. *Vår Fuglefauna 10:* 25-36.

Vauk, G. 1978. Die Meeresgewässer um Helgoland - wichtiges Überwinterungsgebiet für Wasservögel in Kältewintern. In, Andersson Å. & Fredga S. (eds). *Proceedings from the Symposium on Sea Ducks, June 16-17 1975, Stockholm.* Nat. Swed. Env. Prot. Board, Solna & Intern. Waterf. Res. Bur., Slimbridge.

Table 5.5.1 Overall abundance of great crested grebes (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.11	0.00	-	0.00	0.00
	km	319.8	2302.8	1802.6	2839.2	3364.3	14258.1	1755.0	0.0	223.8	1644.7
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.01
	km	1182.5	2596.3	4199.1	4328.1	9577.2	16543.9	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
	km	1249.2	4181.7	3929.2	926.8	2967.4	8348.4	1074.7	496.2	2019.2	1357.7
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1920.0	3133.2	4143.3	898.7	4764.0	11862.2	1316.7	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	3068.3	4143.3	3127.1	10173.7	14239.6	2066.0	844.0	1662.0	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	6461.6	7195.5	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	3123.3	12227.0	5022.7	16371.3	8663.4	3462.7	514.0	3132.1	2146.8
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	6818.3	13207.3	15561.0	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4626.1	9937.2	9838.7	9986.4	4513.6	13.3	1276.7	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	4761.4	11121.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2909.0	1845.7	5346.1	9832.2	889.1	277.2	2522.6	2958.0
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	km	340.5	1094.0	2030.0	2380.8	1316.8	5748.9	930.5	335.6	1553.8	4508.2

5.6 RED-NECKED GREBE *Podiceps grisegena*

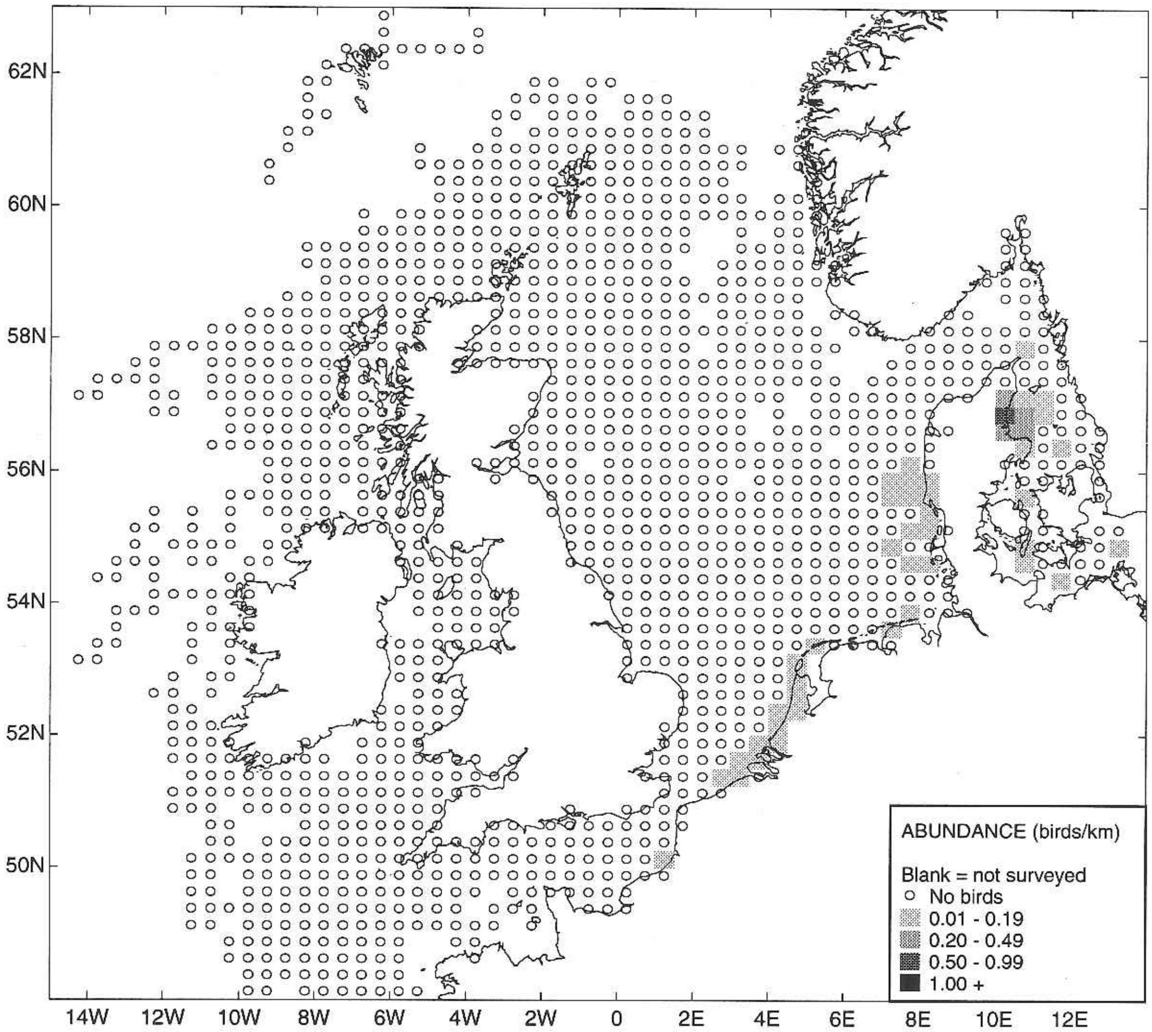

Figure 5.6.1 Distribution of red-necked grebes from October to April

October to April (Figure 5.6.1)

Red-necked Grebes are typically inshore species of which low to moderate numbers occured only close to the coast. Most grebes were found along the continental coast, particularly in Danish waters, with highest numbers in the Kattegat. Numbers were generally low (Table 5.6.1), but were highest in the Ålborg Bight.

Red-necked Grebes are winter visitors in the North Sea of which very small numbers were found between May and September.

Summary and conservation implications

Like great crested grebes, red-necked grebes spend much time on the surface of the water and are vulnerable to pollution in coastal waters between October and April.

Further reading

Andersson, T. 1954. Simflyttning hos skäggdopping (*Podiceps cristatus*) och gråhakedopping (*P. grisegena*). *Vår Fågelvärld 13:* 133-142.

Camphuysen, C.J. & Dijk, J.van 1983. Zee- en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Chandler, R.J. 1981. Influxes into Britain and Ireland of Red-necked Grebe and other waterbirds during winter 1978/79. *Brit. Birds 74(2):* 55-81.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H. & Andell P. 1993. Seabird distribution and numbers in selected offshore parts of the Baltic Sea, winter 1992. *Ornis Svecica 3:* 11-26.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Follestad, A.O. 1978. Takseringer og studier av gråstrupedykker i overvintrings-områdene på Norskekysten. *Anser, suppl. 3:* 84-89.

Ouweneel, G.L. 1990. In 1989 meer overzomerende Roodhalsfuten op de Grevelingen. *Het Vogeljaar 38(4):* 170-171.

Ouweneel, G.L. 1985. Overzomerende Roodhalsfuten *Podiceps grisegena* op de Grevelingen. *Limosa 58(2):* 74-75.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Størkersen, Ø.R. 1985. Trekk av gråstrupedykker *Podiceps grisegena* over Trøndelag. *Vår Fuglefauna 8:* 183-184.

Storstein, B. 1987. Høsttrekket ved Haugesund 1979-84: Trekkforløp og antall Del 1: Lomer-riksefugler. *Vår Fuglefauna 10:* 25-36.

Table 5.6.1 Overall abundance of red-necked grebes (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km	319.8	2302.8	1802.6	2839.2	3364.3	14258.1	1755.0	0.0	223.8	1644.7
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4199.1	4328.1	9577.2	16543.9	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1249.2	4181.7	3929.2	926.8	2967.4	8348.4	1074.7	496.2	2019.2	1357.7
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1920.0	3133.2	4143.3	898.7	4764.0	11862.2	1316.7	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	3068.3	4143.3	3127.1	10173.7	14239.6	2066.0	844.0	1662.0	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	6461.6	7195.5	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	3123.3	12227.0	5022.7	16371.3	8663.4	3462.7	514.0	3132.1	2146.8
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	6818.3	13207.3	15561.0	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4626.1	9937.2	9838.7	9986.4	4513.6	13.3	1276.7	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	4761.4	11121.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2909.0	1845.7	5346.1	9832.2	889.1	277.2	2522.6	2958.0
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	340.5	1094.0	2030.0	2380.8	1316.8	5748.9	930.5	335.6	1553.8	4508.2

5.7 FULMAR *Fulmarus glacialis*

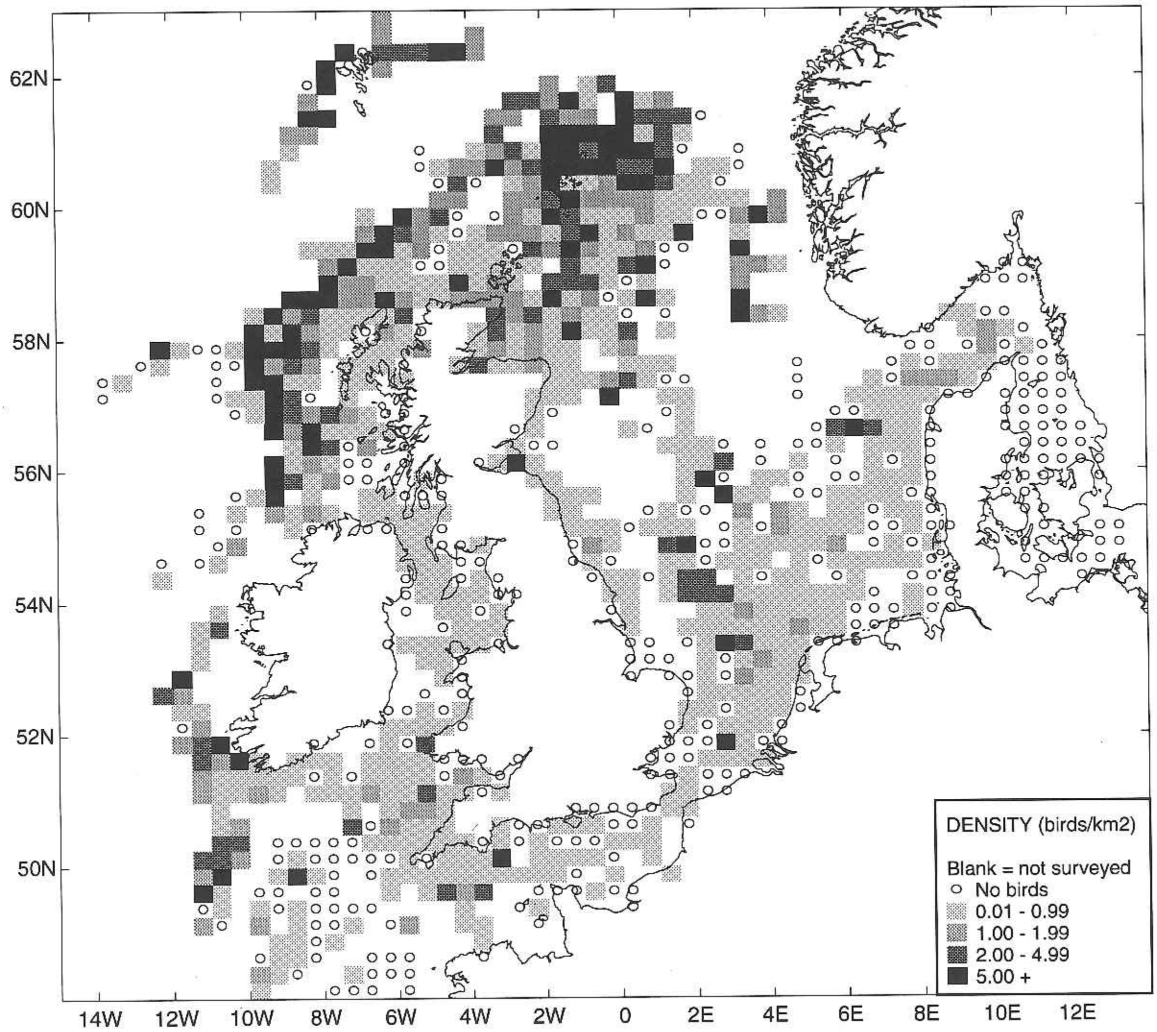

Figure 5.7.1 Distribution of fulmars in March and April

March to April (Figure 5.7.1)

Highest densities of fulmars were observed around the shelf edge to the north and west of Scotland. High densities were also found around Shetland and the Faeroes, and moderate to high densities around the Dogger Bank and at the shelf edge in the South-west Approaches. Elsewhere densities were low or moderate, with the exception of the Kattegat and the Belt Sea, where fulmars were absent.

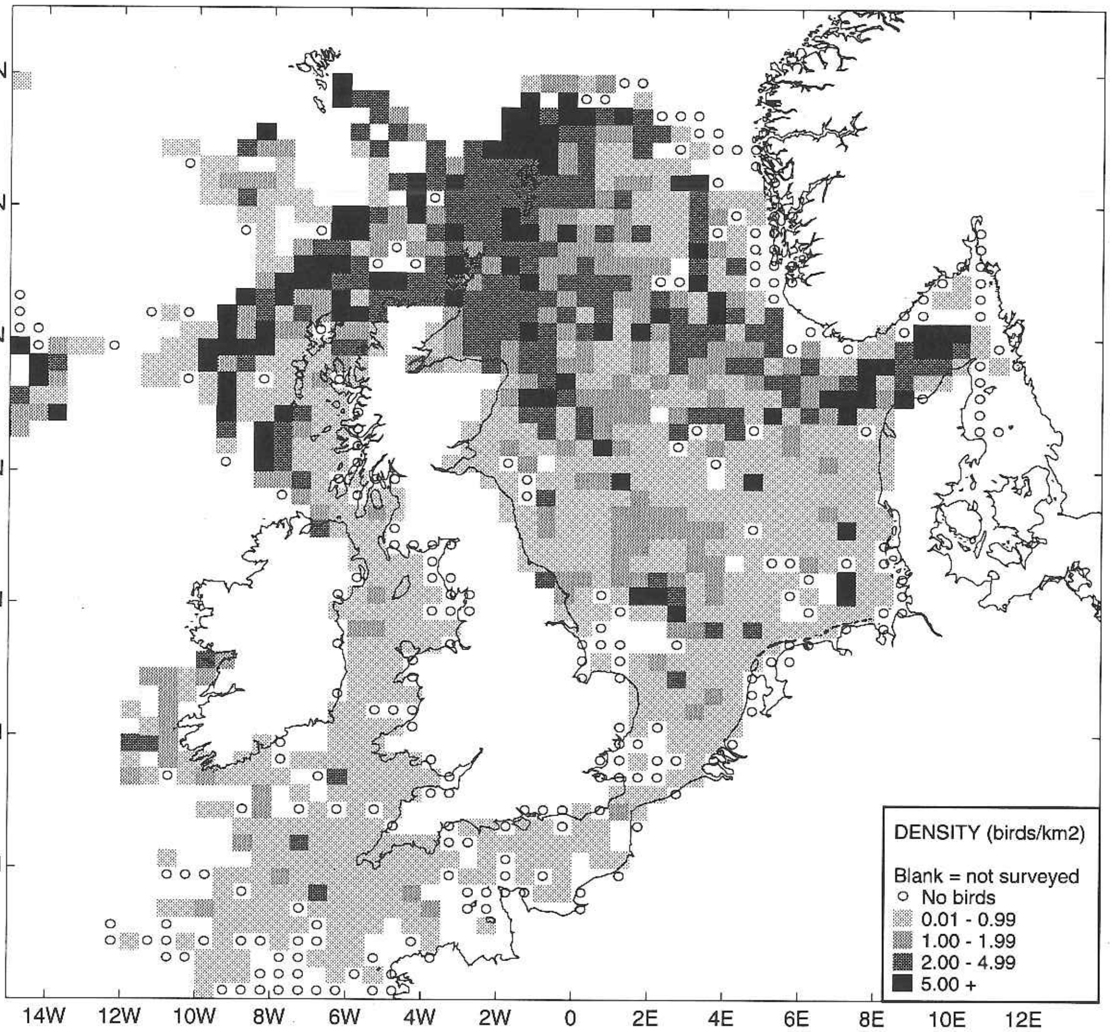

Figure 5.7.2 Distribution of fulmars from May to July

May to July (Figure 5.7.2)

Densities around the colonies at Shetland, Orkney and the Hebrides were higher during the egg-laying and chick-rearing periods than in March and April. However, highest densities were still found at the shelf edge to the north and west of Scotland, and along the western and southern edges of the Rinne. Moderate to high densities were found around the Dogger Bank and the Rockall Bank. Densities in southern areas were low (Table 5.7.1).

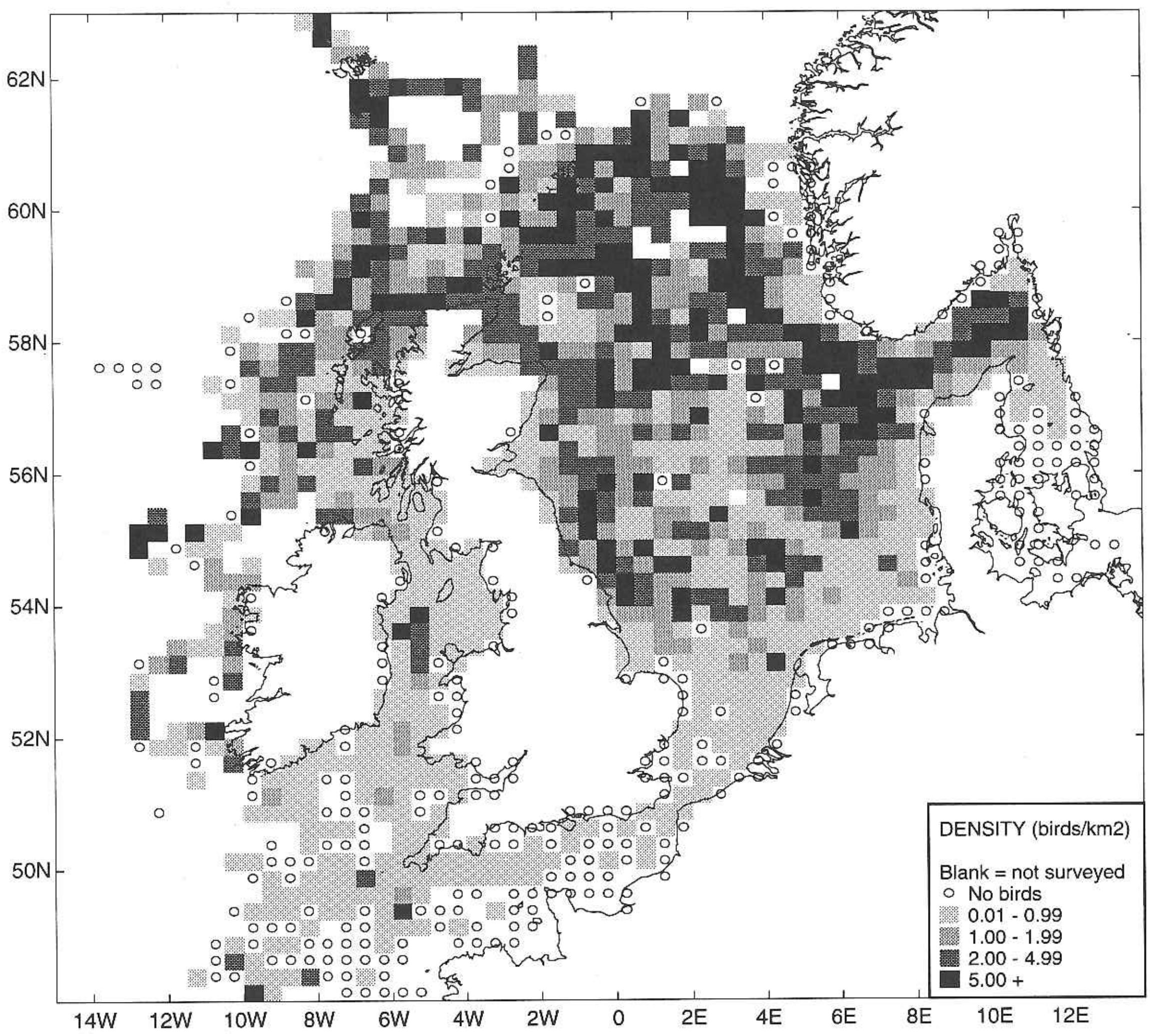

Figure 5.7.3 Distribution of fulmars from August to November

August to November (Figure 5.7.3)

Fulmar distribution extended southwards at this time, with high densities found throughout the North Sea as far south as 53°N. Most fulmars leave their colonies during September. Their distribution also extended into the Kattegat at low densities. Concentrations of birds occurred along the western and southern edges of the Rinne. High densities were also found to the north of Scotland and around Shetland, Orkney and the Faeroes. Moderate or high densities were seen to the west of Scotland, and moderate densities to the west of Ireland. Densities in the Irish Sea were low with the exception of the area of the Irish Sea front, to the south-west of the Isle of Man. Densities in the English Channel, the South-west Approaches and the far south of the North Sea were low.

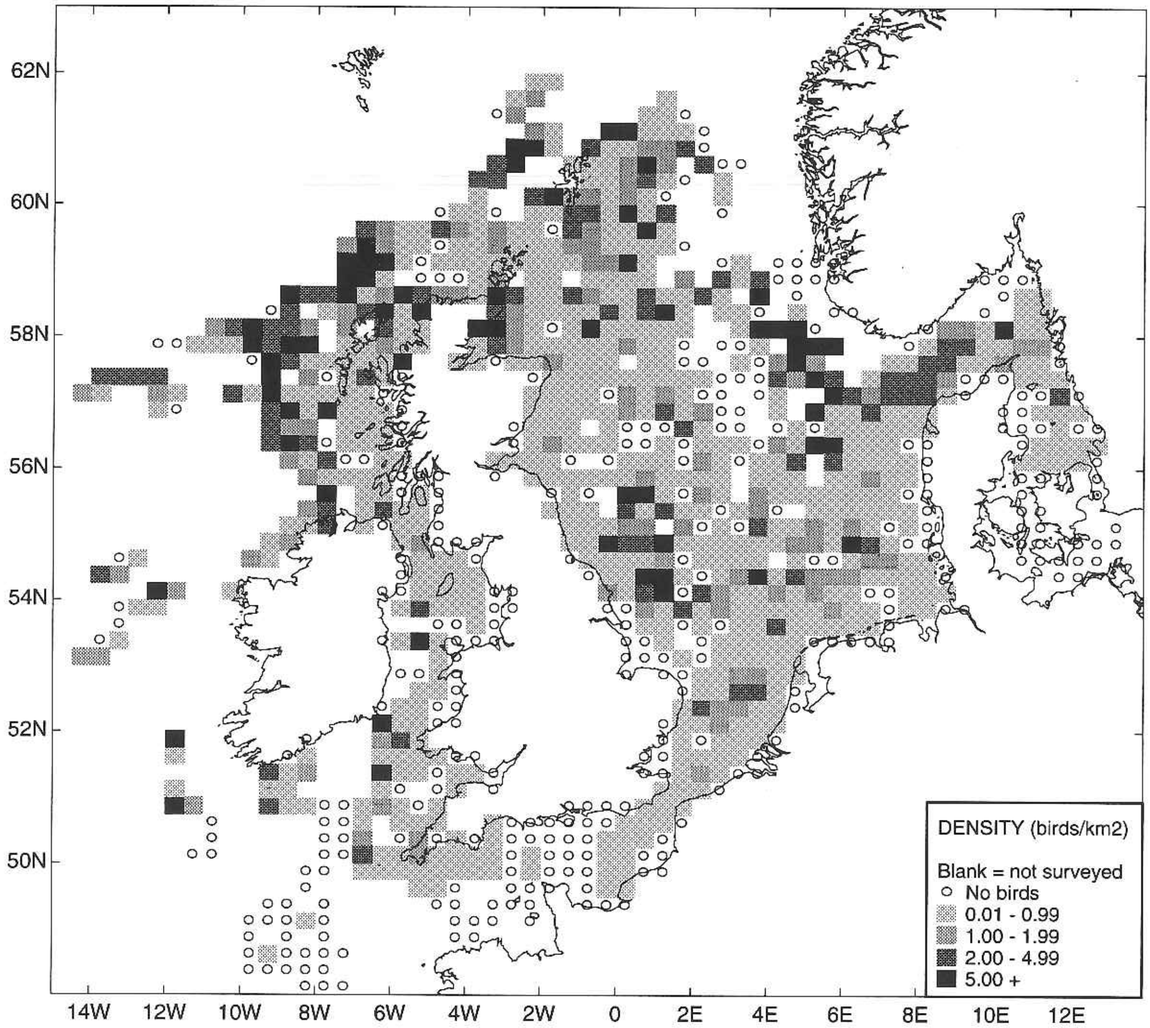

Figure 5.7.4 Distribution of fulmars from December to February

December to February (Figure 5.7.4)

The shelf edge to the west of Scotland regained its importance for this species over winter. The shelf edge to the west of Ireland, although not surveyed much, also held some high densities of fulmars. In the North Sea densities were highest in the vicinity of Shetland, Orkney and the Moray Firth, around the Dogger Bank and along the western and southern edges of the Rinne. Densities in the Kattegat, Irish Sea and English Channel were mostly low.

Summary and conservation implications

The shelf edge was clearly important for fulmars at most times of year, although less so from August to November. The waters around Shetland and Orkney held high densities of fulmars throughout the year, and the Dogger Bank also appeared to hold consistently high or moderate densities. The offshore edge of the Rinne was important for fulmars at all times of the year when it was adequately surveyed. Fulmars were widespread throughout the study area and the only areas where they were in consistently low densities were the English Channel, Celtic Sea, the Kattegat and the extreme southern end of the North Sea. A pollution incident at the shelf edge might put some fulmars at risk; fulmars spend more time at sea than many other species and sleep on the sea surface. They are more likely than gulls to be contaminated by oil because of their need to run with headwinds to get sufficient lift to become airborne when escaping oil slicks. However, their lifestyle is largely aerial, and their main area of distribution in the North Sea is in relatively clean Atlantic water, therefore the numbers affected would be expected to be relatively low. There are low densities in the more polluted areas of the North Sea, hence they suffer insignificant losses from chronic oil pollution.

Further reading

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Joiris, C. 1983. Seabirds recorded in the Fladenground area, Northern North Sea in April, May and June 1976. In, Sünderman & Lenz (eds.), *North Sea Dynamics*, Springer Verlag, pp. 676-685.

Joiris, C. 1978. Seabirds recorded in the northern North Sea in July: the ecological implications of their distribution. *Le Gerfaut 68:* 419-440.

Joiris, C. 1989. Seabirds in the North Sea: distribution and ecological role. *ICES Report C.M. 1989/N:8 - ICES, Copenhagen.*

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report* No. 804.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Tasker, M.L., Blake, B.F., Jones, P.H. & Dixon, T.J. 1985. An atlas study of seabirds at sea in the North Sea, with examples of the results on the distribution of the fulmar *Fulmarus glacialis*. In, Taylor, K., Fuller, R.J. & Lack, P.C. (eds.) *Bird Census and Atlas Studies*, Proceedings of the VIII International Conference on Bird Census and Atlas Work, British Trust for Ornithology, Tring, pp. 367-374.

Table 5.7.1 Overall density of fulmars (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	11.40	2.50	3.05	0.24	1.40	0.37	0.27	-	0.27	0.07
	km^2	96.0	1292.1	712.8	1047.4	1049.1	4048.0	896.7	0.0	71.2	899.0
Feb	Density	8.04	9.92	2.43	0.86	1.69	0.46	1.01	2.56	2.06	0.07
	km^2	332.3	772.6	1270.2	1199.2	2897.2	5770.6	476.2	113.5	191.0	563.2
Mar	Density	6.39	1.80	4.53	1.03	4.91	0.46	0.17	4.20	0.96	0.16
	km^2	359.0	1366.7	1386.5	560.9	1014.7	3101.8	581.6	148.9	609.3	780.0
Apr	Density	24.71	9.09	3.99	0.34	2.10	0.31	0.25	0.55	0.66	0.43
	km^2	567.4	930.8	1243.0	232.9	1706.9	4773.8	483.9	98.9	550.9	770.2
May	Density	20.01	5.14	12.08	0.54	1.56	0.50	0.15	0.71	0.48	0.25
	km^2	450.9	1511.8	1368.2	1126.8	2782.9	3966.7	978.9	253.2	501.1	1197.5
Jun	Density	2.80	1.49	3.44	0.88	1.23	0.82	0.20	0.15	0.32	0.19
	km^2	551.0	1315.5	1304.4	564.4	2113.5	2654.2	875.7	71.6	323.5	583.7
Jul	Density	8.35	8.07	4.01	1.70	1.63	2.17	0.41	0.60	0.51	0.07
	km^2	867.3	1446.5	3241.6	1746.2	4634.4	2245.2	1403.3	153.8	944.4	981.3
Aug	Density	3.74	2.56	3.63	4.33	5.44	2.20	0.91	0.62	0.22	0.27
	km^2	748.0	2402.6	1224.9	1578.0	3768.2	4923.9	1061.6	292.2	524.3	896.4
Sep	Density	3.15	3.71	5.88	4.54	8.13	1.15	0.96	0.00	0.21	0.02
	km^2	208.9	1059.6	1348.2	3084.8	3040.4	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	6.64	5.40	8.62	3.02	2.67	0.81	0.77	0.08	0.90	0.08
	km^2	66.6	1349.0	566.9	707.0	1397.4	3335.5	356.6	12.6	297.6	811.0
Nov	Density	2.11	1.52	10.45	0.46	2.46	0.75	0.47	0.56	0.40	0.07
	km^2	116.3	561.5	1006.3	869.8	1534.2	3648.5	587.7	76.3	710.4	859.0
Dec	Density	0.63	2.75	1.63	0.59	1.95	0.36	1.43	0.00	0.29	0.17
	km^2	71.4	586.1	606.6	816.6	665.0	2675.3	280.7	97.9	460.5	1459.6

5.8 CORY'S SHEARWATER *Calonectris diomedea*

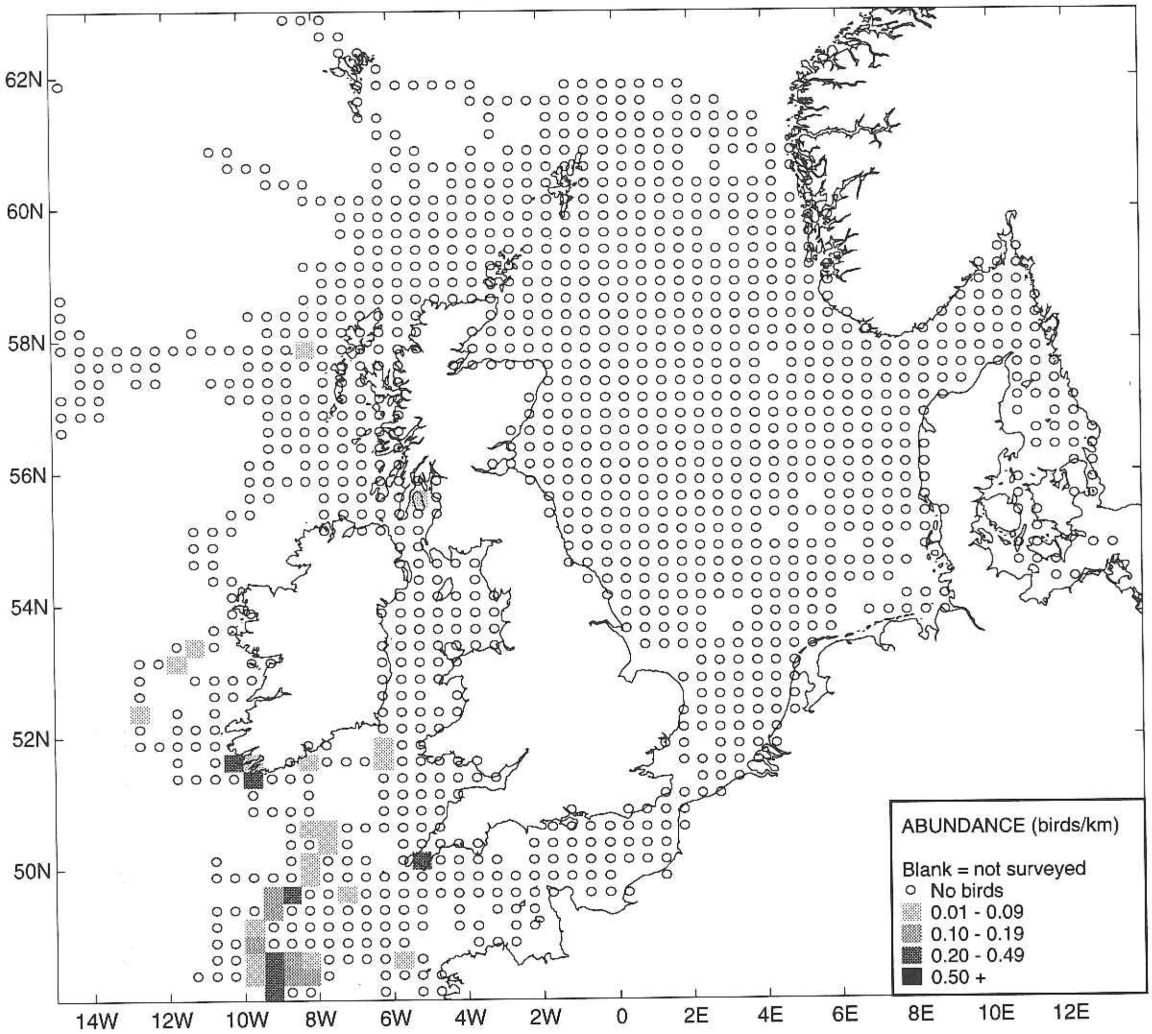

Figure 5.8.1 Distribution of Cory's shearwaters in July and August

July to August (Figure 5.8.1)

With the exception of one bird near St Kilda and one in the Firth of Clyde in August, all Cory's shearwaters were seen to the south-west of Britain. Highest concentrations were found in the South-west Approaches and near Cape Clear.

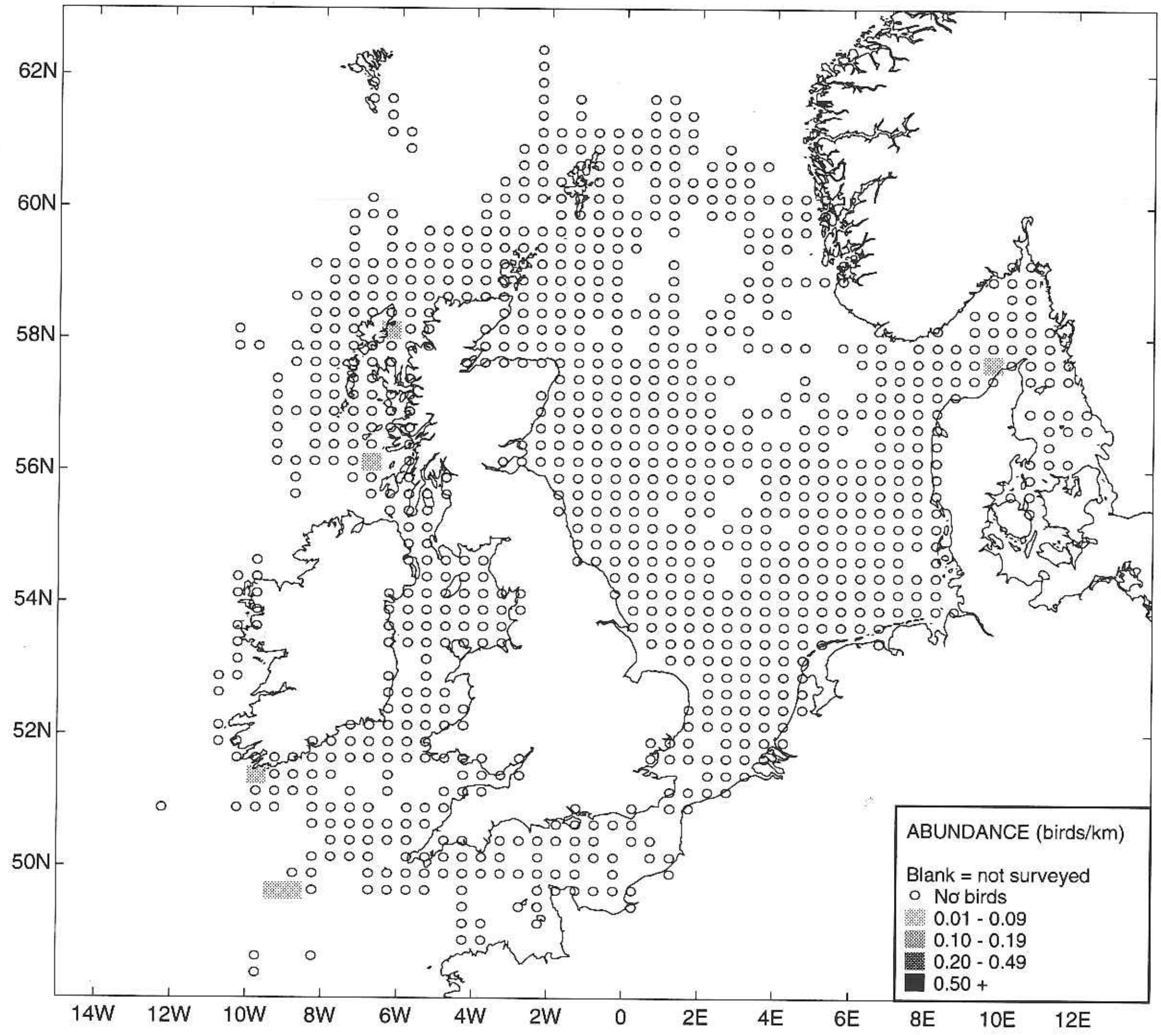

Figure 5.8.2 Distribution of Cory's shearwaters in September and October

September to October (Figure 5.8.2)

Only a few Cory's shearwaters were seen in these months in the study area, these being in the South-west Approaches, near Cape Clear, west of the Inner Hebrides, east of the Outer Hebrides, and one off the north coast of Denmark.

No Cory's shearwaters were seen from November to June (Table 5.8.1).

Summary and conservation implications

This species was most often seen in north-west European waters during July and August to the south-west of the area. It only occurs in low numbers in the study area and is therefore not at risk from oil pollution in these waters.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Newell, R.G. 1968. Influx of great shearwaters in autumn 1965. *British Birds 61:* 145-159.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Table 5.8.1 Overall abundance of Cory's shearwaters (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km	405.3	2302.8	1897.5	2832.0	3359.2	14424.8	1765.7	0.0	223.8	1938.2
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1136.0	2681.3	4390.1	4590.5	10380.2	16685.5	1594.8	378.2	636.7	1966.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1359.3	4407.8	4178.2	1127.8	3046.3	8348.4	1074.7	603.8	2060.7	1453.0
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1923.7	3268.0	4298.0	1040.3	4994.1	12048.2	1316.7	423.8	1982.2	2771.3
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1720.5	3716.3	4328.5	3325.5	10357.4	14351.5	2403.5	844.0	1744.7	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2094.3	6186.1	4620.2	2149.0	7076.5	7362.2	2950.8	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
	km	3534.2	3446.2	12530.7	5612.1	17245.2	8860.1	3675.7	514.0	3209.6	2152.2
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.01
	km	2893.0	8260.8	4596.0	7484.8	14003.9	15915.3	3600.3	929.7	1905.3	3074.4
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4671.7	9846.3	9932.6	10232.2	4515.7	13.3	1383.1	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4531.3	2042.0	2560.6	4714.9	10964.7	1196.0	42.0	1196.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2931.0	1966.3	5332.3	10038.5	916.6	327.2	2550.9	3040.3
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	253.2	979.2	2085.2	2383.7	1370.9	5821.5	940.5	335.6	1553.8	4586.5

5.9 GREAT SHEARWATER *Puffinus gravis*

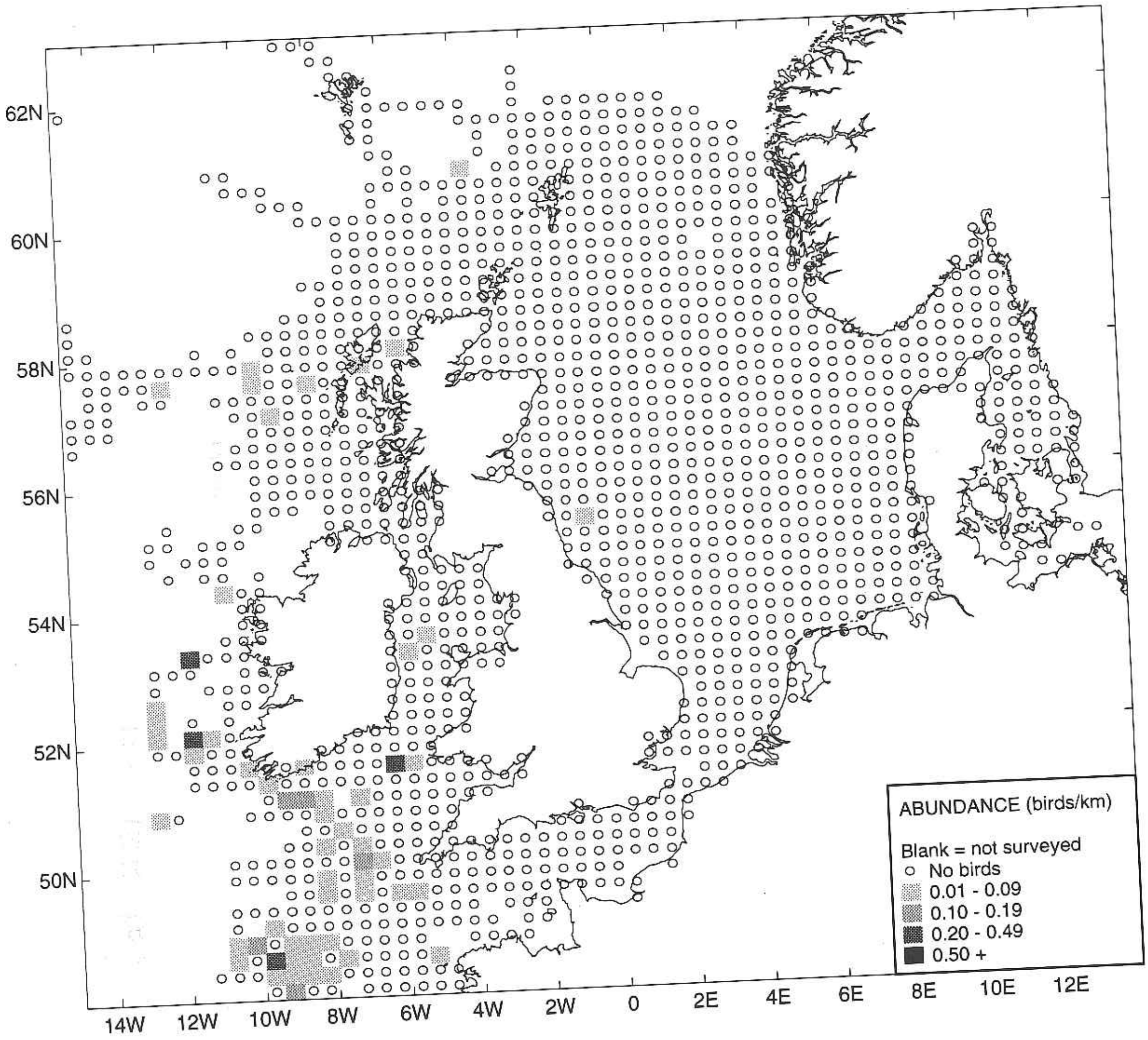

Figure 5.9.1 Distribution of great shearwaters from July to November

July to November (Figure 5.9.1)

Distribution throughout the period was mainly in the South-west Approaches, Celtic Sea and to the west of Ireland. Most great shearwaters were seen in August (Table 5.9.1), but they could be seen as late as November. Some birds were seen in the Minch and to the west of the Outer Hebrides. In August, one bird was seen in August between Shetland and the Faeroes, and one was seen in the western North Sea. Two birds were seen in the region of the Irish sea front, one in August and the other in September.

Few great shearwaters were seen from December to June.

Summary and conservation implications

Great shearwaters occurred during late summer and autumn, mainly to the south-west of Britain. They are not likely to be affected by an oil spill, as they occur in low numbers.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Butcher, W.S., Reed, P.A.Jr. & Butcher, J.B. 1968. Distribution charts of oceanic birds in the north Atlantic. *Woods Hole Oceanographic Institution, Report Reference No. 68-69.*

Geertsma, M. & Knegtering, B. 1993. Grote Pijlstormvogels *Puffinus gravis* in de Golf van Biskaje, November 1993. *Sula 7:* 149-152.

Newell, R.G. 1968. Influx of great shearwaters in autumn 1965. *British Birds 61:* 145-159.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Voous, K.H. & Wattel, J. 1963. Distribution and migration of the greater shearwater. *Ardea 51:* 143-157.

Table 5.9.1 Overall abundance of great shearwaters (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km	405.3	2302.8	1897.5	2832.0	3359.2	14424.8	1765.7	0.0	223.8	1938.2
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1136.0	2681.3	4390.1	4590.5	10380.2	16685.5	1594.8	378.2	636.7	1966.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1359.3	4407.8	4178.2	1127.8	3046.3	8348.4	1074.7	603.8	2060.7	1453.0
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1923.7	3268.0	4298.0	1040.3	4994.1	12048.2	1316.7	423.8	1982.2	2771.3
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1720.5	3716.3	4328.5	3325.5	10357.4	14351.5	2403.5	844.0	1744.7	2807.7
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
	km	2094.3	6186.1	4620.2	2149.0	7076.5	7362.2	2950.8	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3534.2	3446.2	12530.7	5612.1	17245.2	8860.1	3675.7	514.0	3209.6	2152.2
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00
	km	2893.0	8260.8	4596.0	7484.8	14003.9	15915.3	3600.3	929.7	1905.3	3074.4
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
	km	696.3	1644.3	4671.7	9846.3	9932.6	10232.2	4515.7	13.3	1383.1	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	km	222.0	4531.3	2042.0	2560.6	4714.9	10964.7	1196.0	42.0	1196.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
	km	387.5	1418.8	2931.0	1966.3	5332.3	10038.5	916.6	327.2	2550.9	3040.3
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	253.2	979.2	2085.2	2383.7	1370.9	5821.5	940.5	335.6	1553.8	4586.5

5.10 SOOTY SHEARWATER *Puffinus griseus*

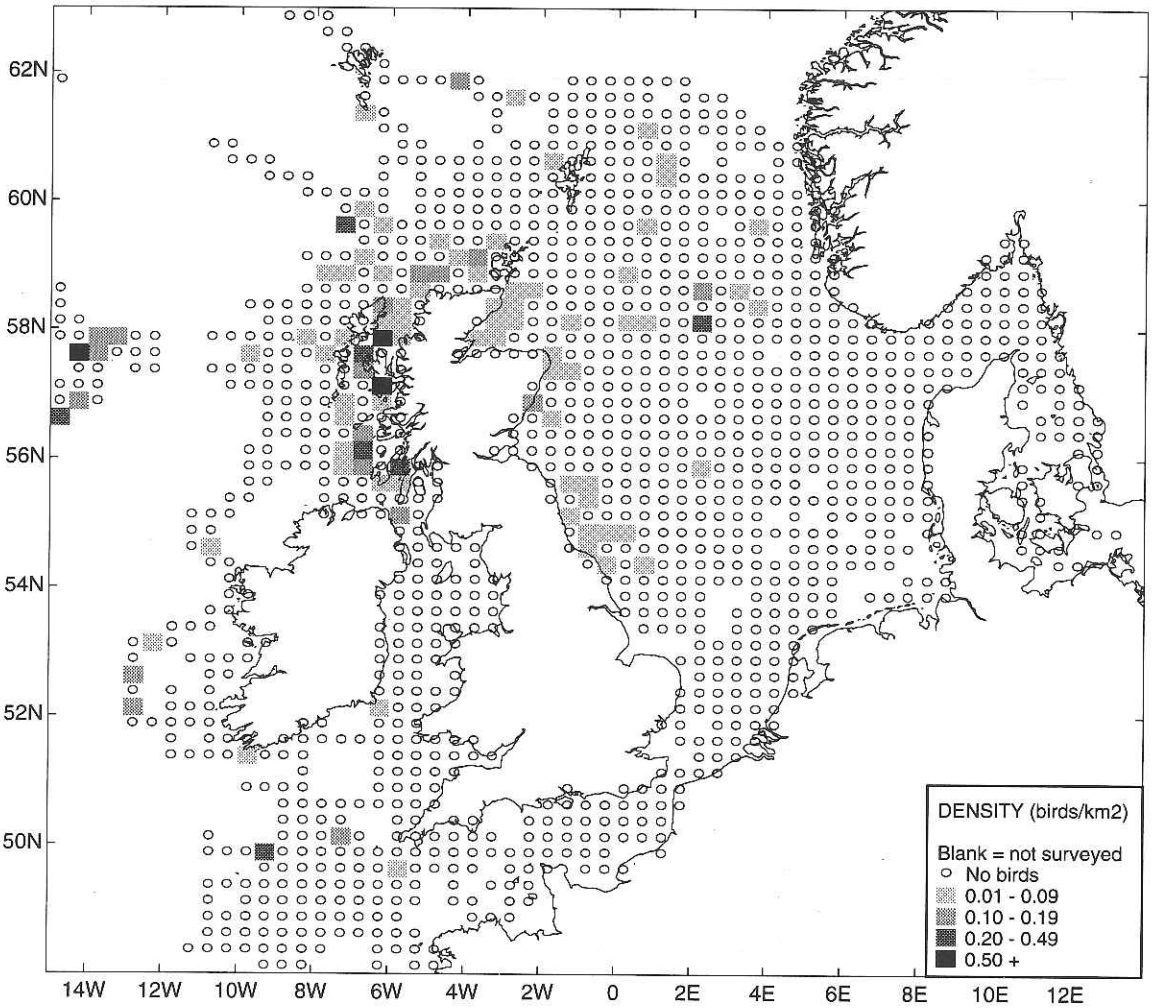

Figure 5.10.1 Distribution of sooty shearwaters in July and August

July to August (Figure 5.10.1)

Densities of sooty shearwaters were mostly low, with highest densities occurring in the Minch. Moderate densities were found around the Rockall Bank and in some areas off the north and west coasts of Scotland and the west coast of Ireland. Low densities were widespread over the continental shelf to the west and north of Scotland, around Shetland, the Moray Firth and the north-east coast of England. Low densities were also found scattered throughout the North Sea, occurring less frequently in the south, and in the South-west Approaches.

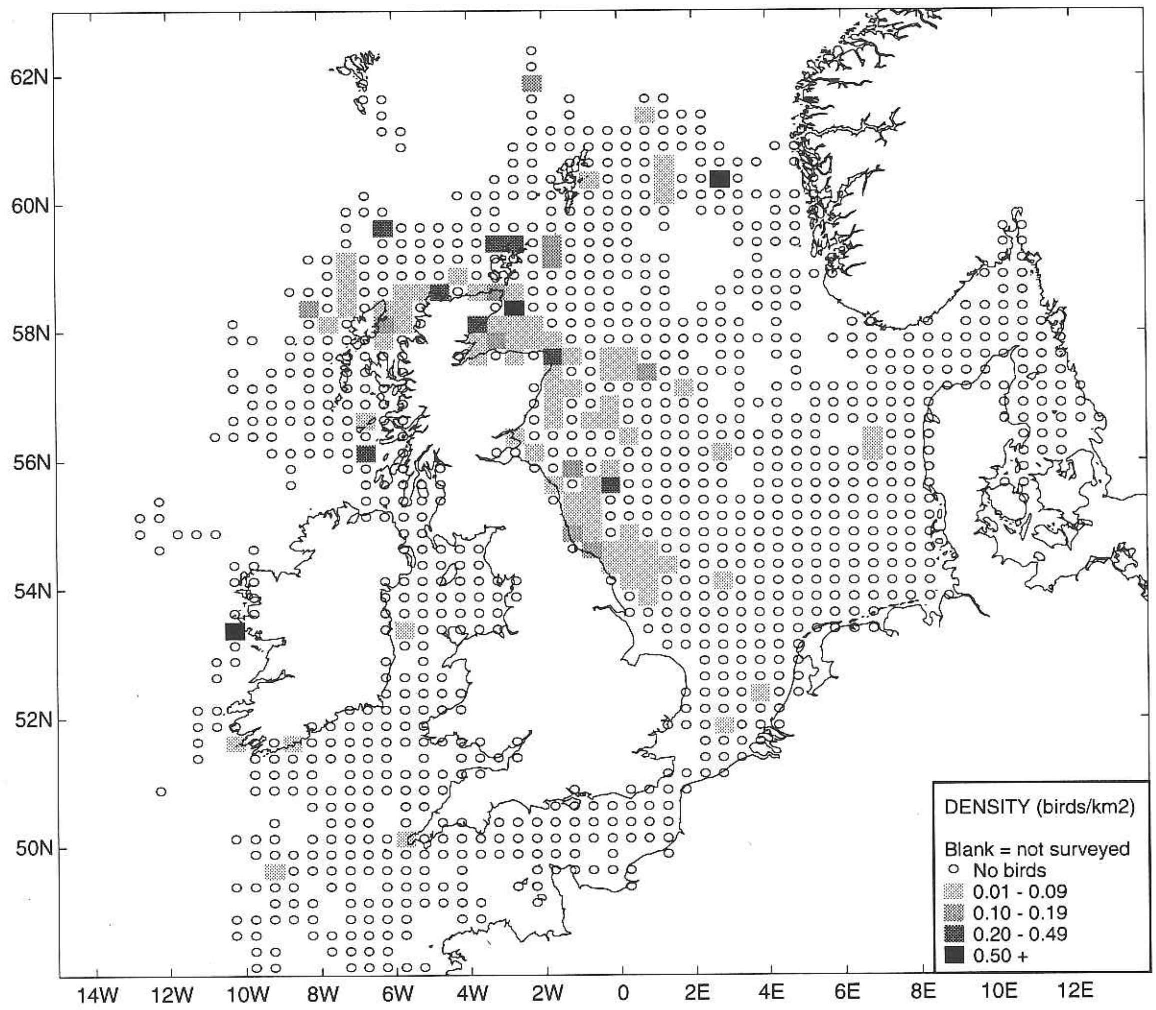

Figure 5.10.2 Distribution of sooty shearwaters from September to November

September to November (Figure 5.10.2)

Highest densities at this time were seen off the west coast of Ireland, and around Orkney and Caithness (Table 5.10.1). Low or moderate densities were still widespread on the continental shelf to the west and north of Scotland and around Shetland and the Moray Firth. Sooty shearwaters occurred more widely at low densities off the north-east coasts of Scotland and England than in previous months, and in the Firth of Forth. Low densities were scattered in the southern North Sea and the South-west Approaches.

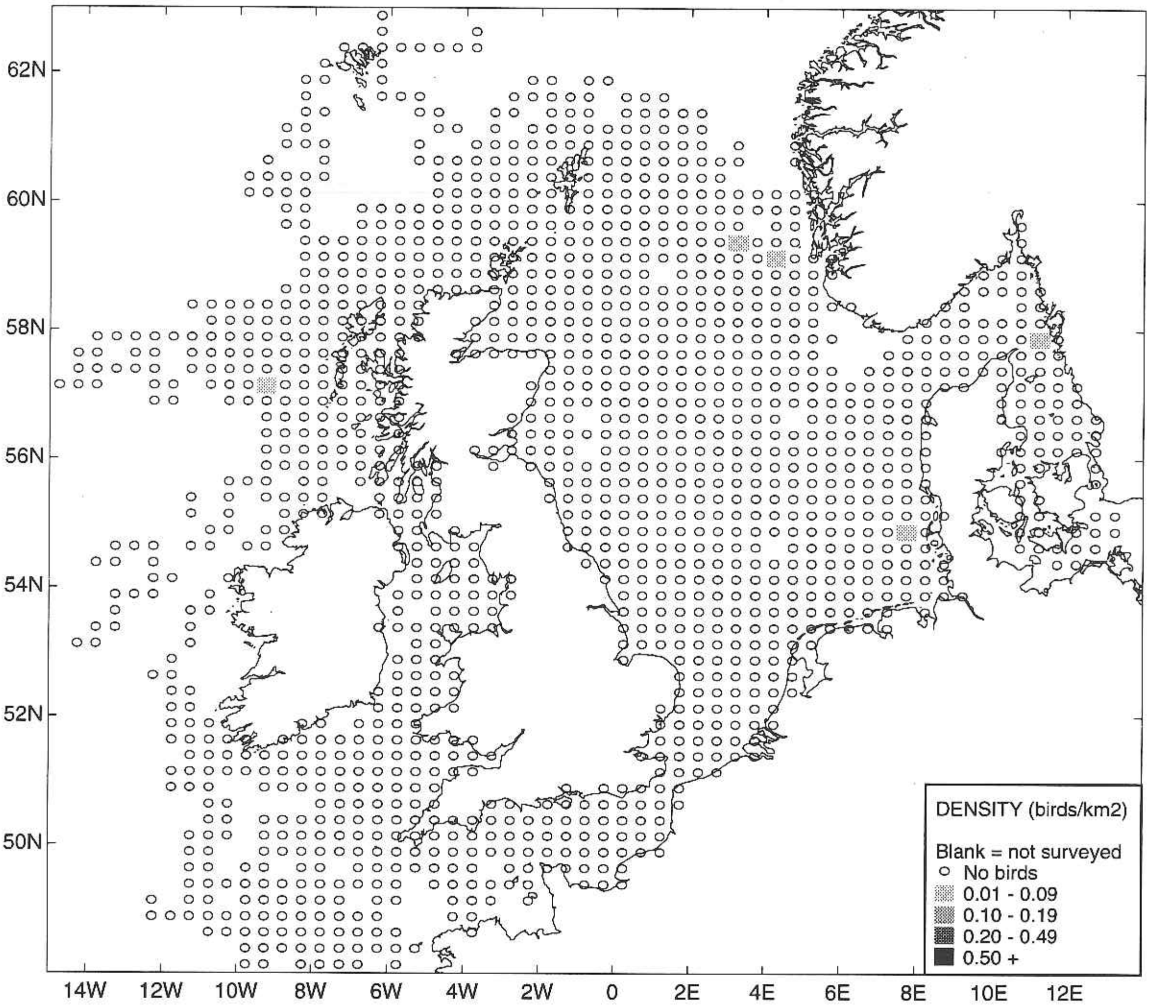

Figure 5.10.3 Distribution of sooty shearwaters from December to June

December to June (Figure 5.10.3)

Very few sooty shearwaters were seen during these months, these mostly occurring in June or December.

Summary and conservation implications

Although sooty shearwaters were widespread in certain areas in the summer and autumn, their numbers were low, which puts this species at little risk from pollution in north-west European waters. Sooty shearwaters appeared to be more numerous in the southern North Sea in the first half of the 1980s than before or since (Camphuysen *pers. comm.*)

Further reading

Blomqvist, S. & Peterz, M. 1984. Cyclones and pelagic seabird movements. *Mar. Ecol. Prog. Ser. 20:* 85-92.

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, C.J. & Dijk, J.van 1983. Zee- en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Dahlman, T. 1972. Massupträdande av Grå Lira vid Kullen. *Medd. Skånes Orn. Fören. 11:* 10-11.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk Orn. Foren. Tidsskr. 84:* 45-63.

Gibbs, A., Grant, P.J., Oliver, P.J. & Walker, C.A. 1965. Unusual numbers of sooty shearwaters in the eastern English Channel. *British Birds 58:* 56-58.

Hall, A.J., Tasker, M.L. & Webb, A. 1987. The marine distribution of sooty shearwater, Manx shearwater, storm petrel and Leach's petrel in the North Sea. *Seabird 10:* 60-70.

Jansen, F.H. 1981. De trek van de Grauwe Pijlstormvogel *Puffinus griseus* langs de Nederlandse kust. *Limosa 54(4):* 117-126.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Lockley, R.M. & Marchant, S. 1951. A midsummer visit to Rockall. *Brit. Birds 44:* 373-383.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Oliver, P.J. 1971. Sooty Shearwaters in the English Channel. *Brit. Birds 64:* 56-60.

Oliver, P.J. & Davenport, D.L. 1970. Large passage of seabirds at Cap Gris Nez. *Seabird Rep. 2:* 16-24.

Phillips, J.H. 1963a. The pelagic distribution of the Sooty Shearwater *Procellaria grisea. Ibis 105:* 340-353.

Phillips, J.H. 1963b. The distribution of the sooty shearwater around the British Isles. *British Birds 56:* 197-203.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Sharrock, J.T.R. 1969. Summary of sea-watching in 1968. *Cape Clear Bird Observatory Report 10:* 18-19.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Vandenbulcke, P. 1978. Trekpatroon van Grauwe Pijlstormvogel (*Puffinus griseus*) door de zuidelijke Noordzee en Het Kanaal. *Veldorn. Tijdschr. 1:* 2-19.

Vandenbulcke, P. 1979. Een analyse van tien jaar zeevogelwaarnemingen langs de Belgische kust en in het binnenland, gebaseerd op de BAHC verslagen. *Veldorn. Tijdschr. 2:* 35-57.

Table 5.10.1 Overall density of sooty shearwaters (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.01	0.11	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.01	0.02	0.33	0.05	0.01	0.00	0.00	0.00	0.00	0.00
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.02	0.00
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.11 MANX SHEARWATER *Puffinus puffinus*

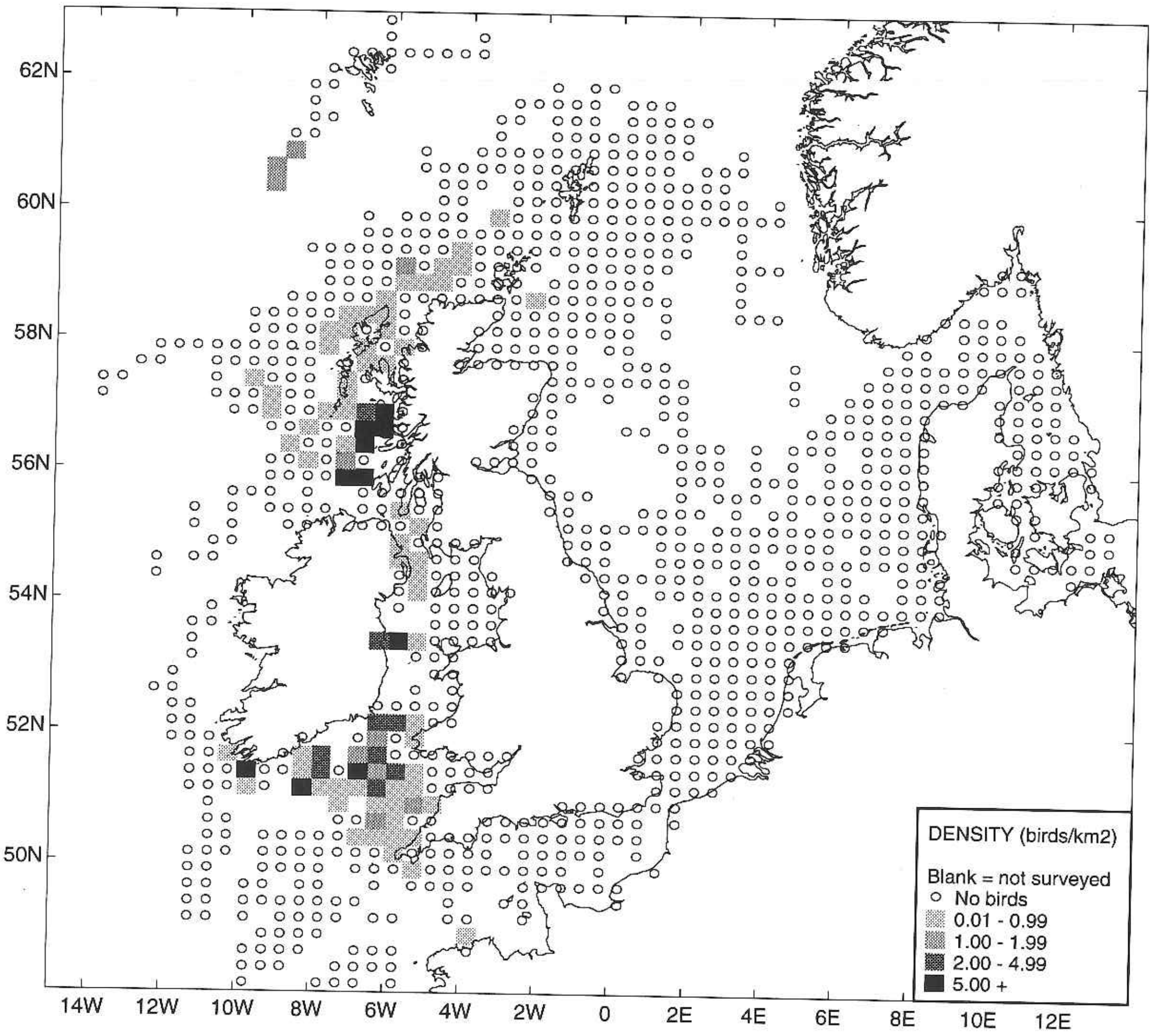

Figure 5.11.1 Distribution of Manx shearwaters in March and April

March to April (Figure 5.11.1)

Densities were highest off the west coast of Scotland and in the Celtic Sea (Table 5.11.1), near the colonies of Rum and Skomer/Skokholm (Pembrokeshire Islands) respectively. Low densities were widespread over the continental shelf to the west and north of Scotland, and in the North Channel. Local concentrations also occurred off Cape Clear and off the east coast of Ireland, and over banks to the south-west of the Faeroes.

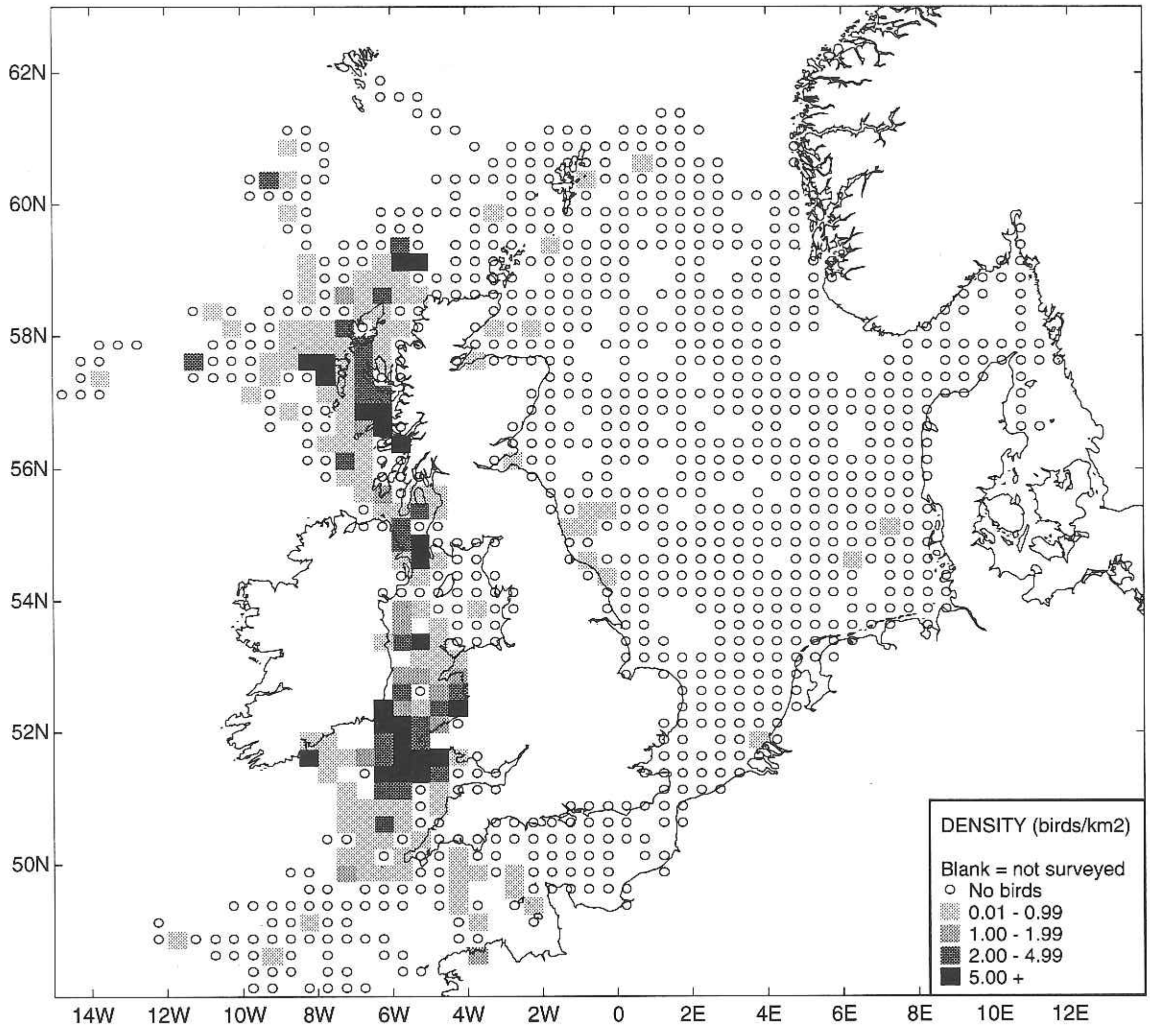

Figure 5.11.2 Distribution of Manx shearwaters in May and June

May to June (Figure 5.11.2)

During this period of egg incubation, Manx shearwater distribution remained close to the colonies of Skomer and Skokholm (Pembrokeshire Islands) and Rum. Manx shearwaters have the potential of foraging far afield during the incubation period as the average incubation spell by each parent is six days (Harris 1966), but their distribution tended to be restricted to the continental shelf around the areas where the colonies are. Low densities were found further afield in the Moray Firth and off the north-east coast of England, with a few in the eastern North Sea. These birds could be non-breeders. There is an annual passage of Manx shearwaters off the Dutch coast in June (Platteeuw, van Ham & den Ouden 1994), of which the origin in unclear. Low densities were seen in the western English Channel, probably birds breeding on the Scillies, the Channel Islands and the Brittany coast.

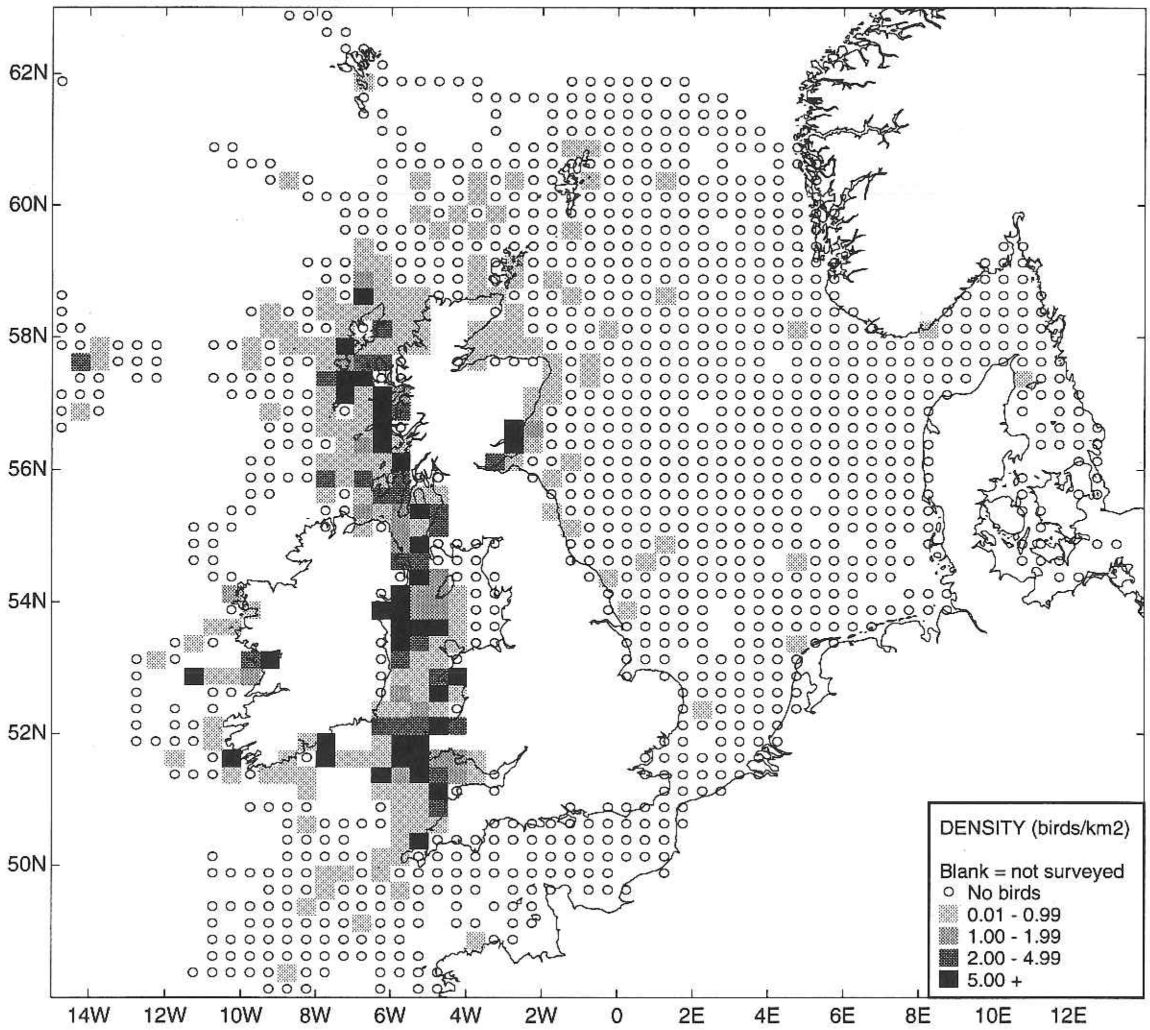

Figure 5.11.3 Distribution of Manx shearwaters in July and August

July to August (Figure 5.11.3)

At this time Manx shearwaters are feeding their chicks. High densities remained close to the main colonies of Skomer and Skokholm (Pembrokeshire Islands) and Rum, as well as smaller colonies in south-west Ireland and the Irish Sea. High densities were also seen in the area of the Irish Sea front and the stratified water to the west of it. Low or moderate densities were seen around the Rockall Bank and over banks to the south-west of the Faeroes. Low densities were found away from colonies, in the Moray Firth and Firth of Forth, and along the north-east coast of England.

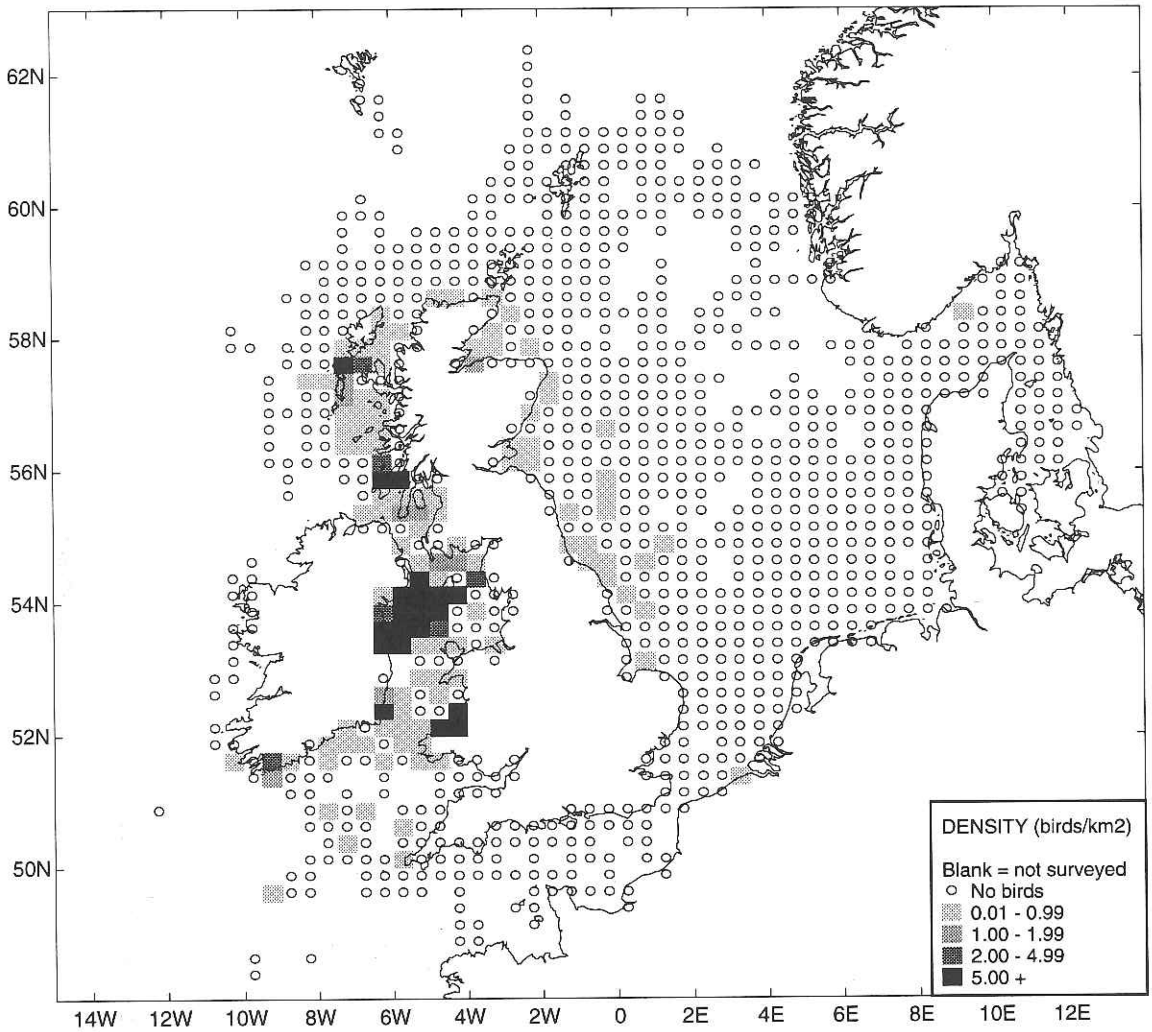

Figure 5.11.4 Distribution of Manx shearwaters in September and October

September to October (Figure 5.11.4)

High densities in the area of the Irish Sea front and the stratified water to the west of it were a striking feature of this period, after the chicks have fledged. High densities were also found in Cardigan Bay, off south-east Ireland, and around the Inner Hebrides. Moderate densities remained around Rum and the Outer Hebrides and off south-west Ireland. Low densities were widespread around the west coast of Scotland, the southern Irish Sea, the Celtic Sea, the Moray Firth, the Firth of Forth and the north-east coast of England.

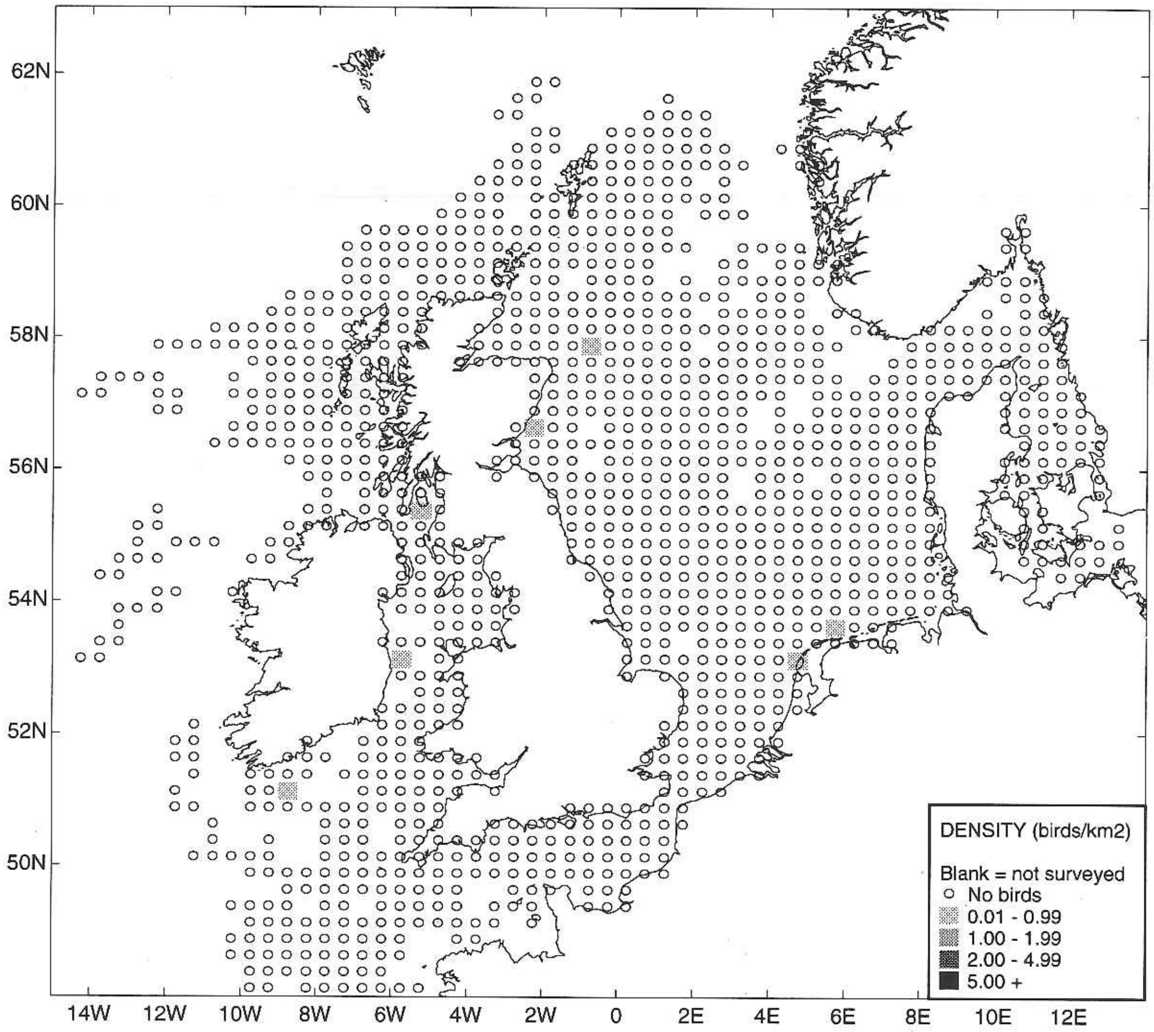

Figure 5.11.5 Distribution of Manx shearwaters from November to February

November to February (Figure 5.11.5)

Very few Manx shearwaters were seen at this time, when they have migrated to South America.

Summary and conservation implications

Approximately 94% of the world population of Manx shearwaters breed in Britain and Ireland. Manx shearwaters spend much of their time sitting on the surface of the water, often in rafts of huge numbers. The combination of a large proportion of the world breeding population and their high level of contact with the water surface makes this species vulnerable to oil pollution in the months when they are present in north-west European waters. Areas of prime importance for this species were the waters off the west coast of Scotland, the Celtic Sea and waters around south-west Wales, and the area around the Irish Sea front.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Hall, A.J., Tasker, M.L. & Webb, A. 1987. The marine distribution of sooty shearwater, Manx shearwater, storm petrel and Leach's petrel in the North Sea. *Seabird 10:* 60-70.

Harris, M.P. 1966. Breeding biology of the Manx shearwater *Puffinus puffinus*. *Ibis 108:* 17-33.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Rees, E.I.S. & Hope Jones, P. 1982. Seabirds associated with frontal systems in the Irish Sea. In, Hope Jones, P. (ed.), *Proceedings of the Seabird Group Conference, Uttoxeter, 12-14 February 1982*, pp. 22-23.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Stone, C.J., Harrison, N.M., Webb, A., & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30.

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Stone, C.J., Webb, A. & Tasker, M.L. 1994. The distribution of Manx shearwaters *Puffinus puffinus* in north-west European waters. *Bird Study 41:* 170-180.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Table 5.11.1 Overall density of Manx shearwaters (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km^2	96.0	1292.1	774.8	1122.9	1078.8	4048.0	896.7	0.0	71.2	899.0
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	338.0	778.9	1372.2	1258.0	2993.5	5770.6	476.2	113.5	191.0	563.2
Mar	Density	0.10	0.12	0.00	0.00	0.00	0.00	0.05	0.00	0.16	0.00
	km^2	374.7	1385.1	1388.4	597.0	1014.7	3101.8	581.6	148.9	609.3	780.0
Apr	Density	0.01	1.50	0.00	0.00	0.00	0.00	1.07	0.00	1.33	0.03
	km^2	576.0	944.6	1243.0	269.6	1743.2	4940.1	483.9	98.9	550.9	787.8
May	Density	0.04	1.24	0.00	0.00	0.00	0.00	3.14	0.00	1.08	0.02
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4024.2	978.9	253.2	501.1	1242.0
Jun	Density	0.10	1.81	0.00	0.05	0.00	0.00	6.61	0.03	0.96	0.13
	km^2	617.1	1763.0	1318.6	572.8	2113.5	2654.2	875.7	71.6	323.5	583.7
Jul	Density	0.02	2.00	0.02	0.03	0.00	0.00	7.02	0.12	1.61	0.65
	km^2	997.4	1512.4	3659.1	1796.0	4782.4	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.01	2.91	0.02	0.32	0.00	0.00	16.42	0.02	0.30	0.01
	km^2	867.9	2468.6	1377.9	2081.2	4028.8	4952.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.67	0.07	0.05	0.00	0.00	5.03	0.00	0.15	0.00
	km^2	208.9	1059.6	1389.6	3103.1	3079.4	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.08	0.01
	km^2	66.6	1354.6	572.7	745.6	1413.5	3335.5	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	116.3	561.5	1013.7	869.8	1578.6	3648.5	587.7	76.3	710.4	859.0
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	76.0	586.1	606.6	847.5	736.5	2873.1	280.7	97.9	460.5	1476.1

5.12 MEDITERRANEAN SHEARWATER *Puffinus mauretanicus*

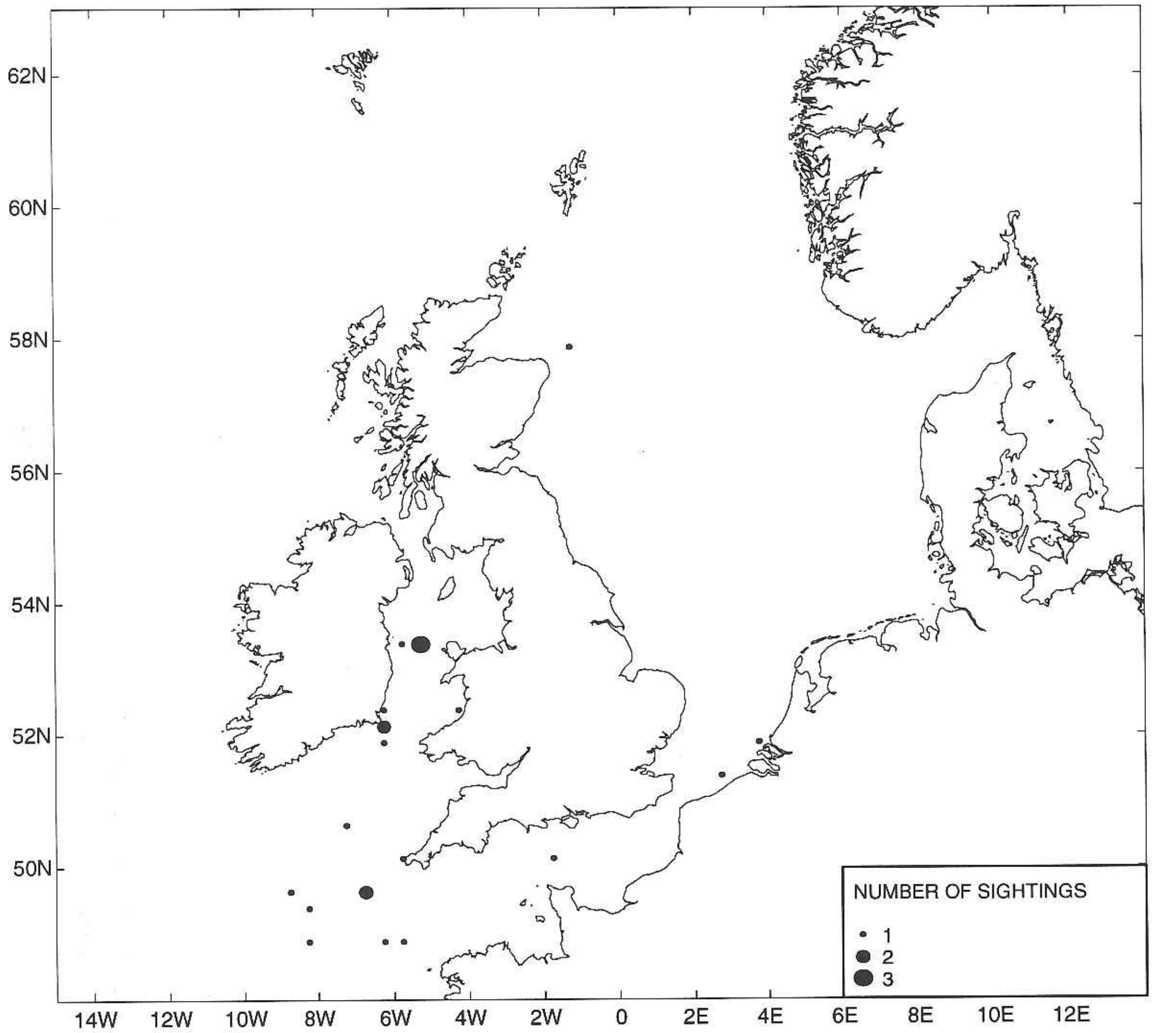

Figure 5.12.1 Sightings of Mediterranean shearwaters from July to November

July to November (Figure 5.12.1)

A total of 22 birds were seen, mostly in the South-west Approaches. One bird was seen off north-east Scotland, otherwise all birds were seen south of 54°N. Most Mediterranean shearwaters were seen in August (Figure 5.12.2).

No Mediterranean shearwaters were seen between December and June.

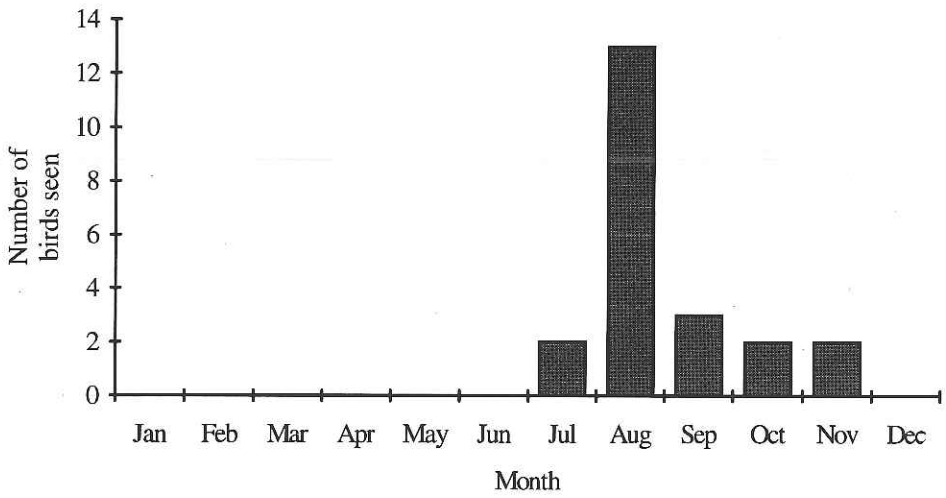

Figure 5.12.2 Number of Mediterranean shearwaters seen per month

Summary and conservation implications

This species occurred in low numbers in summer in the South-west Approaches. Due to its scarcity, this species is under little threat of an oil spill in these waters.

Further reading

Nicholson, E.M. 1952. Shearwaters in the English Channel. *British Birds 45:* 41-55.

5.13 WILSON'S PETREL *Oceanites oceanicus*

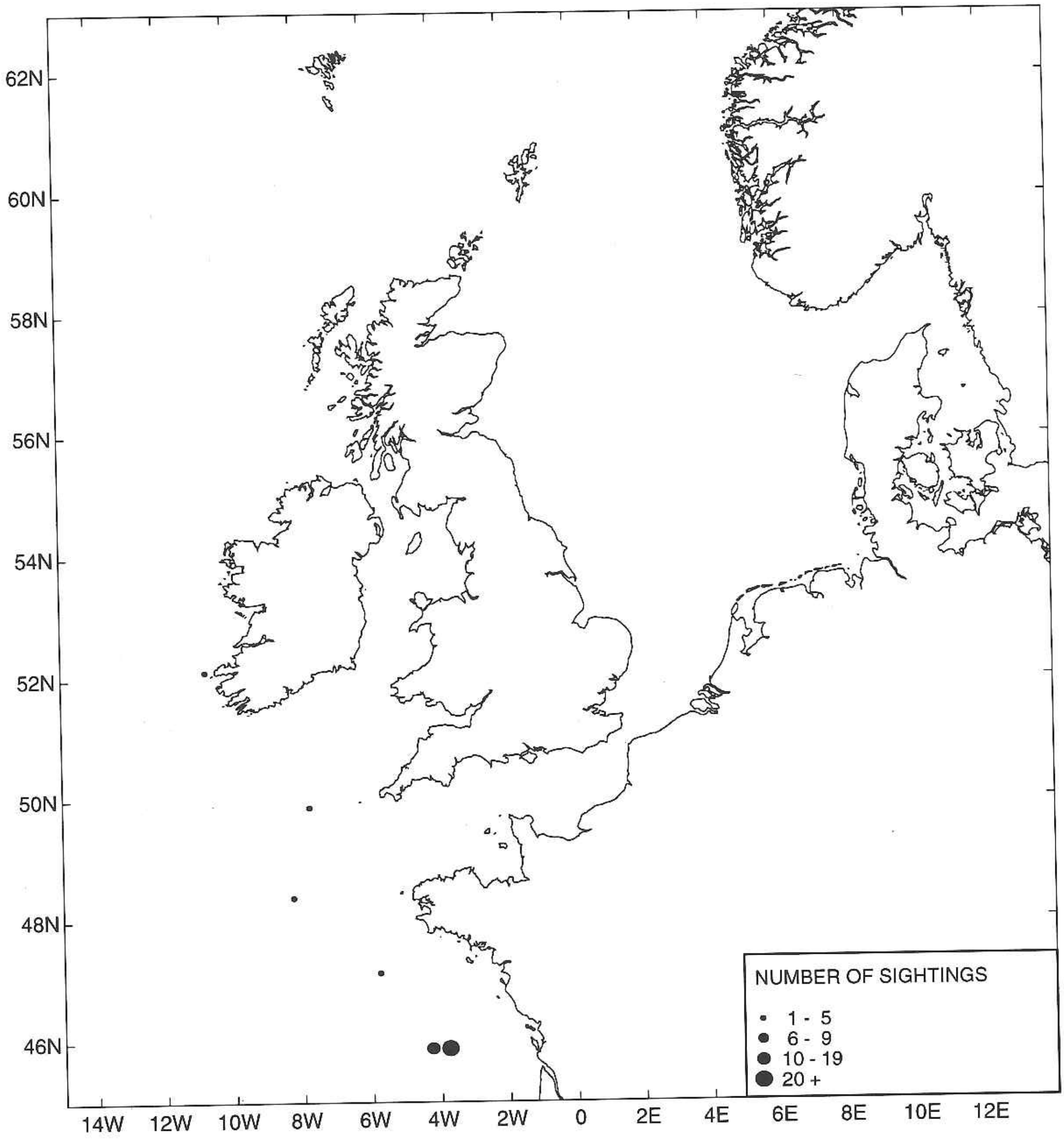

Figure 5.13.1 Sightings of Wilson's petrels from June to August

June to August (Figure 5.13.1)

A total of 41 Wilson's petrels were seen, 38 of these being in the Bay of Biscay (the map for this species extends further south than maps for other species). All but one of the Bay of Biscay sightings occurred in June, giving a high number of sightings for this month (Figure 5.13.2). There was one sighting of a Wilson's petrel off south-west Ireland in July, and two sightings in the South-west Approaches in August.

No Wilson's petrels were seen from September to May.

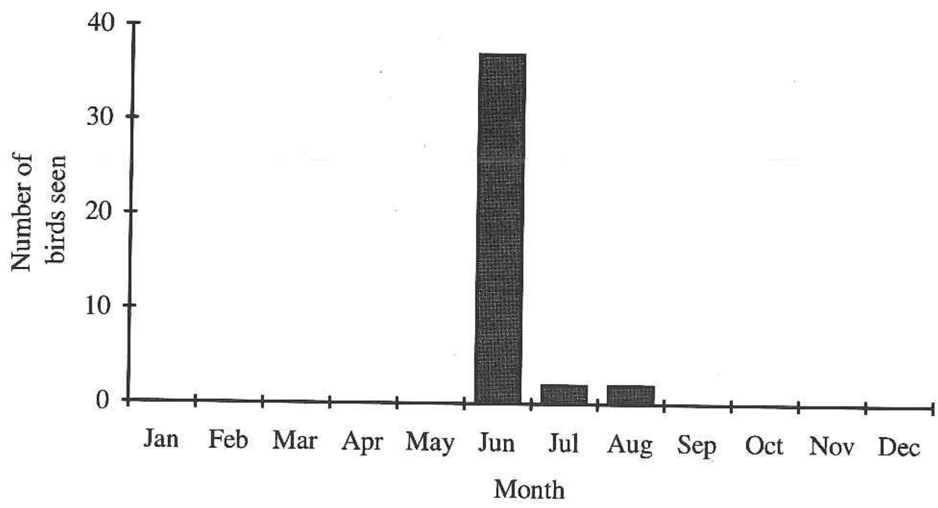

Figure 5.13.2 Number of Wilson's petrels seen per month

Summary and conservation implications

Wilson's petrels were rare in the study area, occurring only in the south-west. Due to its infrequent appearance in these waters, there is little risk to this species from an oil spill.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

5.14 STORM PETREL *Hydrobates pelagicus*

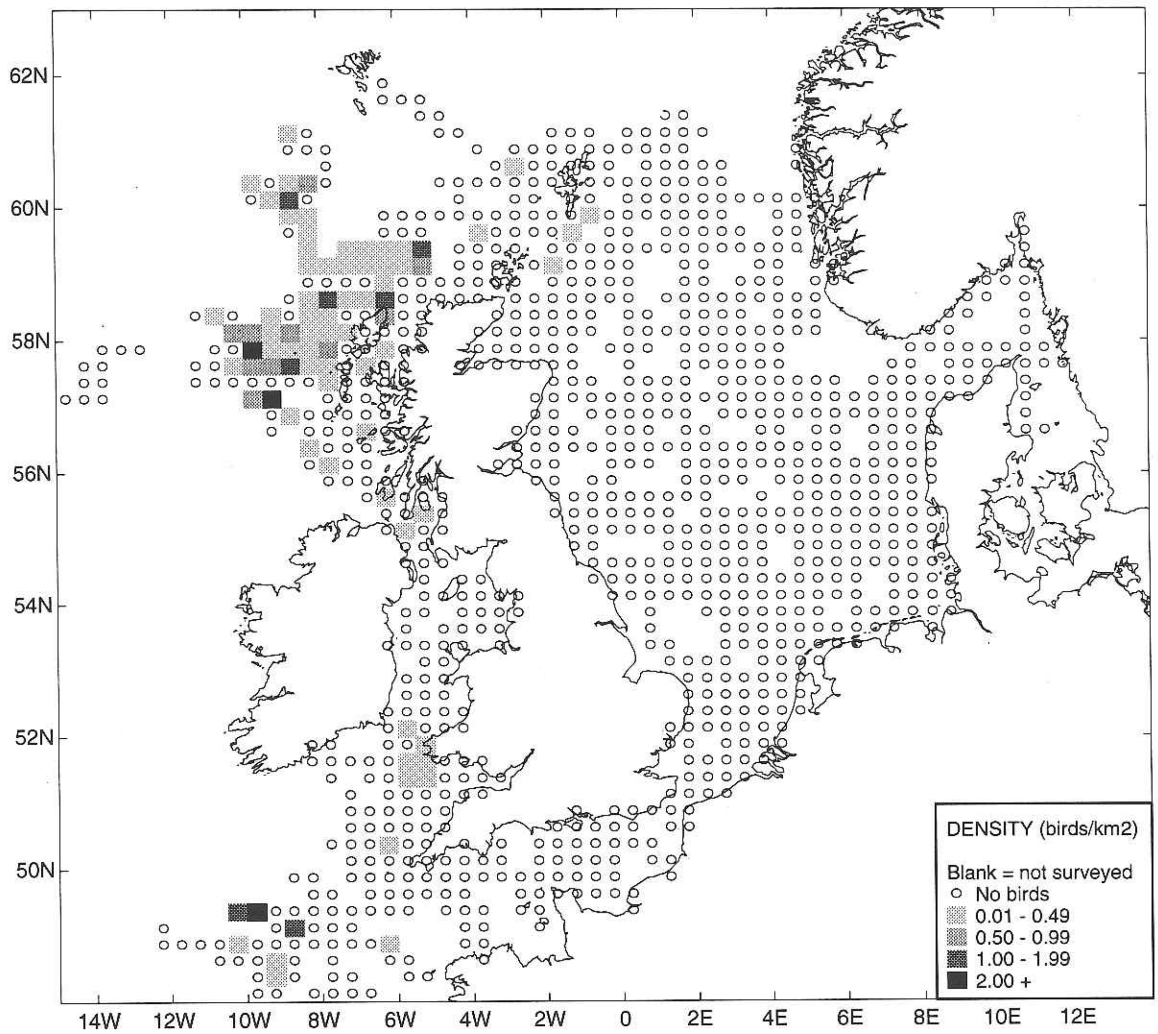

Figure 5.14.1 Distribution of storm petrels in May and June

May to June (Figure 5.14.1)

The main area where storm petrels were found was over the outer shelf and shelf break to the north-west of Scotland. Some birds were also seen, sometimes at high densities, at the shelf break in the South-west Approaches. Low densities were seen around the Pembrokeshire Islands, near Fair Isle and Shetland, and along the west coast of Scotland.

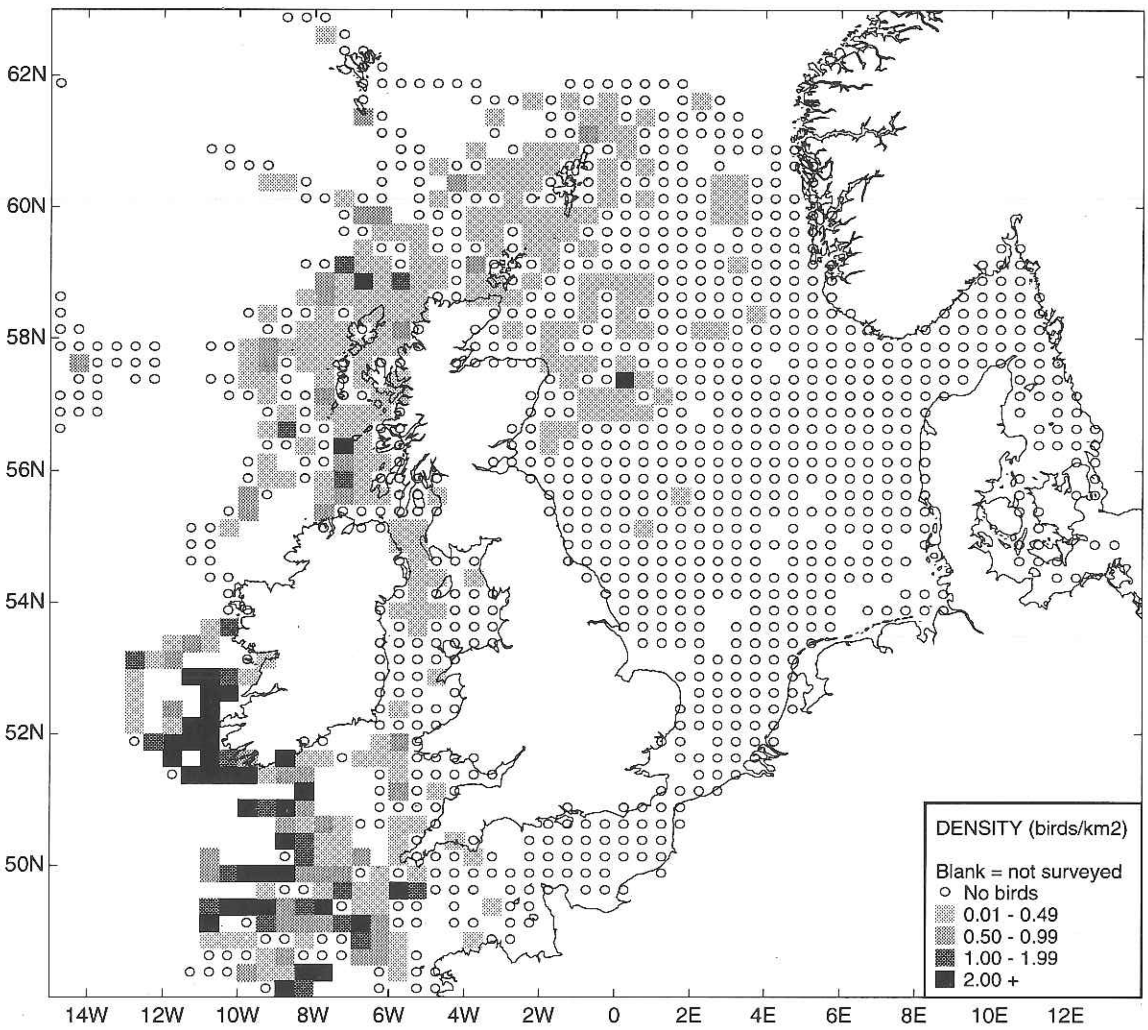

Figure 5.14.2 Distribution of storm petrels in July and August

July to August (Figure 5.14.2)

Highest densities were seen at the shelf edge in the South-west Approaches, and around south-west Ireland (Table 5.14.1). However, this is partly an artefact of differing survey methods; on some surveys in the south-west binoculars were regularly used to search for storm petrels, while in other areas only birds detected with the naked eye were recorded, which may account for lower densities over the north-west shelf. Low densities were seen in the Celtic Sea. Storm petrels were widespread at low densities in the North Channel and over the continental shelf to the west of Scotland, with densities increasing towards the shelf edge. Moderate densities were seen around the Faeroes, where there are large colonies. Low densities were seen around Orkney, Shetland and the north-western North Sea.

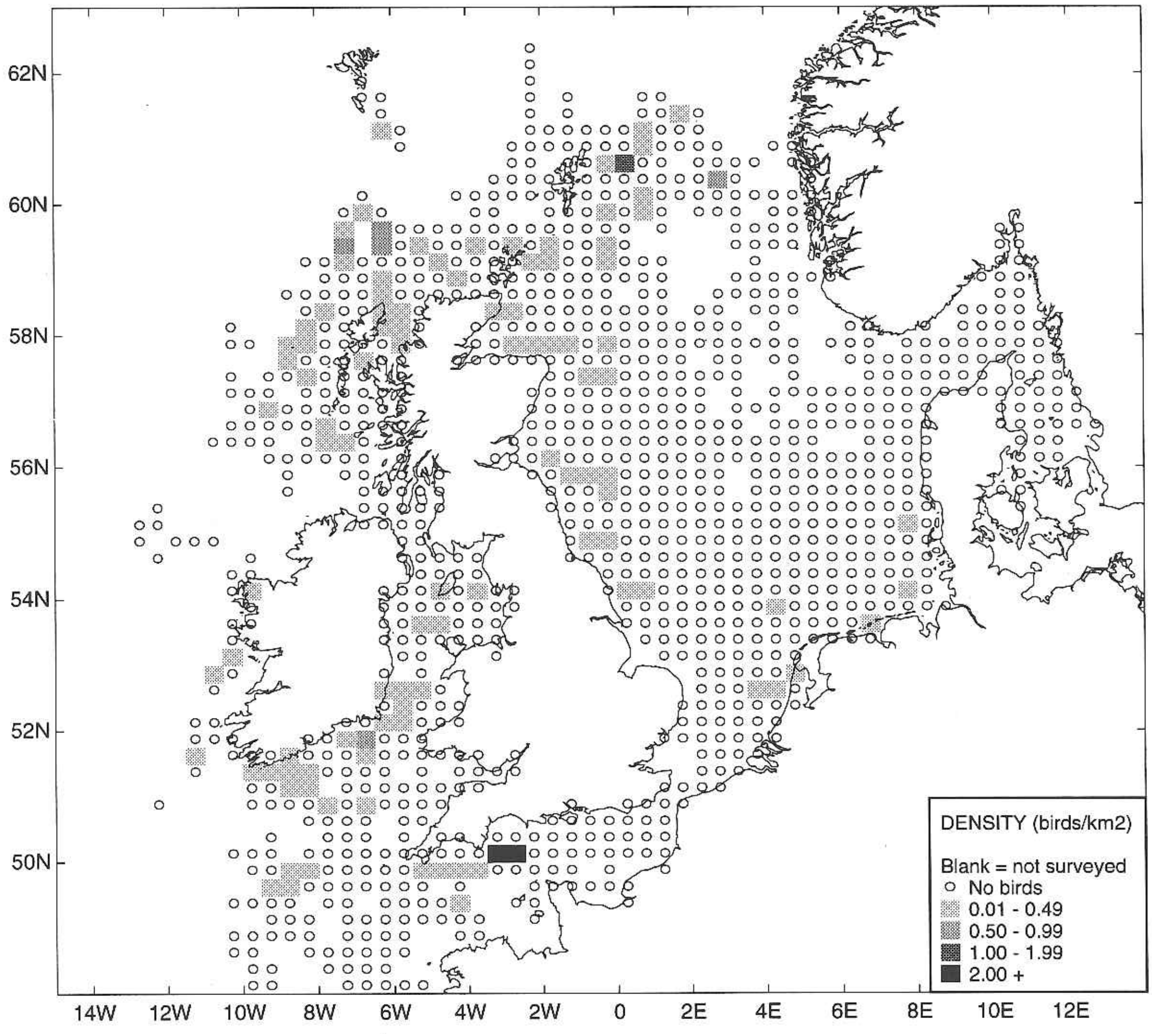

Figure 5.14.3 Distribution of storm petrels from September to November

September to November (Figure 5.14.3)

Densities were low in most places. Storm petrels were seen around southern Ireland, the Celtic Sea, the western English Channel and the continental shelf to the west of Scotland, with a few in the central Irish Sea. Low densities of storm petrels were also dispersed along the coasts of north-east Scotland and north-east England, with a few in coastal regions of the south-eastern North Sea.

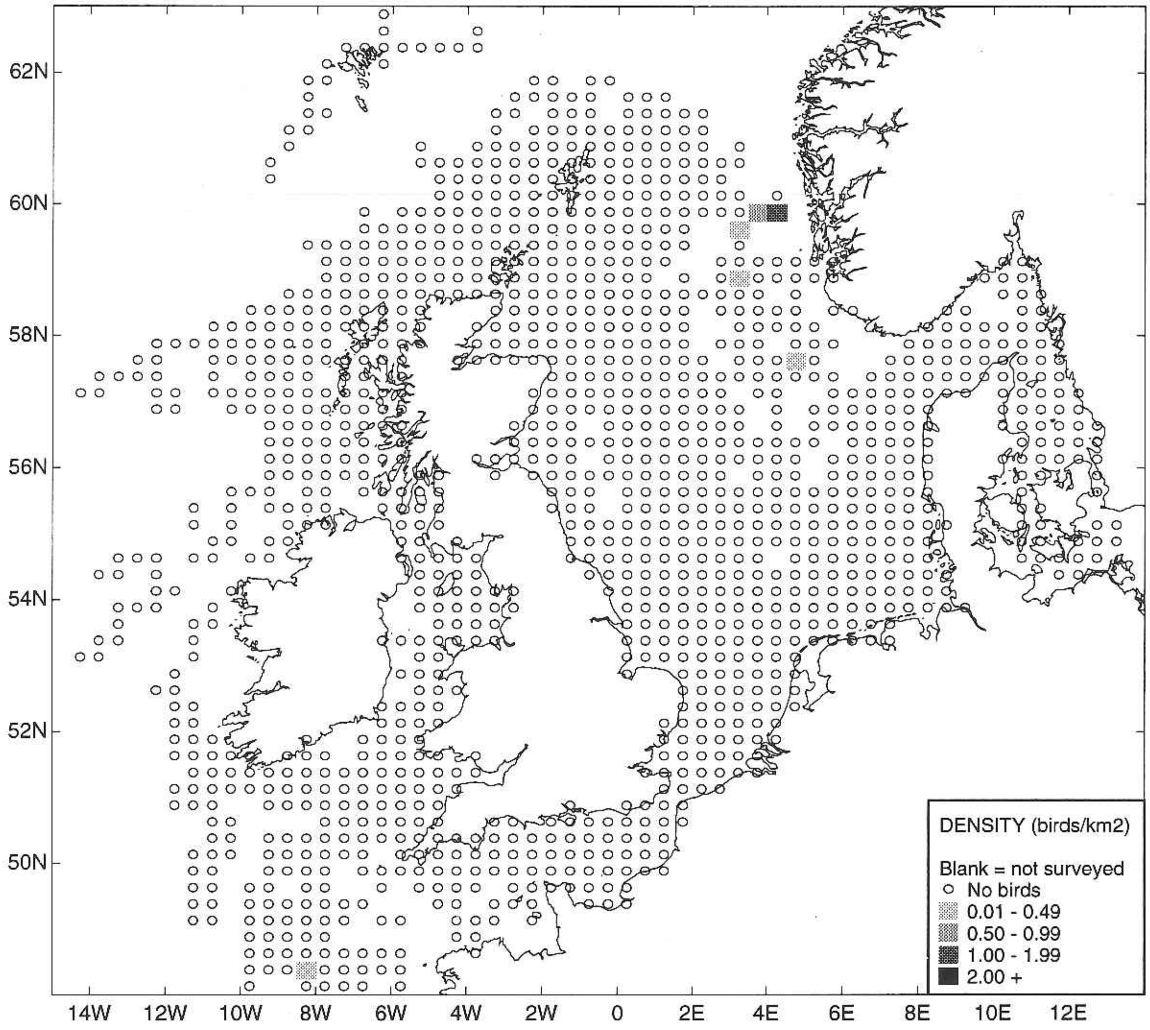

Figure 5.14.4 Distribution of storm petrels from December to April

December to April (Figure 5.14.4)

Very few storm petrels were seen over winter; moderate densities were seen to the west of Norway, and a low density in the South-west Approaches.

Summary and conservation implications

The main areas of importance for storm petrels were the continental shelf and shelf edge to the west of Scotland, and the Celtic Sea and shelf edge in the South-west Approaches. Although the waters of north-west Europe hold internationally important numbers of storm petrels in the summer months, they are not considered to be at risk from oil pollution as they spend little time in contact with the water.

Further reading

Benn, S., Webb, A., Burton, C.A., Tasker, M.L., Murray, S. & Tharme, A. 1987. Studies of seabirds at North Rona and Sula Sgeir, June 1986. *Nature Conservancy Council, CSD Report* No. 736.

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Durinck, J. & Lausten, M. 1990. Effekt af observationindsats på beskrivelsen af havfugles træk, Blåvandshuk 1978-1988. *Pelagicus 5:* 8-16.

Hall, A.J., Tasker, M.L. & Webb, A. 1987. The marine distribution of sooty shearwater, Manx shearwater, storm petrel and Leach's petrel in the North Sea. *Seabird 10:* 60-70.

Koerts, J. 1992. Fouragerende Stormvogeltjes *Hydrobates pelagicus* bij de pieren van IJmuiden, 22 september 1990. *Sula 6(1):* 19-20.

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report* No. 804.

Leopold, M.F. 1990. Distribution patterns of seabirds in the North Sea. *Annual Report of Netherlands Institute for Sea Research 17:* 72-74.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Table 5.14.1 Overall density of storm petrels (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density km^2	0.00 96.0	0.00 690.9	0.00 540.3	0.00 810.7	0.00 932.9	0.00 3476.9	0.00 526.5	- 0.00	0.00 67.2	0.00 493.4
Feb	Density km^2	0.00 338.0	0.00 778.9	0.00 1181.1	0.00 1258.0	0.00 2546.4	0.00 4386.0	0.00 476.2	0.00 113.5	0.00 191.0	0.00 563.2
Mar	Density km^2	0.00 374.7	0.00 1254.5	0.00 1178.7	0.00 278.1	0.00 849.8	0.00 2229.6	0.00 322.4	0.00 148.9	0.00 605.8	0.00 407.3
Apr	Density km^2	0.00 576.0	0.00 939.9	0.00 1243.0	0.00 269.6	0.01 1367.3	0.00 3255.5	0.00 395.0	0.00 98.9	0.00 550.9	0.00 787.8
May	Density km^2	0.07 451.6	0.01 920.5	0.00 1243.0	0.00 938.1	0.00 2980.1	0.00 3914.0	0.00 600.8	0.02 253.2	0.00 498.6	0.00 842.3
Jun	Density km^2	0.43 617.1	0.29 1763.0	0.00 1318.6	0.00 572.8	0.00 1889.7	0.00 1975.4	0.03 875.7	0.03 71.6	0.57 323.5	0.00 583.7
Jul	Density km^2	0.10 997.4	0.39 937.0	0.04 3635.3	0.02 1486.7	0.02 4782.4	0.00 2483.8	0.03 1017.3	6.68 153.8	3.04 939.6	0.01 644.1
Aug	Density km^2	0.09 867.9	0.16 2468.6	0.07 1377.9	0.00 2017.6	0.01 3842.1	0.00 4473.2	0.08 1061.6	0.37 292.2	0.23 524.3	0.15 896.4
Sep	Density km^2	0.07 208.9	0.08 493.3	0.02 1364.7	0.01 2774.0	0.01 2825.7	0.00 2824.4	0.02 1354.1	0.00 4.0	0.08 383.0	0.00 519.3
Oct	Density km^2	0.03 66.6	0.01 1354.6	0.01 572.7	0.00 745.6	0.00 1292.3	0.00 2869.9	0.00 356.6	0.08 12.6	0.00 297.6	0.02 811.0
Nov	Density km^2	0.00 116.3	0.00 425.6	0.00 872.7	0.00 553.7	0.00 1355.5	0.00 2588.8	0.00 264.6	0.03 76.3	0.01 710.4	0.10 856.2
Dec	Density km^2	0.00 76.0	0.00 293.8	0.00 606.6	0.00 714.3	0.00 395.0	0.00 1583.3	0.00 279.2	0.09 97.9	0.00 459.2	0.00 1257.2

5.15 LEACH'S PETREL *Oceanodroma leucorhoa*

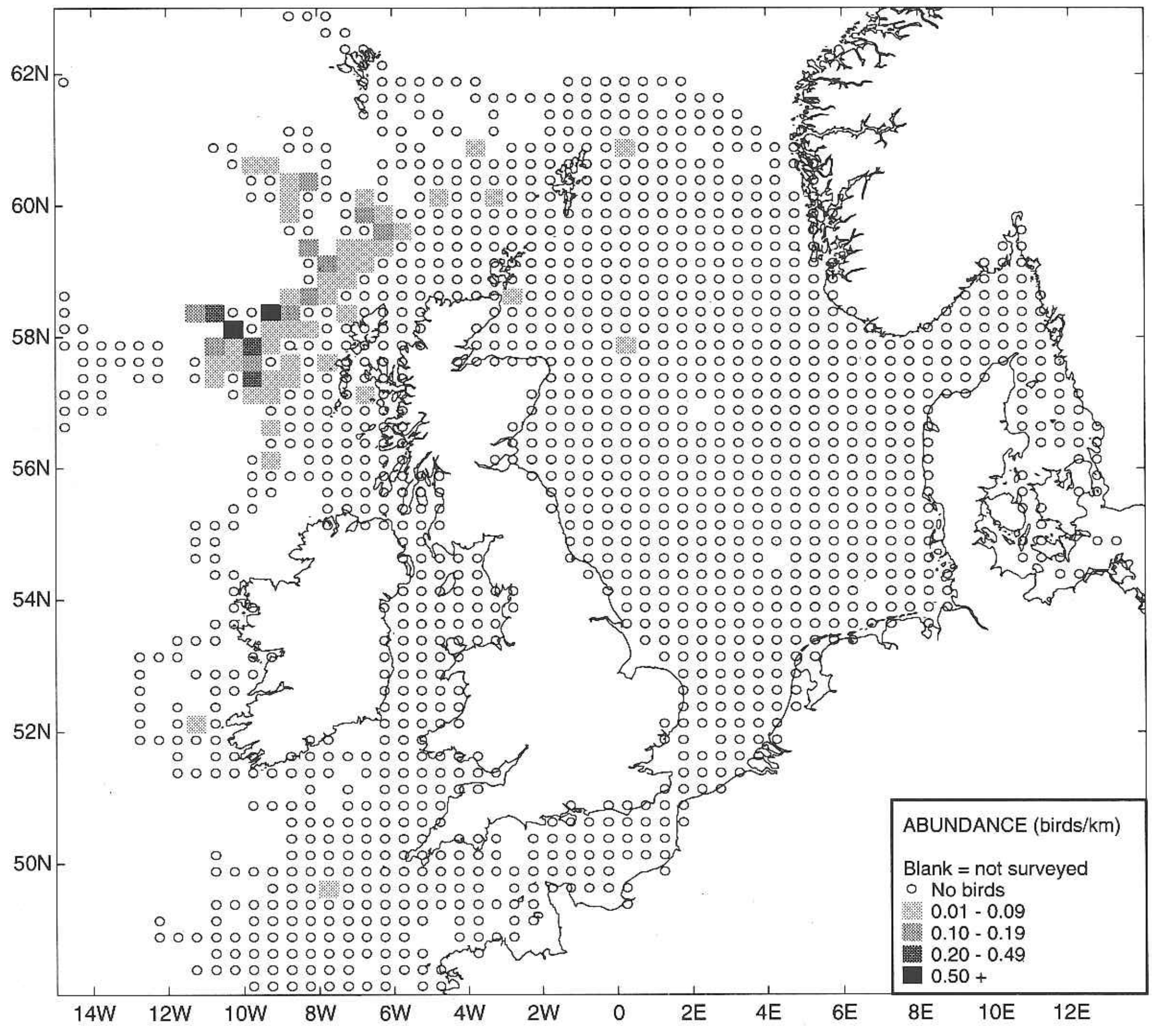

Figure 5.15.1 Distribution of Leach's petrels from May to August

May to August (Figure 5.15.1)

The distribution of Leach's petrels at this time was highly concentrated over the shelf edge and deeper waters to the north-west of Scotland (Table 5.15.1). Numbers here were mostly low, although some areas had moderate or high numbers, especially the waters around St Kilda, which holds the largest colony in the North-east Atlantic. Low numbers occasionally occurred elsewhere in the northern North Sea or in the South-west Approaches.

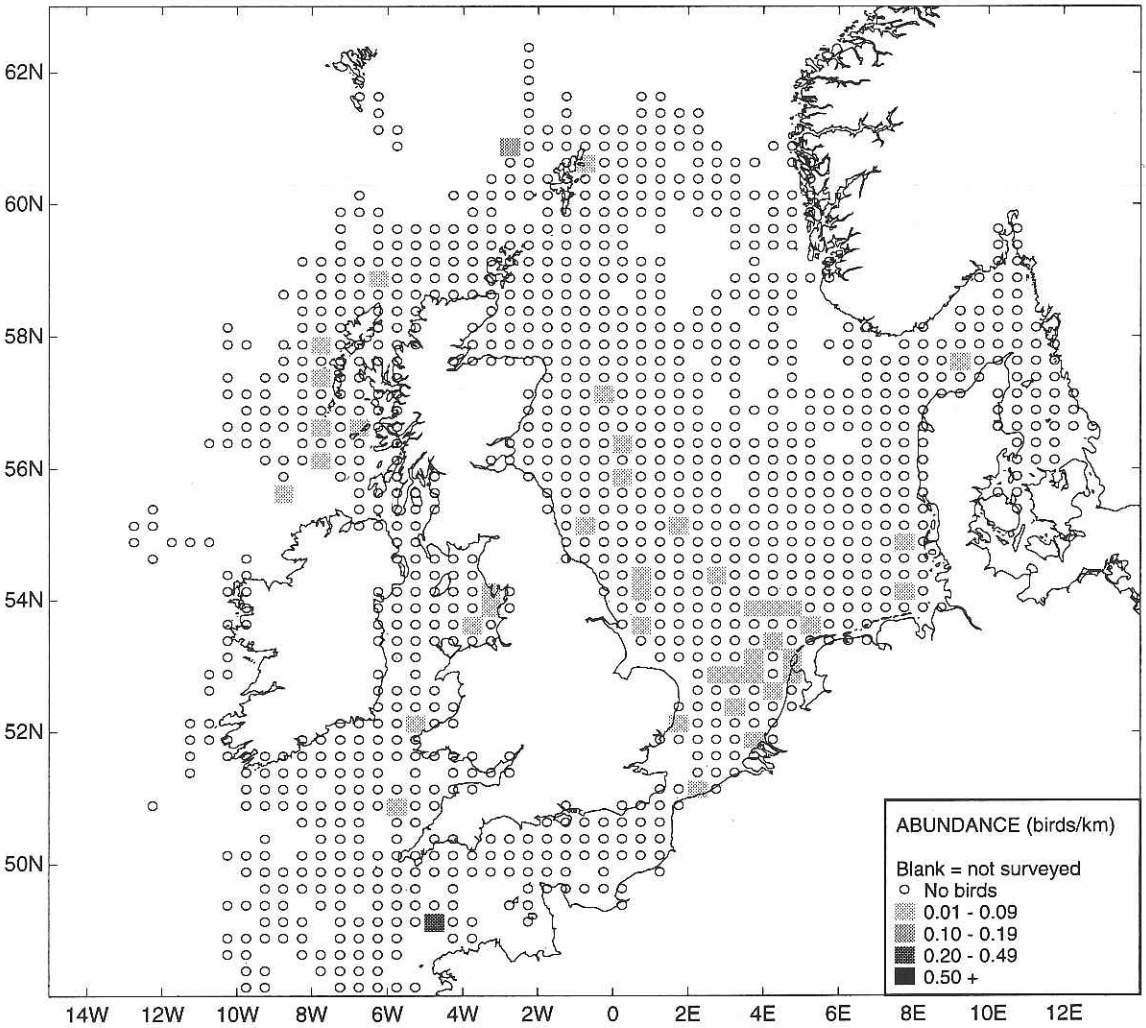

Figure 5.15.2 Distribution of Leach's petrels from September to November

September to November (Figure 5.15.2)

Leach's petrels are much more widely dispersed at this time. Low numbers occurred around the Outer Hebrides, Shetland, and in the eastern Irish Sea. Few were seen in the Celtic Sea/St. George's Channel, while several occurred in the western English Channel. They were widely dispersed at low numbers in the southern North Sea, particularly off the Netherlands coast, although this is probably an artefact of increased effort in this area.

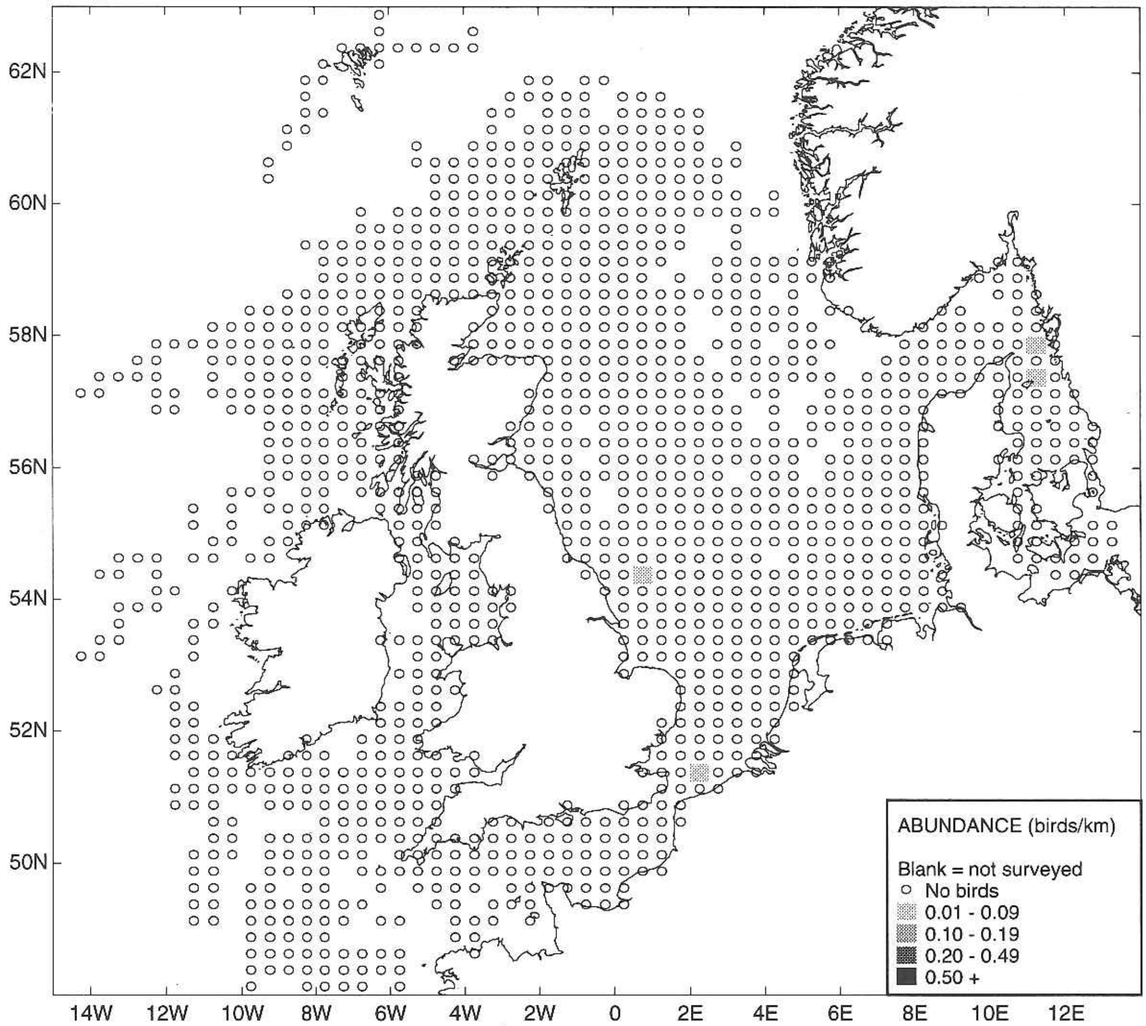

Figure 5.15.3 Distribution of Leach's petrels from December to April

December to April (Figure 5.15.3)

Very few were seen over winter/early spring, these only occurring in the southern North Sea.

Summary and conservation implications

The shelf break was particularly important for Leach's petrels during the main breeding season. In autumn the species was more widely dispersed, and in winter/early spring virtually disappeared from the study area. As it is mainly aerial in its habits, this species is considered to be at low risk from oil pollution.

Further reading

Camphuysen, C.J. & Dijk, J.van 1983. Zee- en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Hall, A.J., Tasker, M.L. & Webb, A. 1987. The marine distribution of sooty shearwater, Manx shearwater, storm petrel and Leach's petrel in the North Sea. *Seabird 10:* 60-70.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Skov, H., Durinck, J., Danielsen, F. & Bloch, D. 1994. The summer distribution of Procellariiformes in the central North Atlantic Ocean. *Die Vogelwarte 37:* 270-289.

Vandenbulcke, P. 1979. Een analyse van tien jaar zeevogelwaarnemingen langs de Belgische kust en in het binnenland, gebaseerd op de BAHC verslagen. *Veldorn. Tijdschr. 2:* 35-57.

Table 5.15.1 Overall abundance of Leach's petrels (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km	405.3	2302.8	1897.5	2832.0	3359.2	14424.8	1765.7	0.0	223.8	1938.2
Feb	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1136.0	2681.3	4390.1	4590.5	10380.2	16685.5	1594.8	378.2	636.7	1966.8
Mar	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1359.3	4407.8	4178.2	1127.8	3046.3	8348.4	1074.7	603.8	2060.7	1453.0
Apr	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1923.7	3268.0	4298.0	1040.3	4994.1	12048.2	1316.7	423.8	1982.2	2771.3
May	Abundance	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1720.5	3716.3	4328.5	3325.5	10357.4	14351.5	2403.5	844.0	1744.7	2807.7
Jun	Abundance	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2094.3	6186.1	4620.2	2149.0	7076.5	7362.2	2950.8	240.1	1078.2	1945.5
Jul	Abundance	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3534.2	3446.2	12530.7	5612.1	17245.2	8860.1	3675.7	514.0	3209.6	2152.2
Aug	Abundance	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8260.8	4596.0	7484.8	14003.9	15915.3	3600.3	929.7	1905.3	3074.4
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	1644.3	4671.7	9846.3	9932.6	10232.2	4515.7	13.3	1383.1	1730.8
Oct	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4531.3	2042.0	2560.6	4714.9	10964.7	1196.0	42.0	1196.0	2703.3
Nov	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	387.5	1418.8	2931.0	1966.3	5332.3	10038.5	916.6	327.2	2550.9	3040.3
Dec	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	253.2	979.2	2085.2	2383.7	1370.9	5821.5	940.5	335.6	1553.8	4586.5

5.16 GANNET *Morus bassanus*

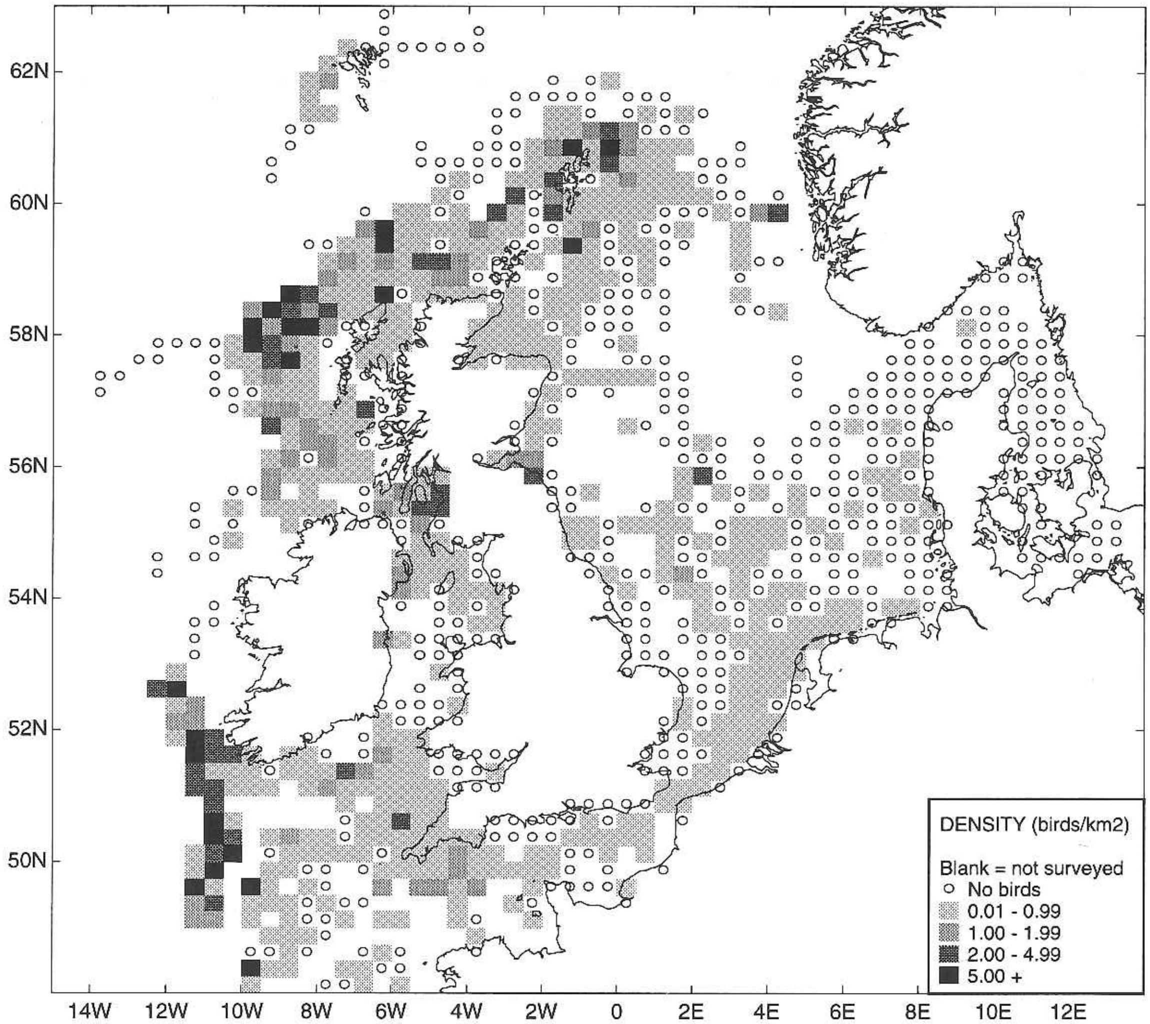

Figure 5.16.1 Distribution of gannets in March and April

March to April (Figure 5.16.1)

Gannets were widespread throughout most areas studied (Table 5.16.1) although highest densities were found at the shelf edge. High densities occurred around the colonies at St Kilda, Shetland and south-west Ireland, with moderate densities near other colonies: Ailsa Craig (Firth of Clyde), Grassholm (Pembrokeshire Islands), Bass Rock (in the Firth of Forth) and the Faeroes. Low or moderate densities were found throughout the Celtic Sea, the western English Channel and the continental shelf to the west of Scotland. Low densities were found in the Moray Firth, the eastern English Channel and along the Belgian and Dutch coasts (the latter probably being an artefact of increased effort in this area). Gannets were absent from the Kattegat and the Belt Sea.

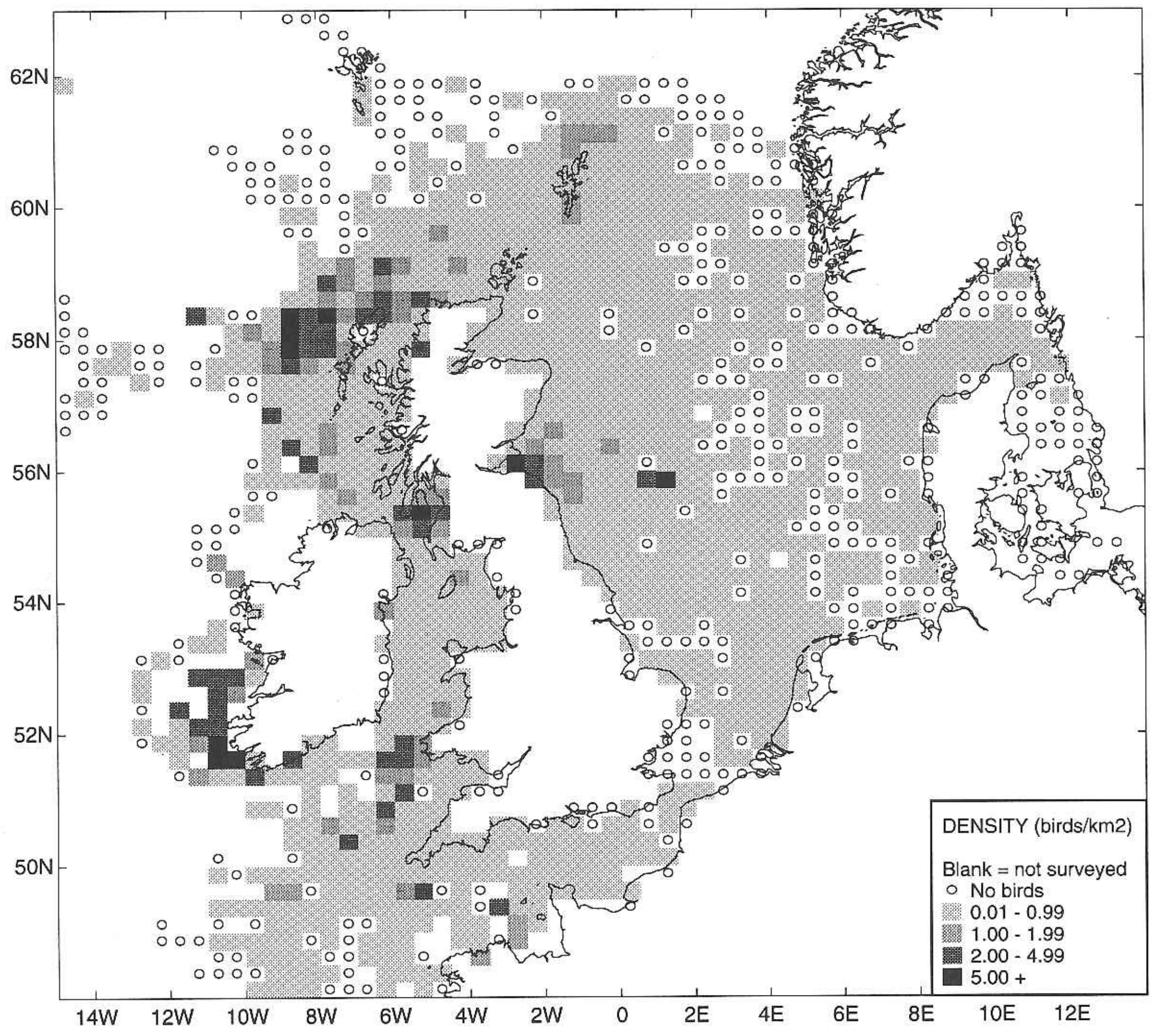

Figure 5.16.2 Distribution of gannets from May to August

May to August (Figure 5.16.2)

During this period gannets are involved in egg-incubation and chick-rearing. Their distribution was widespread but highest densities were seen near the colonies at St Kilda, Ailsa Craig, Grassholm, Bass Rock, Ortac (in the Channel Islands), and in south-west Ireland. Moderate densities were seen around the colonies at Shetland, and low densities around the colonies on the Faeroes. Beyond the colonies gannets were widespread at mostly low densities over the continental shelf and shelf edge. Few gannets were seen in the Kattegat, and none in the Belt Sea.

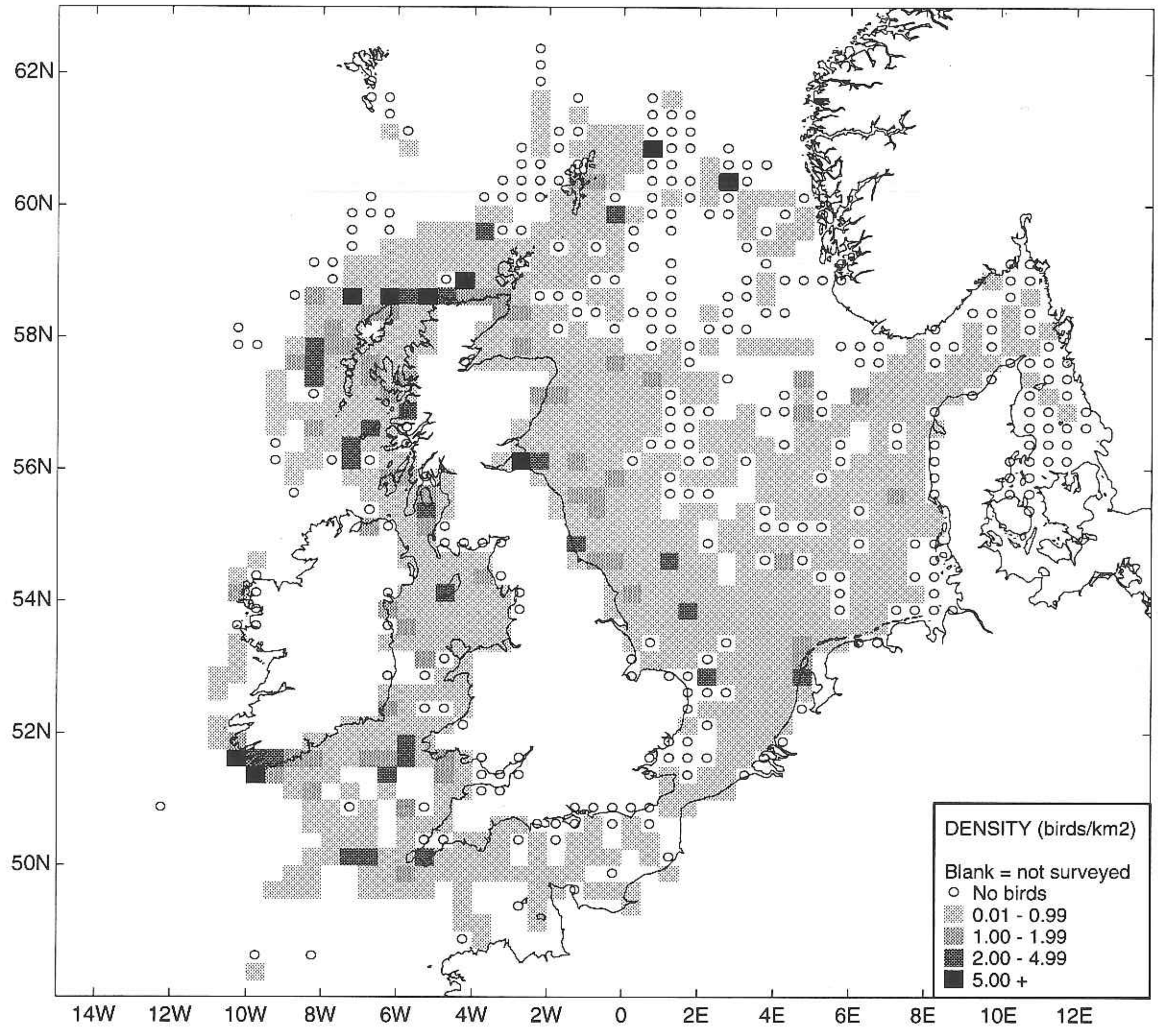

Figure 5.16.3 Distribution of gannets in September and October

September to October (Figure 5.16.3)

The chicks have fledged at this time; although there were still concentrations of gannets around the colonies, densities there were less than in previous months. Again, low densities were widespread throughout the continental shelf and shelf edge in the study area. Numbers of gannets off the Netherlands and Belgium coasts varied between years as a result of fluctuations in the availability of herring (Leopold & Platteeuw 1987.)

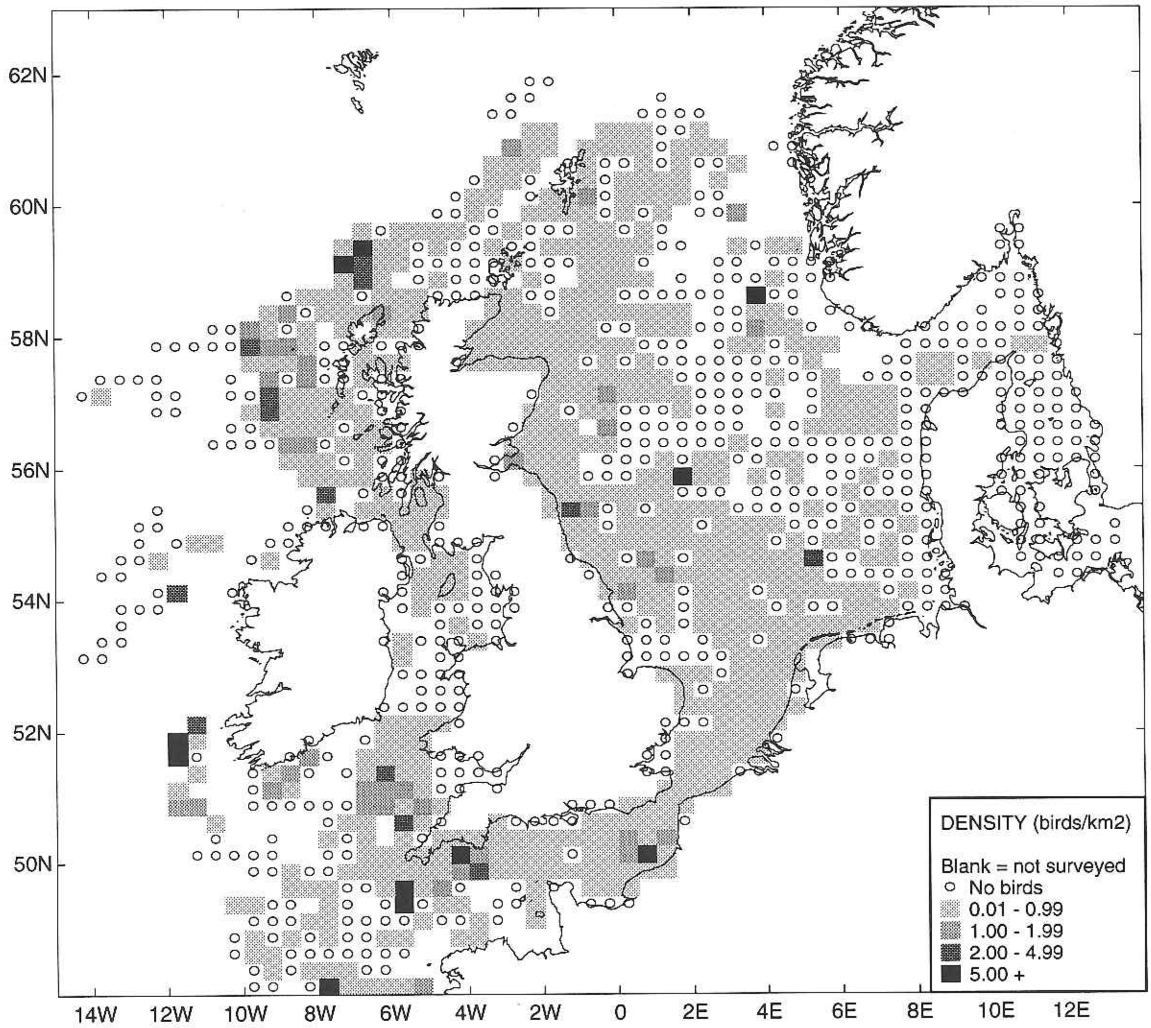

Figure 5.16.4 Distribution of gannets from November to February

November to February (Figure 5.16.4)

Moderate to high densities were found at the shelf edge to the west of Scotland and in the South-west Approaches over winter. Other concentrations occurred in the western English Channel and the Celtic Sea. Low densities were widespread in most areas, but were more thinly scattered in the north-eastern North Sea, and were absent from the Kattegat and Belt Sea.

Summary and conservation implications

Approximately 70% of the world population of the North Atlantic gannet breeds in Britain and Ireland. Their distribution was widespread, with the Kattegat and Belt Sea being the only places where they were virtually never seen. The shelf edge and outer continental shelf were important foraging areas, particularly outside the main breeding season. During the breeding season gannets were concentrated around the colonies. As there are relatively few colonies compared to other seabird species, an oil spill close to these colonies during the breeding season could have serious consequences for gannets. Like fulmars, gannets spend more time at sea than other species, particularly outside the breeding season; because of their need to run with headwinds to become airborne they are more likely to become contaminated with oil when escaping slicks than, for instance, gulls. However, away from the colonies this risk is offset somewhat by their large foraging range and their aerial lifestyle. Their main distribution area is in relatively clean Atlantic water; densities in polluted areas of the North Sea are low, therefore losses from chronic oil pollution are insignificant. Entanglement in fishing gear is common in gannets (Camphuysen 1990).

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, C.J. 1989. Beached bird surveys in the Netherlands 1915-1988. *Techn. Rapp. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam.*

Camphuysen, C.J. 1990. Verstrikking van zeevogels in plastics: een probleem van toenemende omvang? *Sula 4(1):* 12-18.

Camphuysen, C.J. 1994. Verstrikkingen van vogels in plastics en vistuig aan de Nederlandse kust, 1990-93. *Sula 8(3):* 226-229.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Durinck, J. & Lausten, M. 1990. Effekt af observationindsats på beskrivelsen af havfugles træk, Blåvandshuk 1978-1988. *Pelagicus 5:* 8-16.

Joiris, C. 1983. Seabirds recorded in the Fladenground area, Northern North Sea in April, May and June 1976. In, Sünderman & Lenz (eds.), *North Sea Dynamics*, Springer Verlag, pp. 676-685.

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report* No. 804.

Leopold, M.F. & Platteeuw, M. 1987. Talrijk voorkomen van Jan van Genten *Sula bassana* bij Texel in de herfst: reactie op lokale voedselsituatie. *Limosa 60(3):* 105-110.

Lindgren, L. 1986. Forekomsten af Suler *Sula bassana* i Kattegat 1985. *Pelagicus 1:* 15-18.

Meltofte, H. & Overlund, E. 1974. Forekomsten af Suler *Sula bassana* ved Blåvandshuk 1963-1971. *Dansk Orn. Foren. Tidsskr. 68:* 43-48.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Stone, C.J., Harrison, N.M., Webb, A., & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30.

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Tasker, M.L., Hope Jones, P., Blake, B.F. & Dixon, T.J. 1985. The marine distribution of the gannet *Sula bassana* in the North Sea. *Bird Study 32:* 82-90.

Zoun, P.E.F. & Boshuizen, R.S. 1992. Gannets victim to spillage of lubricating oil and dodecylphenol in the North Sea, winter 1990. *Sula 6(1):* 29-30.

Table 5.16.1 Overall density of gannets (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	1.17	0.37	0.12	0.16	0.09	0.01	0.02	-	0.06	0.31
	km^2	96.0	1292.1	774.8	1122.9	1078.8	4048.0	896.7	0.0	71.2	899.0
Feb	Density	0.57	0.64	0.19	0.72	0.21	0.04	0.14	2.42	1.51	0.54
	km^2	338.0	778.9	1372.2	1258.0	2993.5	5770.6	476.2	113.5	191.0	563.2
Mar	Density	0.51	0.85	0.48	0.18	0.19	0.08	0.11	4.99	1.84	0.22
	km^2	374.7	1385.1	1388.4	597.0	1014.7	3101.8	581.6	148.9	609.3	780.0
Apr	Density	4.81	2.34	0.77	0.39	0.11	0.04	0.29	0.93	0.52	0.21
	km^2	576.0	944.6	1243.0	269.6	1743.2	4940.1	483.9	98.9	550.9	787.8
May	Density	0.39	1.58	0.18	0.30	0.02	0.02	0.20	0.36	0.45	0.12
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4024.2	978.9	253.2	501.1	1242.0
Jun	Density	0.66	1.95	0.23	0.49	0.04	0.02	1.39	0.07	0.36	0.35
	km^2	617.1	1763.0	1318.6	572.8	2113.5	2654.2	875.7	71.6	323.5	583.7
Jul	Density	0.29	1.37	0.36	0.40	0.12	0.03	0.46	1.24	1.11	0.24
	km^2	997.4	1512.4	3659.1	1796.0	4782.4	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.20	1.91	0.30	0.81	0.10	0.07	0.80	0.12	0.53	0.55
	km^2	867.9	2468.6	1377.9	2081.2	4028.8	4952.2	1061.6	292.2	524.3	896.4
Sep	Density	0.08	1.04	0.54	0.82	0.23	0.17	0.56	0.00	0.65	0.26
	km^2	208.9	1059.6	1389.6	3103.1	3079.4	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	0.54	1.83	0.26	0.50	0.28	0.35	0.44	0.24	1.68	0.33
	km^2	66.6	1354.6	572.7	745.6	1413.5	3335.5	356.6	12.6	297.6	811.0
Nov	Density	0.19	0.11	0.20	0.14	0.18	0.16	0.04	0.14	0.56	0.77
	km^2	116.3	561.5	1013.7	869.8	1578.6	3648.5	587.7	76.3	710.4	859.0
Dec	Density	0.14	0.10	0.06	0.08	0.68	0.08	0.05	1.39	0.22	0.74
	km^2	76.0	586.1	606.6	847.5	736.5	2873.1	280.7	97.9	460.5	1476.1

5.17 CORMORANT *Phalacrocorax carbo*

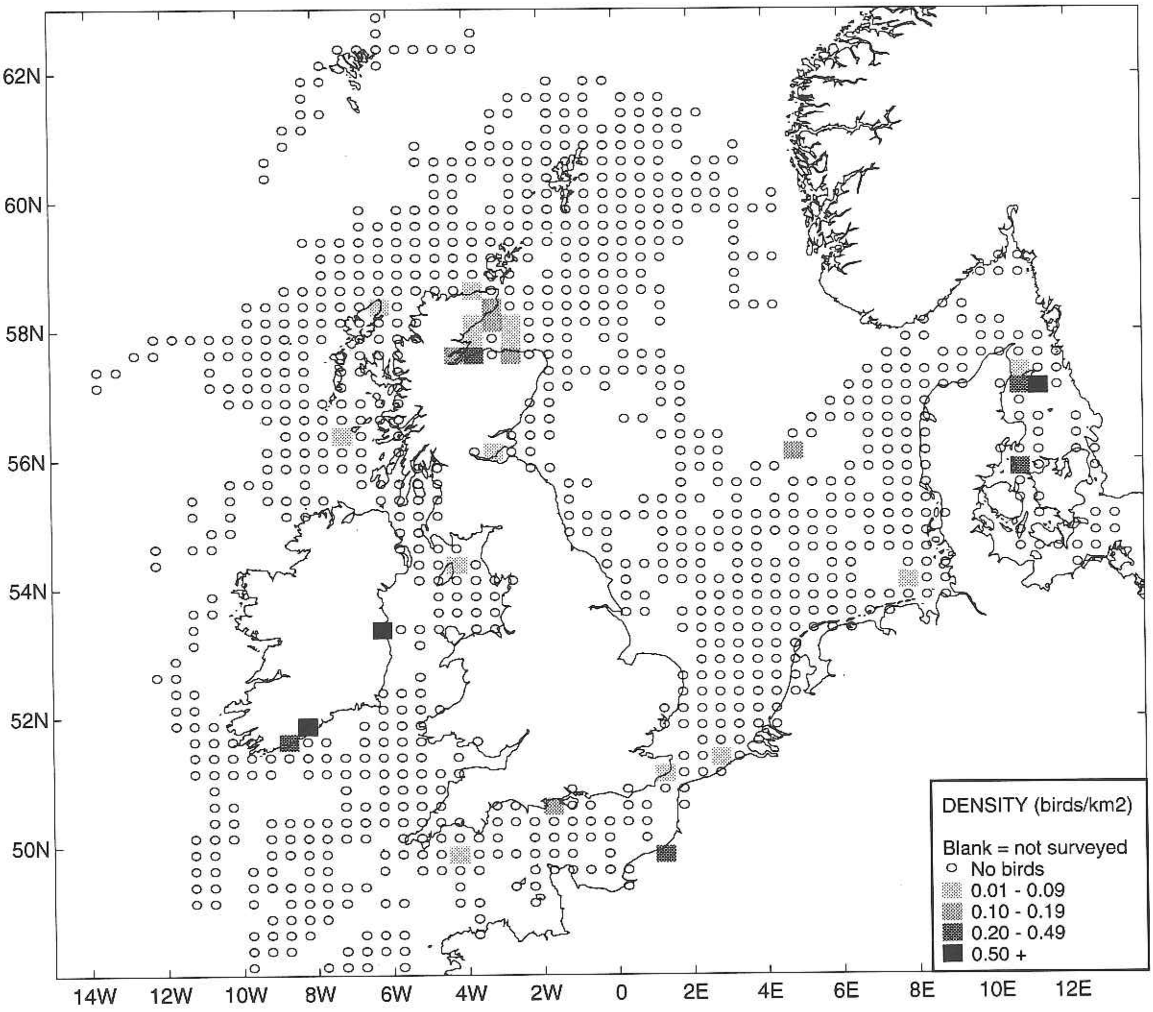

Figure 5.17.1 Distribution of cormorants in March and April

March to April (Figure 5.17.1)

Cormorants occurred in various coastal locations, most commonly in the Moray Firth and in the Kattegat, where densities were highest. *P. c. carbo* and *P. c. sinensis* were not identified separately.

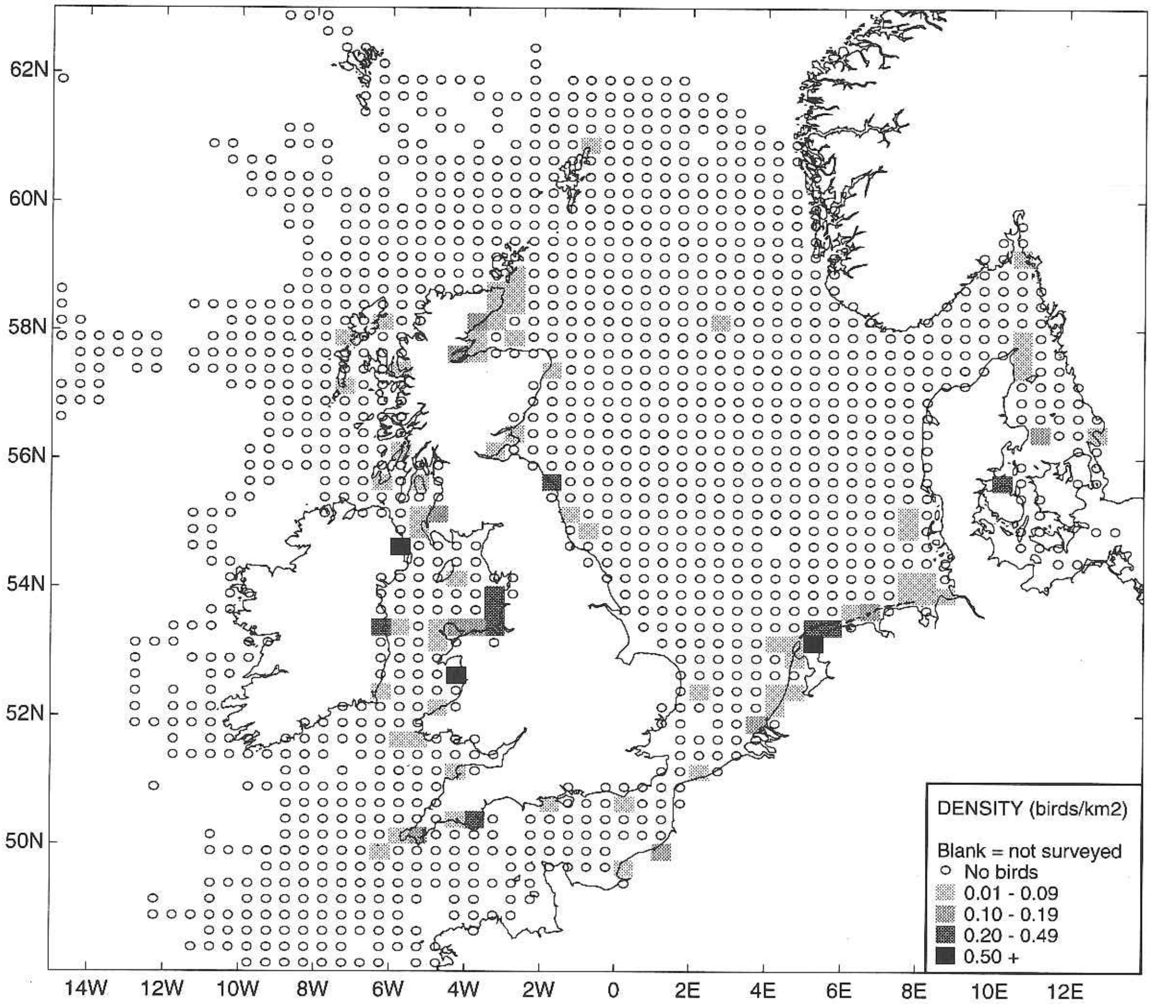

Figure 5.17.2 Distribution of cormorants from May to September

May to September (Figure 5.17.2)

Cormorants were present in coastal waters around Britain and the southern North Sea. High densities were found around the Netherlands coast, particularly around Texel; these were probably non-breeding birds, although recent colonies have been formed in the Dutch Wadden Sea (e.g. Leopold & Van den Berg 1992). Other concentrations were found in Liverpool Bay and the Moray Firth. Cormorants were more widespread than in previous months. Due to difficulty in distinguishing cormorants from shags, aerial survey data for cormorants has not been included. However, aerial surveys in Danish waters have found a maximum of 44 000 cormorants in August, exceeding winter numbers (Laursen *et al.* 1989). Continental birds were probably mostly *P. c. sinensis*, although *P. c. carbo* arrive in large numbers during September.

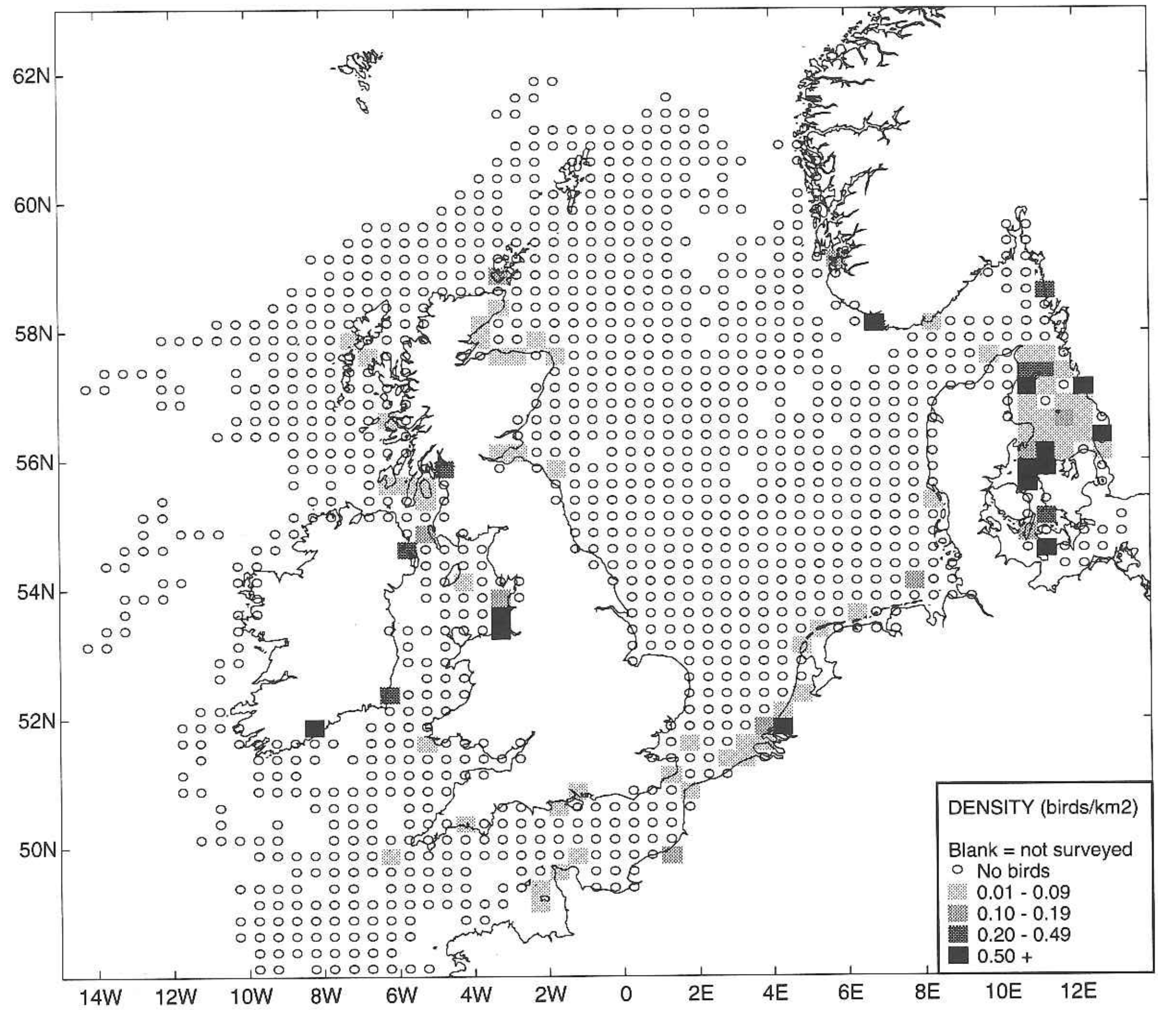

Figure 5.17.3 Distribution of cormorants from October to February

October to February (Figure 5.17.3)

Cormorant distribution remained coastal during this period. The increase in densities in the Kattegat and Belt Sea compared to other times of year (Table 5.17.1) is probably an artefact of greater survey effort during winter months. Low densities of migrating birds were found along the Netherlands and Belgium coasts. High densities were seen in Liverpool Bay. Low densities were found around the west coast of Scotland and near the Channel Islands and the Cherbourg Peninsula. Estuarine areas, such as the Firths of Forth and Tay, the Moray Firth, the Clyde and the Solent also had low densities of cormorants.

Summary and conservation implications

Cormorants were found at sea only in coastal areas. Densities in the coastal zone were probably higher than represented here as surveys were conducted away from the immediate vicinity of the coast. Liverpool Bay and the Moray Firth held concentrations of cormorants. The population of cormorants on the continent has been increasing, and due to the lack of fresh water many birds have been moving to the sea. This was reflected in the widespread occurrence of birds along the Dutch coast. The low salinity Kattegat and Belt Sea were important areas. Cormorants are highly vulnerable to oil pollution as they spend much time on the sea surface whilst feeding. The concentrations described above and waters around large colonies would be at greatest risk from oil pollution.

Further reading

Baptist, H.J.M. 1988. Vogelconcentraties in de Voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Camphuysen, C.J. 1989. Beached bird surveys in the Netherlands 1915-1988. *Techn. Rapp. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam.*

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Gregersen, J. 1987. Bestanden af Mellemskarv i Danmark 1987. *Dansk Orn. Foren. Tidsskr. 81:* 177.

Gregersen, J. 1991. The development of the Danish Cormorant population 1980-1988 and some comments on the breeding success. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 36-38.

Hansen, K. 1984. The distribution and numbers of the southern Cormorant *Phalacrocorax carbo sinensis* in Europe. *Dansk Orn. Foren. Tidsskr. 78:* 29-40.

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1989. Landsdækkende optælling af vandfugle fra flyvemaskine, august 1989. *Rapport fra Vildtbiologisk Station Miljøministeriets Vildtforvaltning December 1989.*

Leopold, M.F. & Berg, J. van den 1992. Een zoutwater-kolonie Aalscholvers *Phalacrocorax carbo* in Groningen. *Sula 6(3):* 100-102.

Lok, C.M. & Bakker, L. 1988. Seizoengebonden terreinkeuze van Aalscholvers *Phalacrocorax carbo* op Voorne. *Limosa 61(1):* 7-12.

Menke, T. 1991. Recent population development of the Cormorant *Phalacrocorax carbo sinensis* in the Federal Republic of Germany. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 49-52.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Zijlstra, M. & Eerden, M.R. van 1991. Development of the breeding population of the Cormorant *Phalacrocorax carbo* in the Netherlands till 1989. In, van Eerden, M.R. & Zijlstra, M. (eds). *Proceedings workshop 1989 on cormorants* Phalacrocorax carbo, Rijkswaterstaat, Dir. Flevoland, Lelystad, pp. 53-60.

Table 5.17.1 Overall density of cormorants (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.01	0.00	0.00	0.05	0.00	-	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.01	0.00	0.00	0.00	0.05	0.05	0.00	0.01	0.01
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.01	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	0.02	0.01	0.00	0.00	0.03	0.03	0.00	0.00	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.01	0.01	0.00	0.03	0.01	0.00	0.00	0.01
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.03	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.00	0.00	0.01
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.01
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.01	0.00	0.00	0.03	0.02	0.24	0.00	0.00	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.02	0.00	0.01	0.00	0.00	0.13	0.00	0.00	0.00
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.18 SHAG *Phalacrocorax aristotelis*

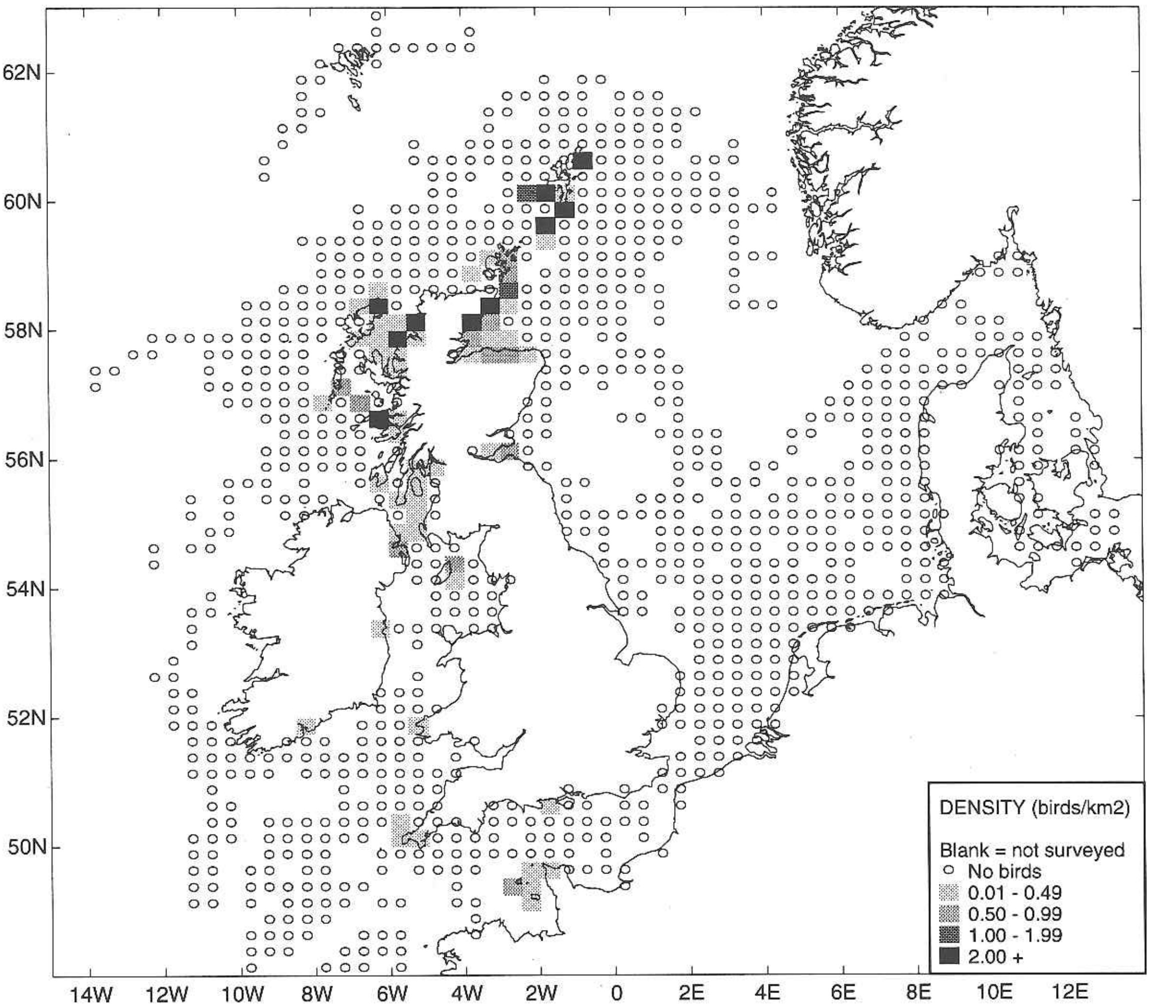

Figure 5.18.1 Distribution of shags in March and April

March to April (Figure 5.18.1)

Shags were mainly distributed around the colonies in Orkney and Shetland, the Moray Firth, Firth of Forth and west coast of Scotland (Table 5.18.1). Low densities were seen around the Channel Islands, south-west Cornwall and the Isle of Man, with occasional occurrences elsewhere.

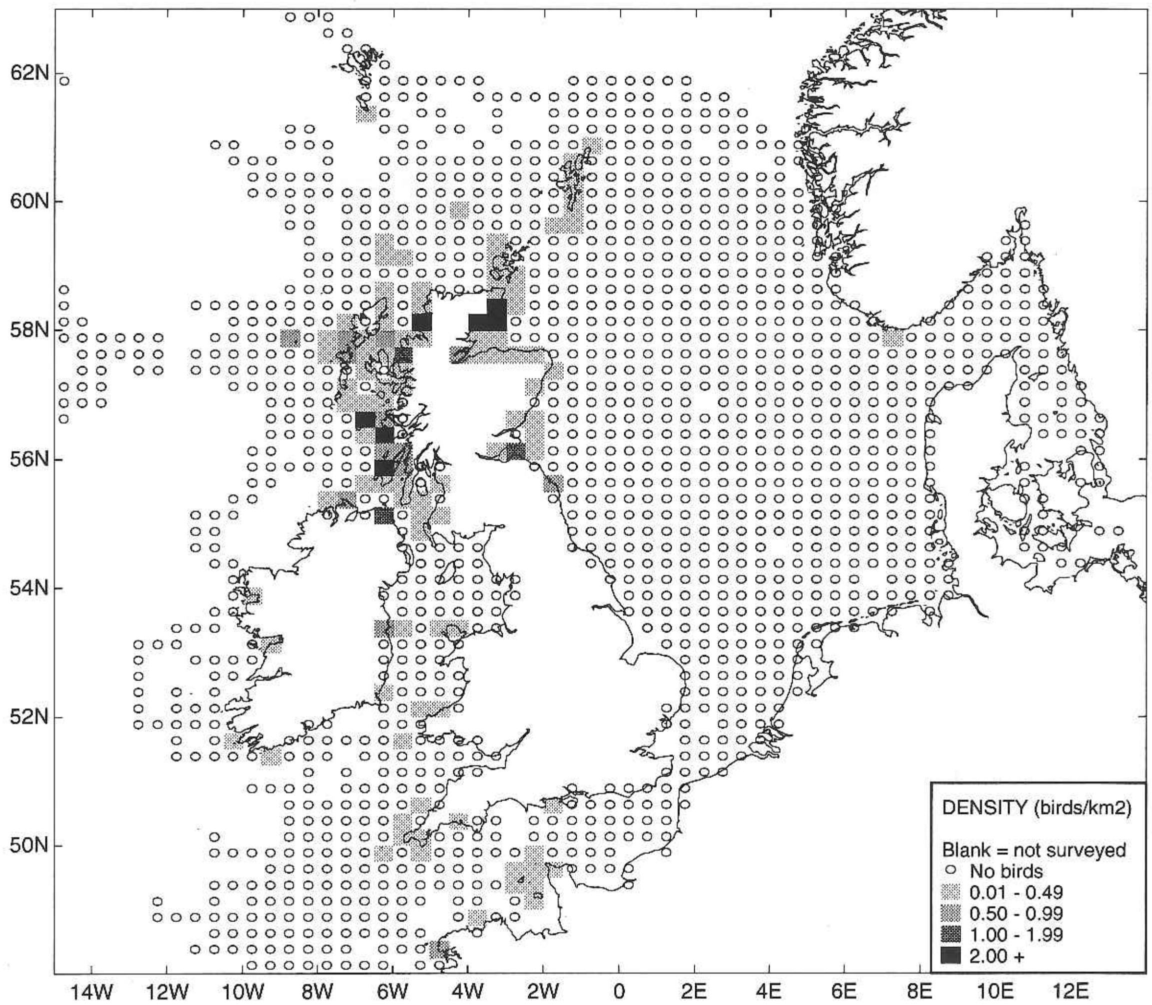

Figure 5.18.2 Distribution of shags from May to August

May to August (Figure 5.18.2)

Low densities were widespread around the colonies in Orkney and Shetland, the Moray Firth, Firth of Forth and west coast of Scotland, extending slightly further out to sea than in other months. High densities were found around the coasts of Caithness and the Inner Hebrides. Low densities were scattered elsewhere, particularly around Cornwall and the Channel Islands.

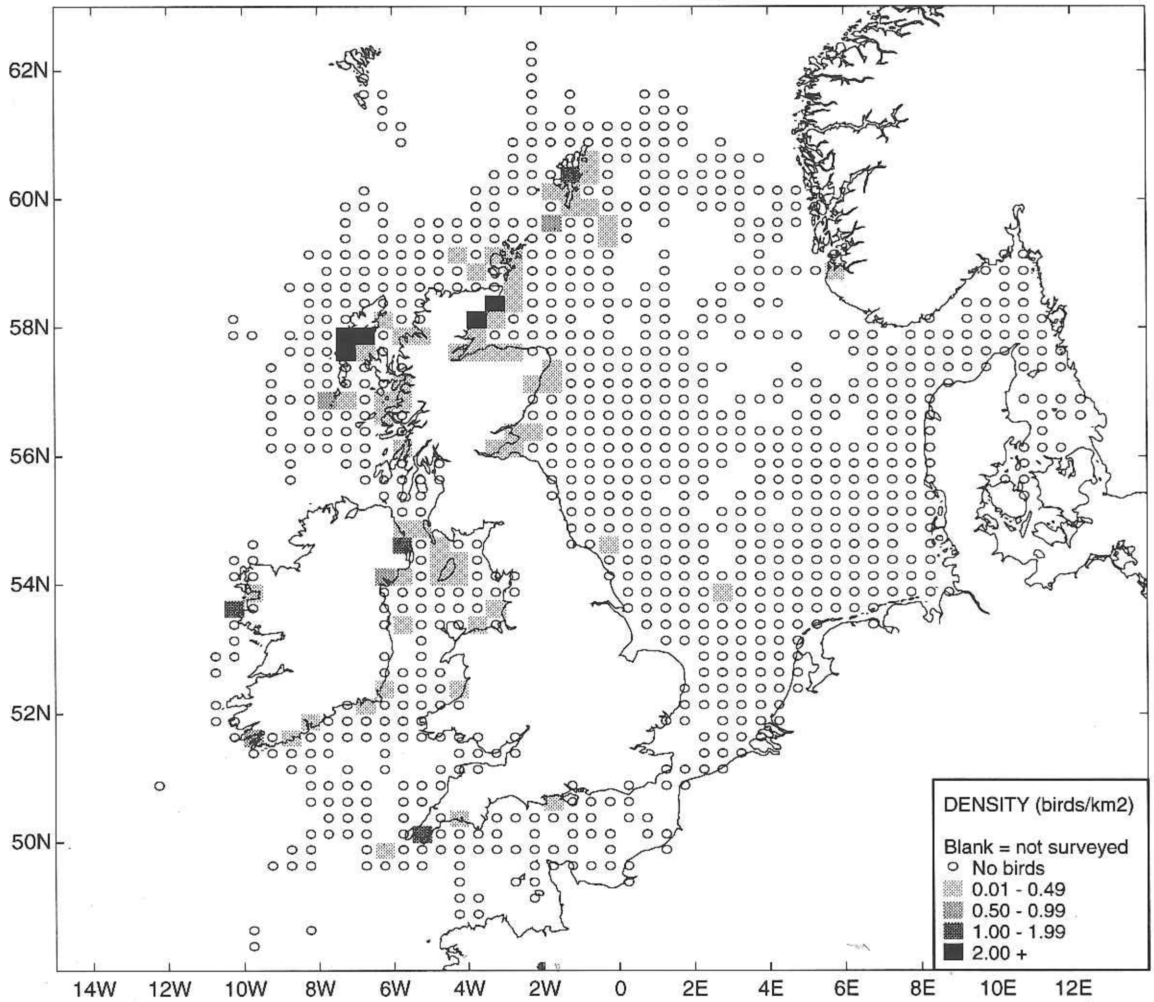

Figure 5.18.3 Distribution of shags in September and October

September to October (Figure 5.18.3)

Shags remained in coastal areas, with highest densities around the Outer Hebrides and Caithness. Low densities were widespread around the coasts of Scotland, the Northern Isles, the Isle of Man and in the North Channel. Low densities were seen elsewhere around British coasts.

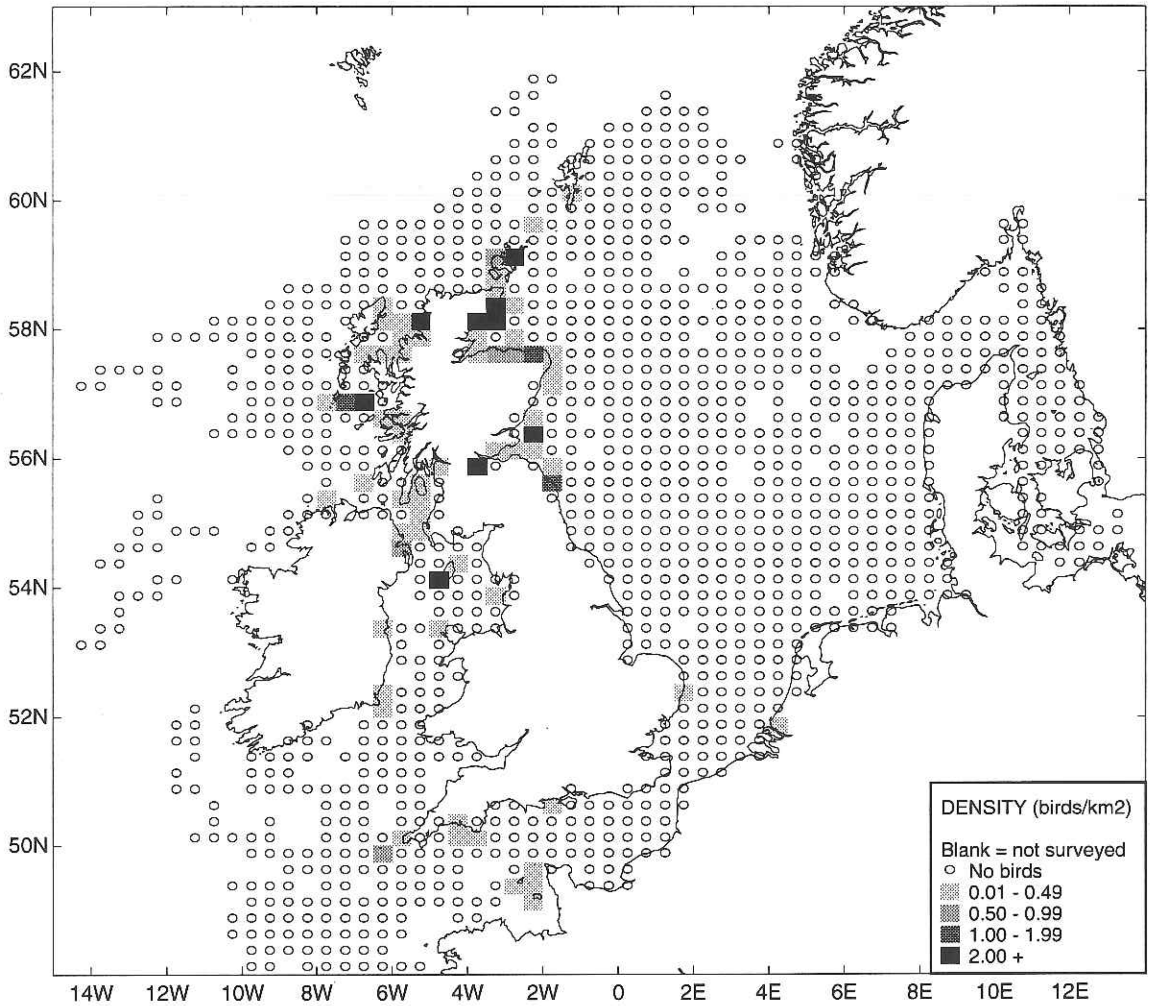

Figure 5.18.4 Distribution of shags from November to February

November to February (Figure 5.18.4)

There was a similar distribution to that of March to April, with shags generally restricted to the coastal waters of Scotland. Densities were highest around Caithness. Elsewhere in the study area shags were thinly scattered at low densities, with some observed along the south coast of England and in the Channel Islands.

Summary and conservation implications

Shags were found in highest numbers around the coast of Scotland and to a lesser extent the rest of Britain and the Channel Islands. They were most widespread from May to August. Shags are highly vulnerable to oil pollution as they spend a considerable proportion of their lives on the sea surface. Although they roost on land, which may lessen their vulnerability slightly, they occur in flocks on the sea, hence numbers affected in oil incidents tend to be high. This species would be at greatest risk from oil pollution in coastal waters in the regions where they occur.

Further reading

Elkins, N. & Williams, M.R. 1972. Aspects of seabird movement off northeast Scotland. *Scot. Birds 7:* 66-75.

Galbraith, H., Russell, S. & Furness, R.W. 1981. Movements and mortality of Isle of May Shags as shown by ringing recoveries. *Ringing and Migration 3:* 181-189.

Galbraith, H., Baillie, S.R., Furness, R.W. & Russell, S. 1986. Regional variations in the dispersal patterns of Shags *Phalacrocorax aristotelis* in northern Europe. *Ornis Scand. 17:* 68-74.

Johansen, O. 1975. Forholdet mellom hekke- og overvintringssteder hos toppskarv i norge som vist ved ringmerkingsgjenfunn. *Sterna 14:* 1-21.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Pearson, T.H. 1968. The feeding biology of seabird species breeding on the Farne Islands, Northumberland. *J. Anim. Ecol. 37:* 521-552.

Phillips, N.A. 1967. After the Torrey Canyon: Results of the pollution and census of Cornish breeding seabirds in 1967. *Cornwall Bird-watching and Preservation Society, 1967 Ann. Rep.* 90-129.

Rees, E.I.S. 1965. The feeding range of Shags. *Brit. Birds 58 (12):* 508-509.

Schuyter, T. de 1988. Influx van Kuifaalscholvers (*Phalacrocorax aristotelis*) te Zeebrugge en Oostende in het voorjaar van 1988. *Mergus 2(3):* 137-141.

Swann, R.L. & Ramsay, A.D.K. 1979. An analysis of Shag recoveries from North West Scotland. *Ringing and Migration 2:* 137-143.

Tasker, M.L. 1994. East coast seabird wreck, February 1994. *Seabird Group Newsletter 68:* 1.

Wanless, S. & Harris, M.P. 1992. At-sea activity budgets of a pursuit-diving seabird monitored by radiotelemetry. In, Priede, I.G. & Swift, S.M. (eds.), *Wildlife telemetry. Remote monitoring and tracking of animals*, Ellis Horwood, Chichester, U.K., pp 591-598.

Wanless, S., Harris, M.P. & Morris, J.A. 1991. Foraging range and feeding locations of shags *Phalacrocorax aristotelis* during chick rearing. *Ibis 133:* 30-36.

Table 5.18.1 Overall density of shags (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^{2}).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.06	0.40	0.00	0.00	0.00	0.10	-	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.31	0.26	0.06	0.00	0.00	0.04	0.00	0.00	0.03
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.58	0.75	0.11	0.00	0.00	0.03	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.23	1.08	0.05	0.00	0.00	0.03	0.00	0.00	0.03
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.01	0.03	0.36	0.04	0.00	0.00	0.01	0.00	0.00	0.02
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.22	0.54	0.23	0.00	0.00	0.00	0.00	0.00	0.01
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.01	0.35	0.00	0.00	0.00	0.02	0.00	0.01	0.07
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.23	0.34	0.01	0.00	0.00	0.01	0.00	0.01	0.02
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.04	0.66	0.00	0.00	0.00	0.03	0.00	0.00	0.03
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.10	0.10	0.05	0.00	0.00	0.02	0.00	0.09	0.01
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.12	1.25	0.01	0.00	0.00	0.02	0.00	0.00	0.01
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.25	0.19	0.41	0.00	0.00	0.05	0.00	0.00	0.01
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.19 EIDER *Somateria mollissima*

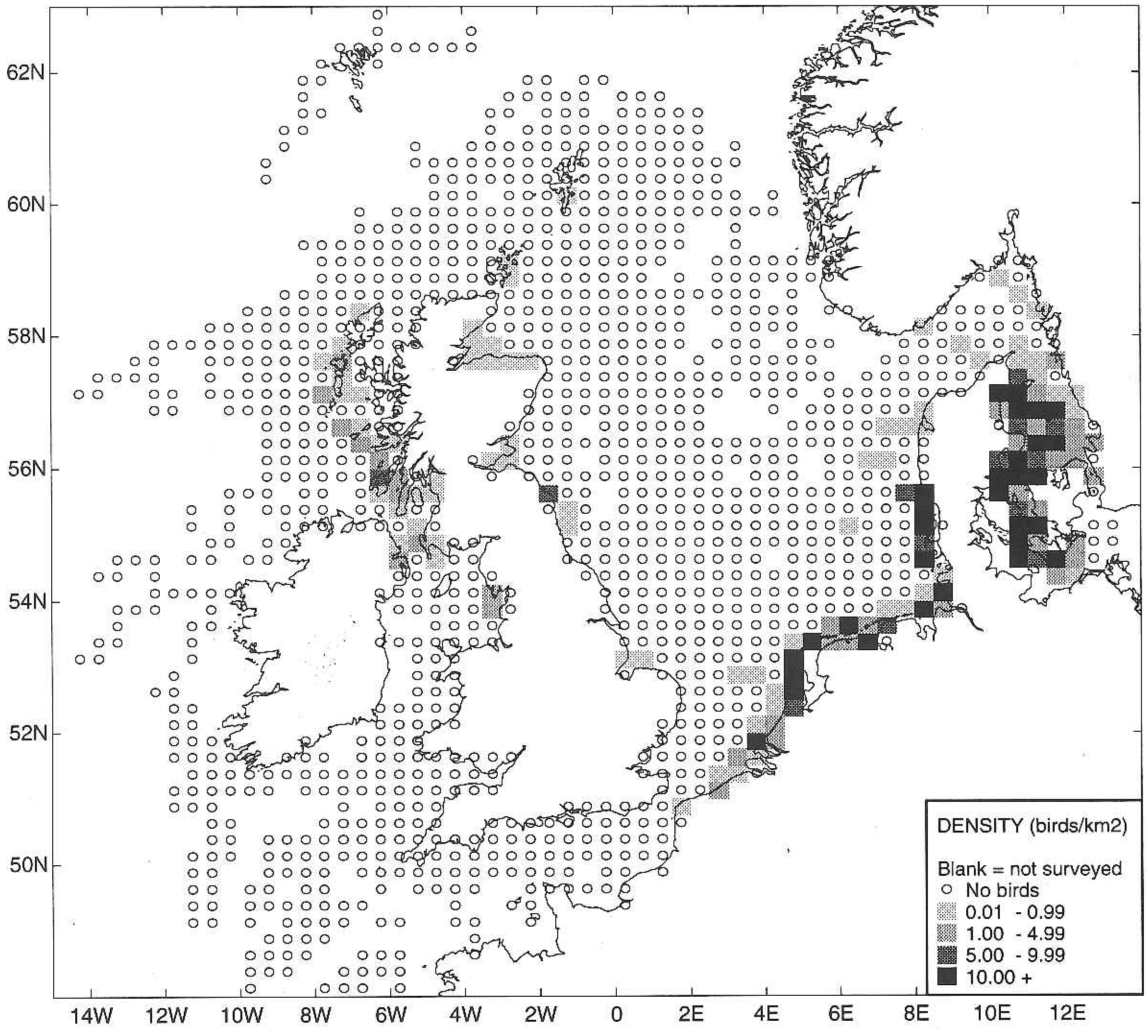

Figure 5.19.1 Distribution of eiders from January to April

January to April (Figure 5.19.1)

Highest densities of eider were found in the Kattegat and Belt Sea (a peak of 324.67 birds.km^{-2} in the Belt Sea), and also along the continental coast of the southern North Sea, from Denmark to Belgium (Table 5.19.1). Birds were also present in moderate densities around the west coast of Scotland and in Morecambe Bay. Lower densities occurred in the Skagerrak, in the Moray Firth, the Firth of Forth, off the Farne Islands and in the Wash.

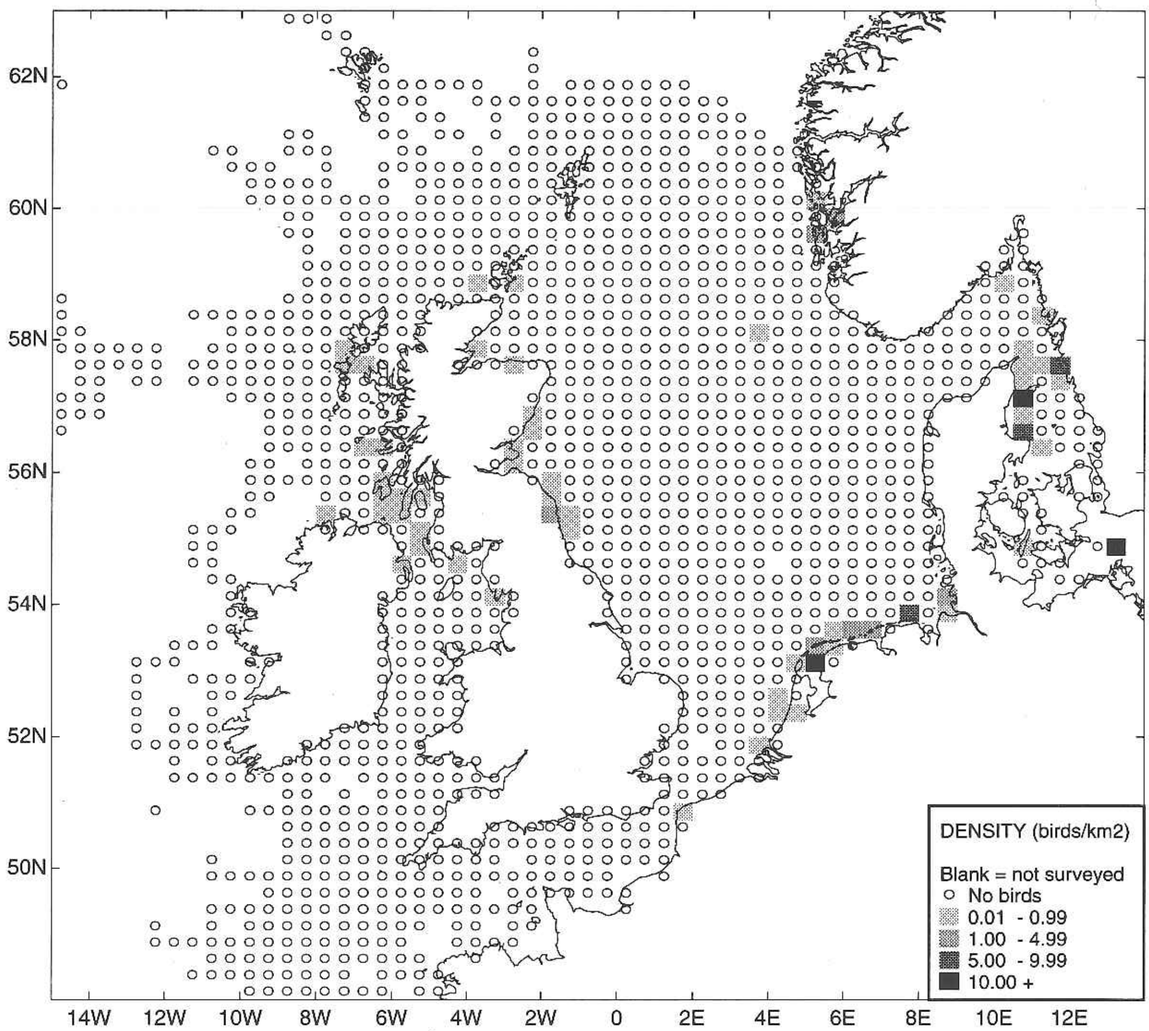

Figure 5.19.2 Distribution of eiders from May to September

May to September (Figure 5.19.2)

Eiders were less widespread over this period. Birds were still present in the Kattegat in moderate to high densities; aerial surveys have found Danish waters to hold a maximum of 130 000 eiders in August, mostly in the northern and south-western Kattegat (Laursen *et al.* 1989b). Eiders were also found in moderate densities along the coast of the Netherlands. Eiders were present in low densities on the west and east coasts of Scotland, and around Orkney.

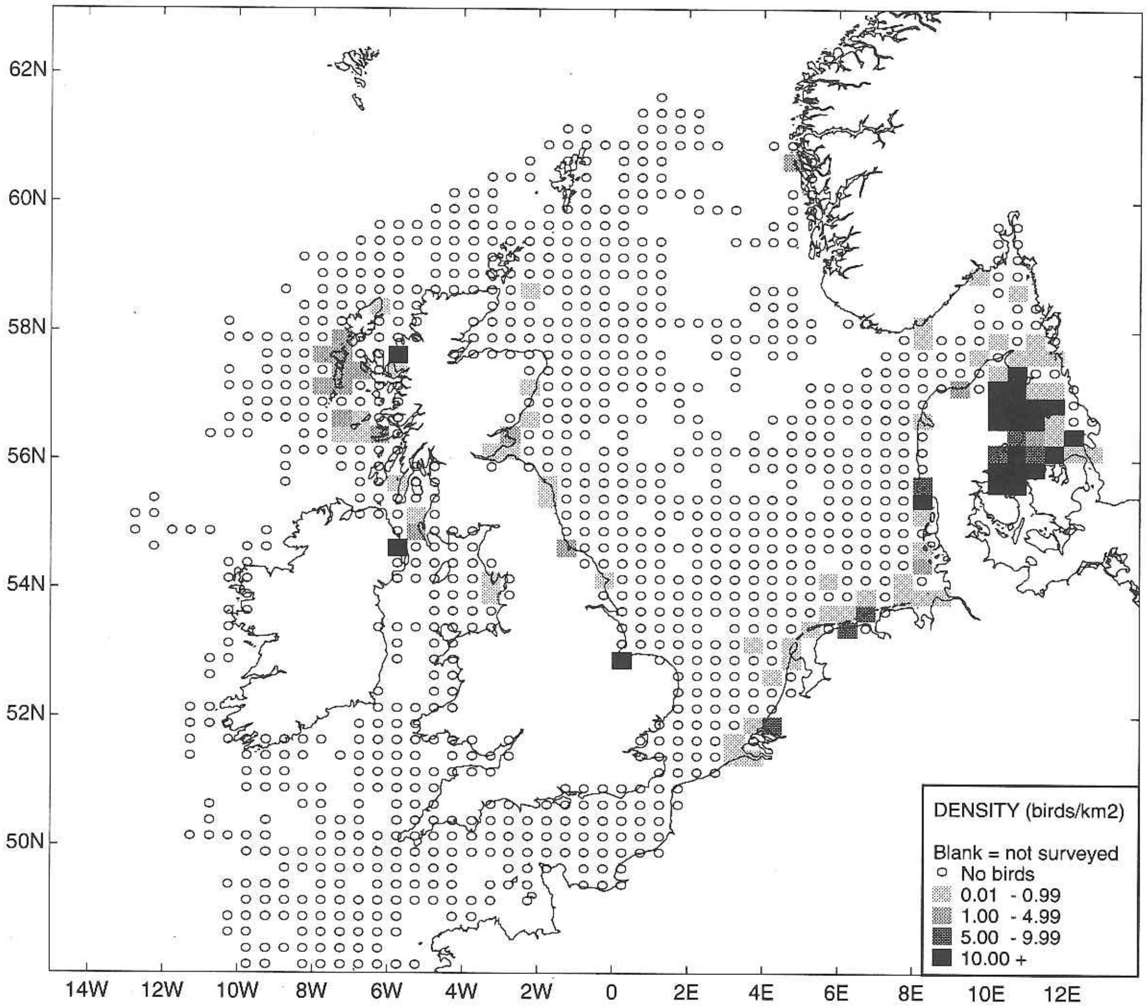

Figure 5.19.3 Distribution of eiders from October to December

October to December (Figure 5.19.3)

High densities were observed in the Kattegat where large numbers of birds winter (Laursen *et al.* 1988, 1989a). In the south-west Kattegat densities peaked at 556.17 birds.km^{-2}. Lower densities were present along the coast of the Netherlands than in previous months. Low densities were found along the east coast of Britain, with a high density in the Wash. Densities around the west coast of Scotland, particularly around the Outer Hebrides, had increased.

Summary and conservation implications

The highest densities of eider were found in the brackish waters of the Kattegat between October and April. Birds were also found around the west coast of Scotland in more moderate densities at this time. The coastal waters of the south-eastern North Sea supported high densities of eider too, particularly between January and April, when birds may move to sea, especially if the Wadden Sea freezes. The vulnerability of eiders to oil pollution is considered to be very high as a result of their behaviour - they spend much time on the sea surface and form large, dense flocks. Eiders would be most vulnerable to oil spillages in areas where this species occurs in large numbers, such as the Kattegat in winter, or during the moult period of July to September. Reduced food availability in the early 1990s in the Dutch Wadden Sea due to overfishing of shellfish caused large numbers of eiders to move into the North Sea, where many died from starvation (Van de Kuip 1991).

Further reading

Baptist, H.J.M. 1988. Vogelconcentraties in de voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Bergstrøm, R. 1990. Ærfuglens årssykklus på den norske Skagerrakkysten. *Fauna och Flora 85:* 180-185.

Camphuysen, C.J. 1989. Beached Bird Surveys in the Netherlands 1915-1988; Seabird Mortality in the southern North Sea since the early days of Oil Pollution. *Techn. Rep. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam 322pp.*

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joensen, A.H. 1974. Waterfowl populations in Denmark 1965-1973. *Danish Review of Game Biology Vol.9 no.1.*

Kirby, J. & Fox, A.D. 1990. Distribution and abundance of seaducks in the U.K.. Summ. lect. Joint Meeting IWRB's West. Pal. Seaduck Database. *IWRB Newsletter December 1990:* 23-24.

Kuip, C. van de 1991. Wanbeleid in de Waddenzee kost duizenden vogels het leven. *Vogels 66:* 230-235.

Laursen, K. & Frikke, J. 1987. Vinterforekomst af dykænder, lommer og alkefugle i den sydøstlige del af Vesterhavet. *Dansk. Orn. Foren. Tidsskr. 81:* 167-172.

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1988. Landsdækkende optælling af vandfugle fra flyvemaskine, oktober/november 1987. *Rapport fra Vildtbiologisk Station Landbrugsministeriets Vildtforvaltning Maj 1988.*

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1989a. Landsdækkende optælling af vandfugle fra flyvemaskine, oktober/november 1988. *Rapport fra Vildtbiologisk Station Landbrugsministeriets Vildtforvaltning April 1989.*

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1989b. Landsdækkende optælling af vandfugle fra flyvemaskine, august 1989. *Rapport fra Vildtbiologisk Station Miljøministeriets Vildtforvaltning December 1989.*

Maertens, L. Meire, P. Devos, K. & Kuijken, E. 1990. Vliegtuigtellingen van watervogels voor de Belgische kust, winters 1987/1988 en 1988/1989. *Oriolus 56:* 11-19.

Maertens, L., Meire, P. & Kuijken, E. 1988. Vliegtuigtellingen van watervogels voor de Belgische kust; winter 1986/1987. *Oriolus 54(2):* 55-60.

Meininger, P.L., Berrevoets, C.M. & Strucker, R.C.W. 1994. Watervogeltellingen in het zuidelijk Deltagebied 1987-91. *Rapport RIKZ-94.005.*

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Noer, H. 1991. Distributions and movements of Eider *Somateria mollissima* populations wintering in Danish waters, analysed from ringing recoveries. *Danish Review of Game Biology 14(3):* 32 pp.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfagelrakning fran farjor i Kattegatt. *Pelagicus 3:* 17-39.

Pihl, S., Hansen, M., Frikke, J. & Laursen, K. 1990. Numbers and distribution of seaducks in Denmark 1987-1989. Summ. lect. Joint Meeting IWRB's West. Pal. Seaduck Database. *IWRB Newsletter December 1990:* 23.

Pihl, S., Laursen, K., Hounisen, J.P. & Frikke, J. 1992. Landsdækkende optælling af vandfugle fra flyvemaskine, januar/februar 1991 og januar/marts 1992. Danmarks Miljøundersøgelser. *Faglig rapport fra DMU, nr. 44.*

Schuyter, T. de 1988. Enkele totaaltellingen van pleisterende Eidereenden (*Somateria mollissima*) langs de West-Vlaamse Noordzeekust in de winter 1984-85. *Mergus 2(4):* 192-194.

Skov, H., Danielsen, F., & Durinck, J. 1987. Seabird mapping in Danish waters: Initial studies 1986-87. *Dansk. Orn. Foren. Tidsskr. 81:* 174-176.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Swennen, C. & Spaans, A.L. 1970. De sterfte van zeevogels door olie in februari 1969 in het Waddengebied. *Het Vogeljaar 18:* 233-245.

Vauk, G. 1978. Die Meeresgewässer um Helgoland - wichtiges Überwinterungs-gebiet für Wasservögel in Kältewintern. In, Andersson Å. & Fredga S. (eds), *Proceedings from the Symposium on Sea Ducks, June 16-17 1975*, Stockholm. Nat. Swed. Env. Prot. Board, Solna & Intern. Waterf. Res. Bur., Slimbridge.

Wrånes, E. 1988. Massedød av ærfugl på Sørlandet vinteren 1981/82. *Vår Fuglefauna 11(2):* 71-74.

Table 5.19.1 Overall density of eiders (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^{2}).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Density	0.00	0.38	0.03	0.13	0.00	13.89	0.06	-	0.00	0.01
	km^2	96.0	1292.1	774.8	1119.4	1078.9	4048.0	896.7	0.0	71.2	899.0
Feb	Density	0.00	0.11	0.04	0.02	0.00	21.73	0.00	0.00	0.00	0.00
	km^2	352.0	778.9	1325.7	1251.6	2862.1	5775.9	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.02	0.05	0.04	0.00	4.95	0.64	0.00	0.00	0.00
	km^2	374.7	1385.1	1388.4	597.0	1015.4	3101.8	581.6	148.9	609.3	780.0
Apr	Density	0.00	0.03	0.00	0.01	0.00	0.10	0.00	0.00	0.00	0.00
	km^2	576.0	944.6	1243.0	269.6	1743.2	4639.5	483.9	98.9	550.9	787.8
May	Density	0.00	0.06	0.00	0.22	0.00	0.29	0.00	0.00	0.00	0.00
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4025.4	978.9	253.2	501.1	1242.0
Jun	Density	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	2114.0	2662.2	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	1002.1	1512.4	3689.2	1798.9	4787.4	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.00	0.03	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.04
	km^2	867.9	2468.6	1377.9	2097.8	4052.5	4954.6	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.05	0.01	0.02	0.00	0.55	0.00	0.00	0.00	0.00
	km^2	208.9	1059.6	1396.9	3171.9	3080.7	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	0.00	0.17	0.00	0.00	0.00	2.53	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	753.5	1427.6	3410.4	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.22	0.01	11.31	0.00	0.00	0.00	0.00
	km^2	116.3	561.5	1013.7	869.8	1592.0	3655.4	587.7	76.3	710.4	859.0
Dec	Density	0.00	0.93	0.00	0.04	0.00	1.34	0.18	0.00	0.00	0.00
	km^2	102.2	620.5	609.0	847.5	736.5	2873.1	280.7	97.9	460.5	1476.1

5.20 LONG-TAILED DUCK *Clangula hyemalis*

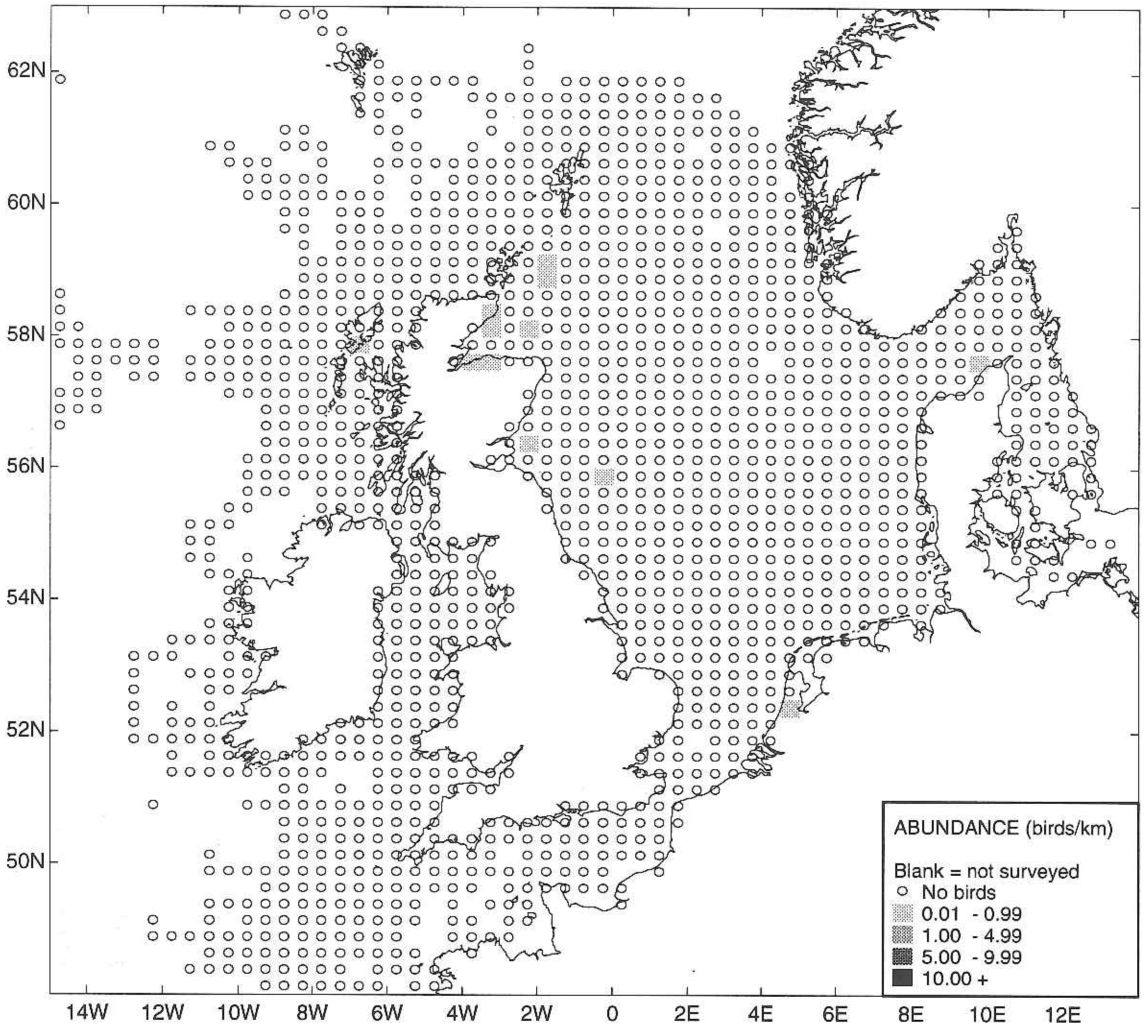

Figure 5.20.1 Distribution of long-tailed ducks from June to October

June to October (Figure 5.20.1)

Few long-tailed ducks were seen over this period, most birds being to the east of Scotland in low numbers. Most birds would be outside the study area at this time, at breeding and moulting sites.

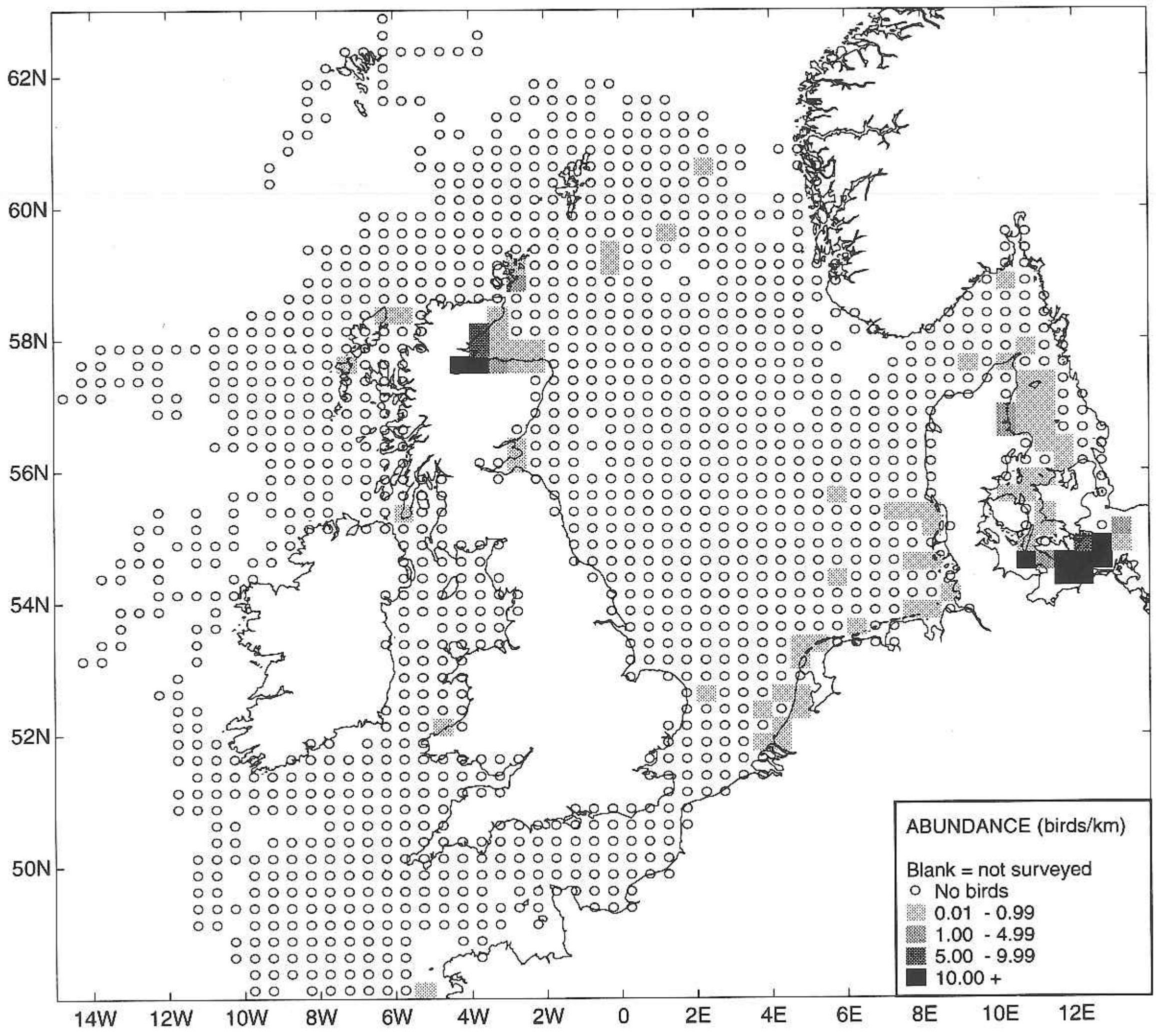

Figure 5.20.2 Distribution of long-tailed ducks from November to May

November to May (Figure 5.20.2)

Long-tailed ducks were more widespread over the winter period. The majority of birds breeding in Scandinavia and Russia winter in the Baltic Sea (Durinck *et al.* 1994), with only low numbers occurring in the North Sea. Highest numbers occurred in the Belt Sea and Kiel Bay, while lower numbers were found in the Kattegat. Low numbers along the Dutch coasts are probably an artefact of intensive surveys in this area. The main wintering areas in Britain were in the Moray Firth and around Orkney (Table 5.20.1), while low numbers were seen in the Firth of Forth and the Outer Hebrides.

Summary and conservation implications

Long-tailed ducks were mainly present in the study area during winter months, although most winter in the Baltic Sea. They were concentrated in Kiel Bay, the Belt Sea, the Kattegat and in the Moray Firth. The vulnerability of long-tailed ducks to oil pollution is high due to the amount of time they spend on the sea surface and their tendency to form flocks, but as numbers are low in the study area the population would be little affected by an oil spill anywhere other than Kiel Bay and the Belt Sea.

Further reading

Bultinck, P. 1987. Voorkomen van de IJseend *Clangula hyemalis* in noord-west Vlaanderen, een vergelijkende studie met de Belgische gegevens. *Mergus 1(6):* 232-256.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H. & Andell, P. 1993. Seabird distribution and numbers in selected offshore parts of the Baltic Sea, winter 1992. *Ornis Svecica 3:* 11-26.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joensen, A.H. 1974. Waterfowl populations in Denmark 1965-1973. *Danish Review of Game Biology Vol.9 no.1.*

Laursen, K. 1989. Estimates of Sea Duck Winter Populations of the Western Palaearctic. *Dan. Rev. Game Biol. 13(6):* 1-22.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Petersen, F.D. 1974. The migration of ducks (Anatinae) at Blåvand, western Jutland, 1963-71. *Dansk. Orn. Foren. Tidsskr. 68:* 25-37.

Pihl, S., Laursen, K., Hounisen, J.P. & Frikke, J. 1992. Landsdækkende optælling af vandfugle fra flyvemaskine, januar/februar 1991 og januar/marts 1992. Danmarks Miljøundersøgelser. *Faglig rapport fra DMU, nr. 44.*

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Table 5.20.1 Overall abundance of long-tailed ducks (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Abundance	0.00	0.00	1.16	0.00	0.00	0.37	0.00	-	0.00	0.00
	km	319.8	5643.3	2462.1	4457.5	4336.9	17833.2	3811.8	0.0	246.6	3896.7
Feb	Abundance	0.00	0.00	0.12	0.00	0.00	0.51	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4676.9	4328.1	12460.9	25624.8	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1249.2	4907.3	4453.4	2574.8	4067.0	13979.9	2514.5	496.2	2039.0	3428.4
Apr	Abundance	0.00	0.00	1.33	0.00	0.00	0.14	0.00	0.00	0.00	0.00
	km	1920.0	3159.0	4143.3	898.7	7145.0	22488.8	1810.8	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	6358.4	4704.1	4656.3	10173.7	14851.7	4166.7	844.0	1675.9	5028.1
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	7953.4	11697.0	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	6319.9	12359.4	6626.4	16371.3	9396.7	5607.2	514.0	3158.5	4120.2
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	7242.7	14452.1	18754.5	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	4790.5	4764.0	11640.3	11416.3	15011.2	6648.9	13.3	1306.8	4009.4
Oct	Abundance	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	5436.0	13885.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	1.34	0.03	0.00	0.06	0.00	0.00	0.00	0.00
	km	387.5	2173.4	3261.6	3484.5	6833.4	16604.9	2684.1	277.2	2522.6	2973.6
Dec	Abundance	0.00	0.00	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	340.5	2717.9	2030.0	3087.5	3593.2	14347.5	939.3	335.6	1560.9	5724.4

5.21 COMMON SCOTER *Melanitta nigra*

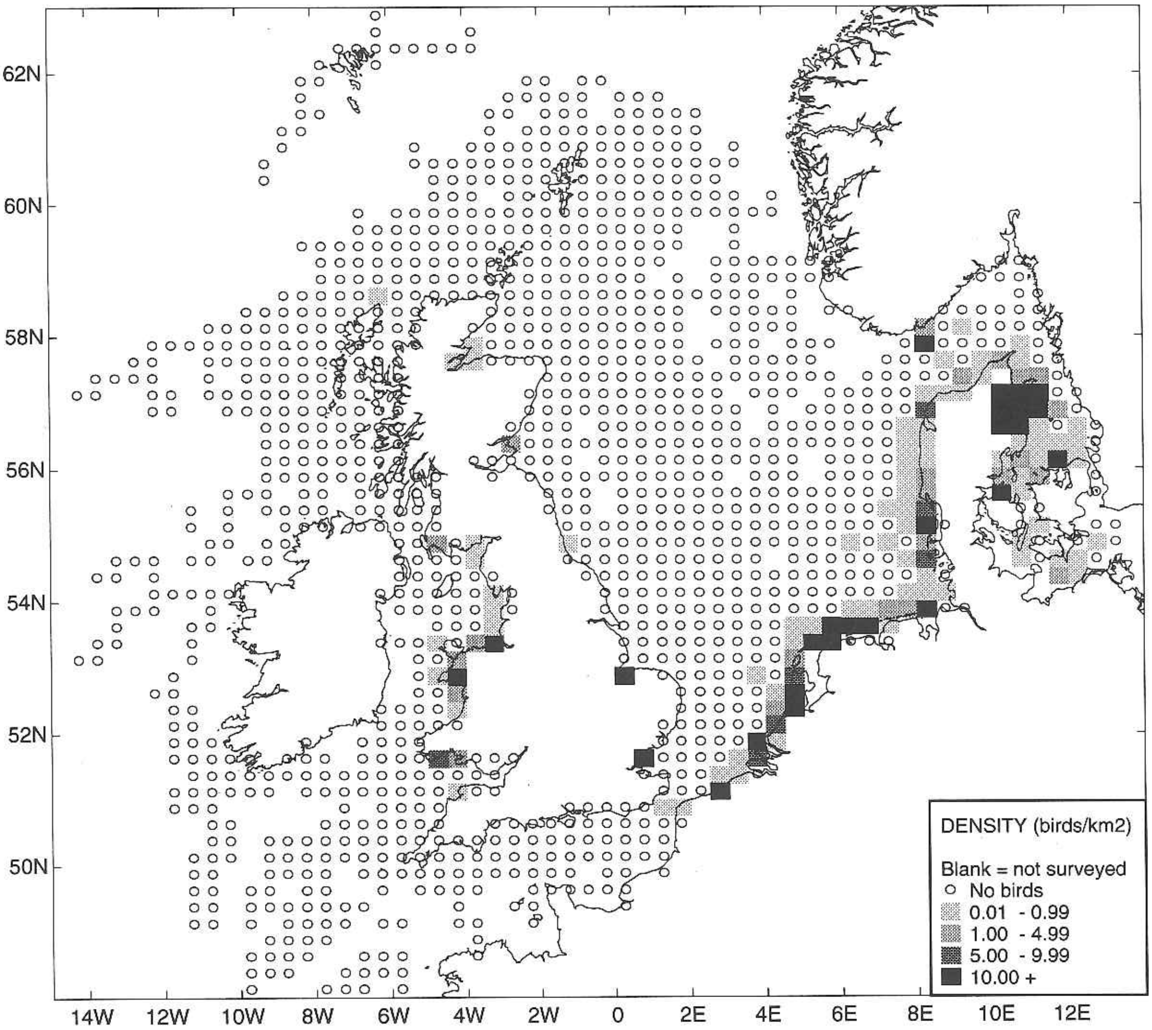

Figure 5.21.1 Distribution of common scoters from January to April

January to April (Figure 5.21.1)

The distribution of common scoter was confined to waters relatively close to land. Most birds occurred on coasts between Belgium and the Belt Sea (Table 5.21.1), with highest densities in the Ålborg Bight, and in the vicinity of the Delta region of the Netherlands and the Dutch and Danish Wadden Seas. Nearly 1 million common scoter were recorded in the Kattegat between January and March 1992 (Pihl *et al.* 1992). The maximum density was recorded in the Dutch Wadden Sea (745.05 birds.km^{-2}). Low densities were recorded in Kiel Bay from these surveys; however, the average number of common scoter wintering in this area between 1988 and 1993 exceeded 60,000 birds (Durinck *et al.* 1994). Common scoter were also present along the west coast of England and Wales, in Liverpool, Cardigan and Carmarthen Bays. High densities were seen in the Wash, and low densities in the Moray Firth and the Firth of Tay.

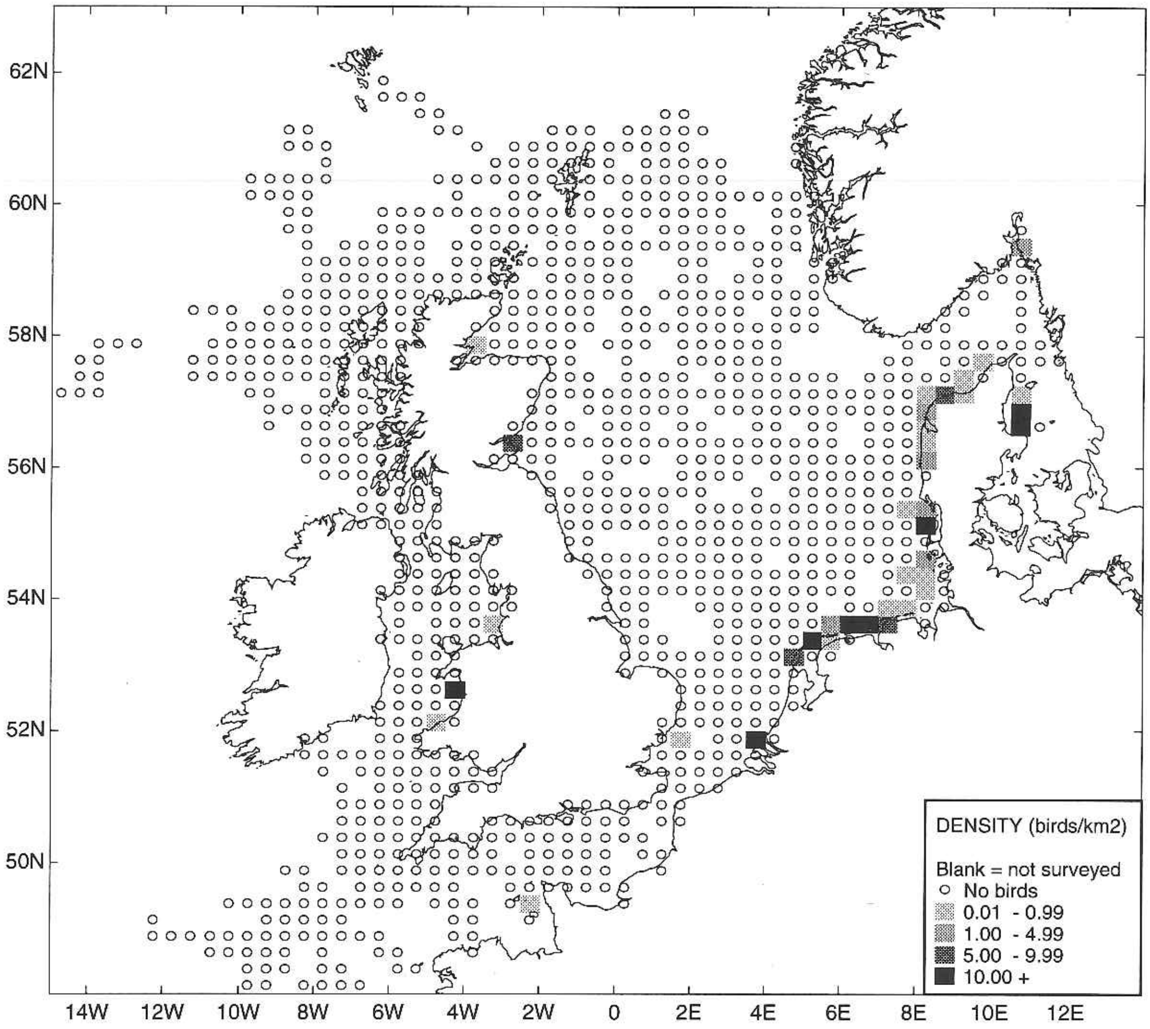

Figure 5.21.2 Distribution of common scoters in May and June

May to June (Figure 5.21.2)

Common scoter were less widespread between May and June, since birds would be returning to their breeding grounds outside the study area at this time of year. Highest densities remained in the Ålborg Bight, the Delta region of the Netherlands, around the Frisian Islands and in the Danish Wadden Sea. High densities were also found in Cardigan Bay. Moderate densities occurred around the Jammerbugten and the Firth of Tay.

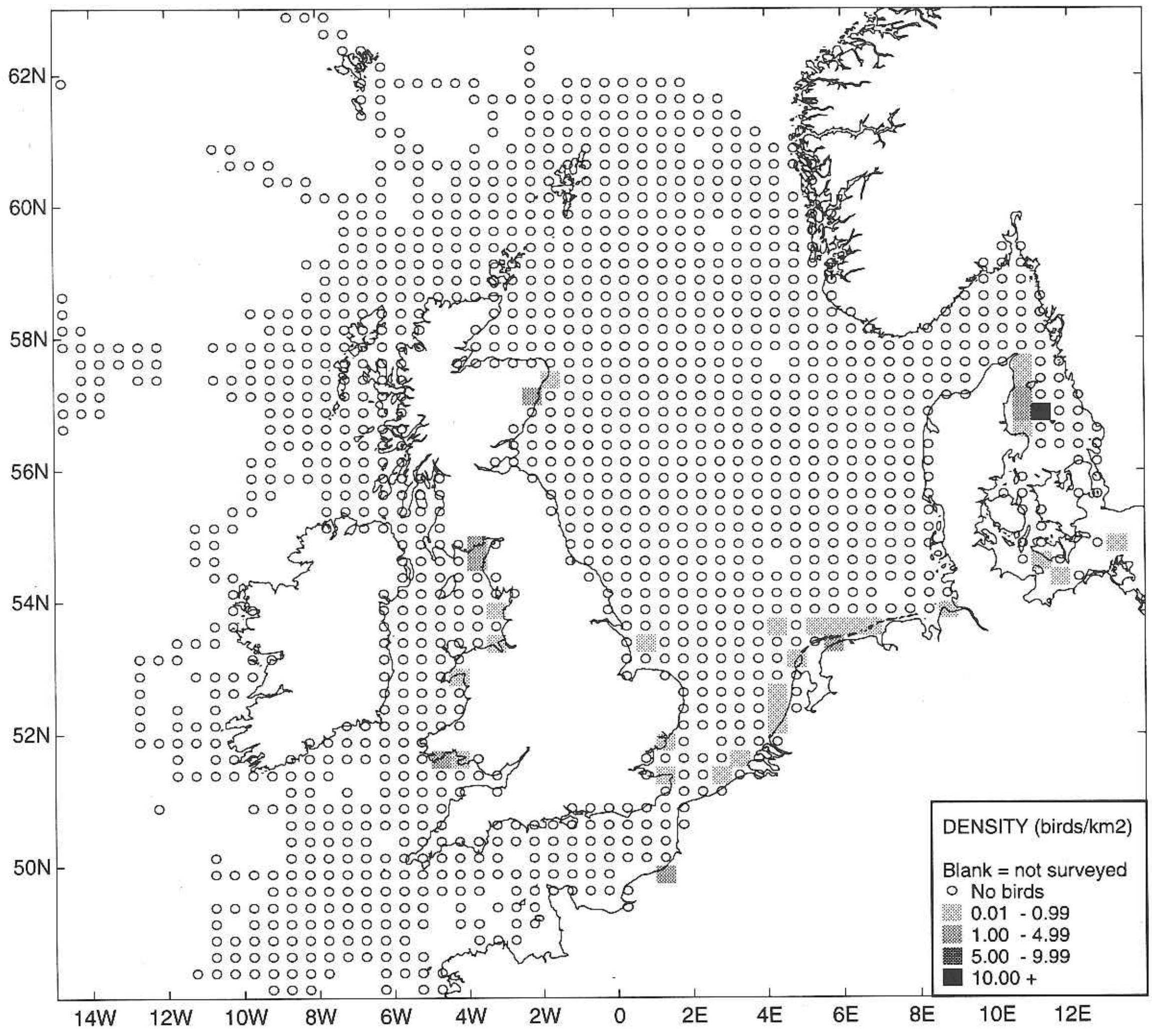

Figure 5.21.3 Distribution of common scoters from July to September

July to September (Figure 5.21.3)

Common scoter density was lowest at this time of year, presumably since many birds would have been outside the study area on breeding grounds. Common scoters were recorded in the Kattegat in high densities and along the Netherlands coast and in the Belt Sea in low densities. Birds migrating at night may have been missed by these surveys. Low densities were also recorded near the Thames and the Wash, in Carmarthen Bay, Liverpool Bay and the Solway Firth.

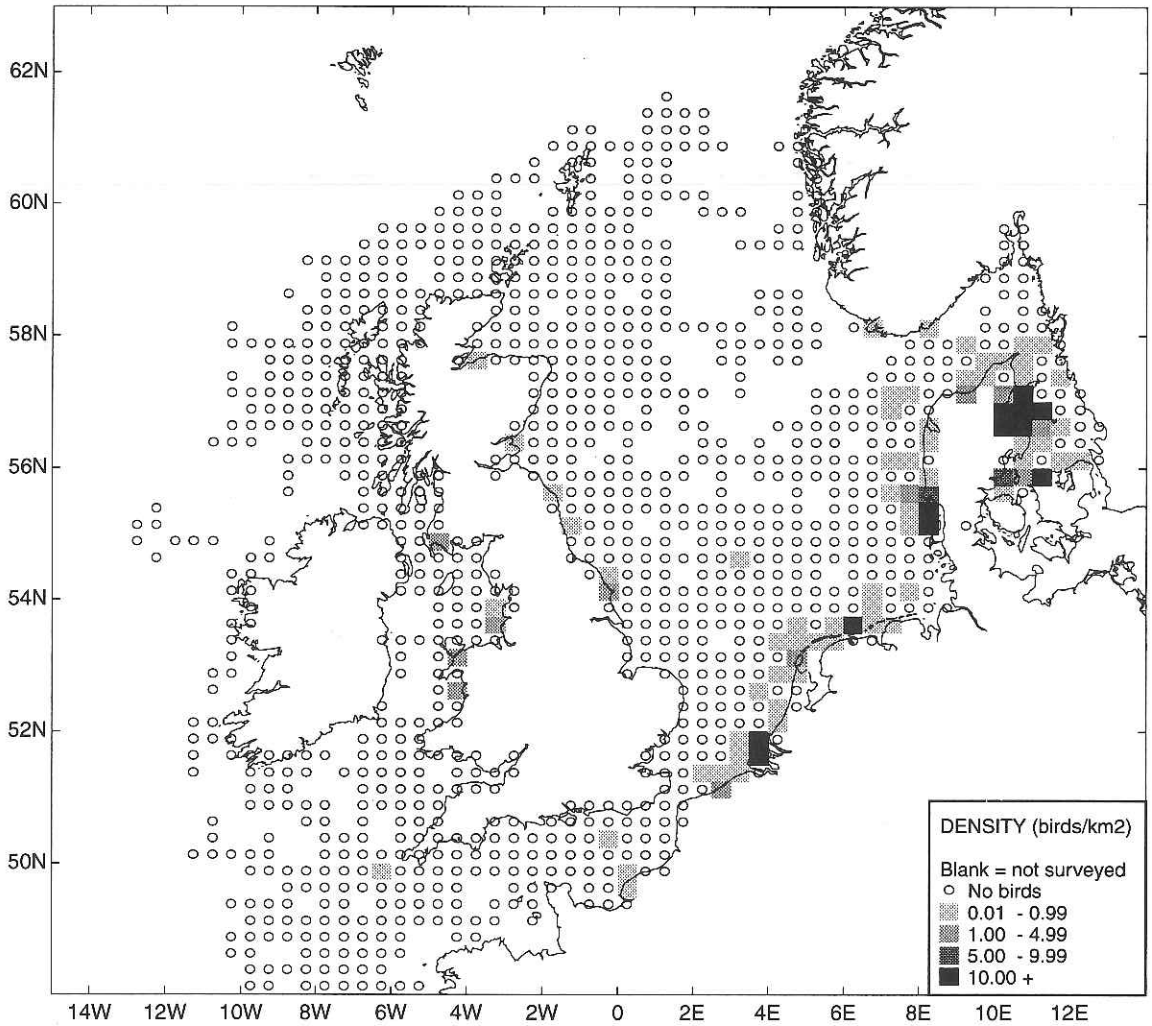

Figure 5.21.4 Distribution of common scoters from October to December

October to December (Figure 5.21.4)

Numbers of common scoter began to build up again between October and December, presumably due to birds moving into the study area after breeding. Densities were highest in the Kattegat (where density peaked at 189.35 birds.km^{-2}) and around Denmark. Birds were also present in high densities in the Netherlands at the Delta region and the Wadden Sea, and in lower densities along the remaining coasts of the Netherlands and Belgium. Moderate densities were noted in Liverpool Bay and Cardigan Bay, and low densities in the eastern English Channel.

Summary and conservation implications

Common scoter occurred in highest densities and were most widespread between January and April. Throughout the year they were present in the low salinity waters of the Kattegat, off the coast of the Netherlands and the west coast of Wales, although densities decreased in summer. Common scoter are highly vulnerable to oil pollution since they spend much of their lives on the sea. They form very large flocks, therefore numbers affected in an oil incident could be catastrophically high. Common scoter are most at risk from a major oil spillage in areas where high numbers are known to overwinter or moult. The developing fishery for the bivalve *Spisula subtruncata* in the Dutch wintering grounds of common scoter could present serious problems of food depletion. This species is also vulnerable to disturbance from shipping.

Further reading

Baptist, H.J.M. 1988. Vogelconcentraties in de voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Baptist, H.J.M. & Camphuysen, C.J. 1987. Concentraties Zwarte Zeeëenden *Melanitta nigra* voor de Hollandse en Zeeuwse kust, 9-11 maart 1987. *Sula 1(1):* 17-18.

Bergman, M.J.N. & Leopold, M.F. 1992. De ecologie van de kustzone van Vlieland en Terschelling. *NIOZ Rapport 1992-2, Nederlands Inst. Onderz. Zee, Texel.*

Camphuysen, C.J. & Dijk, J.van 1983. Zee- en kustvogels langs de Nederlandse kust, 1974-79. *Limosa 56(3):* 81-230.

Camphuysen, C.J. 1989. Beached Bird Surveys in the Netherlands 1915-1988; Seabird Mortality in the southern North Sea since the early days of Oil Pollution. *Techn. Rep. Vogelbescherming 1, Werkgroep Noordzee, Amsterdam 322pp.*

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Dijk, J. van 1987. Veel Zwarte Zeeëenden *Melanitta nigra* voor de kust van Zuid-Holland in januari-februari 1987. *Sula 1(1):* 15-17.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H. & Andell, P. 1993. Seabird distribution and numbers in selected offshore parts of the Baltic Sea, winter 1992. *Ornis Svecica 3:* 11-26.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joensen, A.H. 1974. Waterfowl populations in Denmark 1965-1973. *Danish Review of Game Biology Vol.9 no.1.*

Laursen, K. & Frikke, J. 1987. Vinterforekomst af dykænder, lommer og alkefugle i den sydøstlige del af Vesterhavet. *Dansk. Orn. Foren. Tidsskr. 81:* 167-172.

Leeuwen, A. van, Postma, T.A.C., Leopold, M.F. & Bergman, M.J.N. 1994. De ecologie van de kustzone van Ameland tot Borkum. *NIOZ Rapport 1994-4, Nederlands Inst. Onderz. Zee, Texel.*

Leopold, M.F. 1988. De zeeëenden-survey van Januari 1988. *Sula 2:* 23-24.

Maertens, L., Meire, P. & Kuijken, E. 1988. Vliegtuigtellingen van watervogels voor de Belgische kust; winter 1986/1987. *Oriolus 54(2):* 55-60.

Maertens, L. Meire, P. Devos, K. & Kuijken, E. 1990. Vliegtuigtellingen van watervogels voor de Belgische kust, winters 1987/1988 en 1988/1989. *Oriolus 56:* 11-19.

Meininger, P.L., Berrevoets, C.M. & Strucker, R.C.W. 1994. Watervogeltellingen in het zuidelijk Deltagebied 1987-91. *Rapport RIKZ-94.005.*

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Offringa, H. 1991. Baltsende Zwarte Zeeëenden *Melanitta nigra* voor de Nederlandse kust. *Sula 5(2):* 57-58.

Offringa, H. 1991. Verspreiding en Voedseloecologie van de Zwarte Zeeëend (*Melanitta nigra*) in Nederland. *Verslag Doctoraal onderwerp LU Wageningen/NIOZ Texel, NIOZ Rapport 1991-13, 39pp.*

Offringa, H. & Leopold, M.F. 1991. Het tellen van Zwarte Zeeëenden *Melanitta nigra* voor de Nederlandse kust. *Sula 5(4):* 154-157.

Ouden, J.E. den & Camphuysen, C.J. 1983. Meetpost Noordwijk 1978-1981, Report no. 2 Anatidae-Scolopacidae. *CvZ MpN-verslag nr. 2, Amsterdam.*

Petersen, F.D. 1974. The migration of ducks (Anatinae) at Blåvand, western Jutland, 1963-71. *Dansk. Orn. Foren. Tidsskr. 68:* 25-37.

Pihl, S., Laursen, K., Hounisen, J.P. & Frikke, J. 1992. Landsdækkende optælling af vandfugle fra flyvemaskine, januar/februar 1991 og januar/marts 1992. Danmarks Miljøundersøgelser. *Faglig rapport fra DMU, nr. 44.*

Platteeuw, M. 1990. Het voorkomen van de Zwarte Zeeëend *Melanitta nigra* langs de Nederlandse kust: een evaluatie. *Sula 4(2):* 55-65.

Platteeuw, M. 1990. Zwarte Zeeëenden *Melanitta nigra* snijden Nederlandse kust af. *Sula 4(2):* 70-74.

Platteeuw, M., Ham, N.F. van der & Ouden, J.E. den 1994. Zeetrektellingen in Nederland in de jaren tachtig. *Sula 8:* 1-203.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Table 5.21.1 Overall density of common scoters (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.01	0.00	0.00	50.64	1.68	-	0.00	0.00
	km^2	96.0	1292.1	774.8	1145.1	1093.4	4048.0	896.7	0.0	71.2	899.0
Feb	Density	0.00	0.00	0.01	0.00	0.00	15.99	0.02	0.00	0.00	0.00
	km^2	352.0	778.9	1415.8	1271.7	3006.9	5775.9	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.64	0.00	51.79	0.37	0.00	0.00	0.03
	km^2	374.7	1385.1	1388.4	597.0	1015.4	3101.8	581.6	148.9	609.3	780.0
Apr	Density	0.00	0.00	0.00	0.00	0.00	3.43	0.02	0.00	0.00	0.00
	km^2	576.0	944.6	1243.0	269.6	1743.2	4940.1	483.9	98.9	550.9	787.8
May	Density	0.00	0.00	0.05	0.15	0.00	33.16	0.38	0.00	0.00	0.01
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4025.4	978.9	253.2	501.1	1242.0
Jun	Density	0.00	0.00	0.00	0.00	0.00	4.01	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	2114.0	2662.2	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.00	0.00	0.04	0.00	0.02	0.10	0.00	0.00	0.00
	km^2	1002.1	1512.4	3689.2	1798.9	4787.4	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04
	km^2	867.9	2468.6	1377.9	2097.8	4052.5	4954.6	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.00	0.00	0.00	0.00	0.06	0.20	0.00	0.00	0.00
	km^2	208.9	1059.6	1396.9	3171.9	3080.7	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	753.5	1427.6	3410.4	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.23	0.01	9.28	0.28	0.00	0.00	0.00
	km^2	116.3	561.5	1013.7	869.8	1592.0	3655.4	587.7	76.3	710.4	859.0
Dec	Density	0.00	0.00	0.00	0.20	0.00	0.44	0.00	0.00	0.00	0.00
	km^2	102.2	620.5	609.0	847.5	736.5	2873.1	280.7	97.9	460.5	1476.1

5.22 VELVET SCOTER *Melanitta fusca*

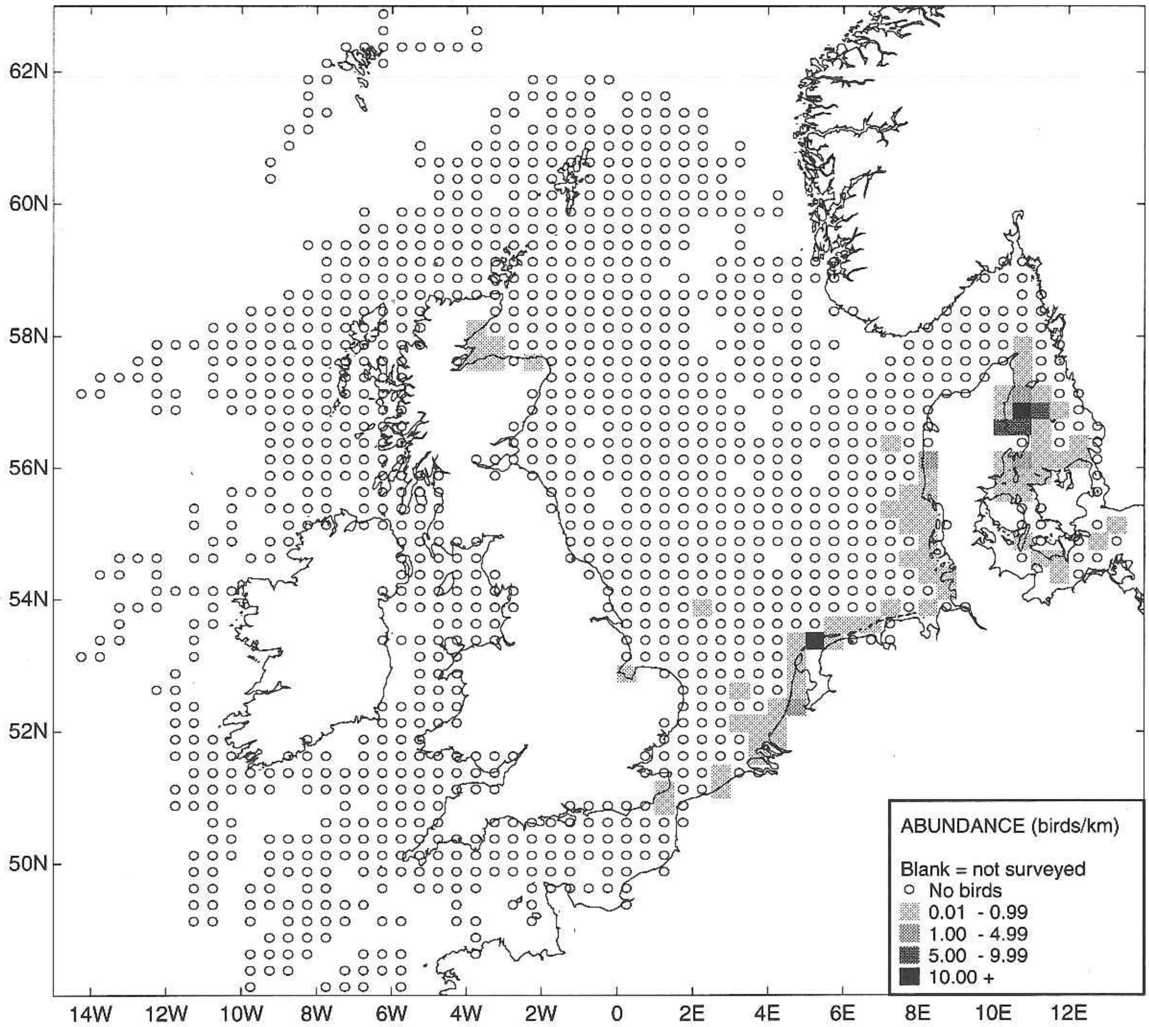

Figure 5.22.1 Distribution of velvet scoters from January to April

January to April (Figure 5.22.1)

Velvet scoter were present in the Moray Firth, the Wash, the Belt Sea and the coastal waters between Belgium and Denmark in low numbers. Moderate numbers were seen in the north-western Kattegat, where approximately 120,000 birds were recorded between January and March 1992 (Pihl *et al.* 1992). This species mainly winters within the Baltic region (Durinck *et al.* 1994).

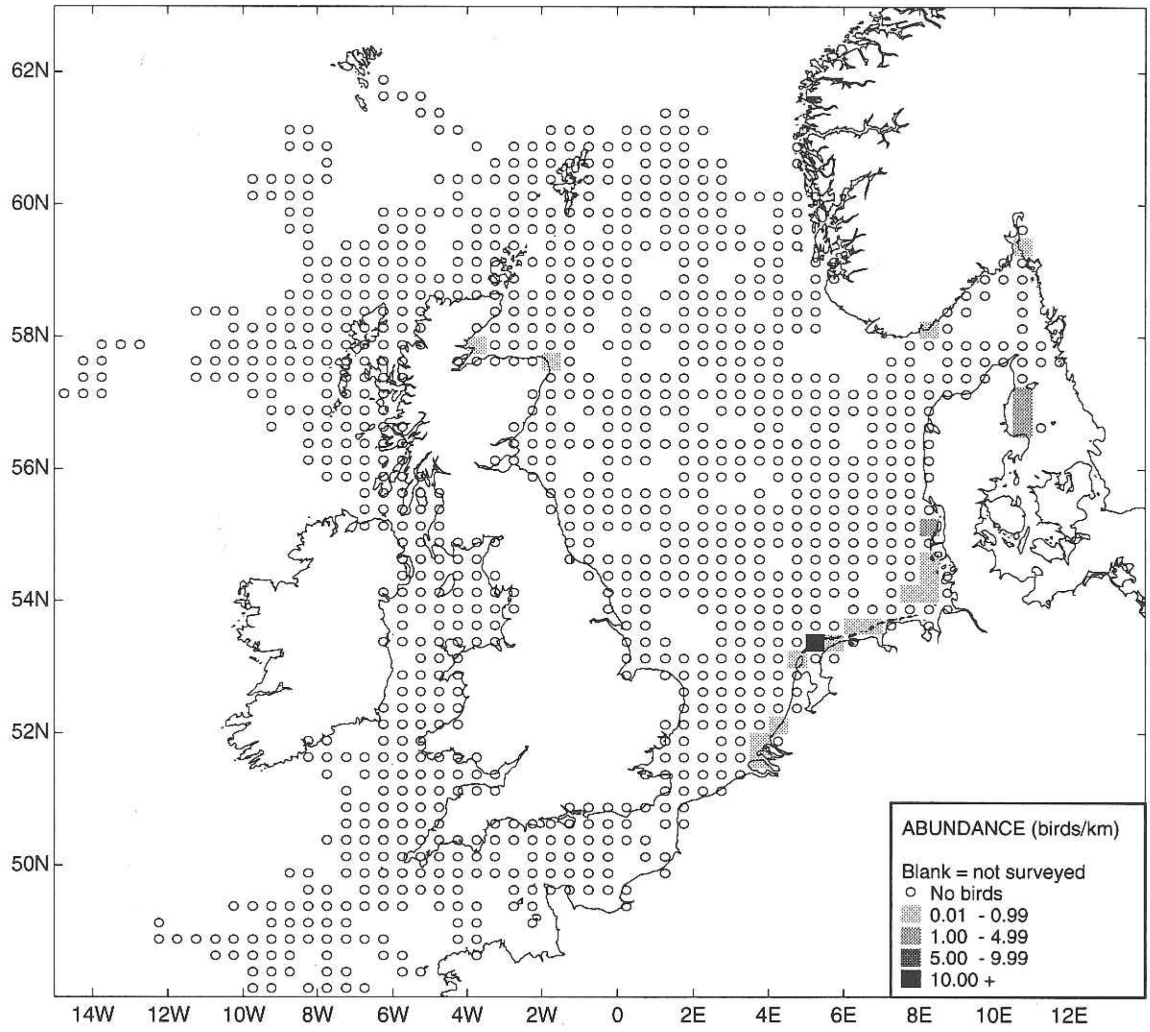

Figure 5.22.2 Distribution of velvet scoters in May and June

May to June (Figure 5.22.2)

A pattern similar to previous months was noted in May and June although birds were more thinly scattered. Highest numbers were again found in the Kattegat, but there was little coverage carried out in the Kattegat and the Belt Sea over this period. Velvet scoter tend to move to the breeding grounds around this time so the drop in numbers of birds could be explained by this.

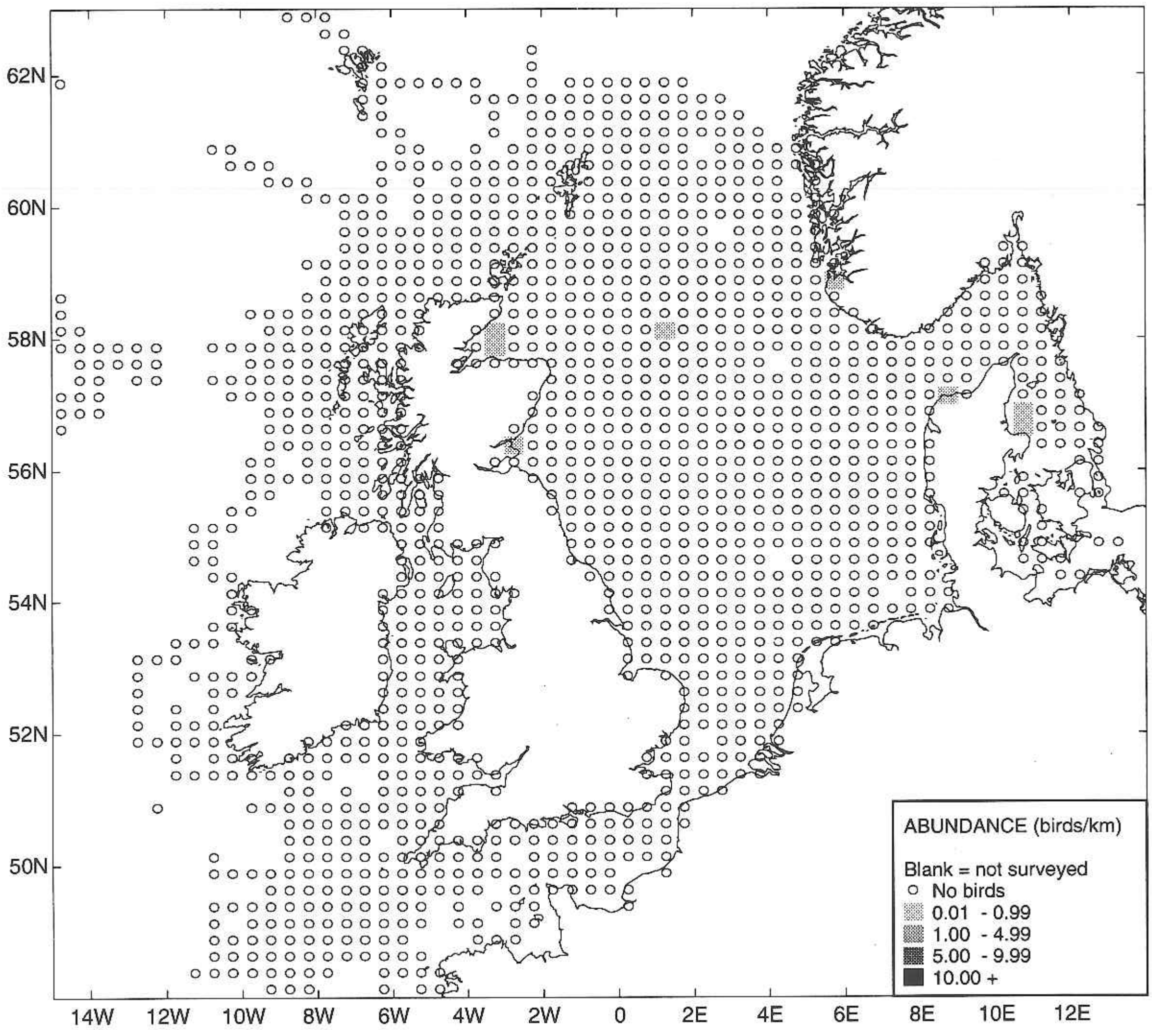

Figure 5.22.3 Distribution of velvet scoters from July to September

July to September (Figure 5.22.3)

Very few birds were seen over this period (Table 5.22.1); low numbers were present in the Moray Firth, the Firth of Tay and the Kattegat. A small flock of six birds were seen in mid-North Sea.

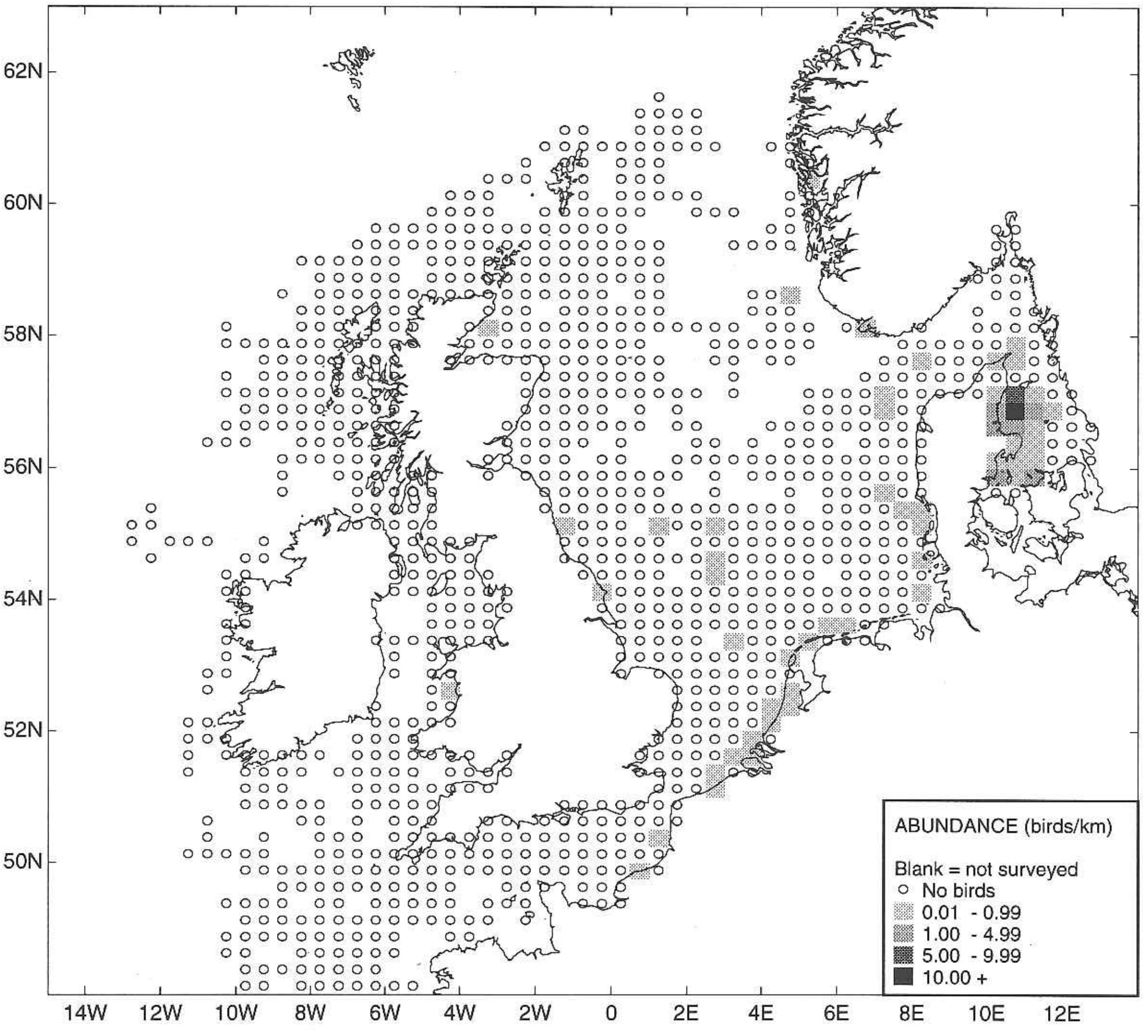

Figure 5.22.4 Distribution of velvet scoters from October to December

October to December (Figure 5.22.4)

Velvet scoter numbers in the Kattegat increased again during the autumn migration, but there was no coverage in the Belt Sea over this period. Velvet scoter also occurred in the coastal waters of northern France, Belgium, the Netherlands and western Denmark but in lower numbers. Low numbers were noted in the middle of the North Sea, off the east coast of Britain and in Cardigan Bay.

Summary and conservation implications

Velvet scoter were present in the study area throughout the year, but were recorded in lower numbers than common scoter (section 5.21). Highest numbers occurred in the Kattegat, with birds also present along continental coasts of the southern North Sea, and in areas such as the Moray Firth on the east coast of Britain. Velvet scoter would be vulnerable to a major oil spillage if it occurred in an area such as the Kattegat, where birds are present in high numbers at certain times of the year.

Further reading

Baptist, H.J.M. 1988. Vogelconcentraties in de voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joensen, A.H. 1974. Waterfowl populations in Denmark 1965-1973. *Danish Review of Game Biology Vol.9 no.1.*

Leopold, M.F. 1988. De zeeëenden-survey van Januari 1988. *Sula 2:* 23-24.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Mudge, G.P. & Cadbury, C.J. 1987. The Moray Firth: its importance for seabirds and seaducks. *RSPB Conservation Review 1:* 51-55.

Petersen, F.D. 1974. The migration of ducks (Anatinae) at Blåvand, western Jutland, 1963-71. *Dansk. Orn. Foren. Tidsskr. 68:* 25-37.

Pihl, S., Laursen, K., Hounisen, J.P. & Frikke, J. 1992. Landsdækkende optælling af vandfugle fra flyvemaskine, januar/februar 1991 og januar/marts 1992. Danmarks Miljøundersøgelser. *Faglig rapport fra DMU, nr. 44.*

Table 5.22.1 Overall abundance of velvet scoters (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance km	0.00 319.8	0.00 5643.3	0.00 2462.1	0.00 4457.5	0.00 4336.9	0.31 17833.2	0.00 3811.8	- 0.0	0.00 246.6	0.01 3896.7
Feb	Abundance km	0.00 1182.5	0.00 2596.3	0.00 4676.9	0.00 4328.1	0.00 12460.9	0.06 25624.8	0.00 1587.3	0.00 378.2	0.00 636.7	0.00 1876.8
Mar	Abundance km	0.00 1249.2	0.00 4907.3	0.00 4453.4	0.01 2574.8	0.00 4067.0	0.22 13979.9	0.00 2514.5	0.00 496.2	0.00 2039.0	0.00 3428.4
Apr	Abundance km	0.00 1920.0	0.00 3159.0	0.00 4143.3	0.00 898.7	0.00 7145.0	0.08 22488.8	0.00 1810.8	0.00 329.7	0.00 1836.3	0.00 2626.0
May	Abundance km	0.00 1505.2	0.00 6358.4	0.01 4704.1	0.00 4656.3	0.00 10173.7	0.44 14851.7	0.00 4166.7	0.00 844.0	0.00 1675.9	0.00 5028.1
Jun	Abundance km	0.00 2056.9	0.00 5893.8	0.00 4395.2	0.00 1923.5	0.00 7953.4	0.02 11697.0	0.00 2919.1	0.00 240.1	0.00 1078.2	0.00 1945.5
Jul	Abundance km	0.00 3340.3	0.00 6319.9	0.00 12359.4	0.00 6626.4	0.00 16371.3	0.00 9396.7	0.00 5607.2	0.00 514.0	0.00 3158.5	0.00 4120.2
Aug	Abundance km	0.00 2893.0	0.00 8228.7	0.00 4592.8	0.00 7242.7	0.00 14452.1	0.00 18754.5	0.00 3538.7	0.00 929.7	0.00 1680.9	0.00 2975.1
Sep	Abundance km	0.00 696.3	0.00 4790.5	0.00 4764.0	0.00 11640.3	0.00 11416.3	0.00 15011.2	0.00 6648.9	0.00 13.3	0.00 1306.8	0.00 4009.4
Oct	Abundance km	0.00 222.0	0.00 4515.3	0.00 1909.0	0.00 2505.8	0.00 5436.0	0.02 13885.8	0.00 1188.5	0.00 42.0	0.00 992.0	0.00 2703.3
Nov	Abundance km	0.00 387.5	0.00 2173.4	0.00 3261.6	0.00 3484.5	0.00 6833.4	0.26 16604.9	0.00 2684.1	0.00 277.2	0.00 2522.6	0.00 2973.6
Dec	Abundance km	0.00 340.5	0.00 2717.9	0.00 2030.0	0.00 3087.5	0.00 3593.2	0.03 14347.5	0.00 939.3	0.00 335.6	0.00 1560.9	0.00 5724.4

5.23 RED-BREASTED MERGANSER *Mergus serrator*

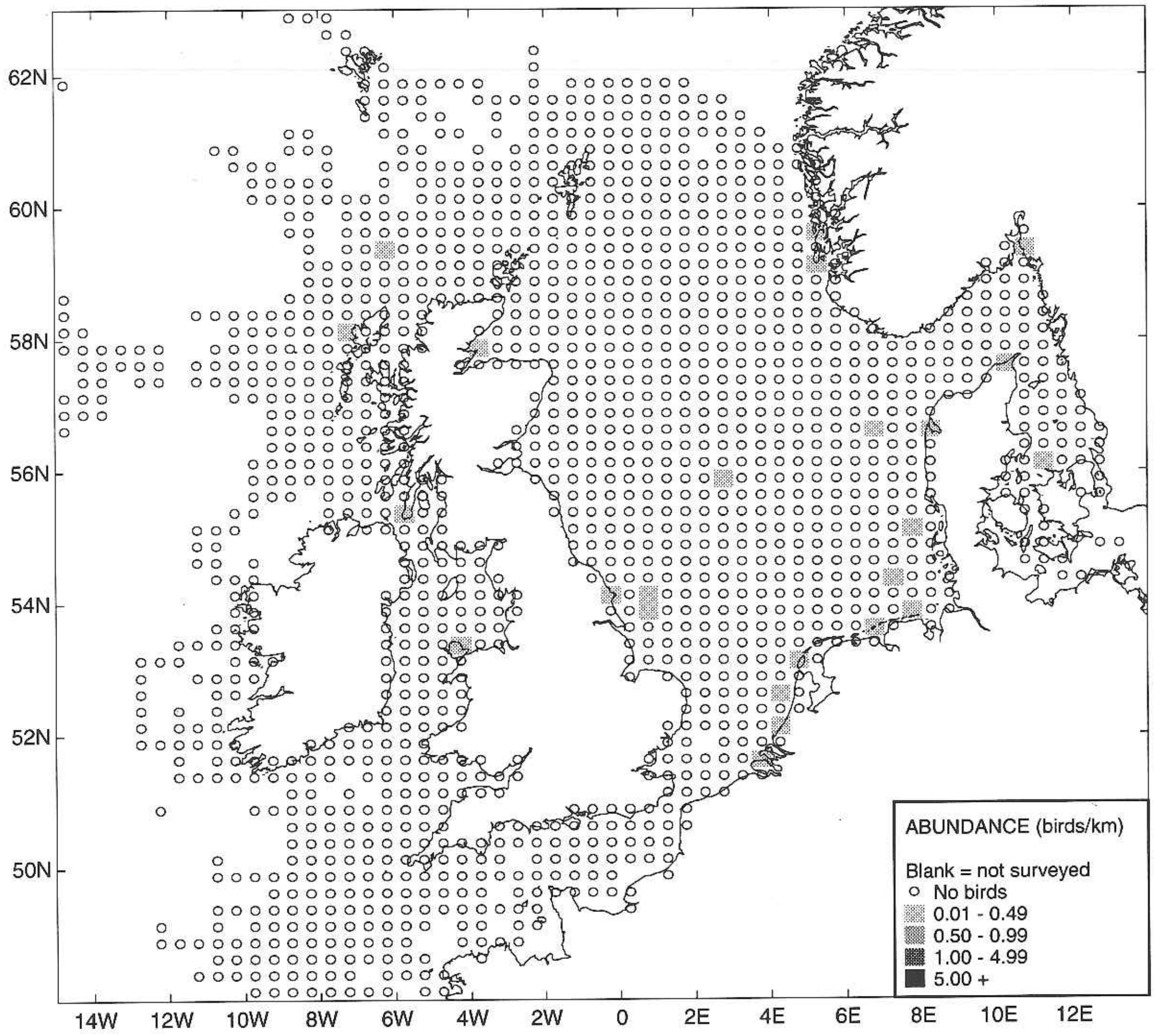

Figure 5.23.1 Distribution of red-breasted mergansers from May to October

May to October (Figure 5.23.1)

Over this period, numbers of red-breasted mergansers were low; many birds would be too far inshore to be detected by these surveys; high numbers have been found in Limfjorden (Laursen *et al.* 1989a,b). Most birds were coastal, although there were a few records from the central North Sea. The majority of birds were found in the coastal waters of the southern North Sea, between the Delta region of the Netherlands and the west coast of Denmark. A few birds were seen around the coasts of Britain.

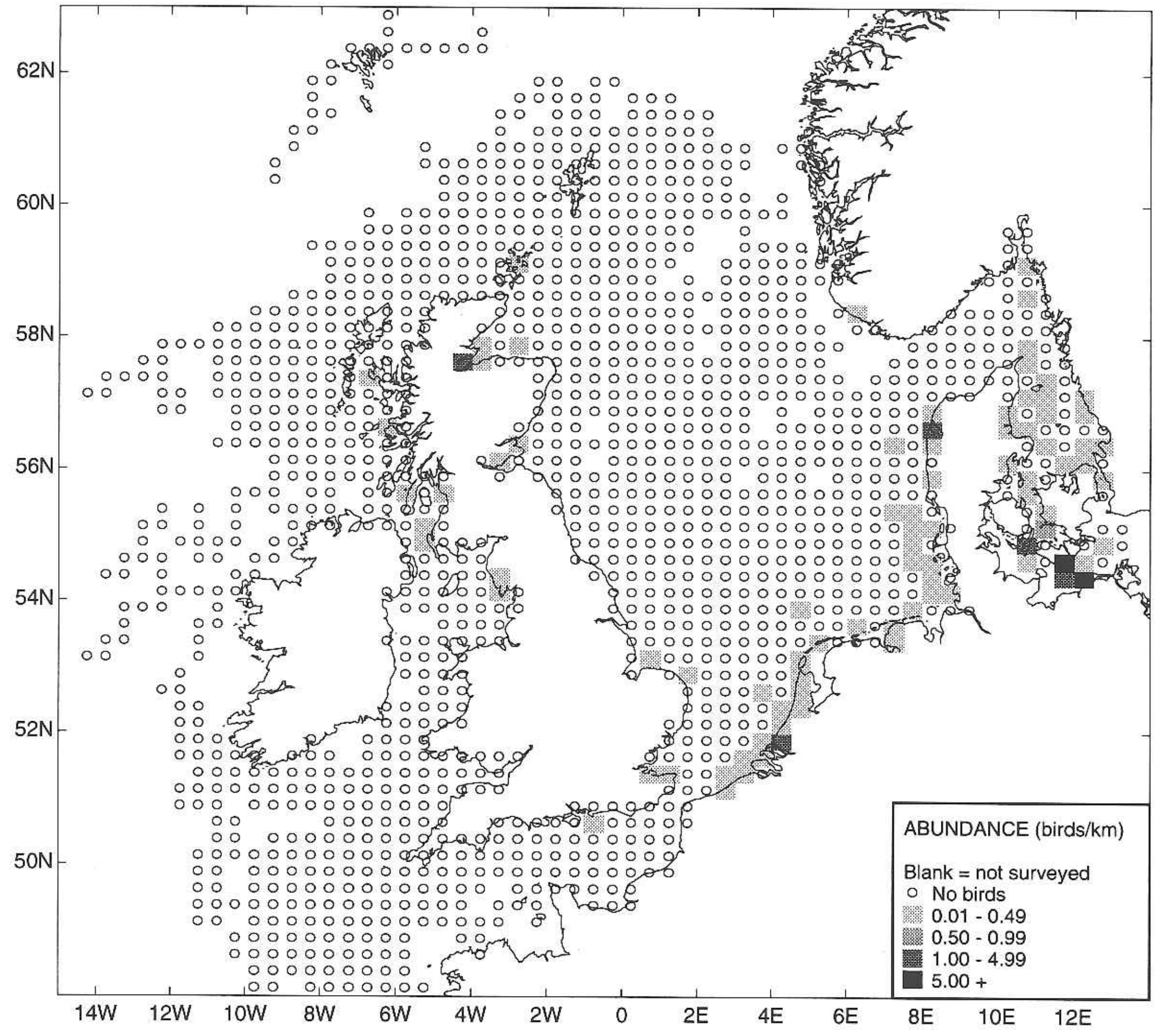

Figure 5.23.2 Distribution of red-breasted mergansers from November to April

November to April (Figure 5.23.2)

More birds were seen between November and April than from May to October, probably a result of birds moving away from breeding locations to the coast for the winter period, and due to Scandinavian and Russian birds migrating into the area. Numbers were still generally low (Table 5.23.1), although higher numbers were present in the Belt Sea, where red-breasted mergansers have been shown to prefer shallow protected coasts (Durinck *et al.* 1994). Birds were widespread in the Kattegat and along continental coasts of the southern North Sea, with increased numbers in the Delta Region. Low numbers were also seen in the Wash, the Firth of Tay, the Moray Firth and around the Clyde.

Summary and conservation implications

Red-breasted mergansers were present in the study area throughout the year, but were more common between November and April. It is likely, however, that many mergansers would have been inshore of the survey area that was covered during this study. Large numbers of red-breasted mergansers winter in Danish waters and they also use these waters to moult (Danielsen *et al.* 1986). They are vulnerable to pollution due to the amount of time they spend on the surface of the water, and an oil spill on continental coasts of the southern North Sea or in the Kattegat or Belt Sea could affect these wintering populations.

Further reading

Baptist, H.J.M. 1988. Vogelconcentraties in de voordelta tijdens en voorafgaande aan het "Borcea-Incident", December 1987 - Januari 1988. *Sula 2:* 21-23.

Benn, S. 1985. Seafowl off North East Scotland and in Orkney. *Nature Conservancy Council, unpublished report, Aberdeen.*

Carss, D.N. 1989. Sawbill ducks at fish farms in Argyll, western Scotland. *Scot. Birds 15:* 145-150.

Cramp, S., & Simmons, K.E.L. (eds.) 1977. *The birds of the western Palearctic, Vol I.* Oxford, Oxford University Press.

Danielsen, F., Durinck, J., & Skov, H. 1986. Havfugle og olieforurening i Dansk farvande 1984-85. *Olieefuglegruppen, Dansk Ornitologisk Forening.*

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Doornbos, G. 1984. Piscivorous birds on the saline lake Grevelingen, The Netherlands: abundance, prey selection and annual food consumption. *Neth. J. Sea Res. 18:* 457-497.

Joensen, A.H. 1974. Waterfowl populations in Denmark 1965-1973. *Danish Review of Game Biology Vol.9 no.1.*

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1989a. Landsdækkende optælling af vandfugle fra flyvemaskine, august 1988. *Rapport fra Vildtbiologisk Station Miljøministeriets Vildtforvaltning Januar 1989.*

Laursen, K., Pihl, S., Hansen, M. & Frikke, J. 1989b. Landsdækkende optælling af vandfugle fra flyvemaskine, august 1989. *Rapport fra Vildtbiologisk Station Miljøministeriets Vildtforvaltning December 1989.*

Meininger, P.L. & Kraker, K. de 1992. De Middelste Zaagbek *Mergus serrator* als broedvogel in het Deltagebied, ZW-Nederland, 1977-91. *Limosa 65(2):* 49-51.

Mudge, G.P. & Allen, D.S. 1980. Wintering sea-ducks in the Moray and Dornoch Firths, Scotland. *Wildfowl 31:* 123-130.

Petersen, F.D. 1974. The migration of ducks (Anatinae) at Blåvand, western Jutland, 1963-71. *Dansk. Orn. Foren. Tidsskr. 68:* 25-37.

Richner, H. 1988. Temporal and spatial patterns in the abundance of wintering Red-breasted Mergansers *Mergus serrator* in an estuary. *Ibis 103(1):* 73-78.

Vessem, J. van 1993. Priorities for the selection of waterbird species in need of international conservation planning in the Western Palearctic. *IWRB/ JNCC Report* 172: 49 pp.

Table 5.23.1 Overall abundance of red-breasted mergansers (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance	0.00	0.00	0.01	0.00	0.00	0.11	0.00	-	0.00	0.00
	km	319.8	5643.3	2462.1	4457.5	4336.9	17833.2	3811.8	0.0	246.6	3896.7
Feb	Abundance	0.00	0.01	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
	km	1182.5	2596.3	4676.9	4328.1	12460.9	25624.8	1587.3	378.2	636.7	1876.8
Mar	Abundance	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1249.2	4907.3	4453.4	2574.8	4067.0	13979.9	2514.5	496.2	2039.0	3428.4
Apr	Abundance	0.00	0.01	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km	1920.0	3159.0	4143.3	898.7	7145.0	22488.8	1810.8	329.7	1836.3	2626.0
May	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	1505.2	6358.4	4704.1	4656.3	10173.7	14851.7	4166.7	844.0	1675.9	5028.1
Jun	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2056.9	5893.8	4395.2	1923.5	7953.4	11697.0	2919.1	240.1	1078.2	1945.5
Jul	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	3340.3	6319.9	12359.4	6626.4	16371.3	9396.7	5607.2	514.0	3158.5	4120.2
Aug	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	2893.0	8228.7	4592.8	7242.7	14452.1	18754.5	3538.7	929.7	1680.9	2975.1
Sep	Abundance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	696.3	4790.5	4764.0	11640.3	11416.3	15011.2	6648.9	13.3	1306.8	4009.4
Oct	Abundance	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	km	222.0	4515.3	1909.0	2505.8	5436.0	13885.8	1188.5	42.0	992.0	2703.3
Nov	Abundance	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	387.5	2173.4	3261.6	3484.5	6833.4	16604.9	2684.1	277.2	2522.6	2973.6
Dec	Abundance	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km	340.5	2717.9	2030.0	3087.5	3593.2	14347.5	939.3	335.6	1560.9	5724.4

5.24 GREY PHALAROPE *Phalaropus fulicarius*

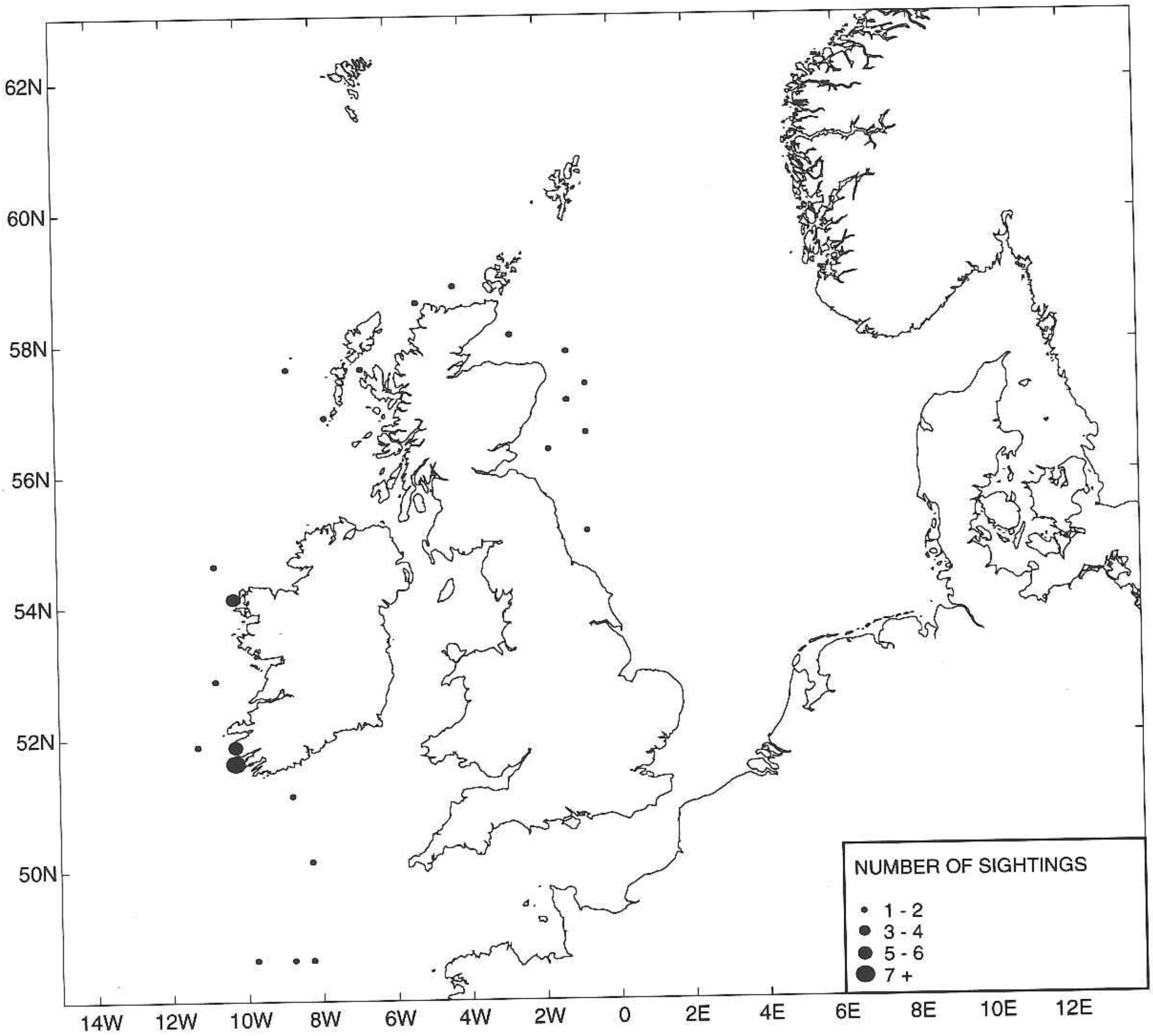

Figure 5.24.1 Sightings of grey phalaropes throughout the year

January to December (Figure 5.24.1)

The distribution of grey phalaropes was restricted to the coast of Britain and Ireland. Sightings were most common along the west coast of Ireland, with low numbers around north-eastern Britain, the Outer Hebrides and St Kilda, the outer shelf of the Celtic Sea and the shelf edge in the South-west Approaches. Peak numbers occurred in October (Figure 5.24.2), with a smaller peak in August.

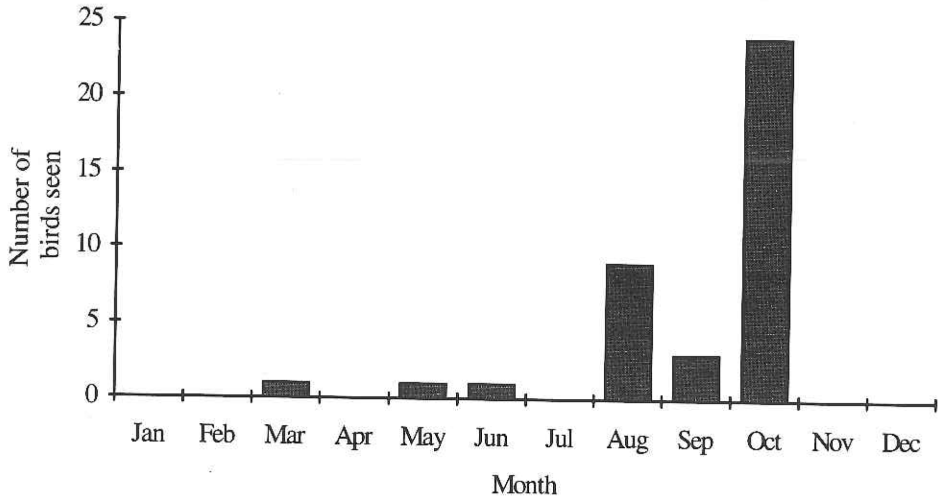

Figure 5.24.2 Number of grey phalaropes seen per month

Summary and conservation implications

Grey phalaropes were seen in low numbers in the study area. The species is widely dispersed in the area, and therefore is under little or no threat from oil pollution.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

5.25 POMARINE SKUA *Stercorarius pomarinus*

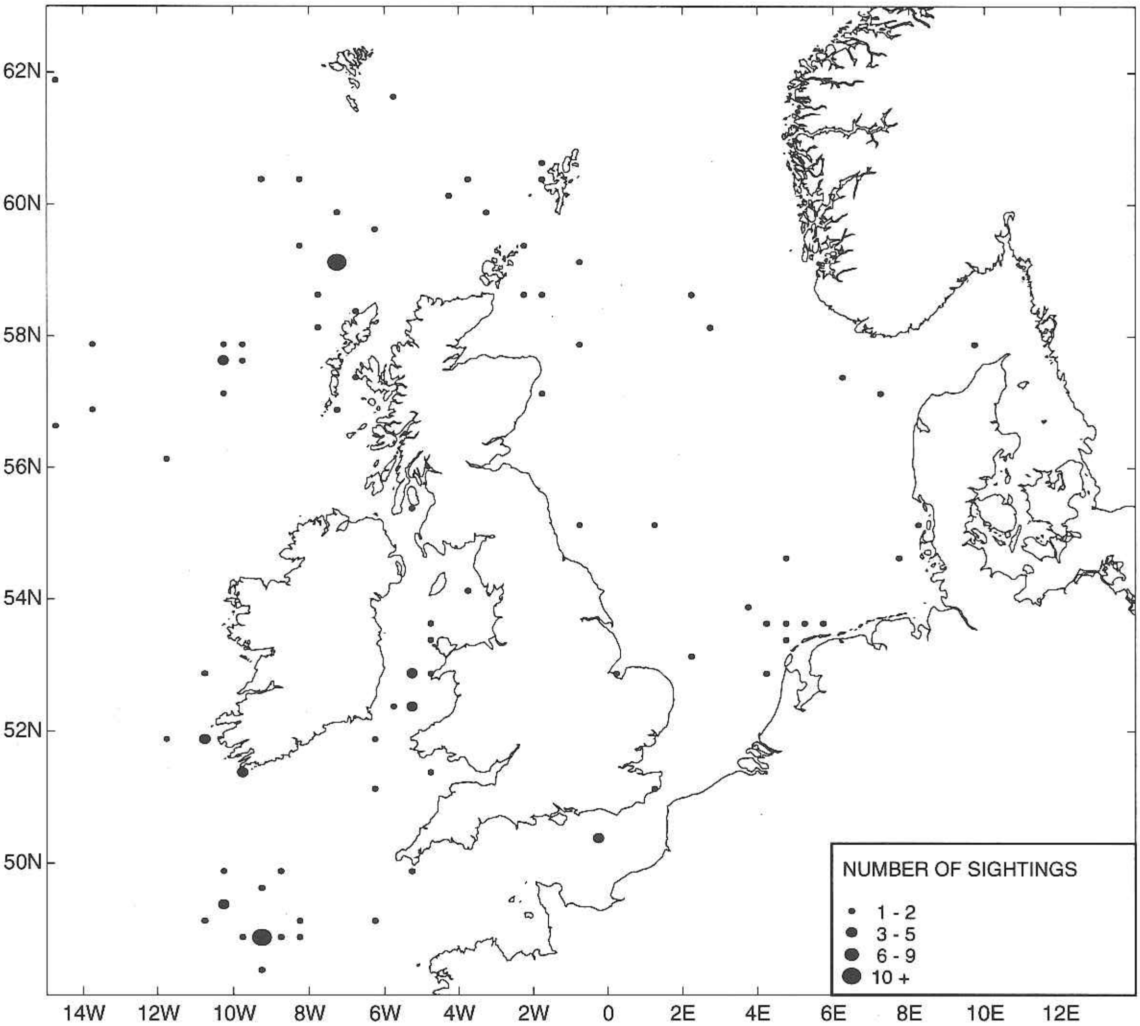

Figure 5.25.1 Sightings of pomarine skuas from March to July

March to July (Figure 5.25.1)

Sightings of pomarine skuas were scarce and widely distributed throughout the study area from March to July. There was a small peak of pomarine skua sightings April and May (Figure 5.25.3)due to the migration of breeding adults from the wintering grounds off the coast of north west Africa to the breeding grounds in north-east Russia and Siberia.

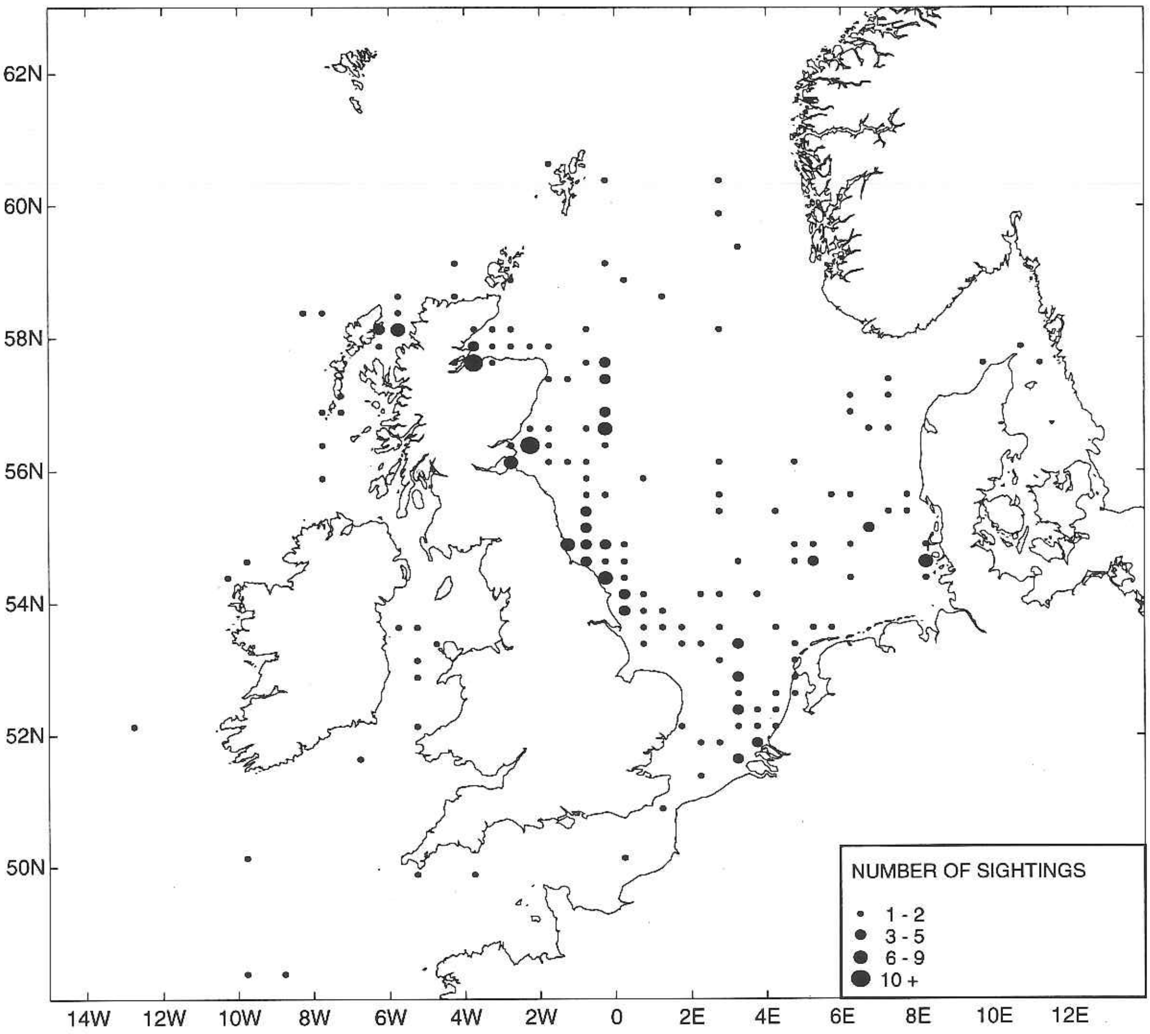

Figure 5.25.2 Sightings of pomarine skuas from August to February

August to February (Figure 5.25.2)

There was a concentration of sightings in the North sea from August to February, especially along the east coast of Britain and the Netherlands coast. Sightings peaked in September (Figure 5.25.3) due to adults and juveniles travelling back to their wintering areas. The peak in abundance drops gradually through October and November to very low levels in winter. Thus it seem the North sea is an important migration path for pomarine skuas during the autumn.

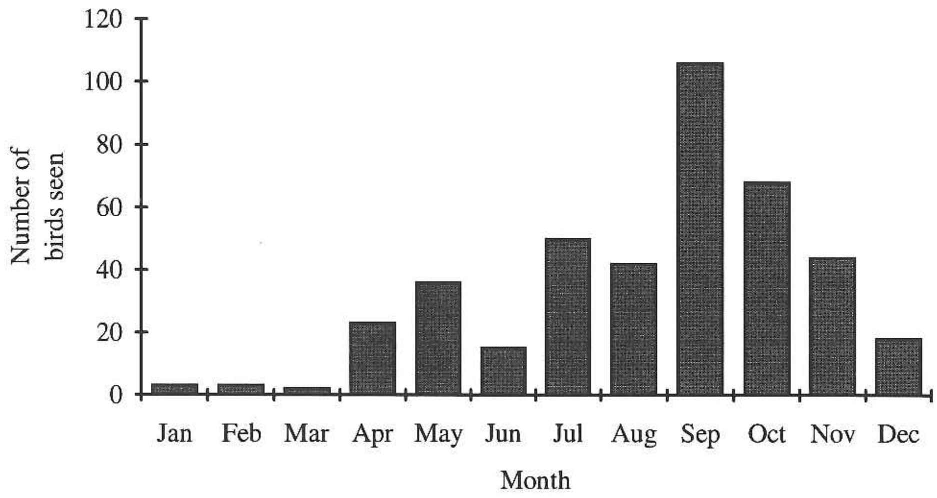

Figure 5.25.3 Number of pomarine skuas seen per month

Summary and conservation implications

Pomarine skuas are migrants through the seas of northern Europe, travelling between west Africa and northern Russia. During the spring migration they were distributed irregularly over a large area while during the autumn migration they concentrated along the east coast of Britain. Pomarine skuas are not very vulnerable to oil pollution in the study area since they are widely dispersed, transient, mobile and highly aerial.

Further reading

Bourne, W.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Butcher, W.S., Reed, P.A.Jr. & Butcher, J.B. 1968. Distribution charts of oceanic birds in the north Atlantic. *Woods Hole Oceanographic Institution, Report Reference No. 68-69.*

Camphuysen, P.J. & den Ouden, J.E. 1988. Opmerkelijke concentratie jagers *Stercorariidae* in zeevogelrijk zeegebied ten oosten van Aberdeen (Schotland), September 1988. *Sula 2:* 91-92.

Meltofte, H. 1979. The occurrence of skuas (Stercorarinae) at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

5.26 ARCTIC SKUA *Stercorarius parasiticus*

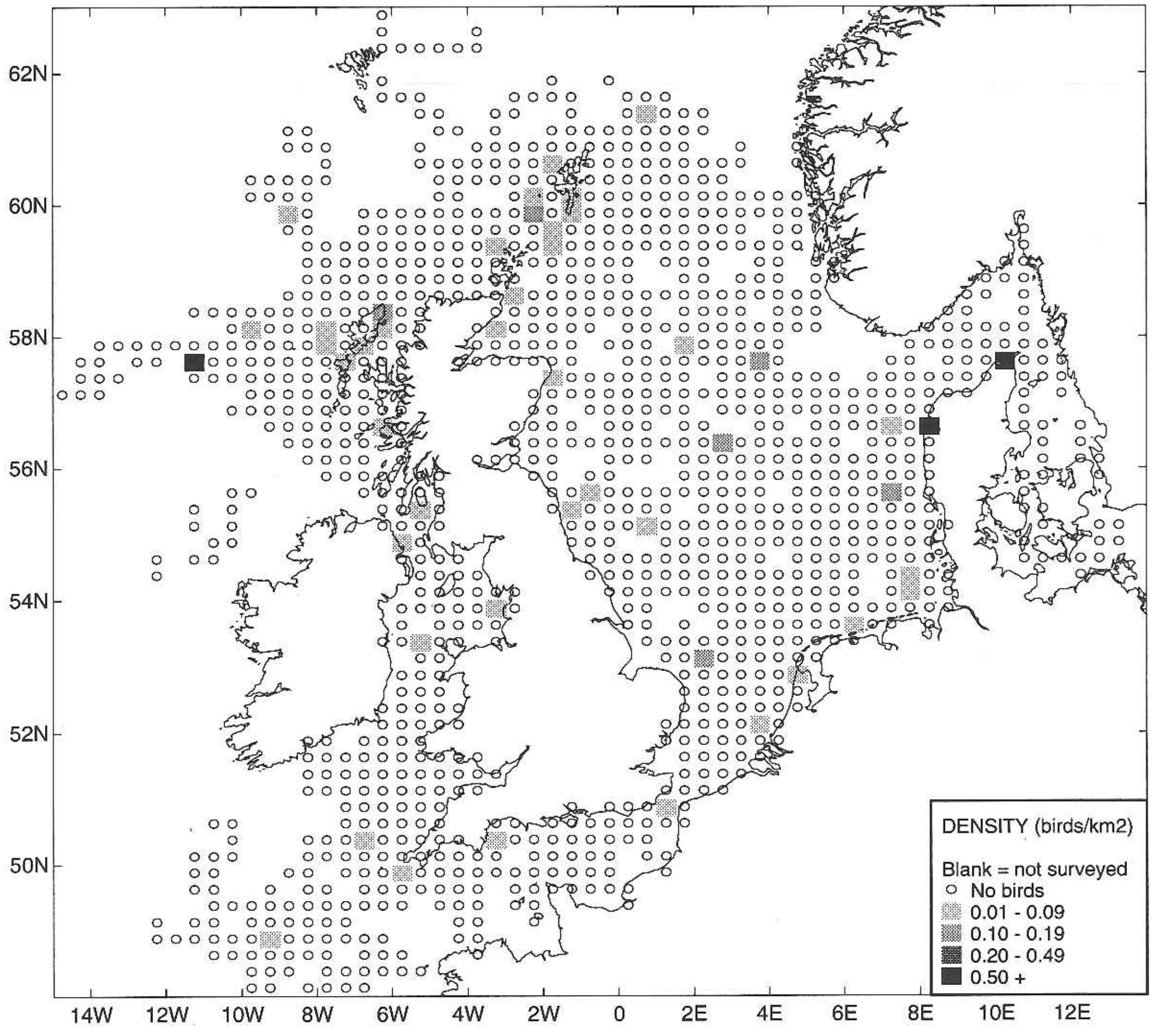

Figure 5.26.1 Distribution of Arctic skuas from April to June

April to June (Figure 5.26.1)

Arctic skuas were widely dispersed during this period with slight concentrations in density around the breeding grounds in Orkney, Shetland and the Outer Hebrides. Elsewhere Arctic skuas were thinly scattered, with higher densities in the North Sea than to the west of Britain.

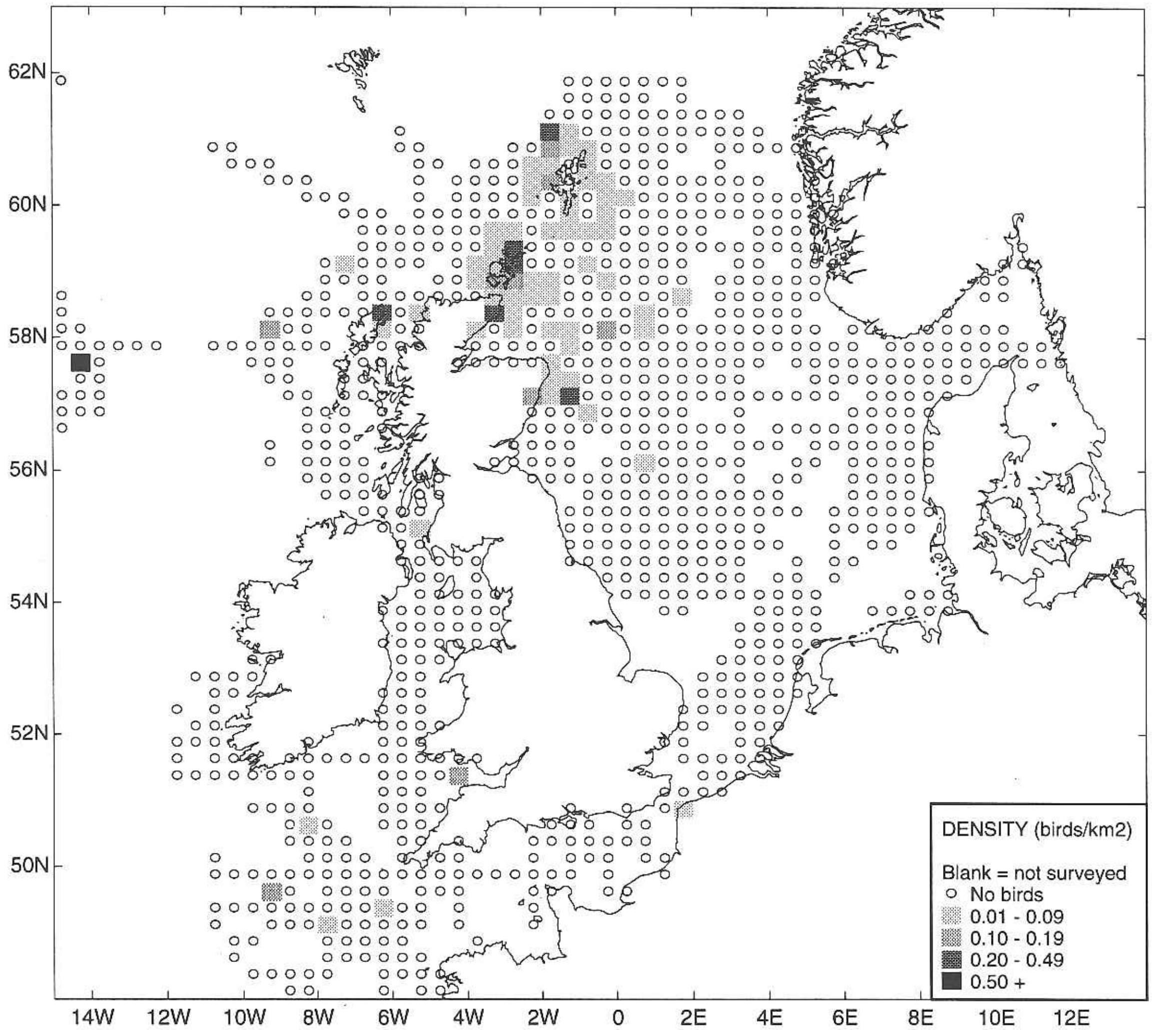

Figure 5.26.2 Distribution of Arctic skuas in July

July (Figure 5.26.2)

During the chick rearing period there were moderate densities of Arctic skuas around Orkney and Shetland breeding colonies and low densities elsewhere. Low to moderate densities in the South-west Approaches were probably non-breeding birds.

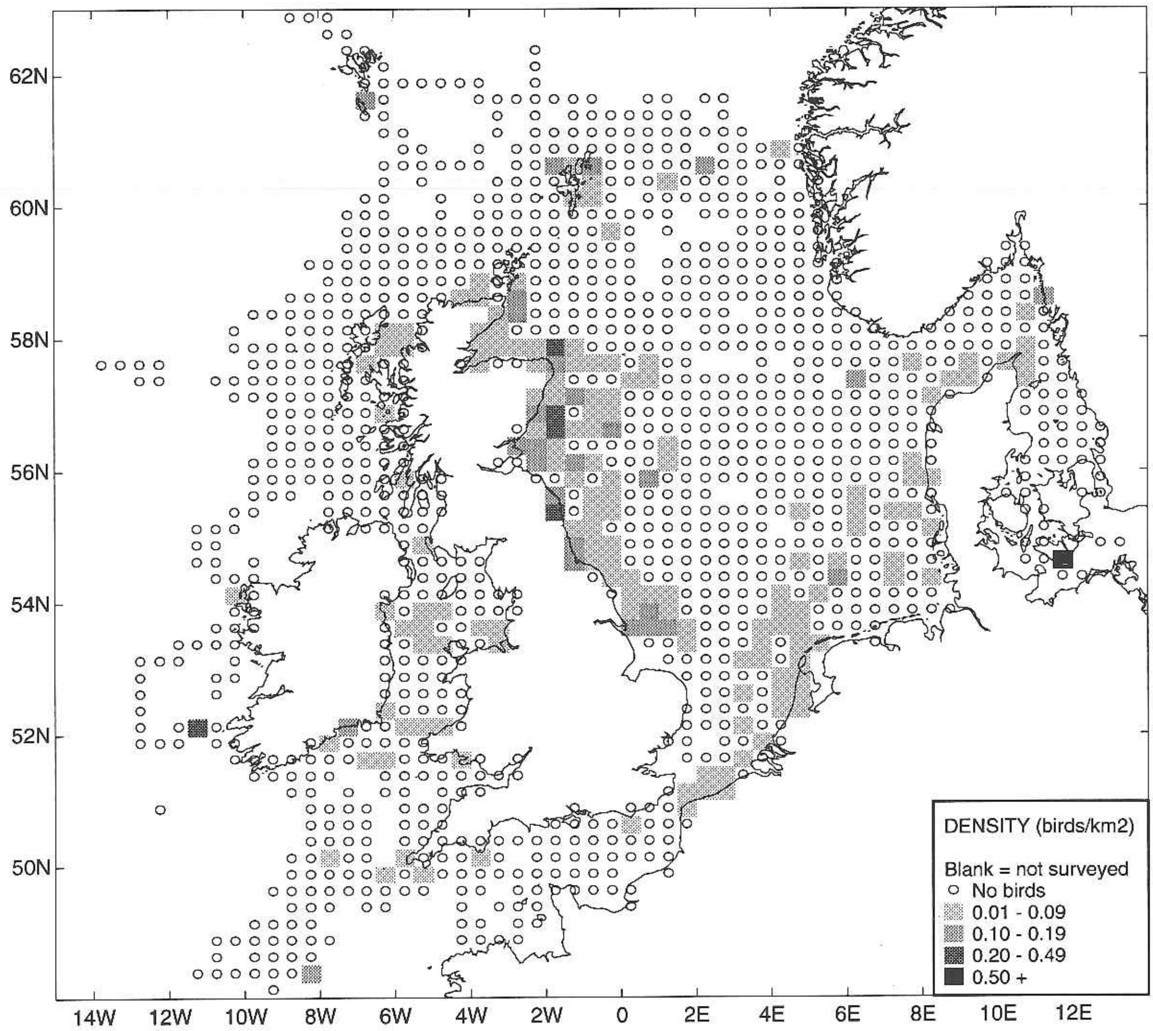

Figure 5.26.3 Distribution of Arctic skuas from August to October

August to October (Figure 5.26.3)

After the breeding season Arctic skuas migrate to the wintering grounds off southern Africa and this is reflected in their distribution along the east coast of Britain (Table 5.26.1) and along the continental coast of the southern North Sea, with a few birds migrating through the Irish sea.

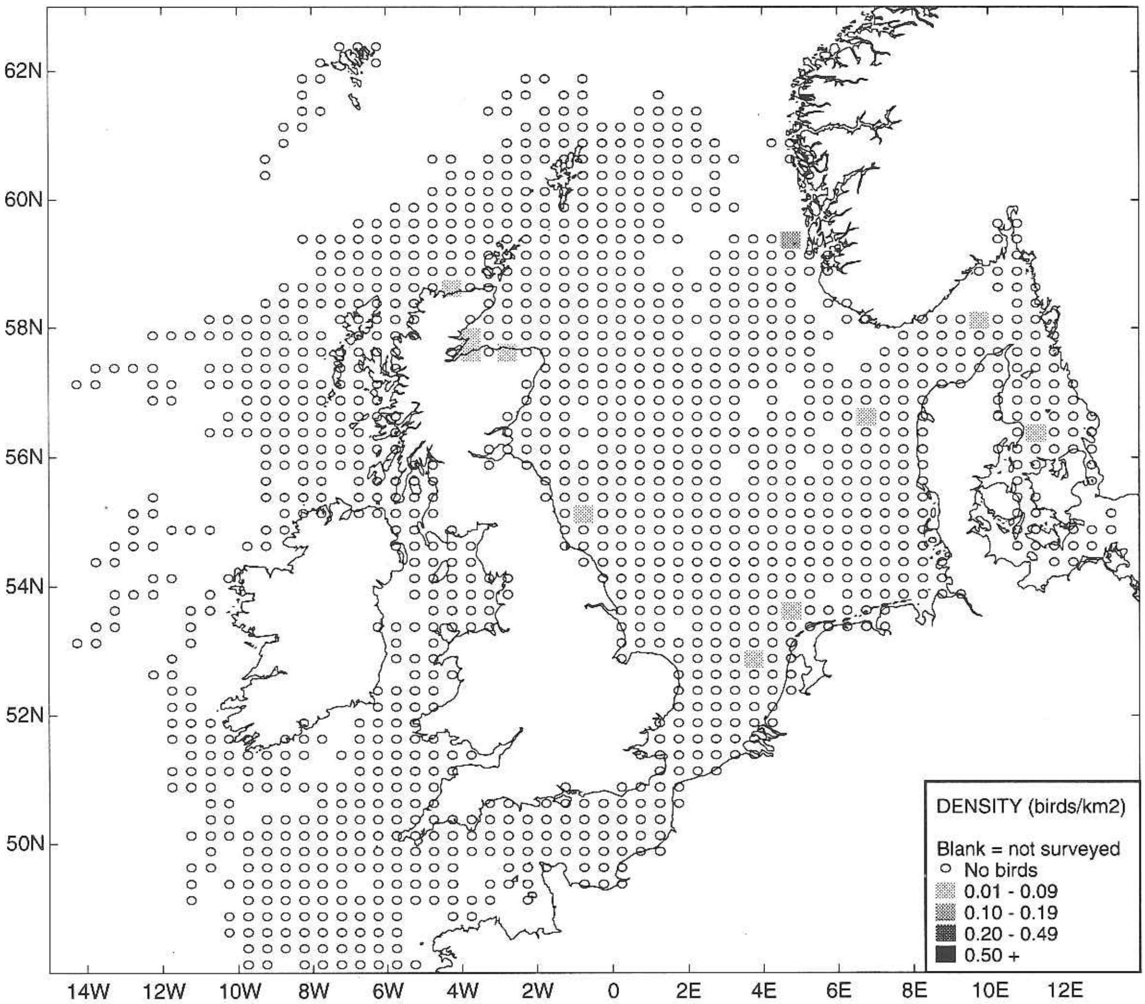

Figure 5.26.4 Distribution of Arctic skuas from November to March

November to March (Figure 5.26.4)

During this period there were low densities of Arctic skuas since most of them have migrated to their wintering grounds.

Summary and conservation implications

During the breeding season Arctic skuas were concentrated around Orkney and Shetland with smaller colonies in northern Scotland and the Outer Hebrides. During the post-breeding period migrating birds were found mainly along the east coast of Britain. Arctic skuas are not very vulnerable to oil pollution since they are highly aerial and seldom alight on the water. However they are perhaps more vulnerable than pomarine and long-tailed skuas since they remain in the Northern Isles throughout the breeding period and a spill around these areas could result in significant levels of mortality.

Further reading

Bourne, W.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, P.J. & den Ouden, J.E. 1988. Opmerkelijke concentratie jagers *Stercorariidae* in zeevogelrijk zeegebied ten oosten van Aberdeen (Schotland), September 1988. *Sula 2:* 91-92.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Meltofte, H. 1979. The occurrence of skuas (Stercorarinae) at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

Table 5.26.1 Overall density of Arctic skuas (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.00	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00.	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.01	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.01	0.04	0.06	0.00	0.01	0.00	0.01	0.00	0.00
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.00	0.02	0.04	0.02	0.01	0.01	0.00	0.02	0.00
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.27 LONG-TAILED SKUA *Stercorarius longicaudus*

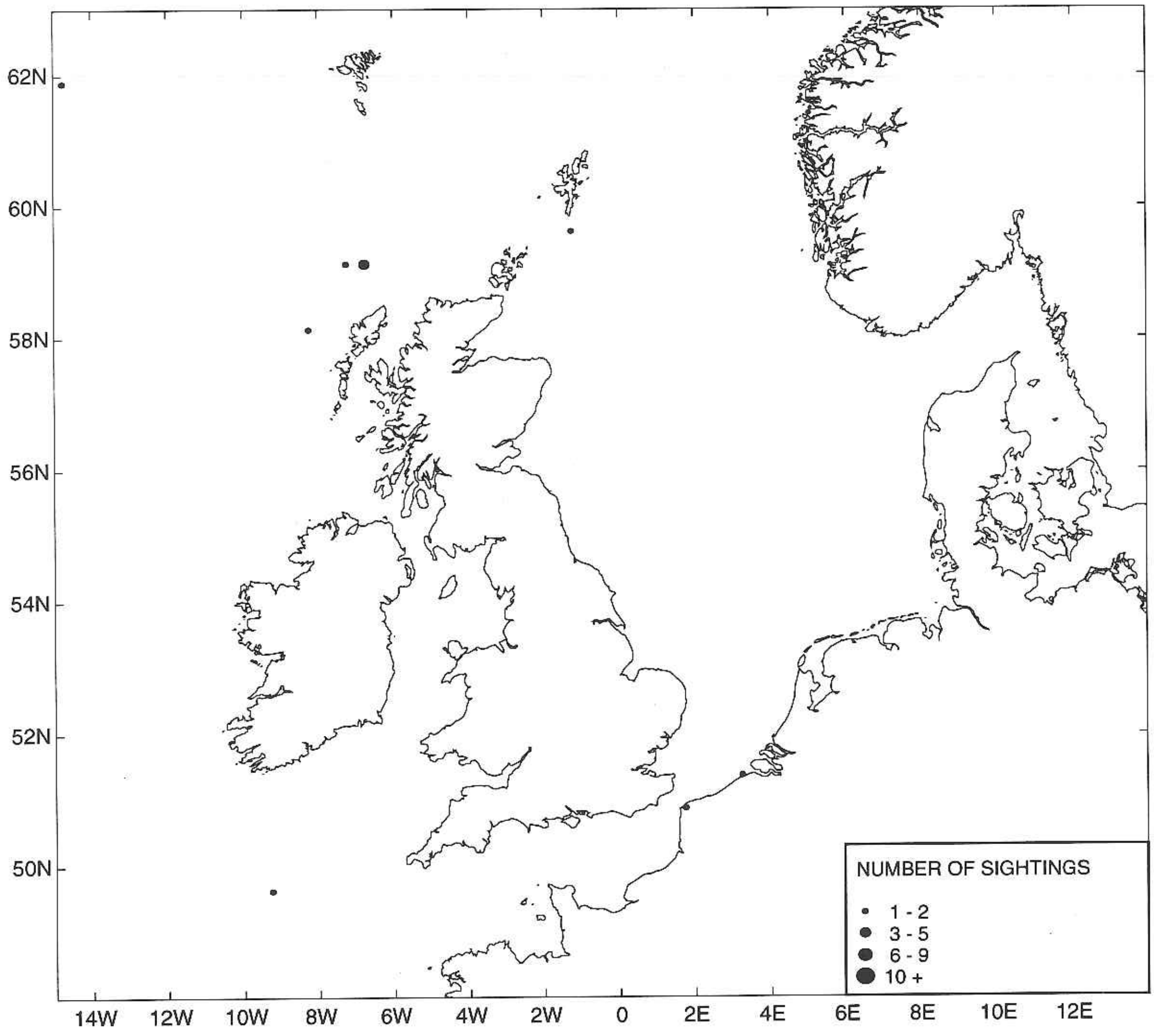

Figure 5.27.1 Sightings of long-tailed skuas from May to July

May to July (Figure 5.27.1)

There were very few sightings of long-tailed skuas during this period with most of the sightings being to the north of the Outer Hebrides. The count of birds in the whole area in these months totalled eleven (Figure 5.27.3). By the end of this period most birds are at the breeding grounds in Scandinavia and northern Russia.

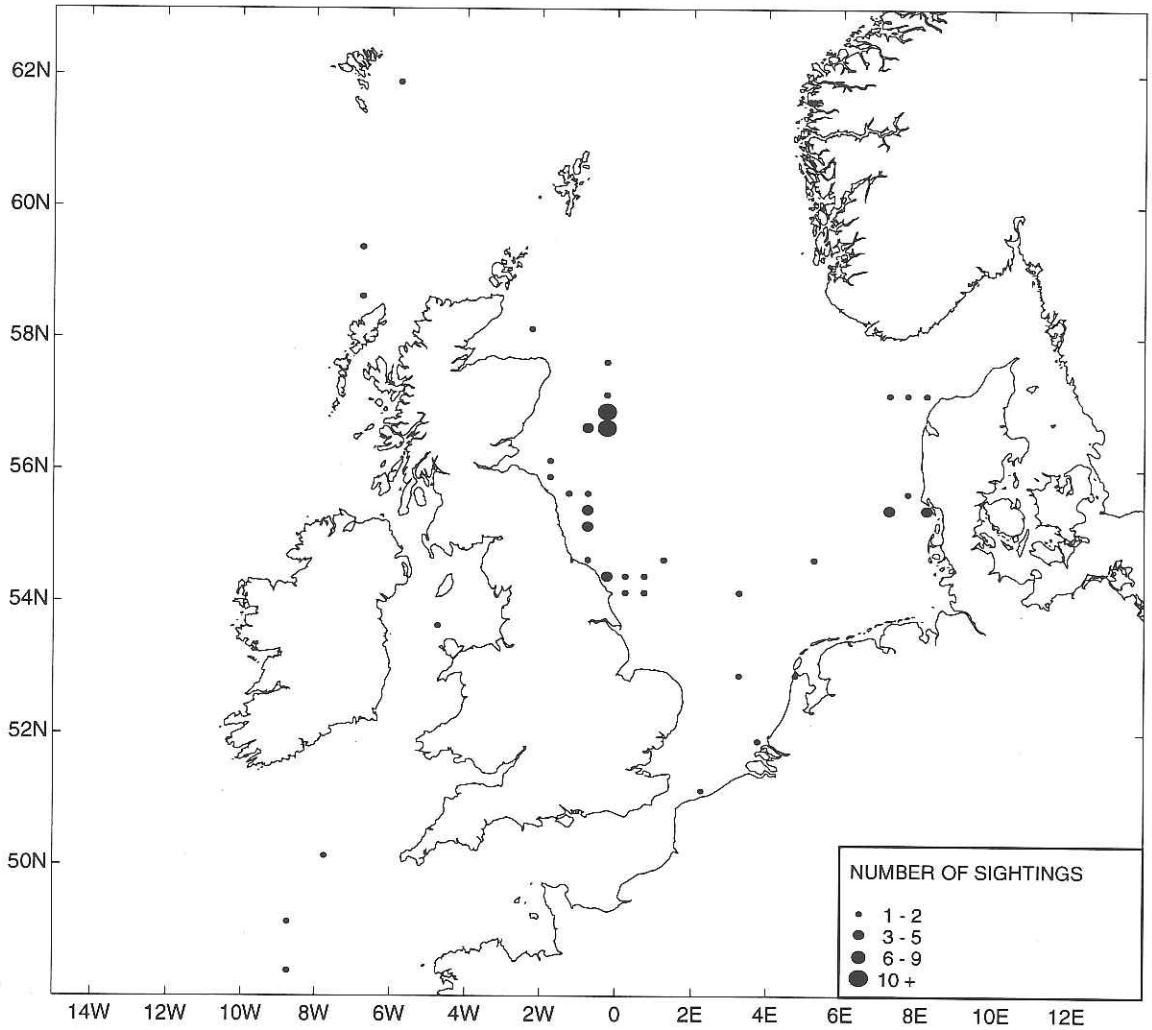

Figure 5.27.2 Sightings of long-tailed skuas from August to November

August to November (Figure 5.27.2)

In common with the other two species of *Stercorarius* skuas, long-tailed skuas showed concentrations along the east coast of Britain as they migrate to the south Atlantic, with scattered sightings along the continental coast of the North Sea and in the South-west Approaches. Numbers of long-tailed skuas reached a sharp peak of 57 birds during September and declined rapidly through October and November and none were sighted from December through to April (Figure 5.27.3).

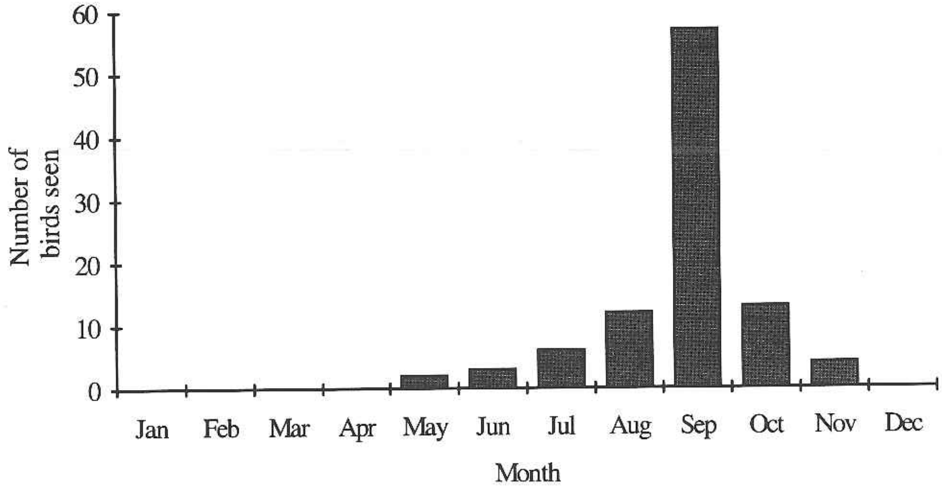

Figure 5.27.3 Number of long-tailed skuas seen per month

Summary and conservation implications

Long-tailed skuas are a scarce migrant in north European seas, with only a few birds using the North Sea as a passage route from the breeding areas in Scandinavia and northern Russia to the wintering areas in the south Atlantic. Their main migration route, as documented by Cramp & Simmons(1983), lies outside the study area towards the central Atlantic. Within the study area, the species was most abundant on the east coast of Britain during the peak migration period in September. Long-tailed skuas are not vulnerable to pollution in this area because they are such scarce transient visitors and are also highly aerial.

Further reading

Bourne, W.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, P.J. & den Ouden, J.E. 1988. Opmerkelijke concentratie jagers *Stercorariidae* in zeevogelrijk zeegebied ten oosten van Aberdeen (Schotland), September 1988. *Sula 2:* 91-92.

Cramp, S. & Simmons, K.E.L. 1983. *Handbook of the birds of Europe, the Middle East and North Africa: the birds of the Western Palearctic. Vol. 3: Waders to gulls.* Oxford University Press, Oxford.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Ham, N.F. van der 1989. Influx of Long-tailed Skuas in the Netherlands in autumn 1988. *Sula 3(4):* 128-133.

Meltofte, H. 1979. The occurrence of skuas (Stercorarinae) at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

5.28 GREAT SKUA *Catharacta skua*

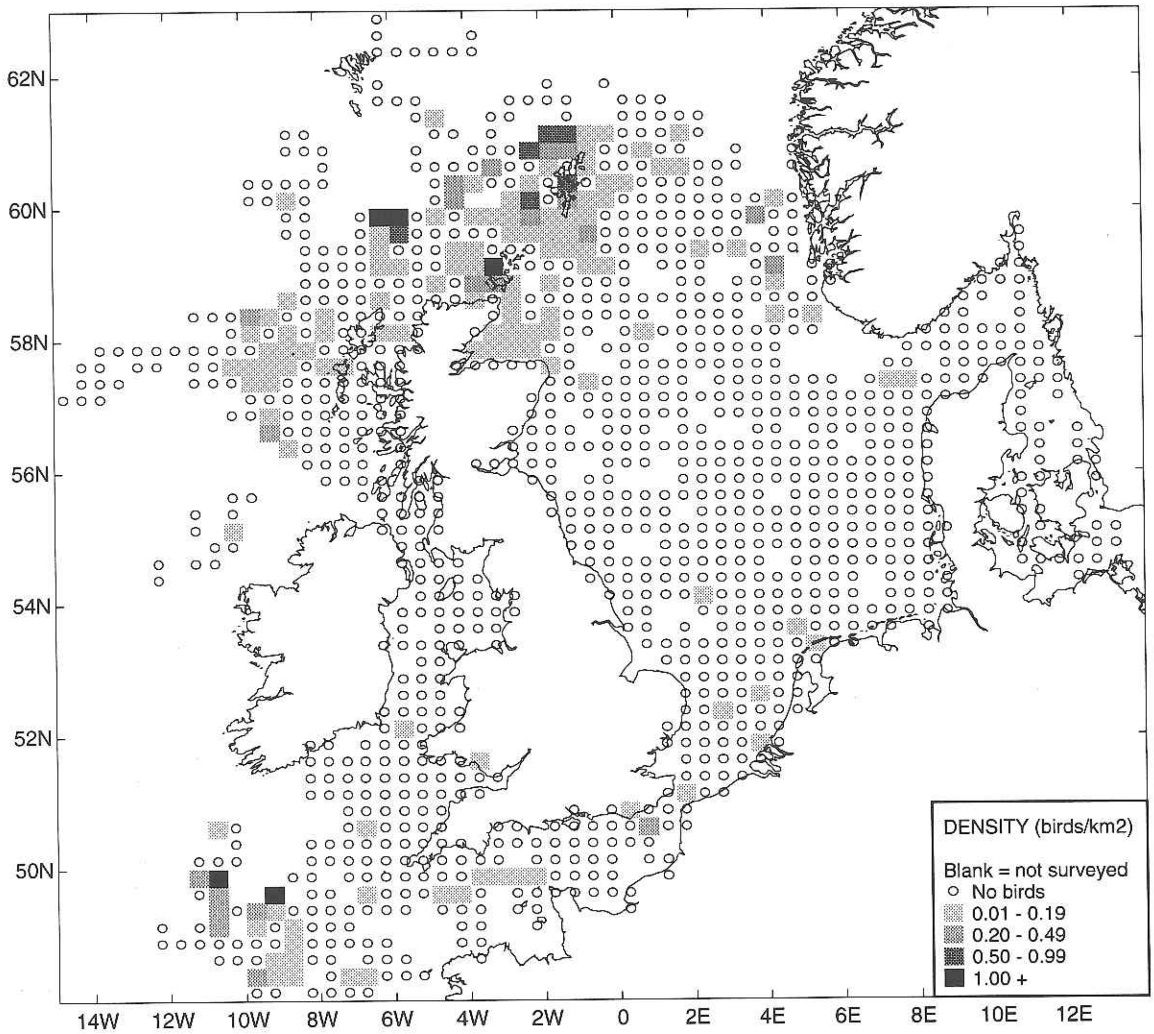

Figure 5.28.1 Distribution of great skuas from April to June

April to June (Figure 5.28.1)

Densities of great skuas were concentrated around the breeding colonies in Shetland, Orkney, with lower densities around St Kilda, in the Moray Firth and to the west of Norway. Moderate densities were seen in the South-west Approaches, these birds probably being non-breeders or stragglers *en route* to the colonies farther north. There were also low densities in the English Channel and southern North Sea.

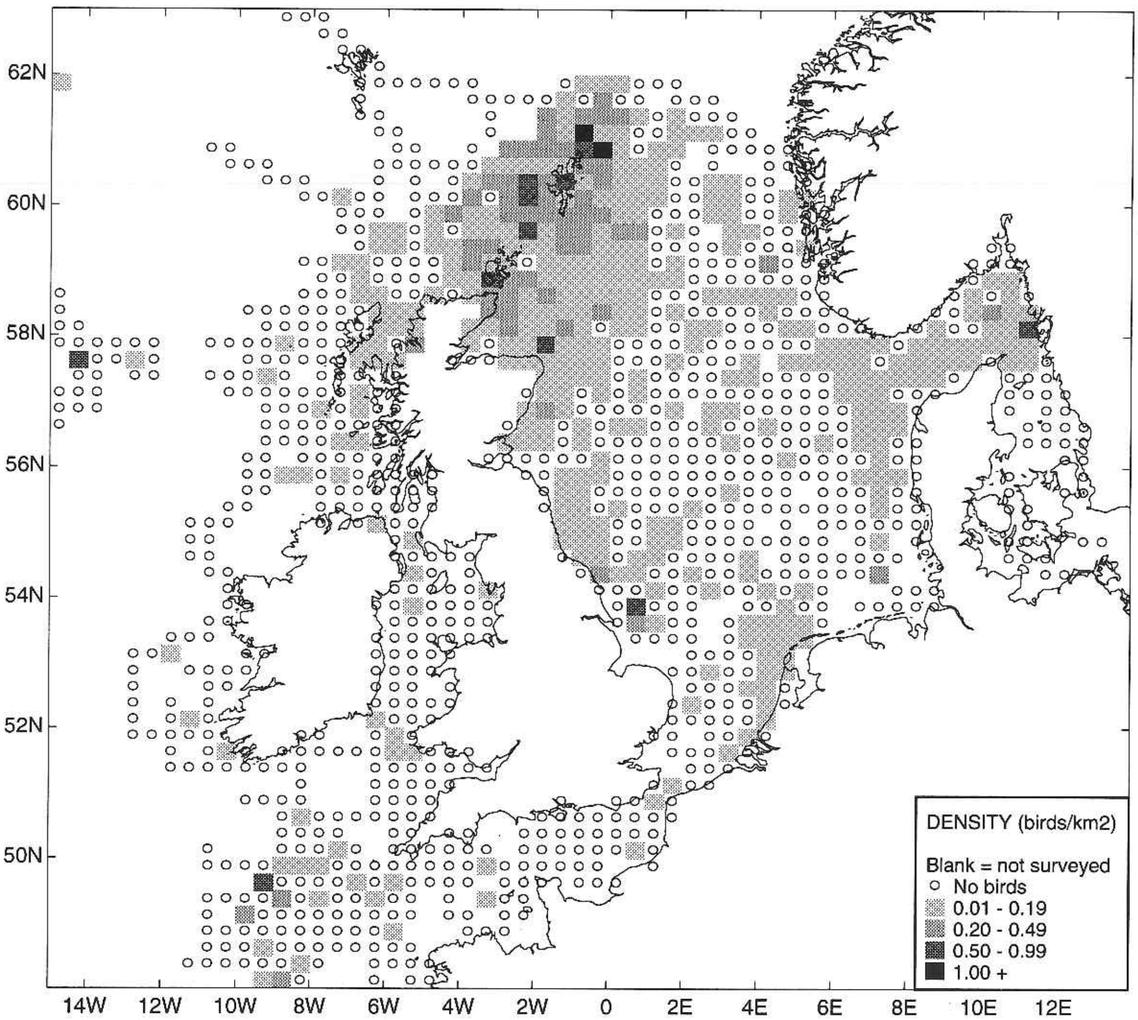

Figure 5.28.2 Distribution of great skuas in July and August

July to August (Figure 5.28.2)

There was a high concentration of great skuas around the Northern Isles at this time of year (Table 5.28.1) since July is the main chick-rearing period. There was also evidence of a southward movement of birds along the east British coast and scattered sightings in the North Sea. Great skuas also occurred at low densities in the Skagerrak and off the west coasts of Denmark and Norway, and off the Netherlands coast. Moderate densities were found in the South-west Approaches.

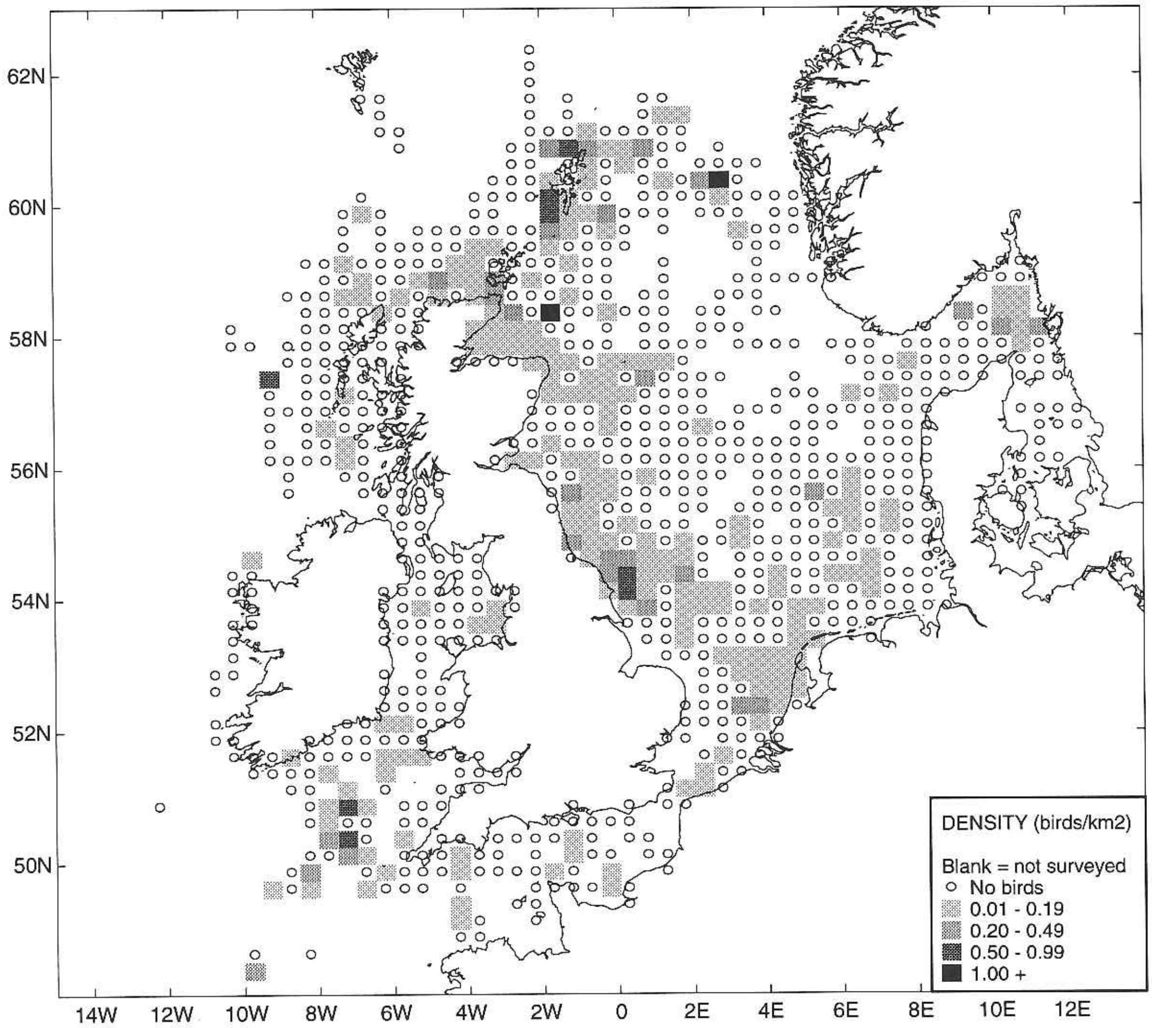

Figure 5.28.3 Distribution of great skuas in September and October

September to October (Figure 5.28.3)

High densities of great skuas were still evident around the colonies, probably due to late breeders. There was further evidence for a southward movement of birds along the east coast of Britain, the coast of the Netherlands and in the English Channel. Fewer birds occupied the Skagerrak area and the density of birds in the Celtic Sea increased.

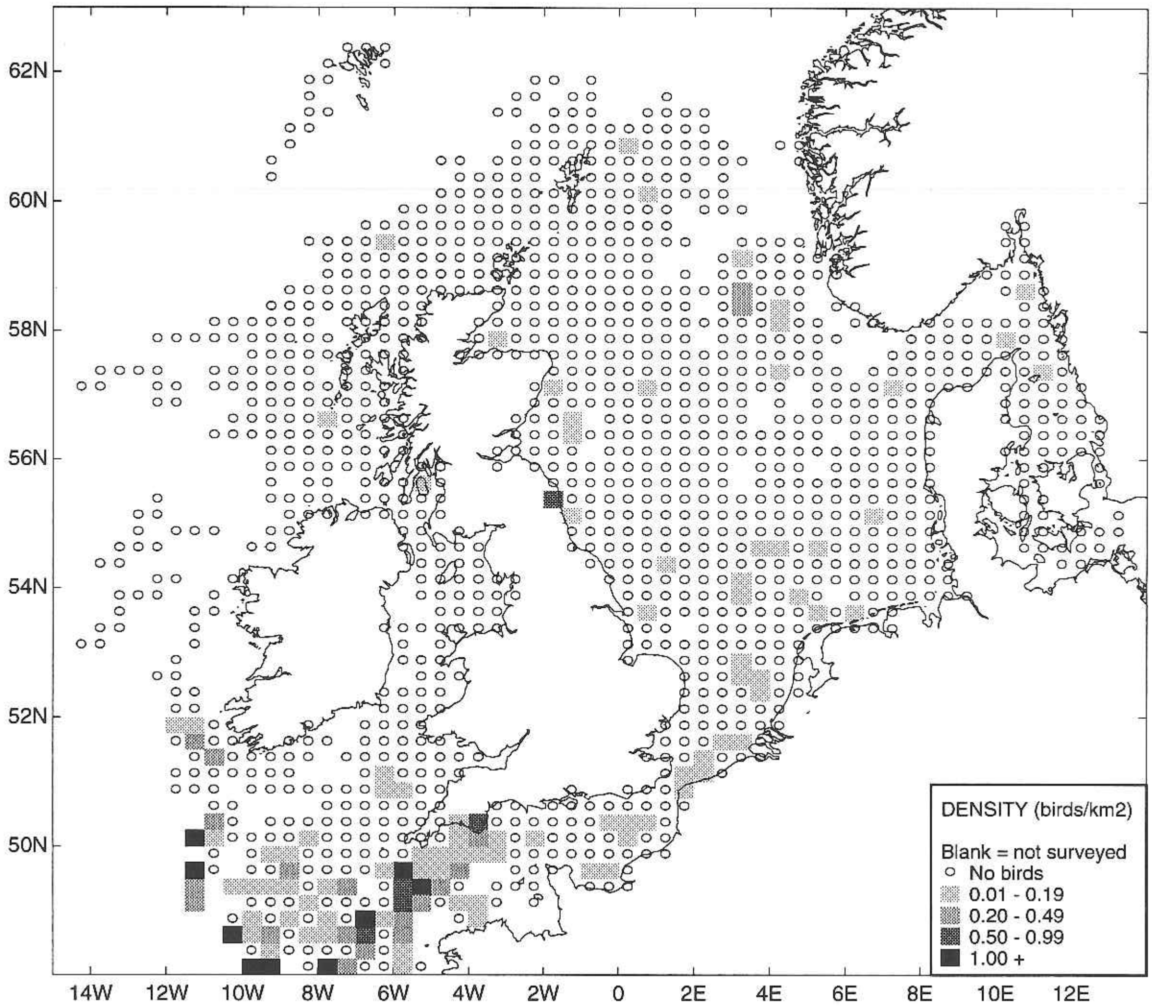

Figure 5.28.4 Distribution of great skuas from November to March

November to March (Figure 5.28.4)

The areas around the main breeding colonies were deserted during winter and there were few great skuas seen in the North Sea and the English Channel. There were moderate to high densities of great skuas in the western English Channel and South-west Approaches, this area being the northernmost extreme of the wintering area which extends southward to the Bay of Biscay and the Spanish coast.

Summary and conservation implications

Great skuas were concentrated around the major breeding colonies of Shetland and Orkney from April through to August. From September to October there was a southward movement along the east coast of Britain with considerable scatter through the North Sea as birds migrated to the wintering grounds in the Bay of Biscay and around Spain. During winter great skuas were concentrated in the South-west Approaches. North Scottish colonies contain an estimated 50% of the world breeding population of this species. Great skuas spend more time on the water than other skuas and so they could be more affected by oil pollution than other species in this group. A large spill around one of the major colonies such as on Shetland could have serious implications for this species.

Further reading

Bourne, W.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Butcher, W.S., Reed, P.A.Jr. & Butcher, J.B. 1968. Distribution charts of oceanic birds in the north Atlantic. *Woods Hole Oceanographic Institution, Report Reference No. 68-69.*

Camphuysen, P.J. & den Ouden, J.E. 1988. Opmerkelijke concentratie jagers *Stercorariidae* in zeevogelrijk zeegebied ten oosten van Aberdeen (Schotland), September 1988. *Sula 2:* 91-92.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Meltofte, H. 1979. The occurrence of skuas (Stercorarinae) at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 67:* 109-114.

Tasker, M.L., Jones, P.H., Blake, B.F. & Dixon, T.J. 1985. Distribution and feeding habits of the great skua *Catharacta skua* in the North Sea. *Seabird 8:* 34-43.

Table 5.28.1 Overall density of great skuas (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.01	0.02
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.00	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.03
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.12	0.01	0.01
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.03	0.01	0.03	0.00	0.01	0.00	0.00	0.10	0.02	0.02
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.14	0.00	0.07	0.00	0.00	0.00	0.00	0.01	0.01	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.06	0.03	0.10	0.00	0.00	0.00	0.00	0.00	0.03	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.14	0.02	0.20	0.03	0.02	0.01	0.01	0.01	0.03	0.00
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.03	0.03	0.21	0.09	0.03	0.04	0.00	0.02	0.02	0.01
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.01	0.01	0.12	0.15	0.03	0.04	0.01	0.00	0.04	0.01
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.02	0.02	0.03	0.02	0.01	0.01	0.00	0.08	0.07	0.01
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.05	0.04
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.29 UNIDENTIFIED GULLS

Gulls are often difficult to identify to species level at sea, especially immature birds. This is a particular problem when large numbers of gulls are gathered around fishing vessels. Tables 5.29.1 and 5.29.2 present densities of two categories of unidentified gulls: birds identified only as gull species, and those identified as large gulls (a category commonly used to mean lesser black-backed gulls, herring gulls or great black-backed gulls, but which may also include glaucous and iceland gulls). These tables show that in certain areas at certain times, there have been high densities of birds not identified to species level. This should be borne in mind when interpreting the species maps in sections 5.30 to 5.40. Areas and months when particular caution should be exercised are the west coast of Scotland in April, May, October and November, the deep sea to the north-west of the study area in May, the Northern Isles and the Moray Firth in October and the continental coast of the southern North Sea in November.

Table 5.29.1 Overall density of unidentified gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.03	0.12	0.01	-	0.00	0.01
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.04	0.00	0.37	0.00	0.00	0.00	0.00
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.35	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.03	0.00	0.46	0.23	0.05	0.00	0.00	0.00	0.00
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	7.99	0.06	0.00	0.00	0.04	0.24	0.00	0.00	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.00	0.02	0.01	0.10	0.00	0.00	0.01	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.03	0.15	0.14	0.01	0.05	0.00	0.00	0.00	0.01
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.00	0.00	0.05	0.00	0.24	0.00	0.00	0.00	0.00
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	2.82	0.00	0.02	0.00	1.18	0.00	0.00	0.00	0.01
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.01	0.58	0.00	0.00	0.00
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

Table 5.29.2 Overall density of unidentified large gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.04	0.00	0.04	0.12	0.01	0.04	-	0.00	0.56
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.17	0.02	0.24	0.01	0.00	0.26	0.00	0.39	0.20
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.39	0.64	0.04	0.10	0.00	0.03	0.00	0.00	0.02
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.19	2.24	0.18	0.05	0.00	0.00	0.01	0.00	0.00	0.01
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	2.30	0.55	0.10	0.02	0.00	0.06	0.01	0.00	0.01	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.01	0.01	0.01	0.00	0.00	0.07	0.00	0.00	0.01
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.03	0.01	0.01	0.00	0.10	0.00	0.00	0.00	0.01
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.05	0.00	0.03	0.00	0.03	0.03	0.00	0.00	0.37
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.02	0.09	0.14	0.00	0.28	0.09	0.00	0.79	0.02
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	1.81	1.15	0.51	0.01	0.01	0.02	0.00	0.14	0.07
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.06	0.04	0.08	0.11	0.00	0.01	0.08	0.00	0.15	0.05
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.03	0.69	0.38	0.00	0.01	0.00	0.00	0.02	0.01
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.30 MEDITERRANEAN GULL *Larus melanocephalus*

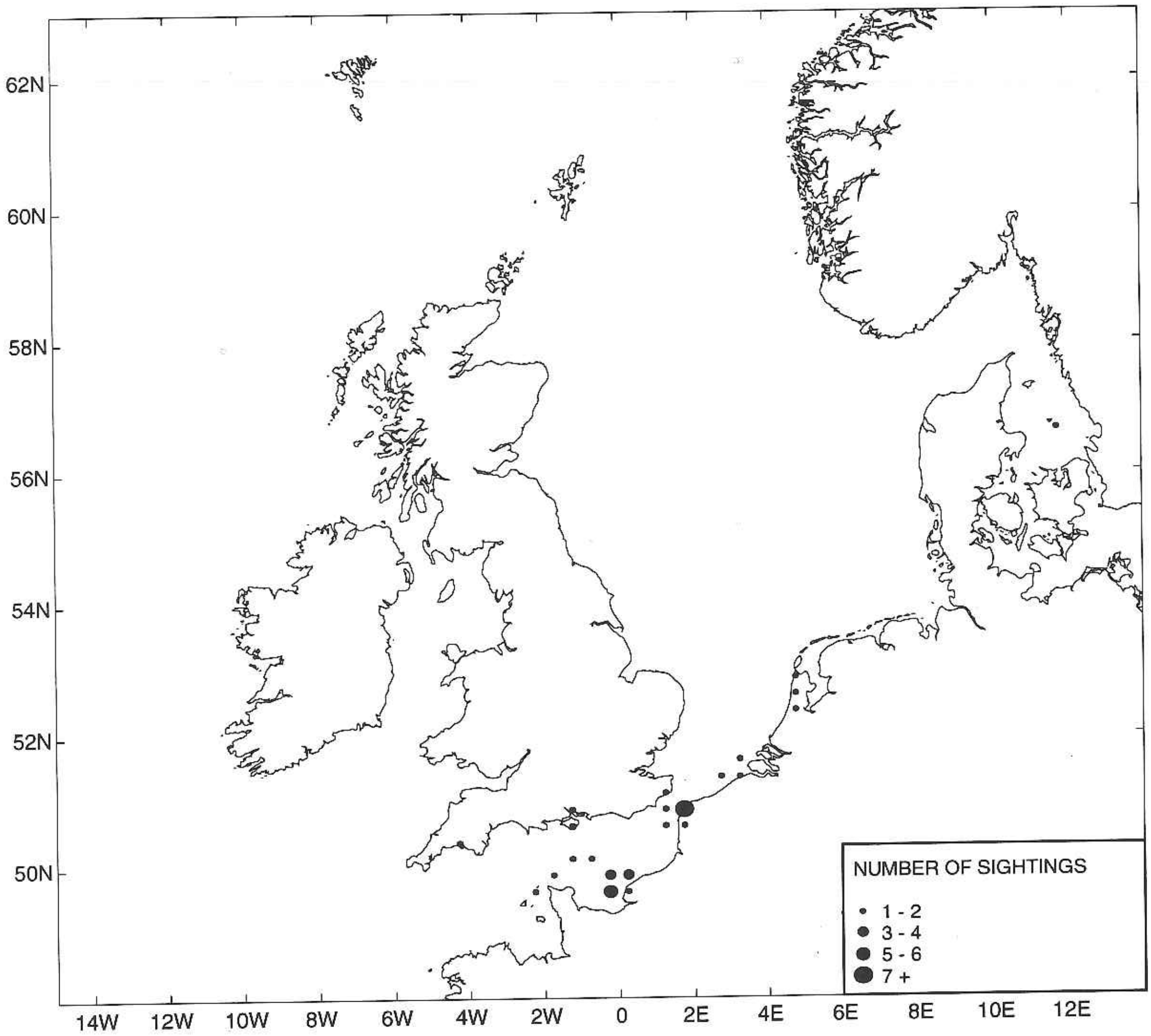

Figure 5.30.1 Sightings of Mediterranean gulls throughout the year

January to December (Figure 5.30.1)

There were very few sightings of Mediterranean gull in the study area with most sightings being in the English Channel and the Belgian coast. Numbers of birds seen increased during November and peaked in December (Figure 5.30.2). This species breeds and winters mostly outside the study area but there is some passage, mainly of immatures, to the Baltic and along the western seaboard of Northern Europe. Some Mediterranean gulls breed in the Delta Region; these birds live inland while breeding, but after the breeding season they migrate to France, where they winter.

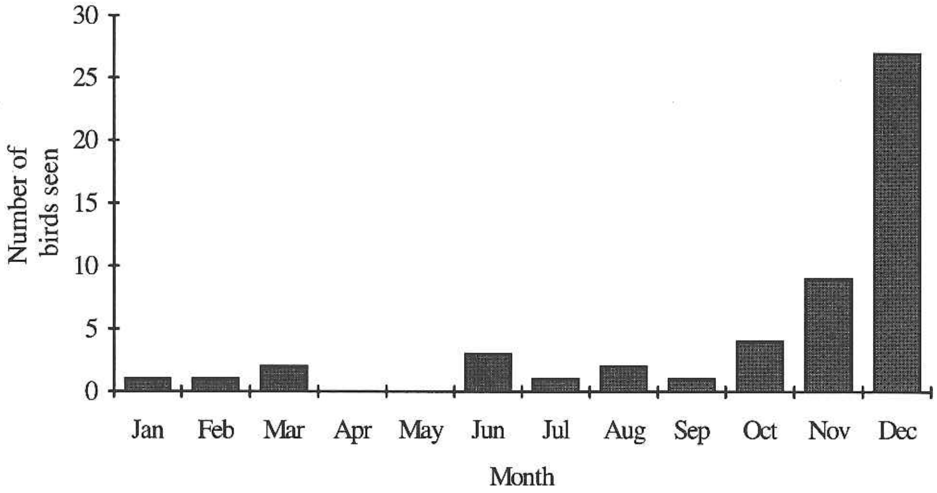

Figure 5.30.2 Number of Mediterranean gulls seen per month

Summary and conservation implications

The Mediterranean gull is a very scarce winter visitor to the English Channel mainly from south-east Europe and Russia. Since the numbers are so low and represent a tiny fraction of the European population there will be no effects of oil pollution on the population.

Further reading

Meininger, P.L., Raevel, P. & Hoogendoorn, W. 1993. Occurrence of Mediterranean Gull at Le Portel in north-western France. *Dutch Birding 15:* 45-54.

5.31 LITTLE GULL *Larus minutus*

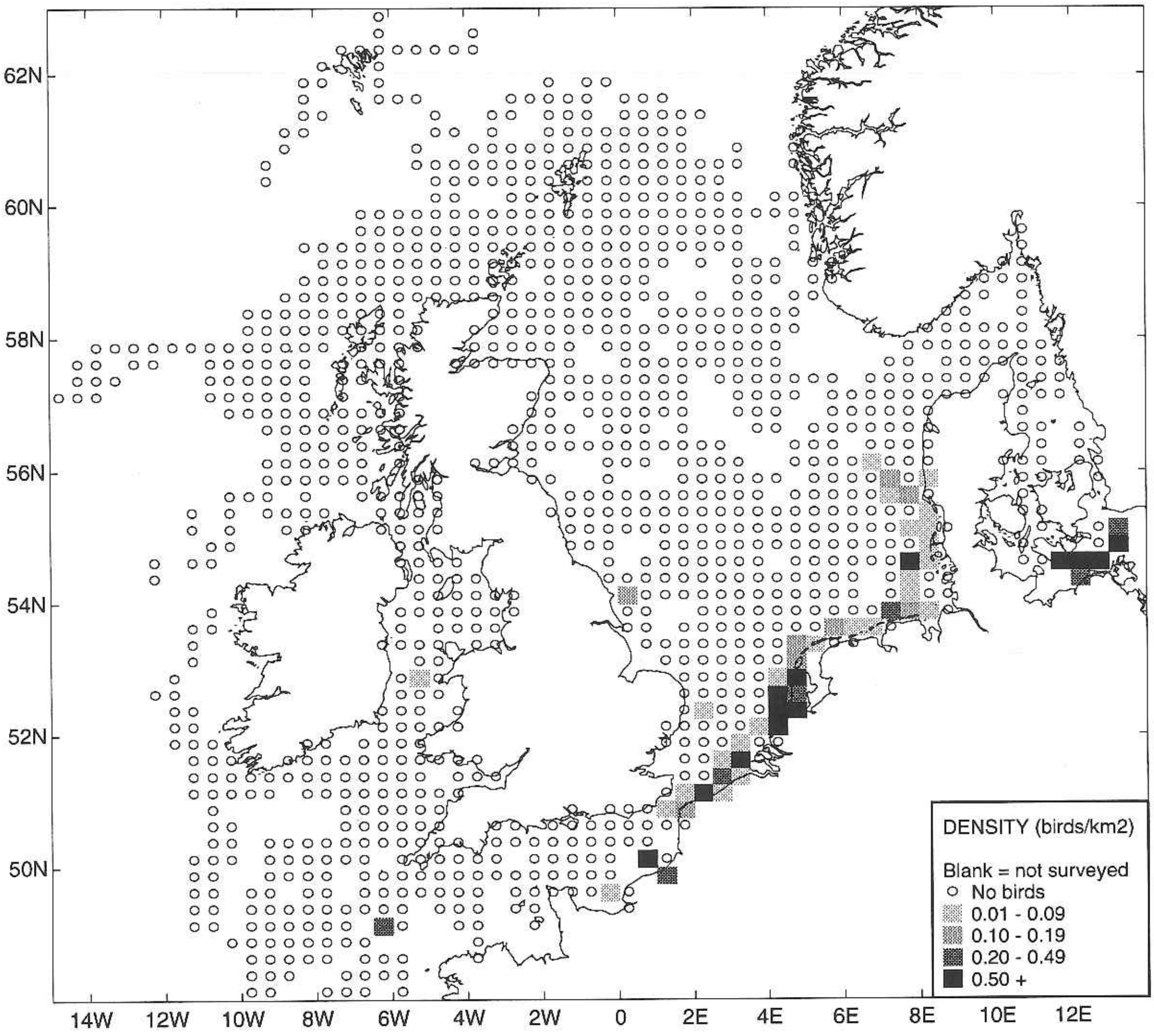

Figure 5.31.1 Distribution of little gulls from March to May

March to May (Figure 5.31.1)

Little gulls during the spring migration period were found mainly along the continental coast of the North Sea (Table 5.31.1) as far north as Denmark and in the Belt Sea, with highest densities in April. There were fewer seen in the eastern English Channel and isolated sightings in the western English Channel and off Flamborough Head. Little gulls are distributed in shallow neritic areas outside the breeding season, especially estuarine habitats.

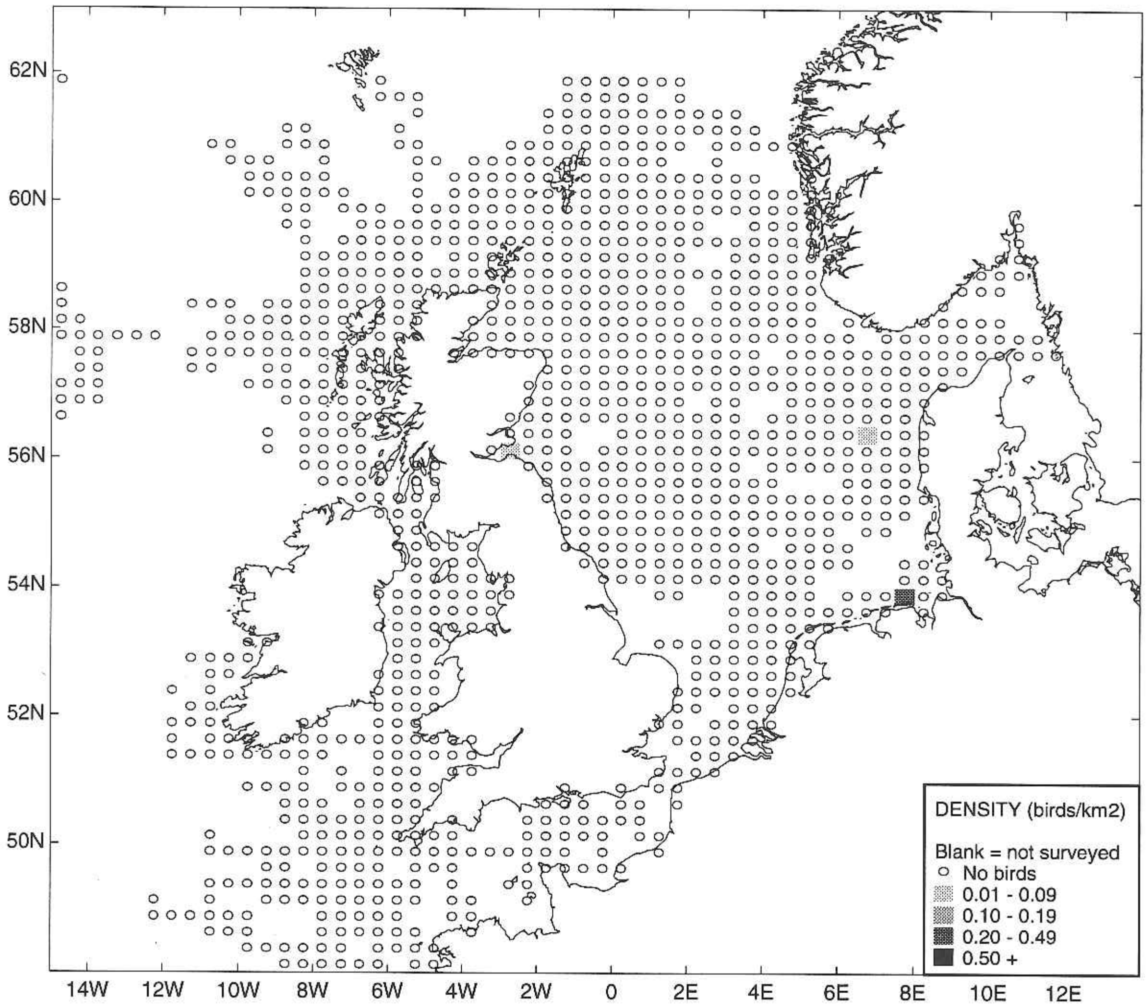

Figure 5.31.2 Distribution of little gulls from June to July

June to July (Figure 5.31.2)

Few little gulls were seen during the breeding season as most of them move out of the area to breed. A few little gulls remained in the German Bight.

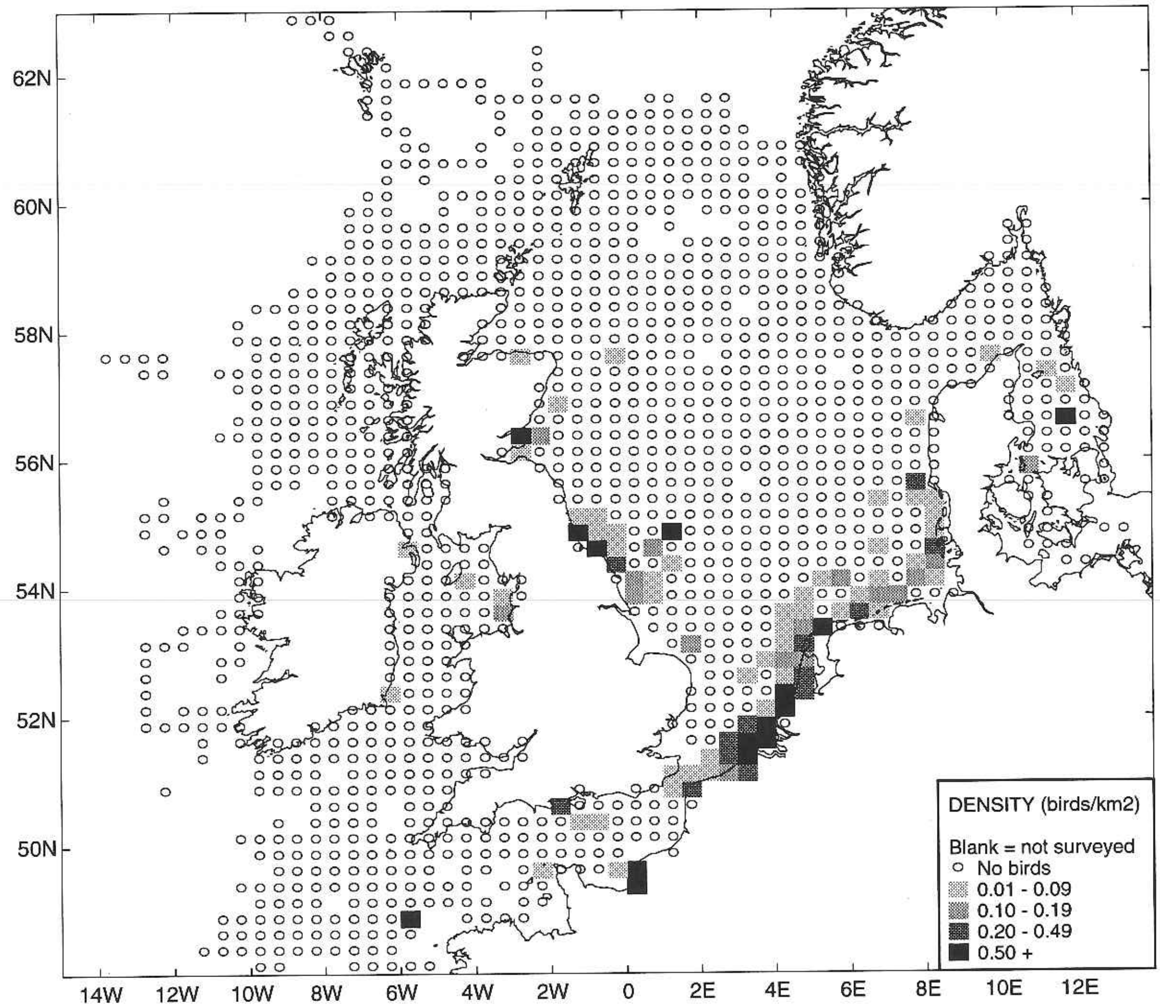

Figure 5.31.3 Distribution of little gulls in August to November

August to November (Figure 5.31.3)

After breeding, moderate densities of little gulls on passage were seen along the continental coast of the southern North Sea as far north as Blåvandshuk. There was also a concentration of little gulls along the coast of north-east England, around the Firths of Forth and Tay and in Liverpool and Morecambe Bays on the west coast of England.

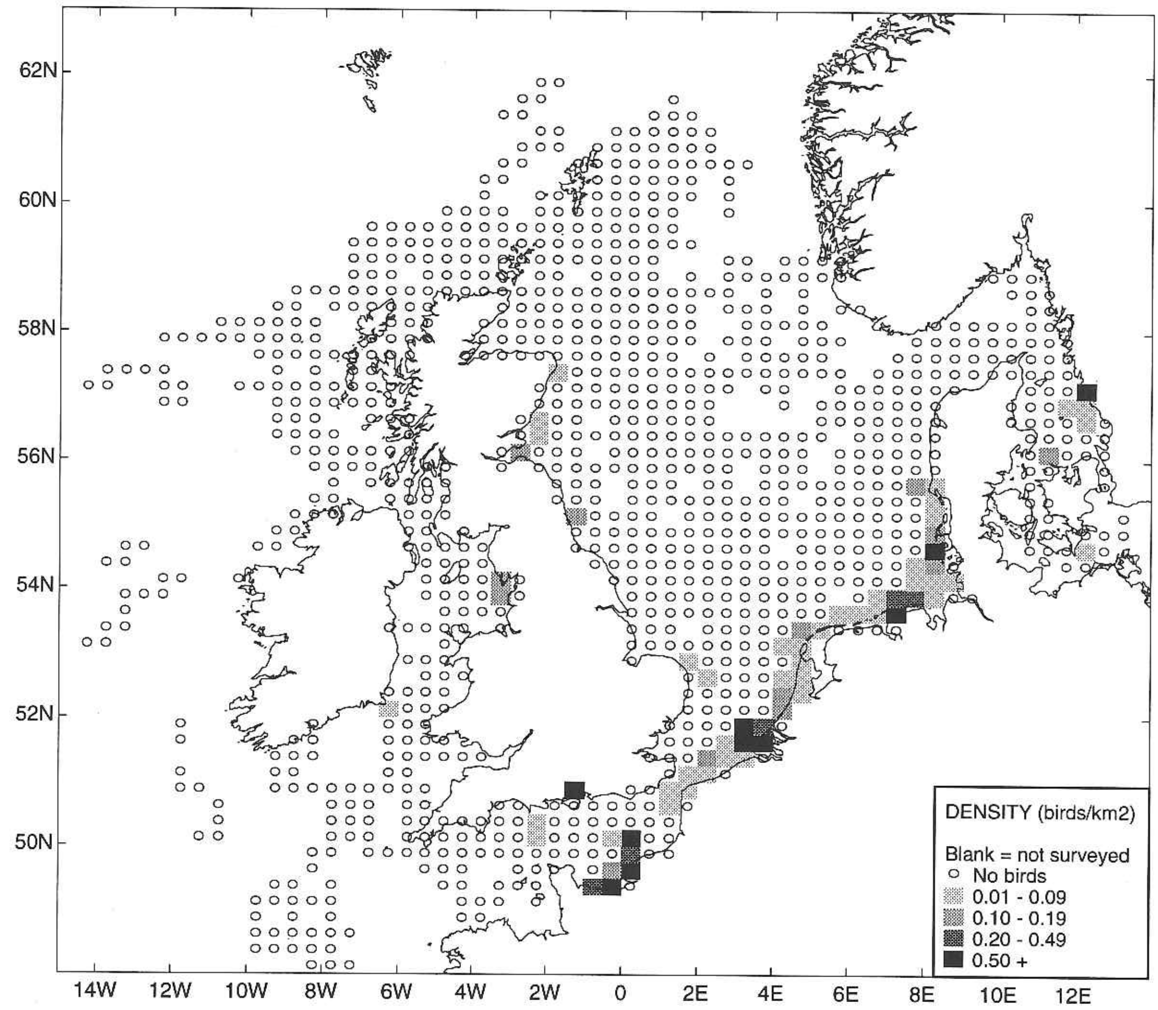

Figure 5.31.4 Distribution of little gulls from December to February

December to February (Figure 5.31.4)

Over-wintering little gulls were found mostly along continental coasts of the southern North Sea, with high densities in the Delta Region, around the Frisian Islands and near the Danish Wadden Sea. High densities were also seen at Middelgrundene, in the Baie de la Seine and in the Solent. A few were seen in Morecambe Bay and off the Firths of Forth and Tay. Low densities are known to occur in the Belt Sea (Durinck *et al.* 1994).

Summary and conservation implications

Little gulls were concentrated primarily along continental coasts of the North Sea during the spring and autumn passage, when birds were numerous off the Netherlands and Belgian coasts, having a preference for the brackish waters found in these areas. The passage of little gulls along these coasts comprises major proportions of the total breeding population of the Western Palearctic and as such the species is highly vulnerable at this time. However, there will probably be little impact of oil pollution on little gulls as their lifestyle is largely aerial.

Further reading

Camphuysen, C.J. & Dijk, J. van 1983. Zee- en Kustvogels langs de Nederlanse Kust, 1974-79. *Limosa 56:* 81-230.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Eades, R.A. 1982. Notes on the distribution and feeding of little gulls at sea in Liverpool Bay. *Seabird Report 6:* 115-121.

Eggers, J. 1965. Zum Vorkommen der Zwergmöwe, *Larus minutus* Pallas, in Schleswig-Holstein und im Niederelbe-Gebiet. *Corax 1:* 88-111.

Garthe, S. 1993. Durchzug und Wintervorkommen der Zwergmöwe (*Larus minutus*) bei Helgoland in den Jahren 1977 bis 1991. *Vogelwarte 37:* 118-129.

Gloe, P. 1987. Zwergmöwen (*Larus minutus*)-Vorkommen 1979-1985 an der Meldorfer Bucht (Westküste von Schleswig-Holstein). *Seevögel 8:* 41-44.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Ouden, J.E. den & Stougie, L. 1990. Voorjaarstrek van Dwergmeeuwen *Larus minutus* langs de Noordzeekust. *Sula 4(3):* 90-98.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Woutersen, K. 1980. Migrating Little Gulls in The Netherlands. *Brit. Birds 72:* 192-193.

Table 5.31.1 Overall density of little gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density km^2	0.00 96.0	0.00 690.9	0.00 540.3	0.00 785.0	0.00 914.6	0.09 3476.9	0.03 526.5	- 0.0	0.00 67.2	0.01 493.4
Feb	Density km^2	0.00 338.0	0.00 775.0	0.00 1063.3	0.00 1235.1	0.00 2379.6	0.07 4386.0	0.00 476.2	0.00 113.5	0.00 191.0	0.06 563.2
Mar	Density km^2	0.00 374.7	0.00 1254.5	0.00 1178.7	0.00 278.1	0.00 849.8	0.14 2229.6	0.00 322.4	0.00 148.9	0.00 605.8	0.02 407.3
Apr	Density km^2	0.00 576.0	0.00 938.8	0.00 1243.0	0.01 269.6	0.01 1367.3	0.24 3255.5	0.00 395.0	0.00 98.9	0.00 550.9	0.05 787.8
May	Density km^2	0.00 451.6	0.00 920.5	0.00 1243.0	0.00 938.1	0.00 2980.1	0.02 3914.0	0.00 600.8	0.00 253.2	0.00 498.6	0.00 842.3
Jun	Density km^2	0.00 617.1	0.00 1763.0	0.00 1318.6	0.00 572.8	0.00 1889.7	0.00 1975.4	0.00 875.7	0.00 71.6	0.00 323.5	0.00 576.8
Jul	Density km^2	0.00 997.4	0.00 937.0	0.00 3582.7	0.00 1484.8	0.00 4780.7	0.00 2483.8	0.00 1017.3	0.00 153.8	0.00 939.6	0.00 644.1
Aug	Density km^2	0.00 866.4	0.00 2468.6	0.00 1377.9	0.00 1592.9	0.00 3817.3	0.00 4473.2	0.00 1061.6	0.00 292.2	0.00 524.3	0.00 892.0
Sep	Density km^2	0.00 208.9	0.00 493.3	0.00 1364.7	0.18 2765.9	0.02 2825.7	0.01 2824.4	0.02 1354.1	0.00 4.0	0.00 383.0	0.00 519.3
Oct	Density km^2	0.00 66.6	0.00 1354.6	0.00 572.7	0.09 745.6	0.01 1292.3	0.24 2869.9	0.01 356.6	0.00 12.6	0.00 297.6	0.09 811.0
Nov	Density km^2	0.00 116.3	0.00 425.6	0.00 871.3	0.00 553.7	0.00 1355.5	0.24 2588.8	0.00 264.6	0.00 76.3	0.01 710.4	0.05 856.2
Dec	Density km^2	0.00 71.4	0.00 293.8	0.00 606.6	0.05 708.3	0.0 395.0	0.06 1579.3	0.01 279.2	0.00 97.9	0.00 459.2	0.08 1257.2

5.32 SABINE'S GULL *Larus sabini*

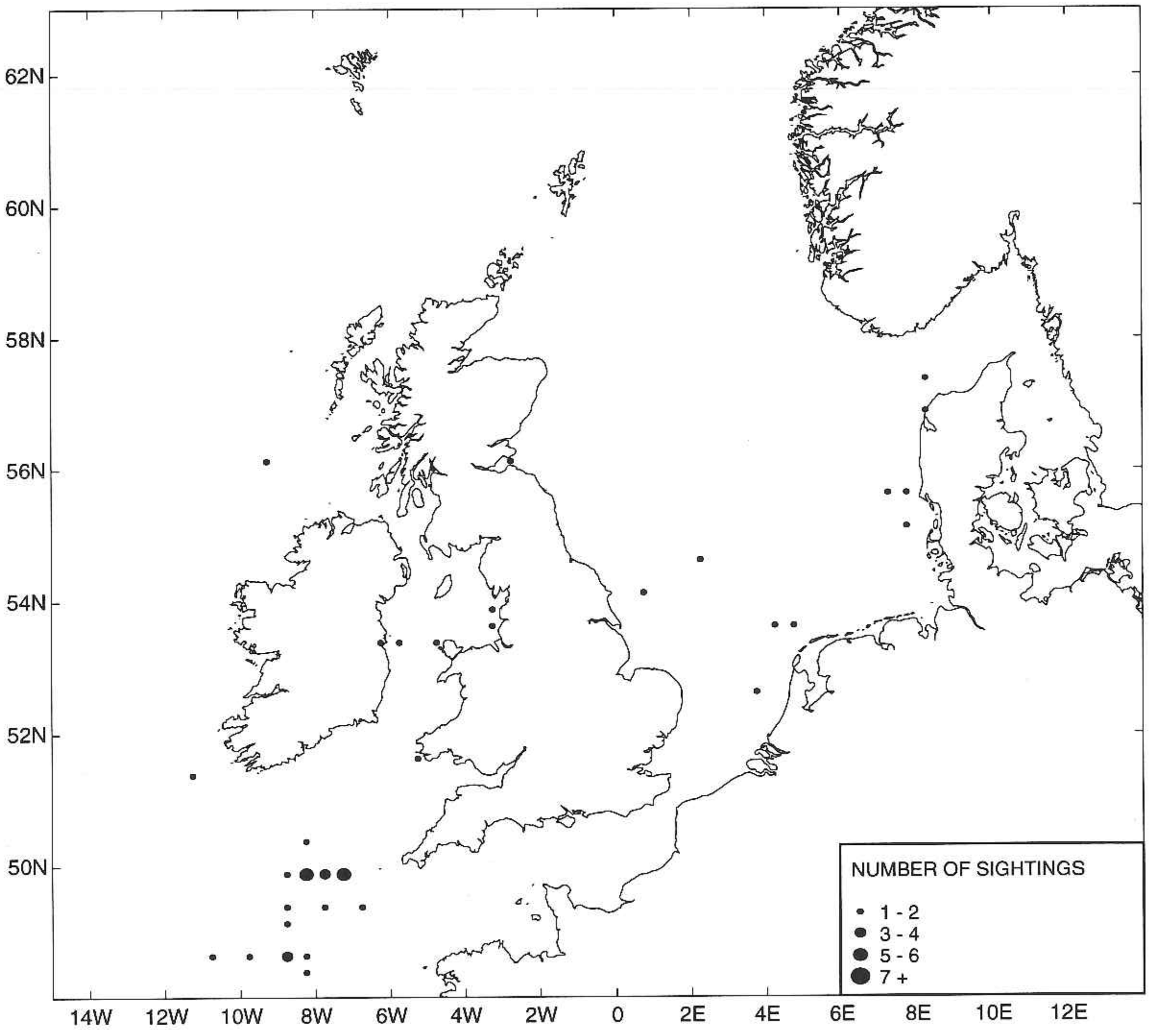

Figure 5.32.1 Sightings of Sabine's gulls from July to March

July to March (Figure 5.32.1)

Sightings of Sabine's gulls were concentrated mainly in the South-west Approaches with isolated sightings in the southern North Sea and Irish Sea. Most sightings occurred in August with fewer in September and October (Figure 5.32.2), although there has been no coverage in the far south-west of the study area during the latter months. Sabine's gulls are trans-equatorial migrants passing British waters *en route* from breeding colonies in Greenland to wintering areas in the South Atlantic off the coast of South Africa. Sabine's gulls are highly pelagic, thus being dispersed over a large area of the north-east Atlantic during migration.

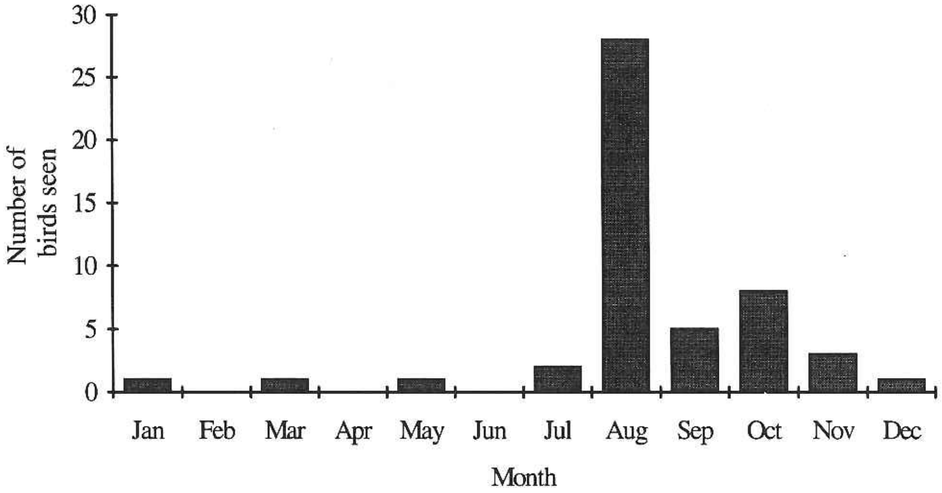

Figure 5.32.2 Number of Sabine's gulls seen per month

Summary and conservation implications

Sabine's gulls are pelagic birds which are passage migrants through the north-east Atlantic. Surface pollutants represent little threat to Sabine's gulls since these birds are scarce, highly mobile and transient visitors to the area. They are an aerial species which are widely and thinly dispersed over deep water, thus the pollution risk to the species is minimised.

Further reading

Bourne, W.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Dare, P.J. 1982. Notes on seabirds attending a commercial trawler fishing in shelf waters off Ireland in summer. *Seabird Report 6:* 110-114.

5.33 BLACK-HEADED GULL *Larus ridibundus*

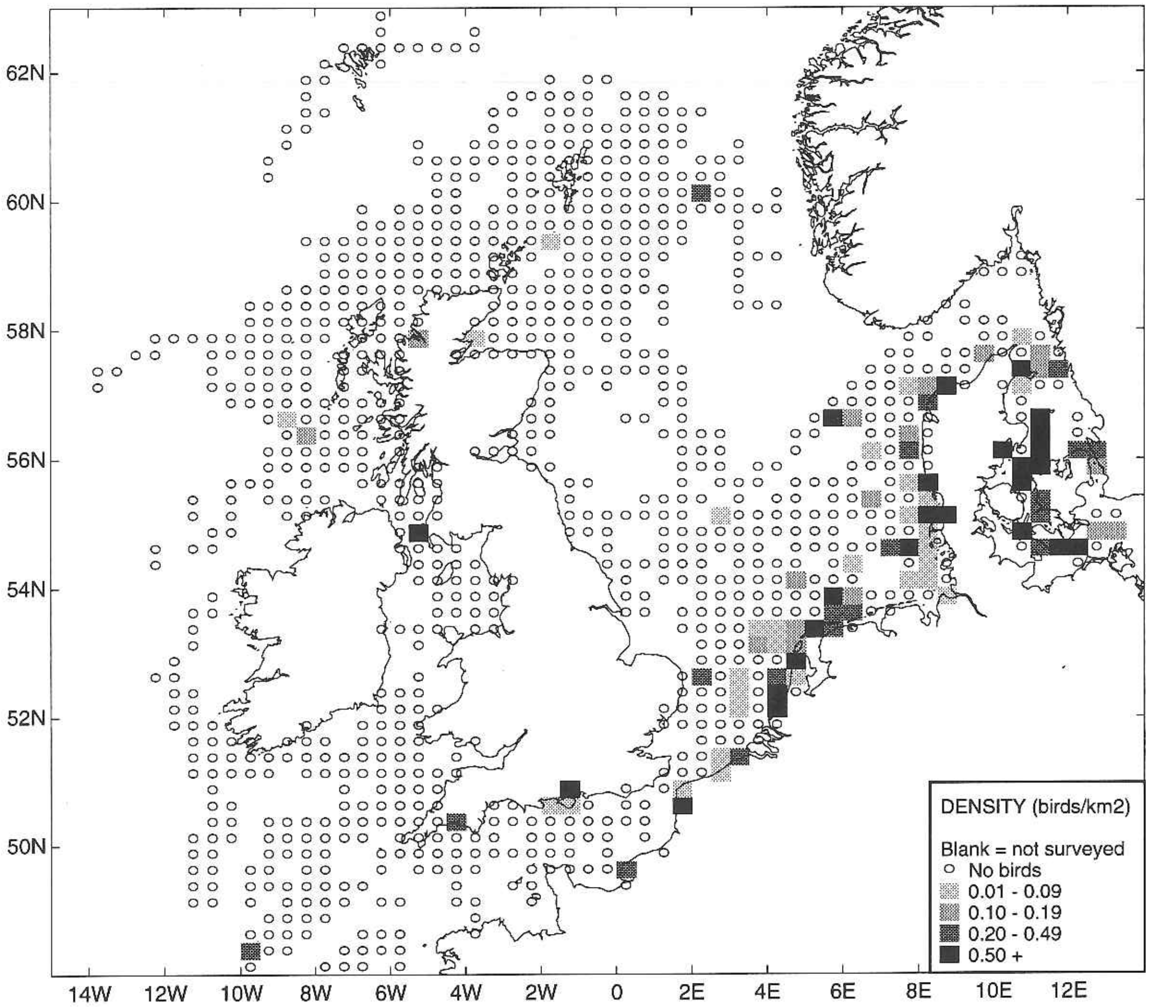

Figure 5.33.1 Distribution of black-headed gulls from March to April

March to April (Figure 5.33.1)

The density of black-headed gulls during the spring migration was greatest along the Netherlands coast and in the Kattegat and Belt Sea (Table 5.33.1). High densities were also evident in the Solent and in the North Channel. Densities around Denmark peaked at this time.

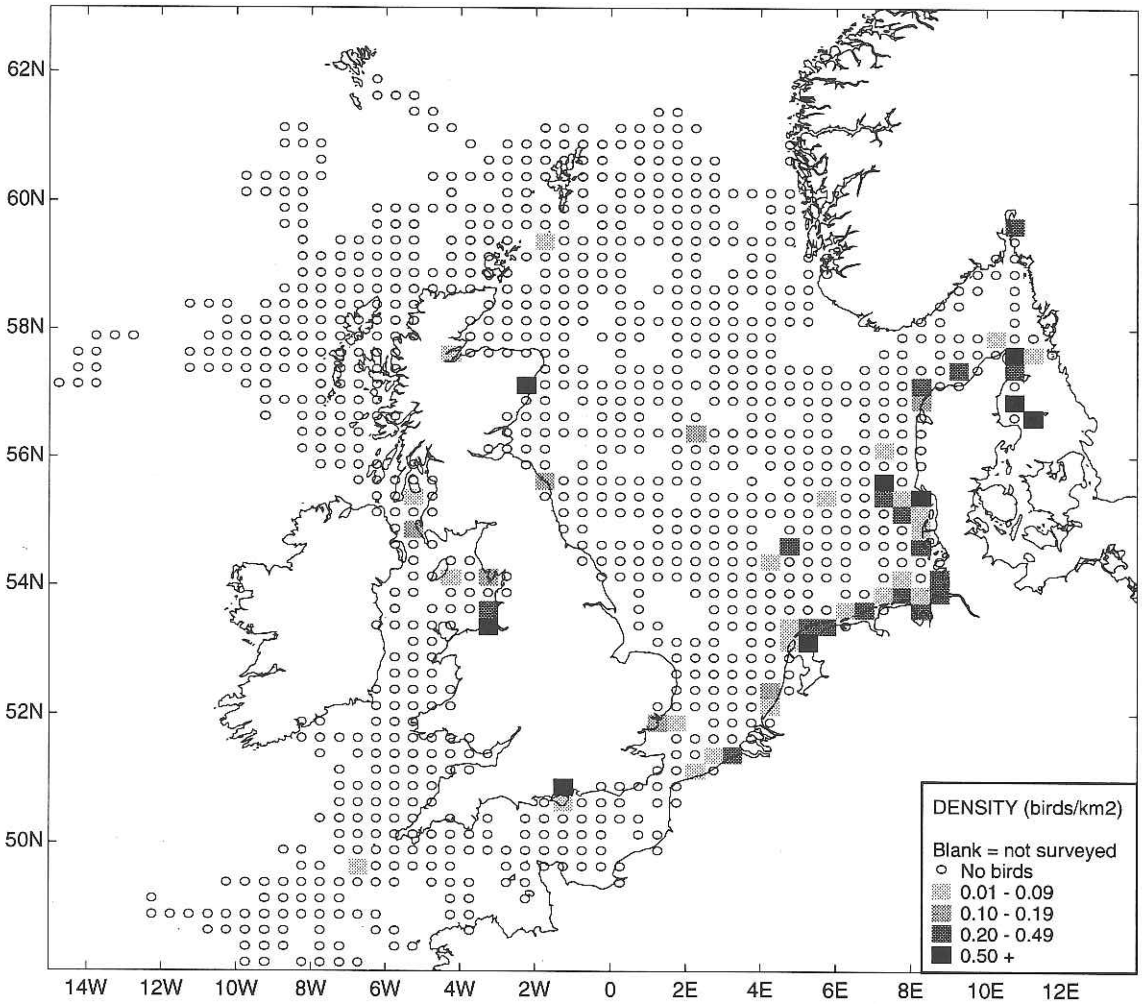

Figure 5.33.2 Distribution of black-headed gulls from May to June

May to June (Figure 5.33.2)

The density of black-headed gulls was greatest along the Netherlands and Danish coasts in the breeding season, and was confined closer to the coasts than in previous months. High densities were also evident in Liverpool and Morecambe Bays and in the Solent, with moderate densities in the North Channel. This reflects the distribution of colonies on the continent and in north-west England.

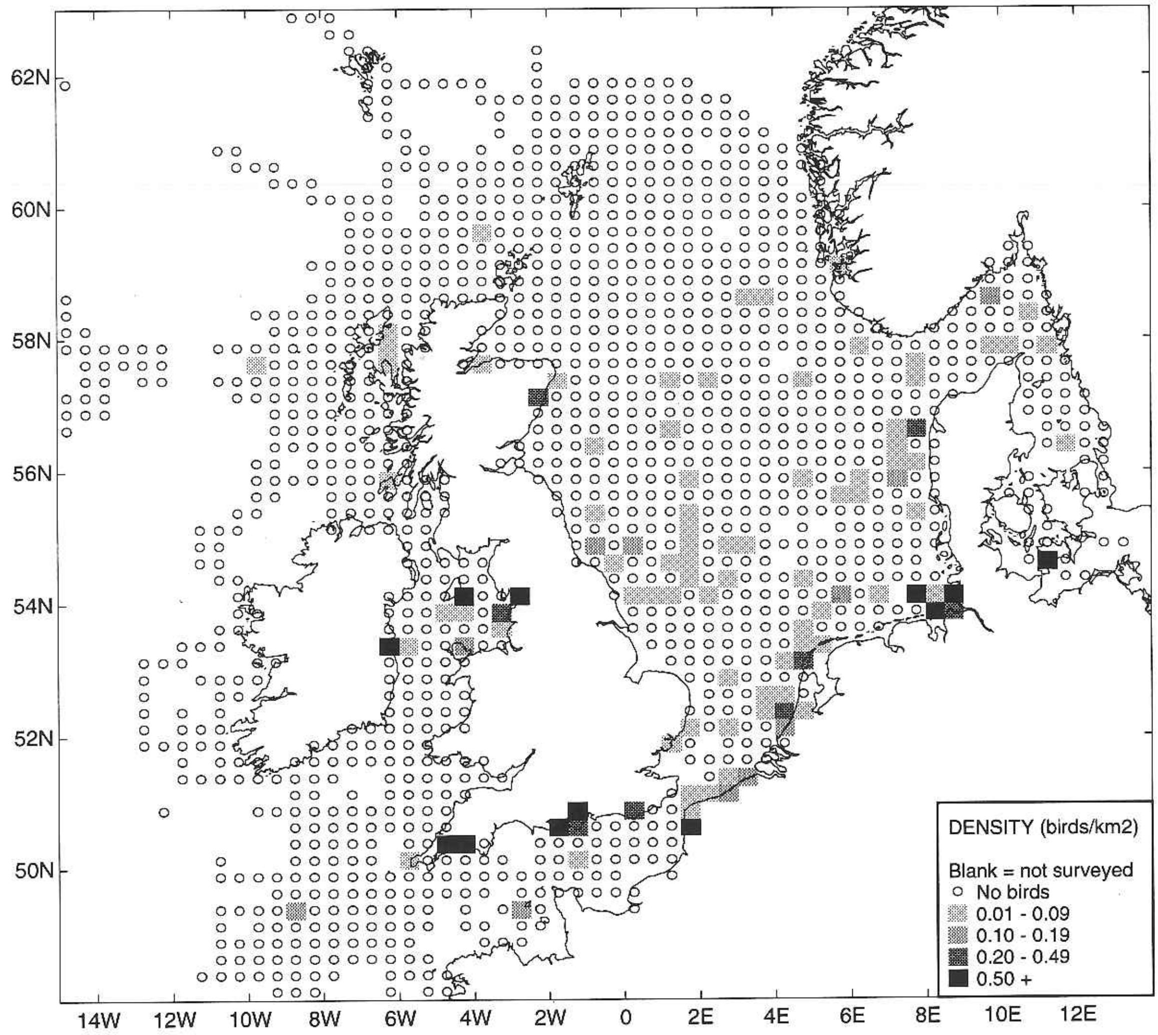

Figure 5.33.3 Distribution of black-headed gulls from July to September

July to September (Figure 5.33.3)

There was evidence of dispersion away from the coastal breeding colonies after the breeding season with more birds in the middle of the North Sea and the Irish Sea. Moderate to high densities were found along the coasts of Belgium and the Netherlands, with high densities in the German Bight. High densities were seen in the eastern Irish Sea, around the Solent, off the coast of east Dorset and off southern Cornwall.

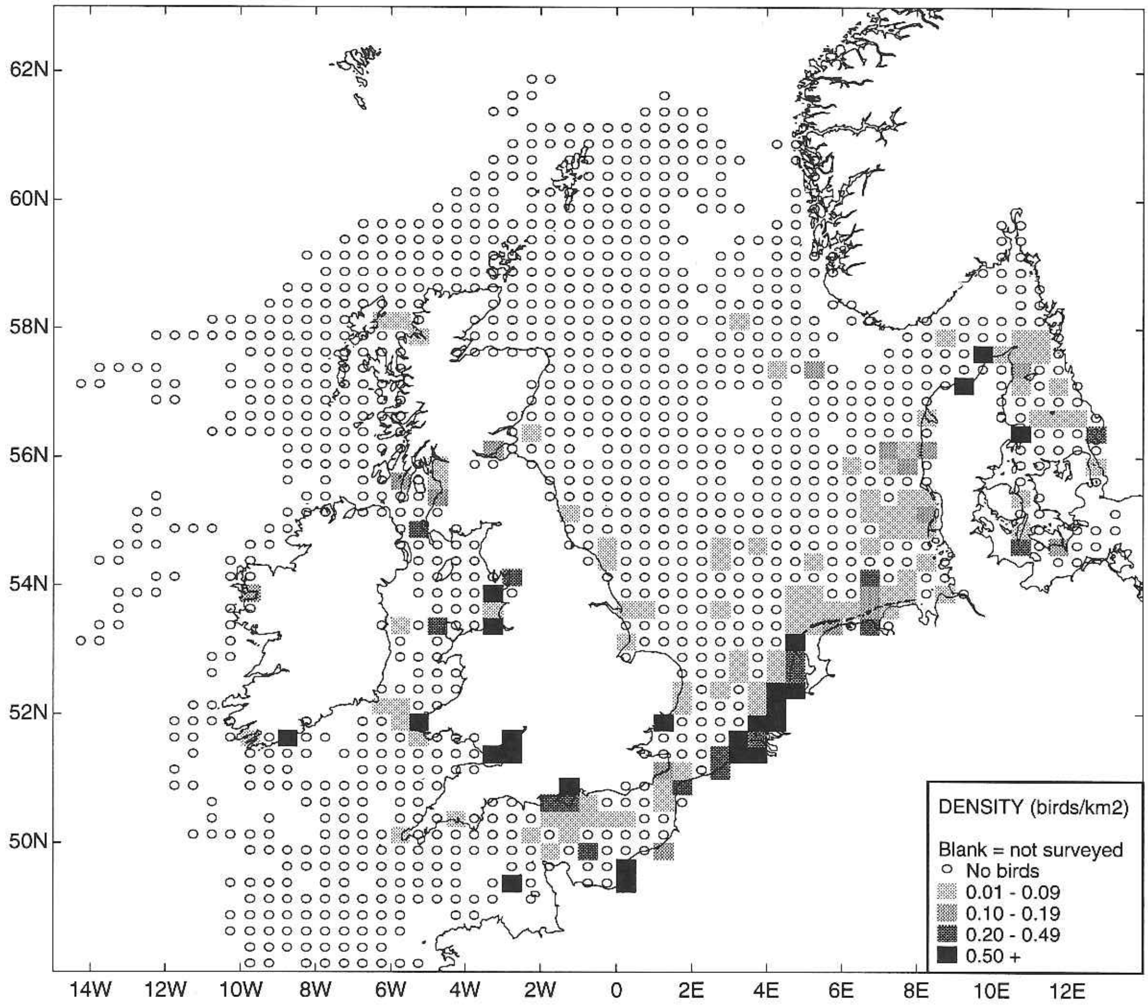

Figure 5.33.4 Distribution of black-headed gulls from October to February

October to February (Figure 5.33.4)

During winter, densities in the centre of the North Sea were reduced and black-headed gulls concentrated once more on the Netherlands coast, with smaller concentrations along Danish coasts. These birds are probably immigrants from Sweden, Finland and other Baltic countries. Lower densities were seen to the west of Denmark and in the English Channel (with high densities around east Dorset, the Solent and the Baie de la Seine). High densities also occurred in isolated areas around the British coast, notably south-west Wales, the upper Bristol Channel, Anglesey, and Morecambe and Liverpool Bays.

Summary and conservation implications

Black-headed gulls were found mainly along the Netherlands and Danish coasts, with isolated concentrations around Liverpool and Morecambe Bays, the North Channel, east Dorset and the Solent. However, this species is also widespread inland, where numbers are much higher than at sea. Numbers are augmented in winter by immigrants from continental Europe and Iceland. Black-headed gulls are generally at low risk from oil pollution due to their mainly terrestrial distribution.

Further reading

Aspinall, S. & Tasker, M.L. 1990. *Coastal birds of east Dorset.* Nature Conservancy Council, Peterborough.

Aspinall, S. & Tasker, M.L. 1992. *Birds of the Solent.* Joint Nature Conservation Committee, Aberdeen.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Platteeuw, M. 1987. Trekbewegingen van Kokmeeuwen *Larus ridibundus* langs de Noordzeekust: oorzaken en achtergronden. *Sula 1(2):* 29-37.

Pruter, J. 1986. Das vorkommen der häufigen Möwenarten (Laridae) im Seegebiet der Deutschen Bucht - Ergebnisse mehrjähriger Planbeobachtungen auf der Forschungsplattform "Nordsee". *Seevögel 7:* 13-19.

Table 5.33.1 Overall density of black-headed gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^{2}).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.60	0.45	-	0.00	0.02
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.01	0.00	0.31	0.07	0.00	0.00	0.17
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.07	0.00	0.00	0.02	0.26	0.00	0.00	0.00	0.02
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.01	0.00	0.00	0.01	0.16	0.00	0.01	0.00	0.01
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	0.01	0.00	0.00	0.01	0.08	0.01	0.00	0.00	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.00	0.02	0.00	0.03	0.07	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.00	0.00	0.03	0.01	0.04	0.03	0.00	0.00	0.01
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.01	0.12
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.00	0.00	0.00	0.00	0.07	0.15	0.00	0.00	0.07
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.02	0.00	0.03	0.01	0.22	0.15	0.00	0.31	0.33
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.52	0.01	0.00	0.00	0.12
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.04	0.29	0.00	0.00	0.05
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.34 COMMON GULL *Larus canus*

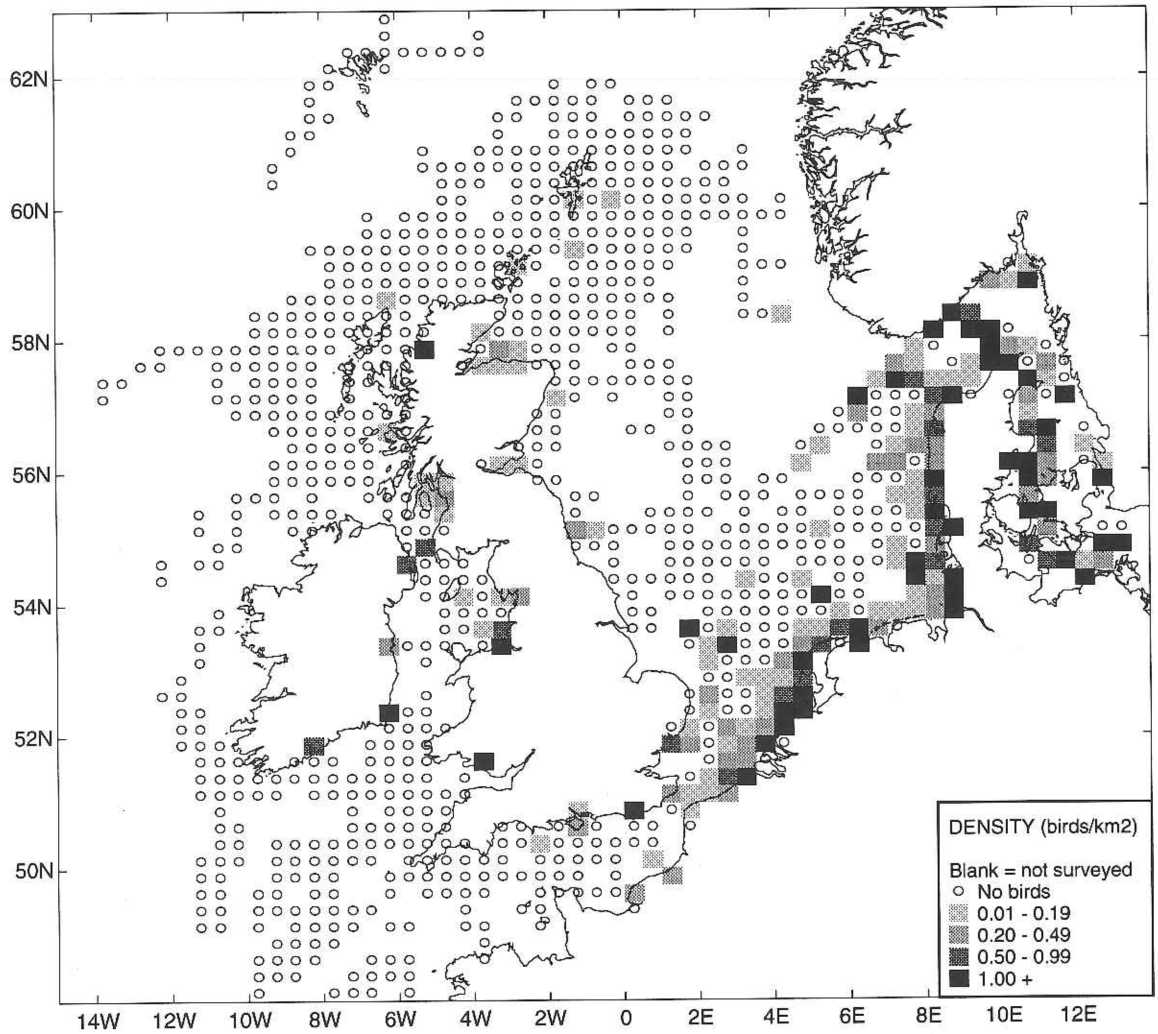

Figure 5.34.1 Distribution of common gulls in March and April

March to April (Figure 5.34.1)

The highest density of common gulls was found along continental coasts of the North Sea, with high densities also apparent in the Skagerrak, Kattegat and Belt Sea (Table 5.34.1). Moderate to high densities were found off south-east England, in Liverpool Bay, off the Solent and in the North Channel, thus showing a similar distribution to black-headed gulls. Low densities were seen in the Moray Firth and the Firths of Forth and Clyde.

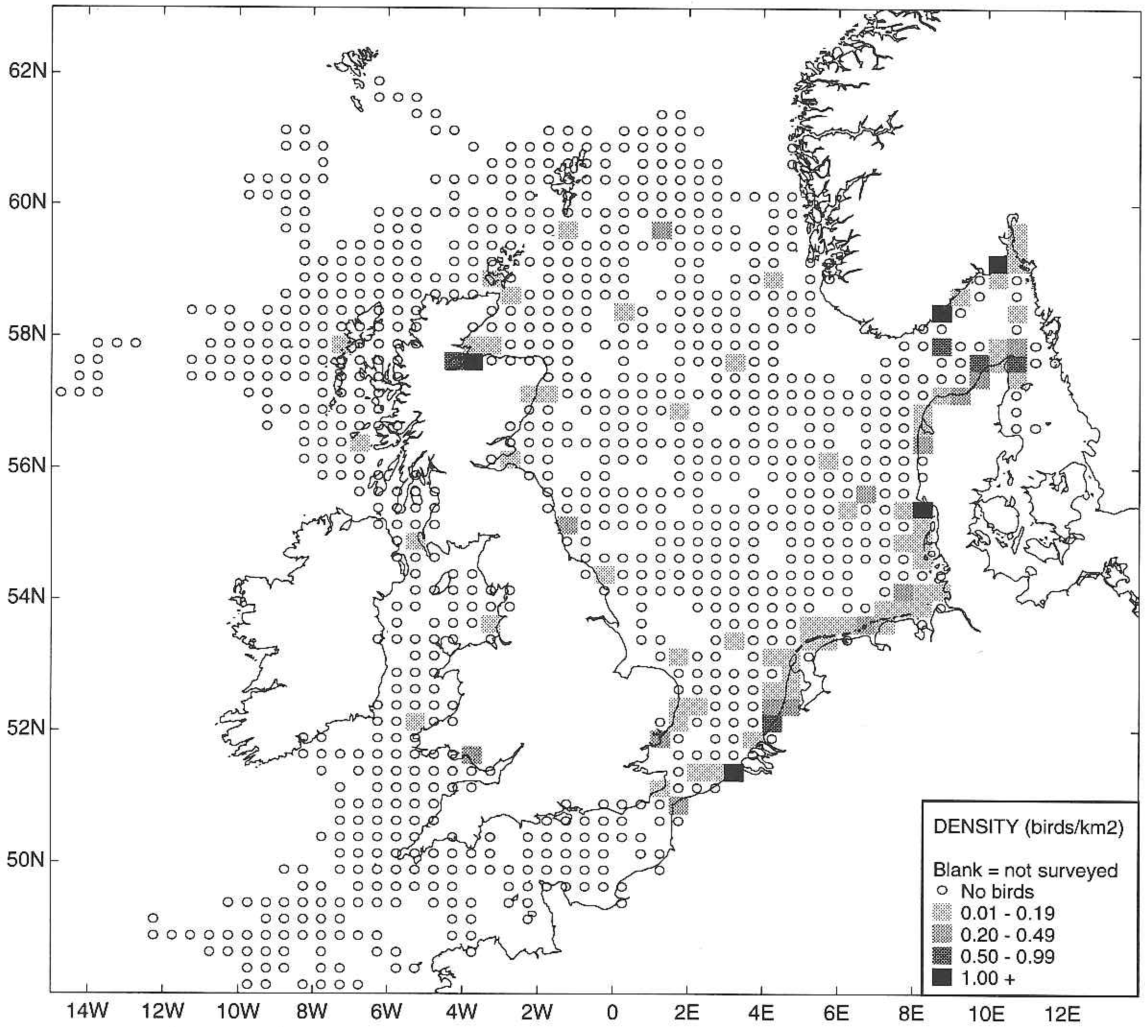

Figure 5.34.2 Distribution of common gulls in May and June

May to June (Figure 5.34.2)

During the breeding season the density of common gulls in the North Sea was drastically reduced due to many birds moving to their northern and eastern breeding grounds. The distribution of common gulls reflected their breeding colonies along the coasts; low densities were apparent along continental coasts of the southern North Sea, with isolated low densities around British coasts.

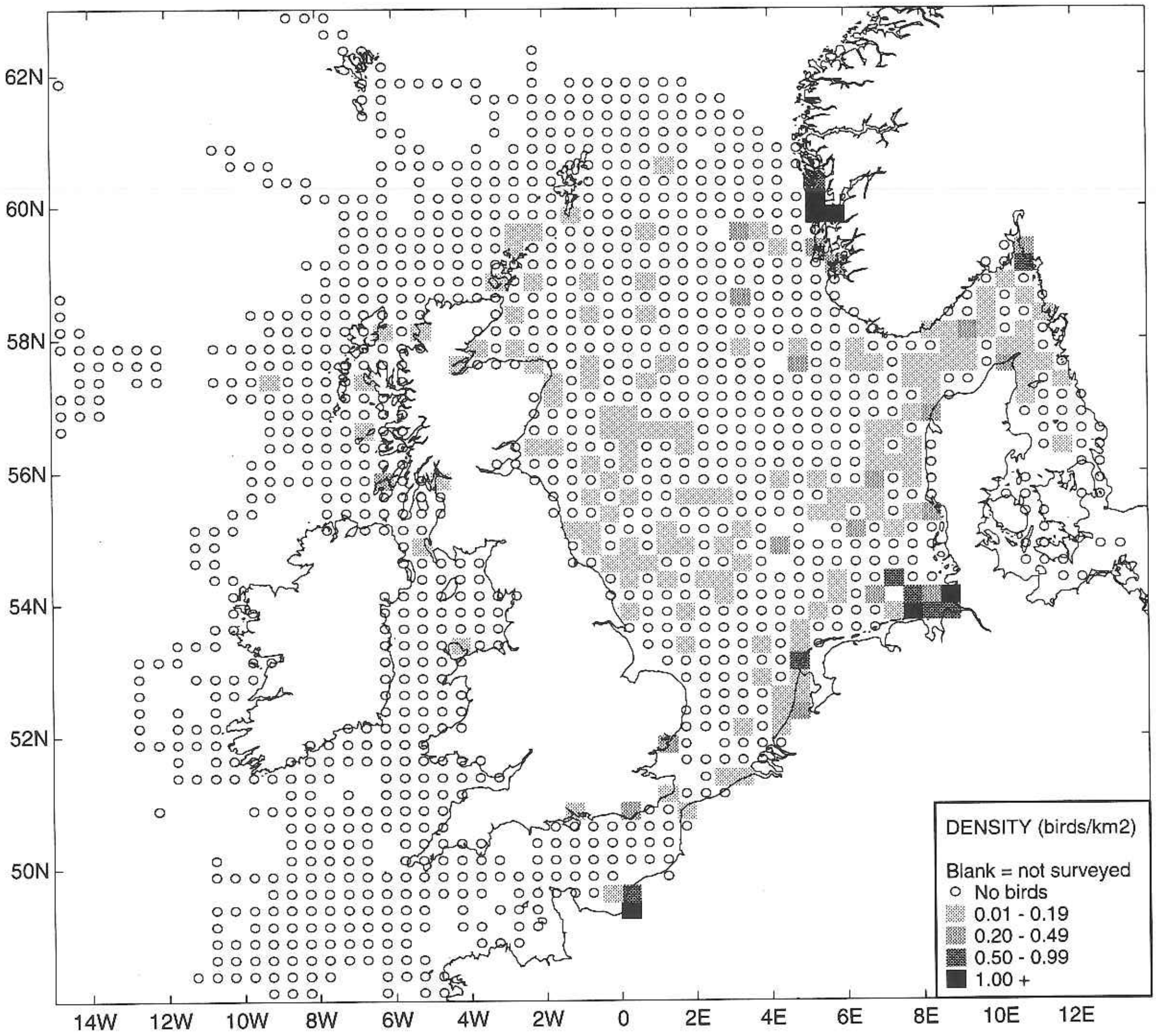

Figure 5.34.3 Distribution of common gulls from July to September

July to September (Figure 5.34.3)

There were low densities of common gulls throughout the North Sea in these months, with birds occurring more frequently towards the coasts. The highest densities occurred in the German Bight. The scatter of birds through the North Sea is probably due to breeding birds moving south to the wintering areas in the southern North Sea. Few common gulls were seen to the west of Britain at this time.

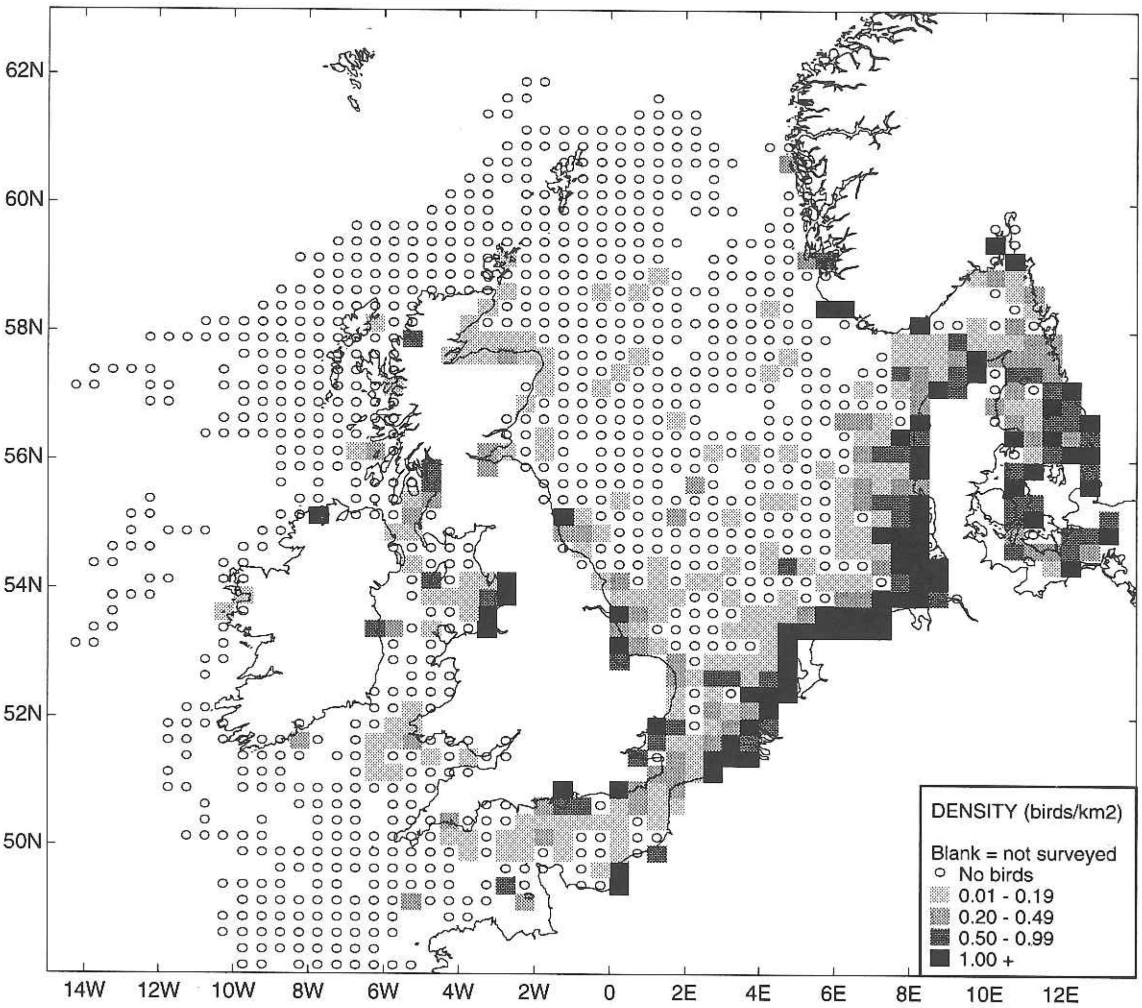

Figure 5.34.4 Distribution of common gulls from October to February

October to February (Figure 5.34.4)

During winter high densities of common gulls were apparent along continental coasts of the North Sea, concurrent with findings from aerial surveys by Baptist & Wolf (1993). Moderate densities occurred in the Belt Sea and the Kattegat, with particular concentrations around Middelgrundene; high densities are known to winter in this area (Durinck *et al.* 1994). Birds in Danish waters at this time of year are migrants from the east and north, especially the Baltic countries (Meltofte & Faldborg 1987). High densities also occurred north of the Wash and in Liverpool and Morecambe Bays.

Summary and conservation implications

Common gulls were found mainly along continental coasts of the North Sea and in the Skagerrak, Kattegat and Belt Sea, and occurred at lower densities around the coast of Britain. Since common gulls are concentrated at high densities in restricted areas, inshore oil spills around the south-eastern North Sea outside the breeding season could result in a high localised mortality of common gulls. They often occur in large roost aggregations inshore during migration, and would be vulnerable at this time. However the species is common in Europe, and is also widespread inland, so oil pollution is unlikely to have any serious implications for the population.

Further reading

Baptist, H.J.M. & Wolf, P.A. 1993. *Atlas van de vogels van het Nederlands Continentaal Plat.* Rapport DGW-93.013, Rijkswaterstaat, Dienst Getijdewateren, Middelburg.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joiris, C. 1983. Winter distribution of seabirds in the North Sea: an oceanographical interpretation. *Le Gerfaut 73:* 107-123.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Table 5.34.1 Overall density of common gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.07	0.03	0.12	0.04	2.94	0.77	-	0.00	0.08
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.04	0.03	0.20	0.06	1.34	1.22	0.00	0.08	0.14
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.04	0.03	0.05	0.01	0.75	0.04	0.00	0.00	0.03
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.11	0.01	0.06	0.04	0.89	0.05	0.00	0.01	0.02
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	0.00	0.14	0.04	0.00	0.14	0.00	0.00	0.00	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.00	0.00
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.01	0.00	0.02	0.04	0.11	0.00	0.00	0.00	0.00
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.00	0.01	0.01	0.02	0.02	0.00	0.00	0.00	0.00
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.00	0.00	0.01	0.01	0.04	0.00	0.00	0.00	0.03
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.03	0.01	0.01	0.04	0.73	0.05	0.00	0.01	0.02
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.01	0.02	0.03	0.02	0.99	0.18	0.00	0.00	0.17
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.03	0.31	0.00	1.08	0.41	0.00	0.00	0.19
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.35 LESSER BLACK-BACKED GULL *Larus fuscus*

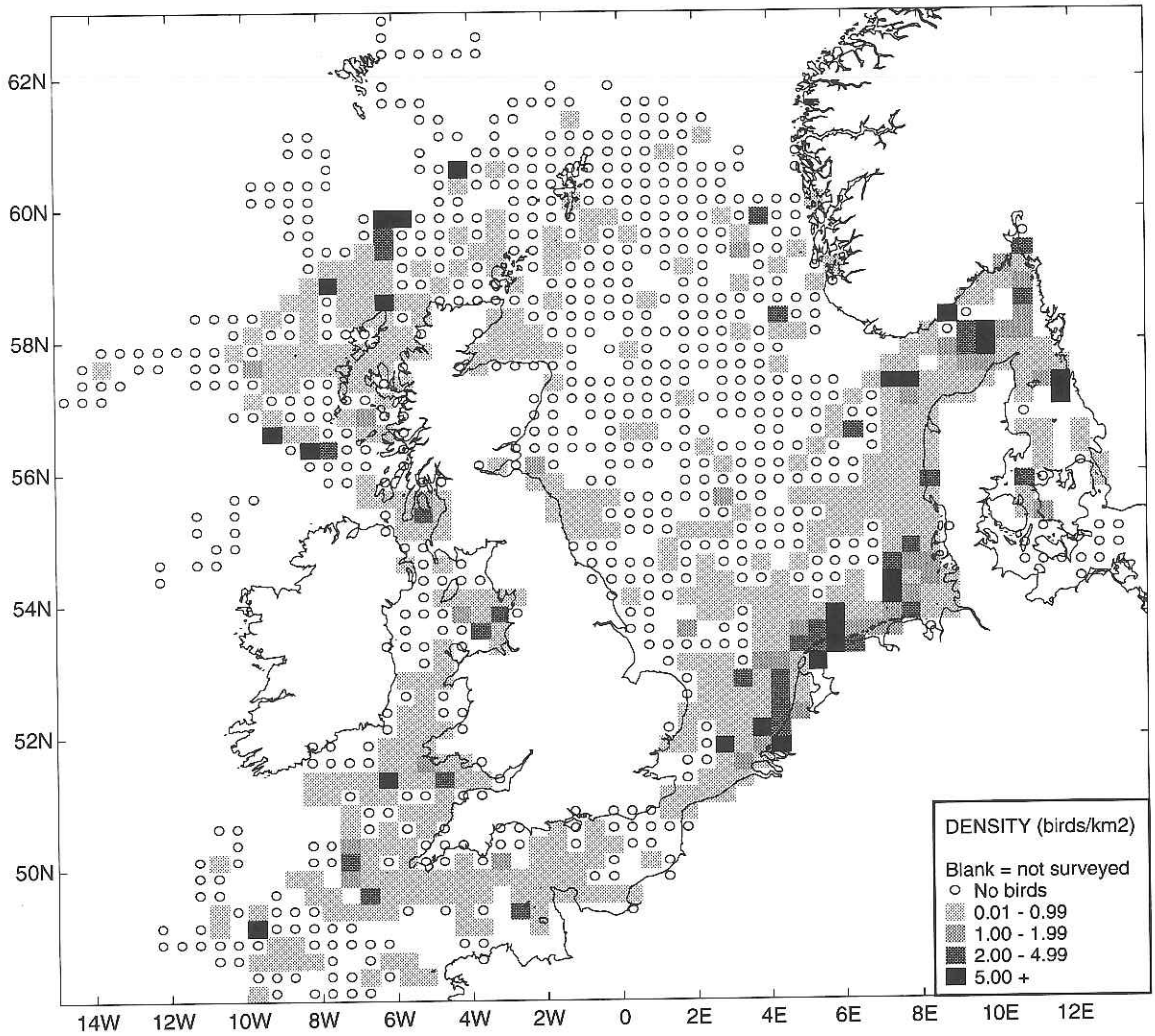

Figure 5.35.1 Distribution of lesser black-backed gulls from April to June

April to June (Figure 5.35.1)

Lesser black-backed gulls were most densely distributed along the Netherlands coast, in the German Bight and in the Skagerrak. Lower densities were widespread along other stretches of the continental coast of the North Sea, and in the Kattegat. Moderate densities were found in the South-west Approaches, around the colonies on Skomer and Skokholm (Pembrokeshire Islands), and at the shelf edge to the north-west of Scotland. There were widespread low densities along the western coast of Scotland, in the Celtic Sea, the Irish Sea and the English Channel. Lesser black-backed gulls were less common along the east coast of Britain. This distribution at sea reflects the distribution of colonies along the western coast of Britain and on the continent.

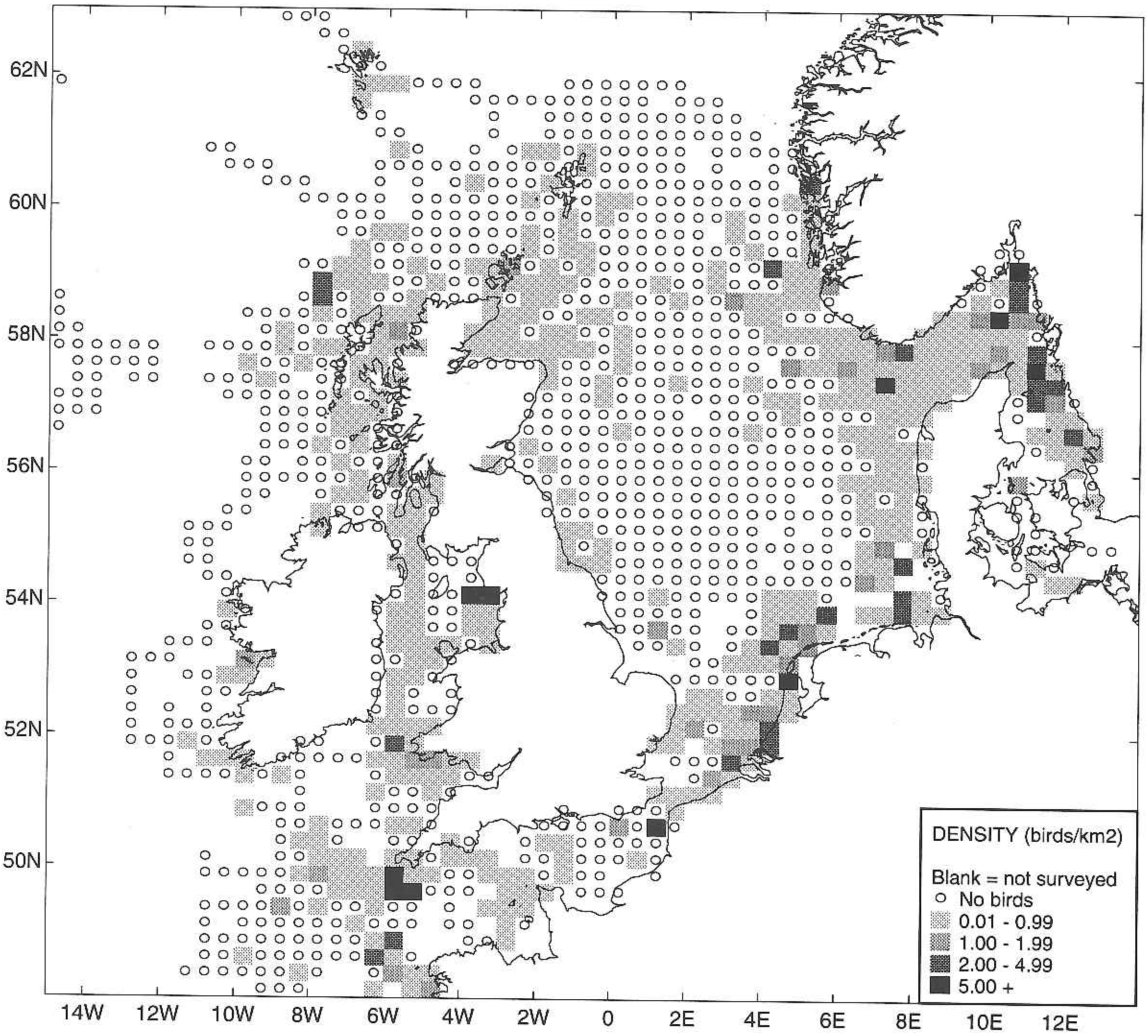

Figure 5.35.2 Distribution of lesser black-backed gulls in July and August

July to August (Figure 5.35.2)

Lesser black-backed gulls were widespread at low densities along the west coast of Britain and Ireland, with concentrations around Morecambe Bay, near the Pembrokeshire Islands and in the western English Channel. Few were found along the east coast of Britain, with the exception of the Moray Firth. They were widespread along continental coasts of the North Sea as far north as 60°N. High densities were found off the Netherlands and Germany and in the Skagerrak and Kattegat, particularly around Middelgrundene.

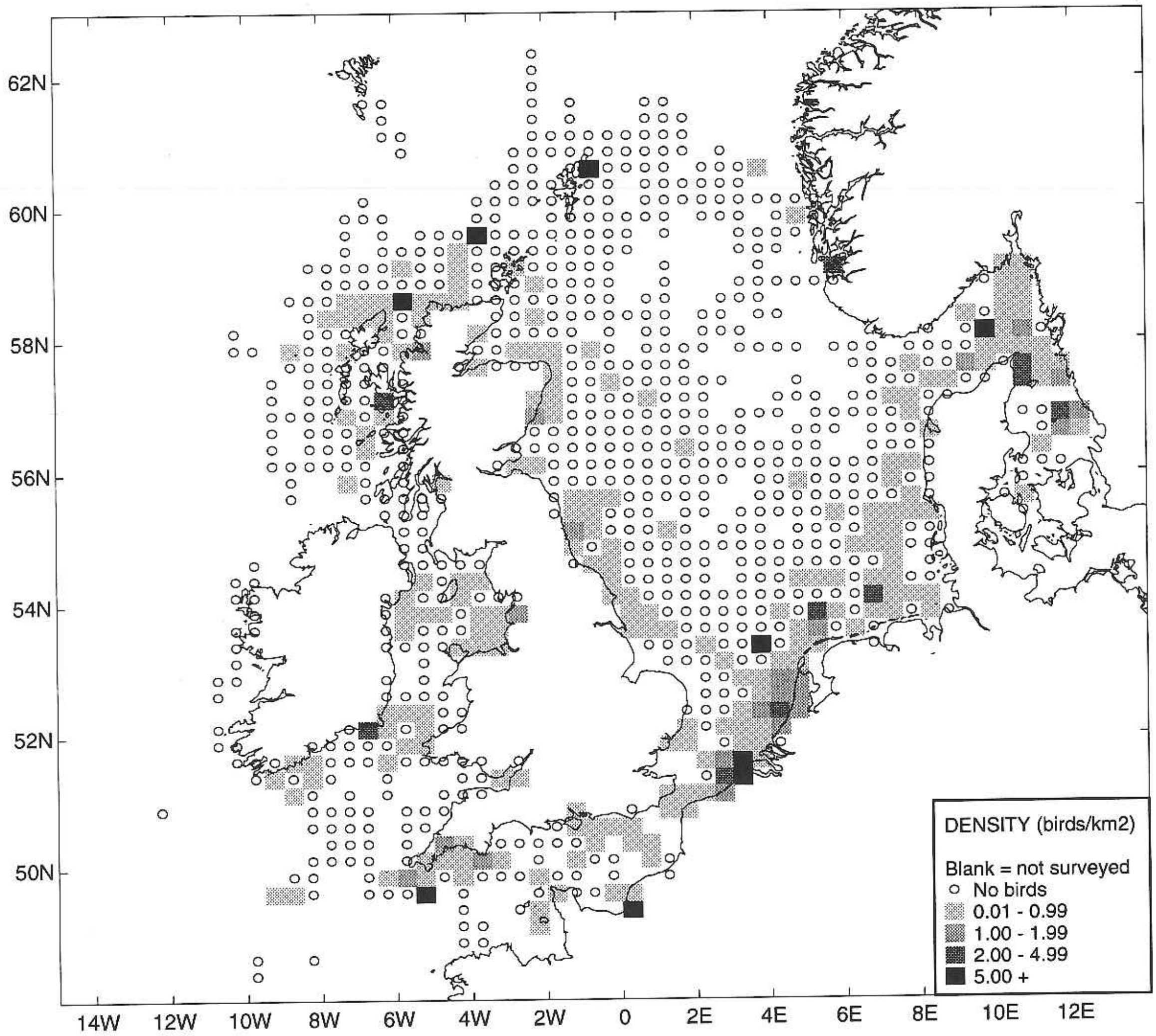

Figure 5.35.3 Distribution of lesser black-backed gulls in September and October

September to October (Figure 5.35.3)

The range of lesser black-backed gulls had contracted closer inshore than in previous seasons. Distribution was more evenly balanced between the west and east coasts of Britain. Low densities remained in the English Channel, and the species was still widespread along continental coasts of the North Sea, although there were few around Norway. Highest densities were seen off the Netherlands and north Denmark, although most birds had left Danish waters by the latter half of this period. The scarcity in northern regions around Shetland and Norway at this time reflects the beginning of the migration southwards to the main wintering areas in the Bay of Biscay and off the coast of west Africa.

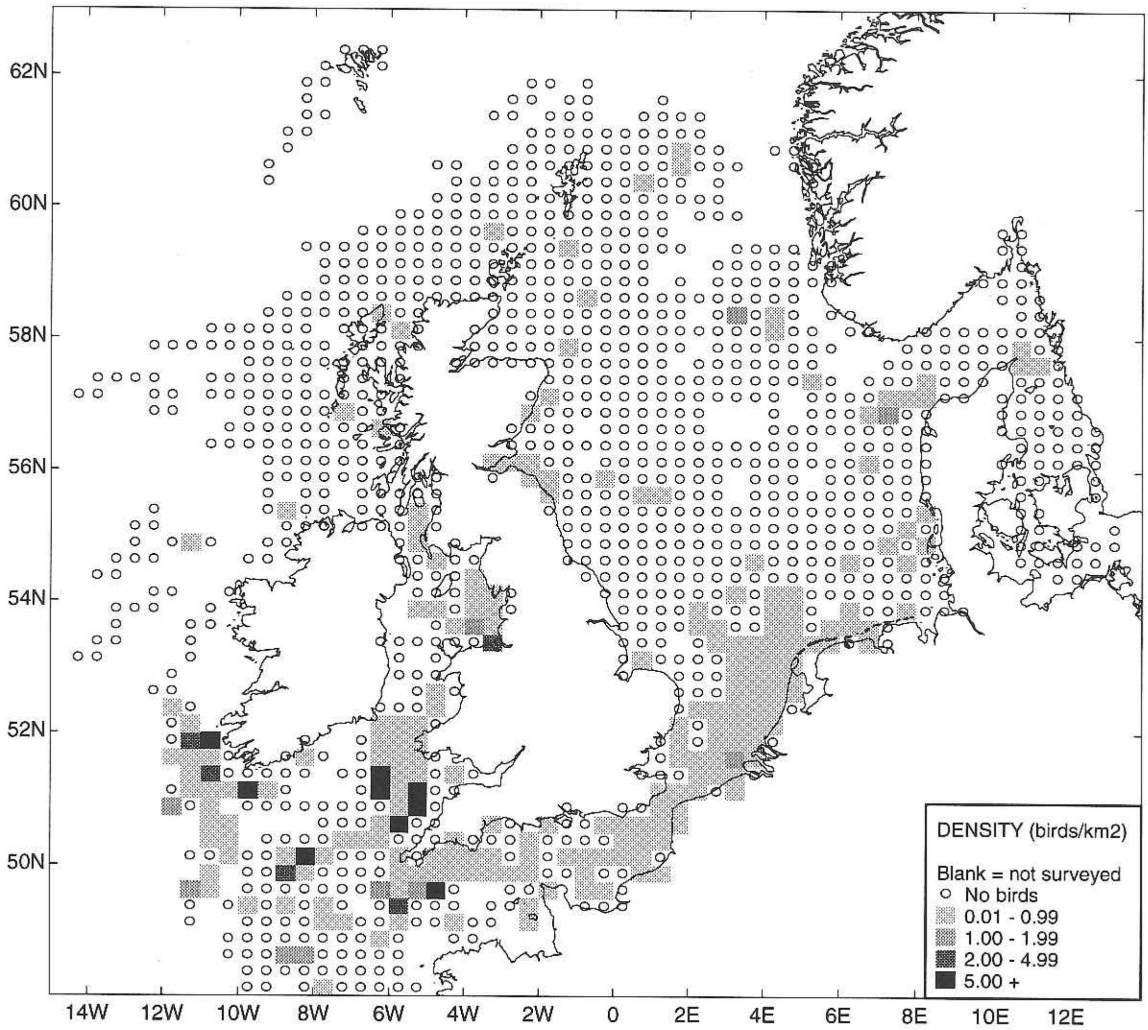

Figure 5.35.4 Distribution of lesser black-backed gulls from November to March

November to March (Figure 5.35.4)

The highest densities of lesser black-backed gulls during winter were in the Celtic Sea and South-west Approaches (Table 5.35.1) with lower densities in the English Channel, the eastern Irish Sea and along the coast of Belgium and the Netherlands. These areas represented the northernmost extent of the wintering range, and beyond this densities were low and the species was thinly scattered. March marks the beginning of the spring migration; low densities in the Skagerrak probably reflects this.

Summary and conservation implications

Lesser black-backed gulls breed mainly along the west coast of Britain and the coasts of the Netherlands, Belgium, Denmark and the Belt Sea, and their distribution at sea reflects this. Few were seen in the central North Sea at any time of year. After the breeding season they migrate south-west to the wintering grounds in the Bay of Biscay and West Africa, although birds at the north of the wintering range are found in the north-east Atlantic. Since many lesser black-backed gulls move outside the study area during winter they are less threatened by oil at this time of year. During the breeding season they are aerial and relatively dispersed at sea so oil presents little problem. Populations of this species are more likely to be affected by a reduction in the availability of discards from trawlers due to changes in fisheries' practices.

Further reading

Hudson, A.V. & Furness, R.W. 1988a. Utilization of discarded fish by scavenging seabirds behind whitefish trawlers in Shetland. *Journal of Zoology, London 251:* 151-166.

Hudson, A.V. & Furness, R.W. 1988b. The behaviour of seabirds foraging at fishing boats around Shetland. *Ibis 131:* 225-237.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Stone, C.J., Harrison, N.M., Webb, A., & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30.

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Stone, C.J., Webb, A. & Carter, I.C. 1992. Lesser black-backed gull distribution at trawlers and food availability in the Celtic Sea, 1991. *JNCC Report* No. 106.

Table 5.35.1 Overall density of lesser black-backed gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.03	0.25	-	0.01	0.06
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.01	0.03	0.32	0.07	7.90	0.34
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.01	0.00	0.01	0.05	0.34	0.14	0.92	3.45	0.07
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.32	1.99	0.03	0.08	0.16	1.06	0.79	0.58	0.28	0.11
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.91	1.83	0.02	0.02	0.05	1.65	0.16	0.10	0.87	0.14
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.10	0.10	0.02	0.07	0.04	0.69	0.65	0.00	0.30	0.07
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.01	0.35	0.05	0.01	0.03	0.92	0.33	0.01	0.27	0.25
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.02	0.14	0.02	0.03	0.10	0.85	0.79	0.08	0.13	1.14
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.04	0.02	0.12	0.05	0.87	0.10	0.00	0.07	0.33
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	1.05	0.35	0.99	0.09	0.04	0.58	0.19	0.00	0.02	0.25
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.04	0.00	0.00	0.05	0.00	0.20	0.53	0.00	0.44	0.16
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.10	0.05	0.03	0.30	0.12
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.36 HERRING GULL *Larus argentatus*

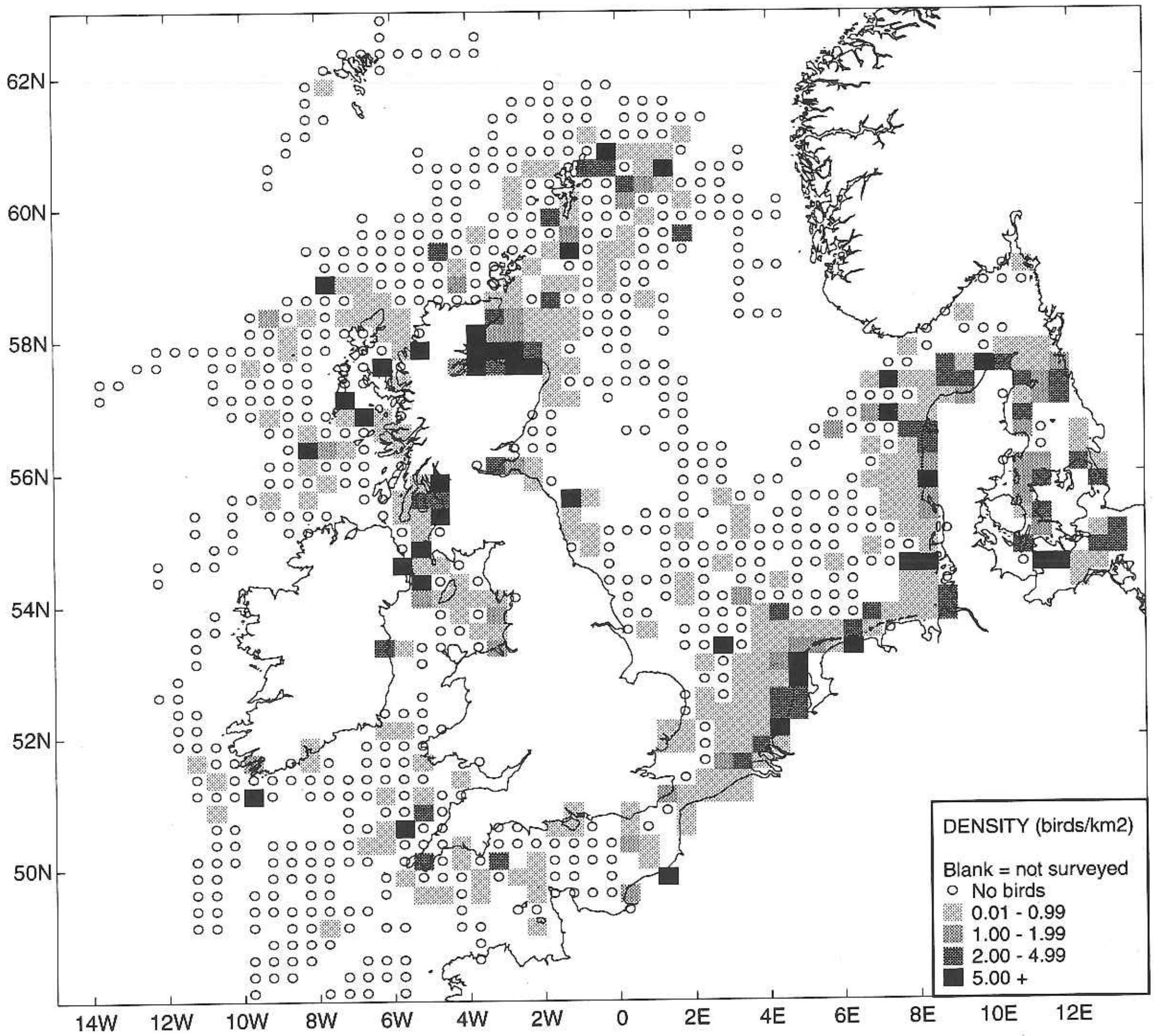

Figure 5.36.1 Distribution of herring gulls in March and April

March to April (Figure 5.36.1)

The highest densities of herring gulls were found along the Netherlands coast, in the German Bight, the Skagerrak and the Belt Sea, and in the Moray Firth and around Shetland (Table 5.36.1). Moderate to high densities were found in the Kattegat, off the north Cornish coast, around the Inner Hebrides and in the Firths of Clyde and Forth. Lower densities were widespread along continental coasts of the North Sea, in the western English Channel, the eastern Irish Sea and the North Channel, as well as around northern coasts of Britain.

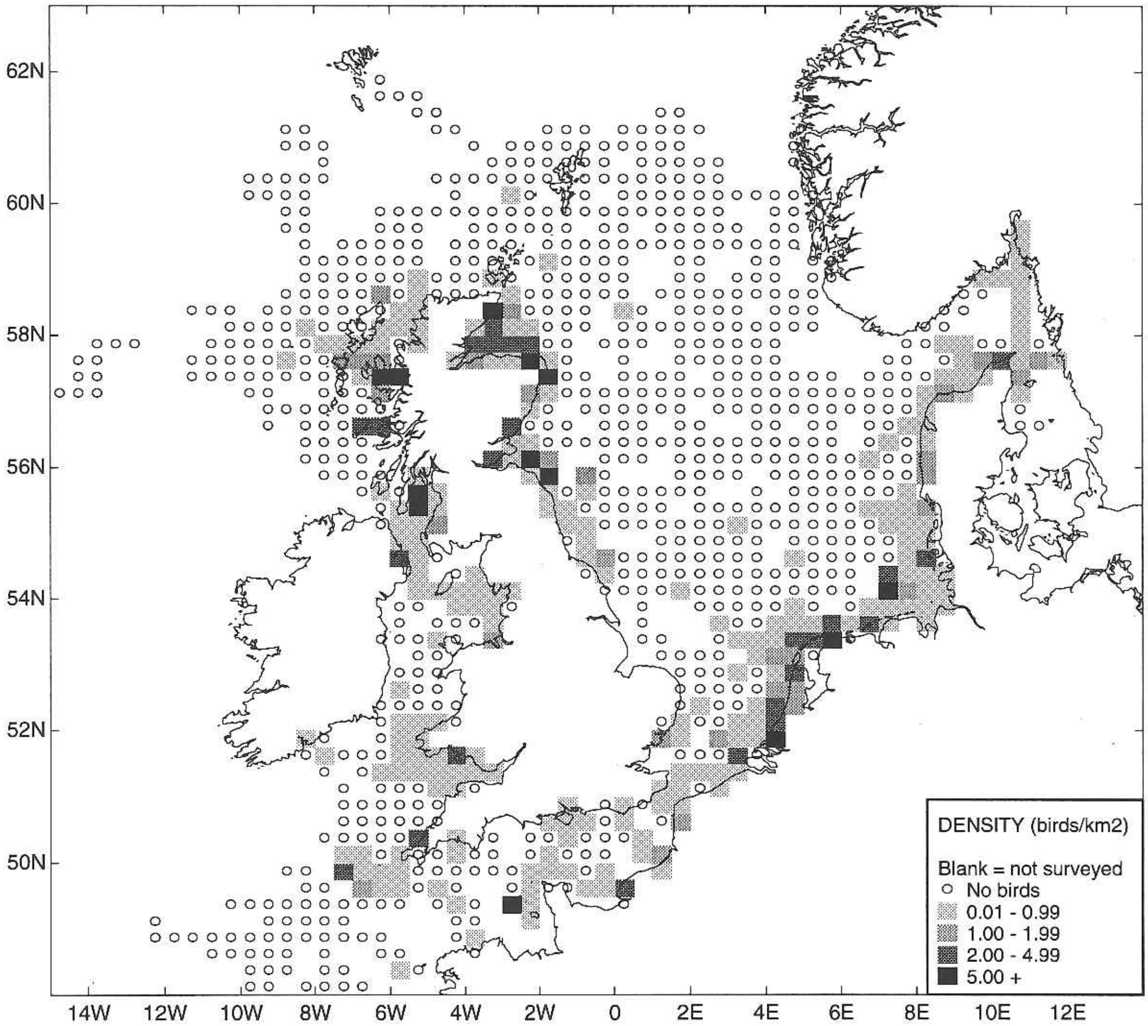

Figure 5.36.2 Distribution of herring gulls in May and June

May to June (Figure 5.36.2)

During the breeding season, herring gulls were widespread around most coastal regions, with the exception of the west coast of Norway. Highest densities were found along the Netherlands coast, near the Firths of Clyde and Forth, and in the Moray Firth. This species was virtually absent from the offshore central and northern North Sea at this time.

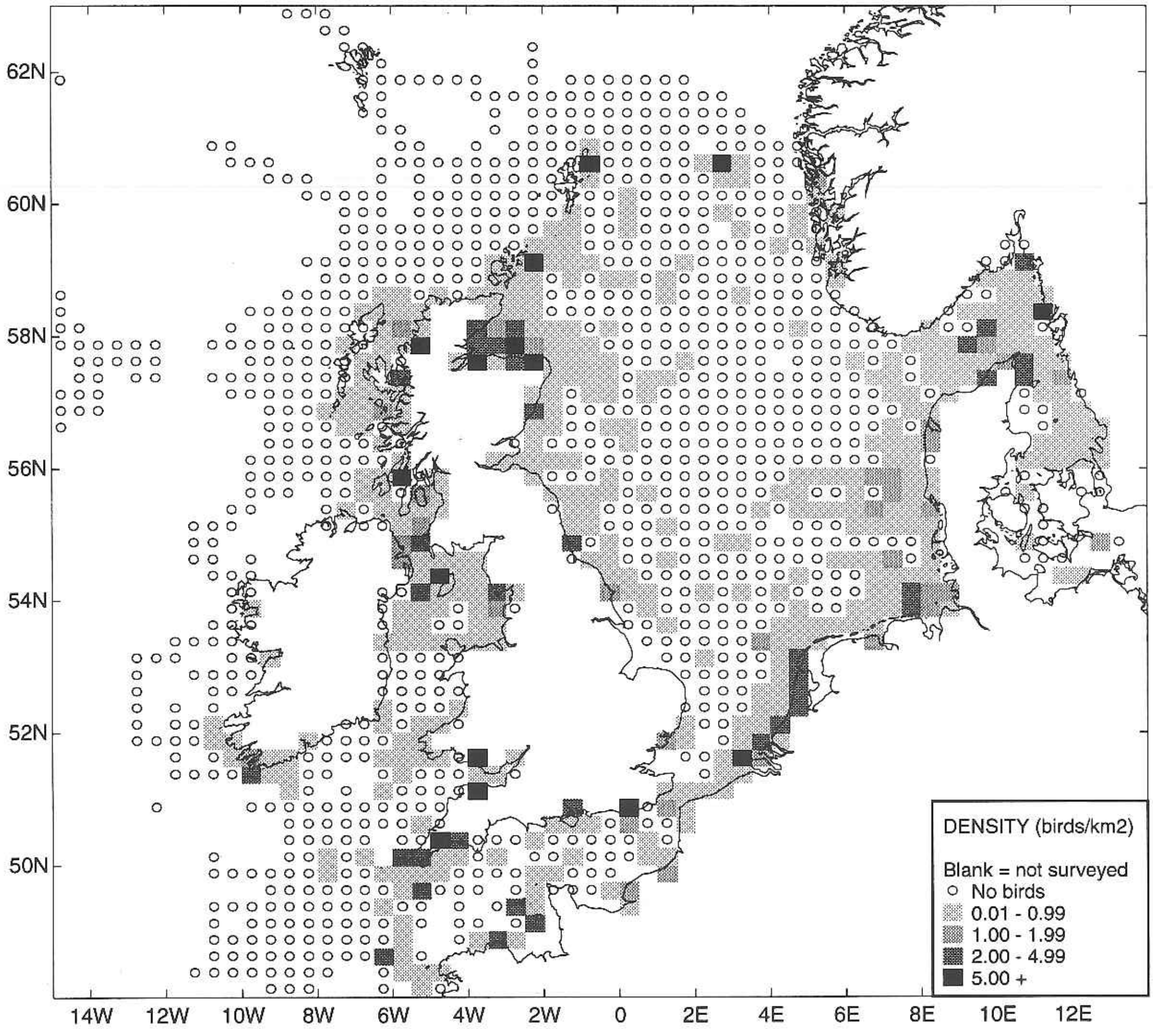

Figure 5.36.3 Distribution of herring gulls from July to October

July to October (Figure 5.36.3)

Again herring gulls were widespread around coastal regions, with concentrations around the Netherlands coast, in the Moray Firth, the German Bight and at Skagen. Their distribution extended further out to sea than in May and June, presumably connected with the end of the breeding season.

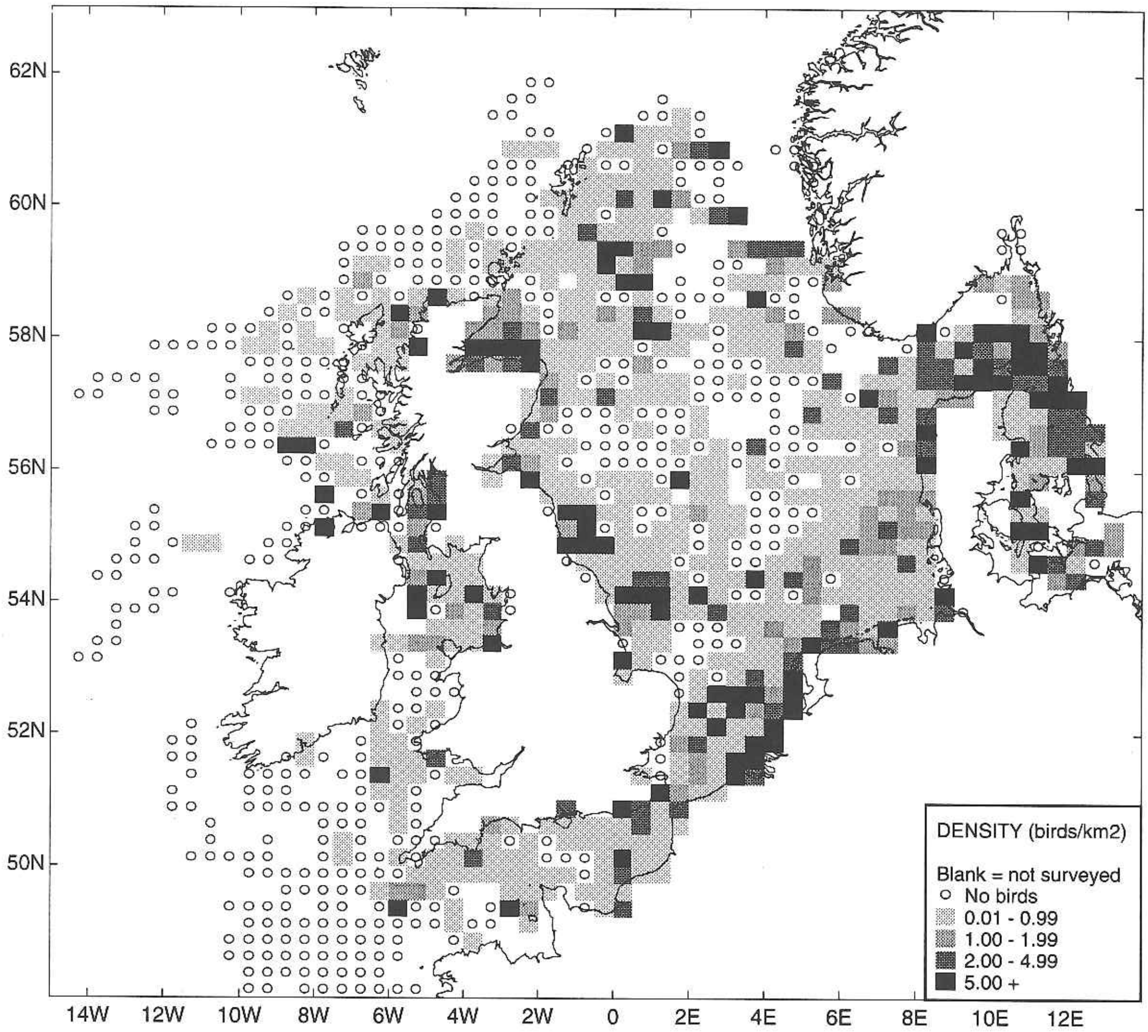

Figure 5.36.4 Distribution of herring gulls from November to February

November to February (Figure 5.36.4)

During winter there was a large increase in the range of herring gulls throughout the North Sea, the English Channel and the Irish Sea with the highest densities being in the Kattegat and Skagerrak (particularly around Skagen), the Moray Firth, off Flamborough Head and Tyneside, off the coast of the Netherlands (particularly in the Delta region), and in the northern half of the Irish Sea. Further offshore high densities of herring gulls were found to the east of Fair Isle. The increase in numbers and extended distribution is probably due to the influx of birds from the northern colonies augmenting existing populations of resident birds.

Summary and conservation implications

Herring gulls were found on most of the coastline in the area with the highest densities along the Netherlands coast and in the Moray Firth. Their distribution was mainly coastal during spring and summer, but expanded to cover the whole North Sea in winter. An oil spill in coastal waters may be expected to affect some herring gulls, but the population would not be much affected as the species is widespread, being widely distributed inland as well as along the coast.

Further reading

Camphuysen, C.J. 1993. *Scavenging seabirds behind fishing vessels in the Northeast Atlantic, with emphasis on the southern North Sea.* Nioz Report 1993-1, Netherlands Institute for Sea Research, Texel.

Camphuysen, C.J., Ensor, K., Furness, R.W., Garthe, S., Hüppop, O., Leaper, G., Offringa, H. & Tasker, M.L. 1993. *Seabirds feeding on discards in winter in the North Sea.* EC DG XIV research contract 92/3505. NIOZ Rapport 1993- 8, Netherlands Institute for Sea Research, Texel.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Pruter, J. 1986. Das vorkommen der häufigen Möwenarten (Laridae) im Seegebiet der Deutschen Bucht - Ergebnisse mehrjähriger Planbeobachtungen auf der Forschungsplattform "Nordsee". *Seevögel 7:* 13-19.

Table 5.36.1 Overall density of herring gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^{2}).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.03	0.52	2.51	2.25	0.67	5.38	0.56	-	0.00	1.14
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.06	3.55	1.15	5.05	0.79	4.02	3.27	0.00	4.95	0.85
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.02	0.64	2.53	0.28	.0.23	1.40	0.66	0.01	1.61	0.30
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.02	1.10	3.14	1.06	0.27	2.04	0.29	0.00	0.01	0.20
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.00	2.88	1.47	0.76	0.00	0.90	0.22	0.00	0.06	0.39
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.29	0.72	0.70	0.00	0.57	0.16	0.00	0.17	0.18
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.23	0.34	0.23	0.01	0.44	0.54	0.00	0.09	0.60
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.26	1.77	0.04	0.01	0.21	0.15	0.00	0.00	0.46
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.08	0.44	0.13	0.06	0.32	0.13	0.00	0.00	0.29
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.80	5.31	0.33	0.19	1.50	0.53	0.00	0.59	0.62
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.08	1.11	6.20	0.62	1.19	3.12	3.05	0.00	0.17	0.37
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	2.25	10.19	1.66	0.54	1.61	1.23	0.00	0.11	0.89
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.37 ICELAND GULL *Larus glaucoides*

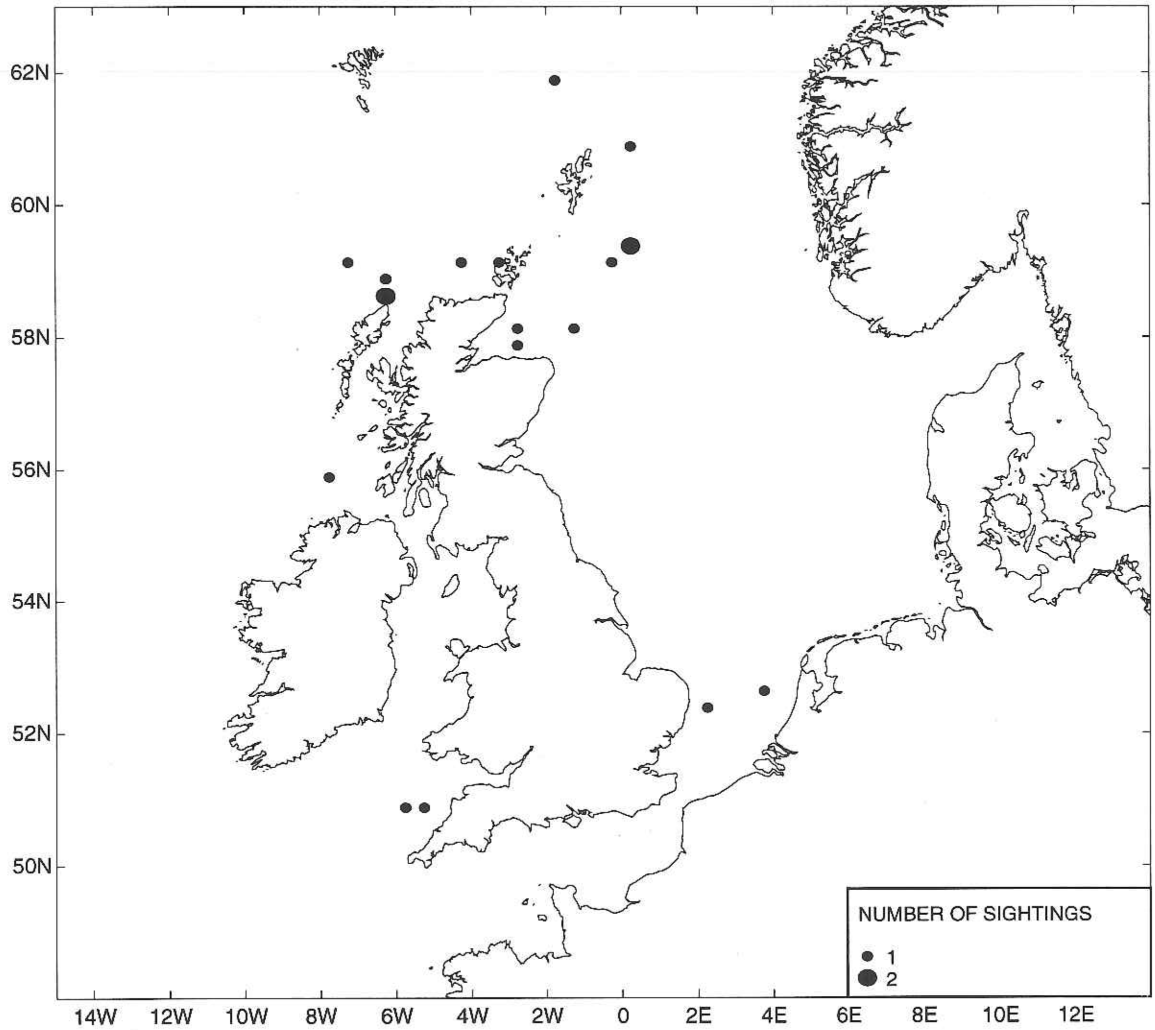

Figure 5.37.1 Sightings of Iceland gulls from November to April

November to April (Figure 5.37.1)

There were very few isolated sightings of Iceland gulls in north-west European seas, with most being seen in the north of Scotland, the Outer Hebrides and around the Northern Isles. There were two occurrences in the southern North Sea and two off the north coast of Cornwall. Most birds were present in the winter months from January to March with a few also seen in April and November (Figure 5.37.2). Iceland gulls breed on the coast of Greenland and are scarce winter visitors to the study area.

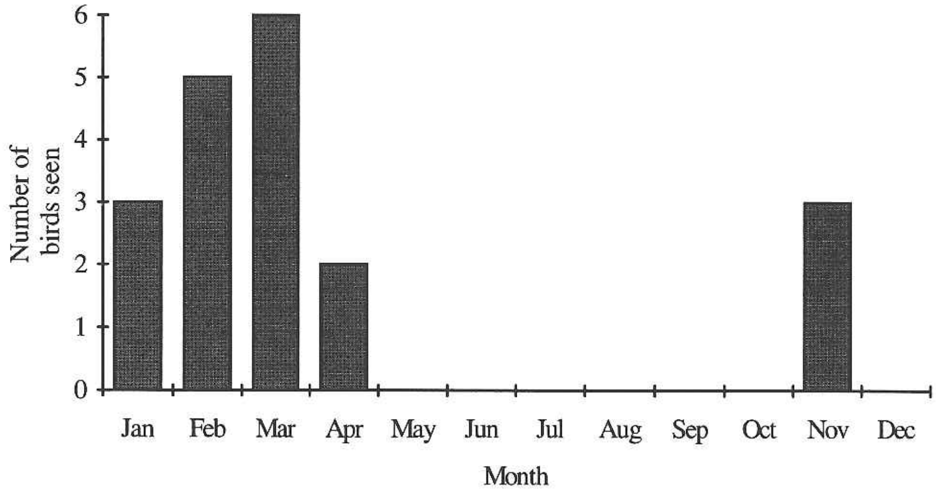

Figure 5.37.2 Number of Iceland gulls seen per month

Summary and conservation implications

Iceland gulls were scarce winter visitors to the Scottish coasts and islands, the main wintering area being in Iceland. Since they are rare in this area, and the numbers found here are only a tiny fraction of the wintering population, there will be little effect of oil pollution on Iceland gulls.

5.38 GLAUCOUS GULL *Larus hyperboreus*

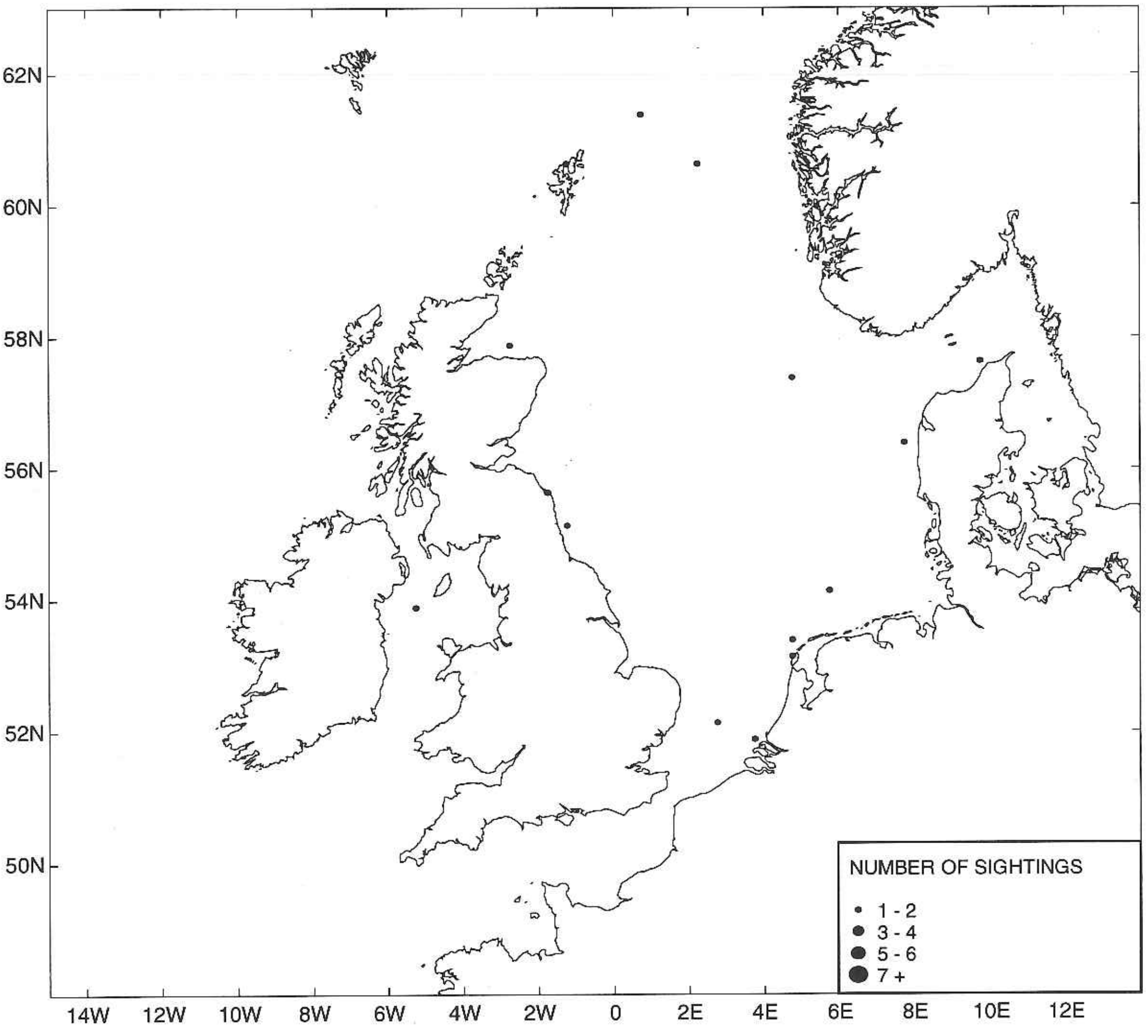

Figure 5.38.1 Sightings of glaucous gulls from April to September

April to September (Figure 5.38.1)

There were very few sightings of glaucous gulls during the summer months, and most of these were in April (Figure 5.38.3). The sightings were scattered around the coasts of the North Sea with an isolated record in the Irish Sea. Of birds that were aged, 70% were immatures.

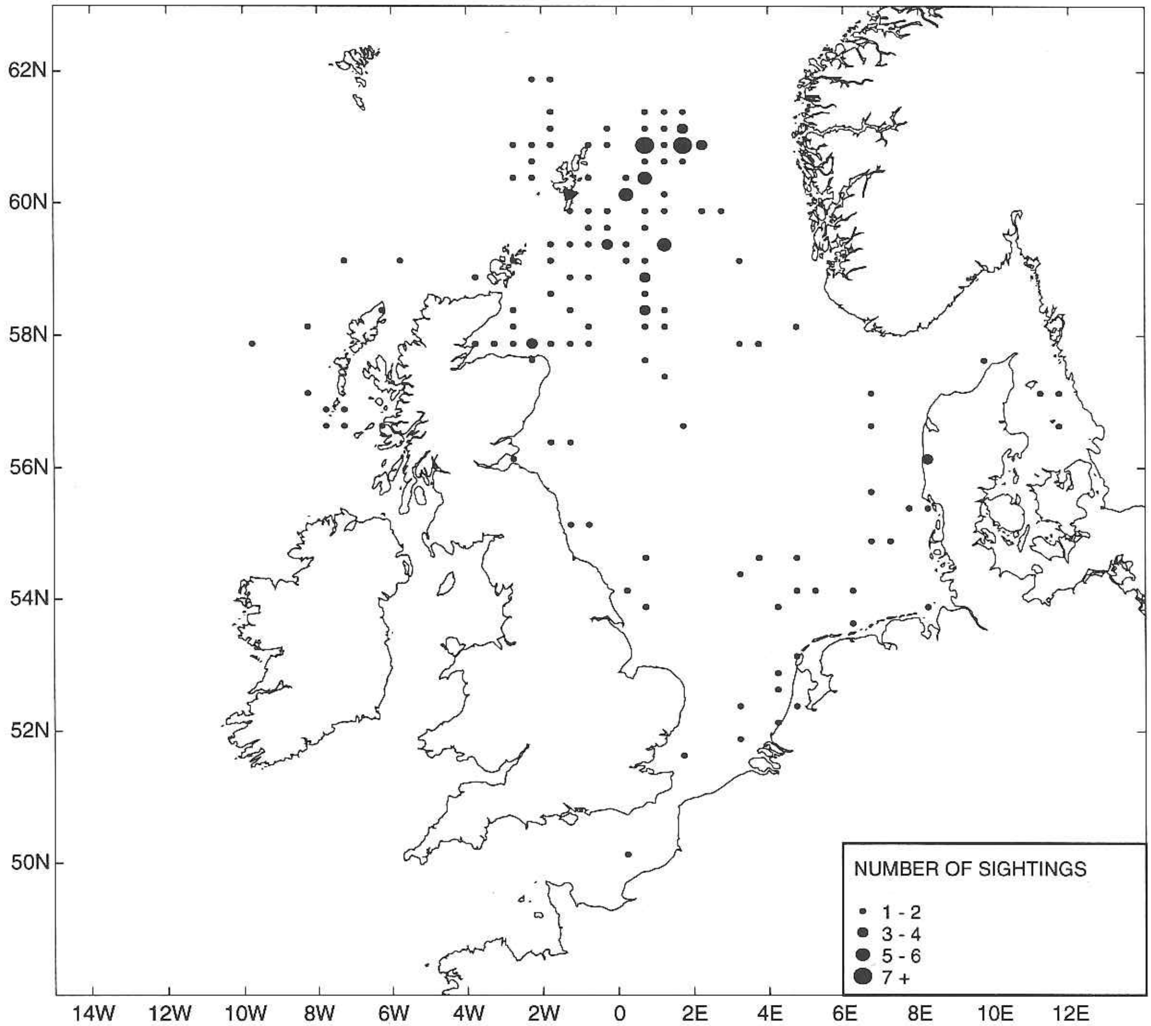

Figure 5.38.2 Sightings of glaucous gulls from October to March

October to March (Figure 5.38.2)

During winter there was a large increase in the number of glaucous gulls in the area due to birds arriving from the breeding colonies in Greenland, Iceland and Spitzbergen. Glaucous gulls were mostly seen from November to February with fewer sightings in March and October (Figure 5.38.3). Sightings were most common around Shetland, the Moray Firth and the Outer Hebrides, with scattered sightings throughout the North Sea and in the Kattegat.

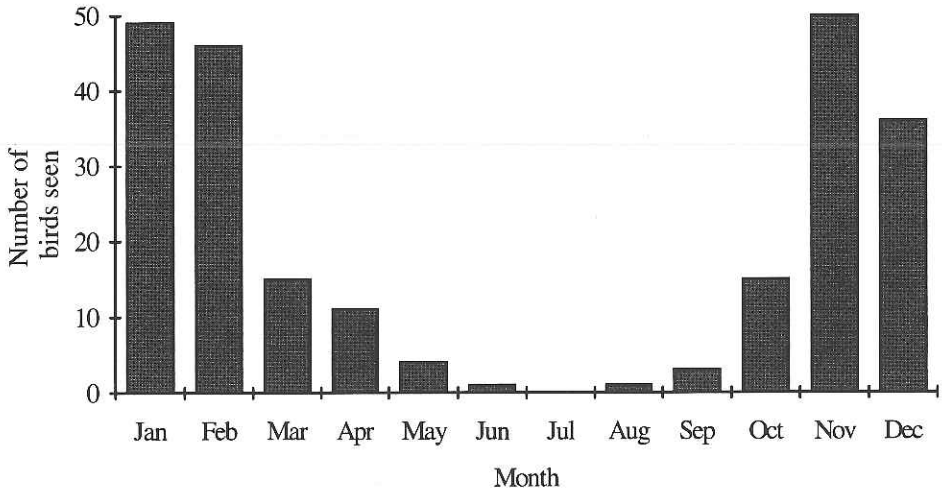

Figure 5.38.3 Number of glaucous gulls seen per month

Summary and conservation implications

Glaucous gulls were scarce winter visitors to the North Sea, mainly to the Northern Isles and Scotland, although some birds, mostly immature, remained into the summer months. Oil pollution in the study area will probably have little effect on glaucous gulls since they are scarce and on the edge of their wintering range.

5.39 GREAT BLACK-BACKED GULL *Larus marinus*

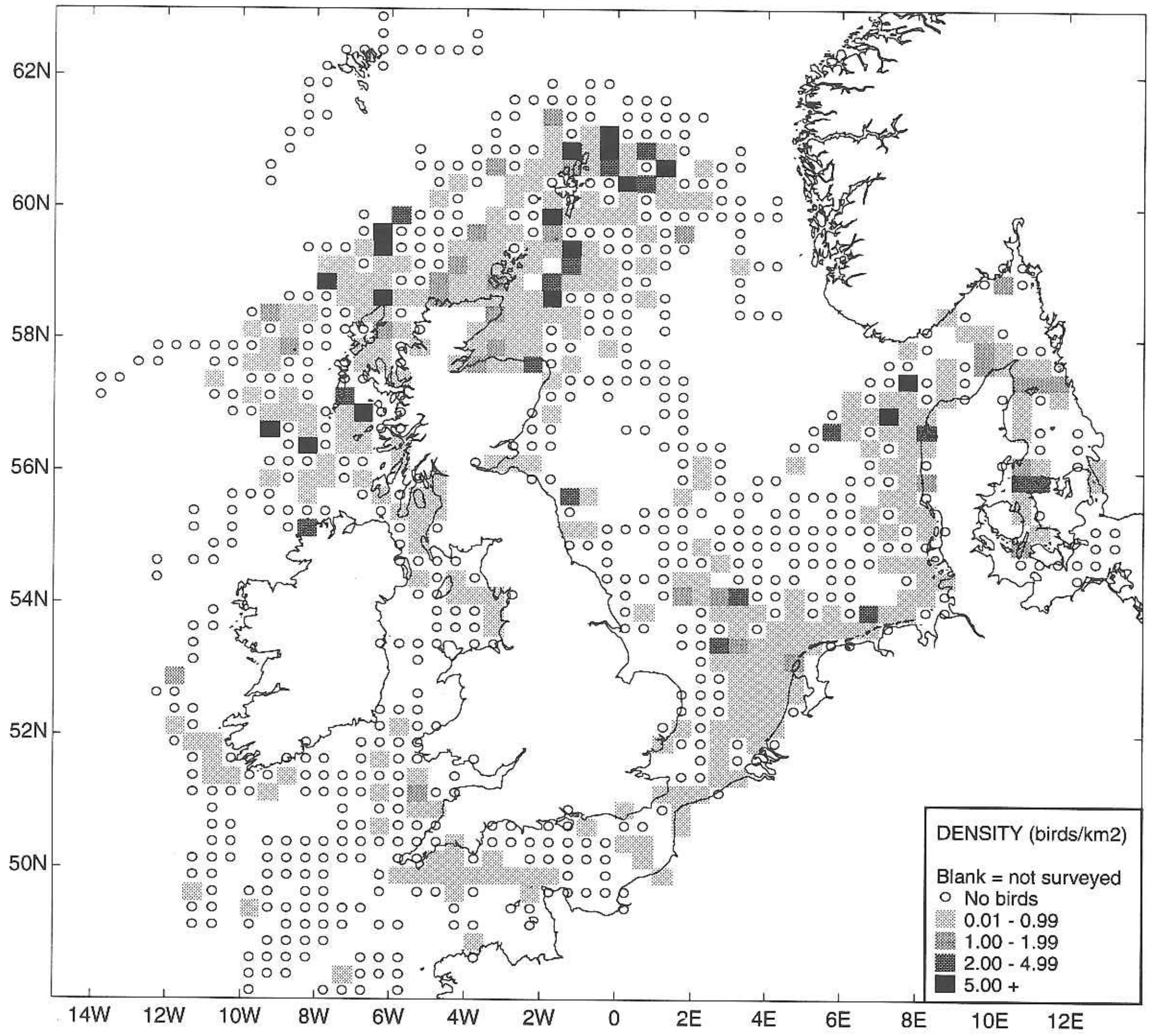

Figure 5.39.1 Distribution of great black-backed gulls in March and April

March to April (Figure 5.39.1)

The highest densities of great black-backed gulls were around Shetland, Orkney and at the shelf edge to the north-west of Scotland. They occurred at lower density in the Moray Firth and on north and west coasts of Scotland. Low densities were also seen along continental coasts of the North Sea, in the Skagerrak and Kattegat, in the western English Channel, eastern Irish Sea and off south-west Ireland.

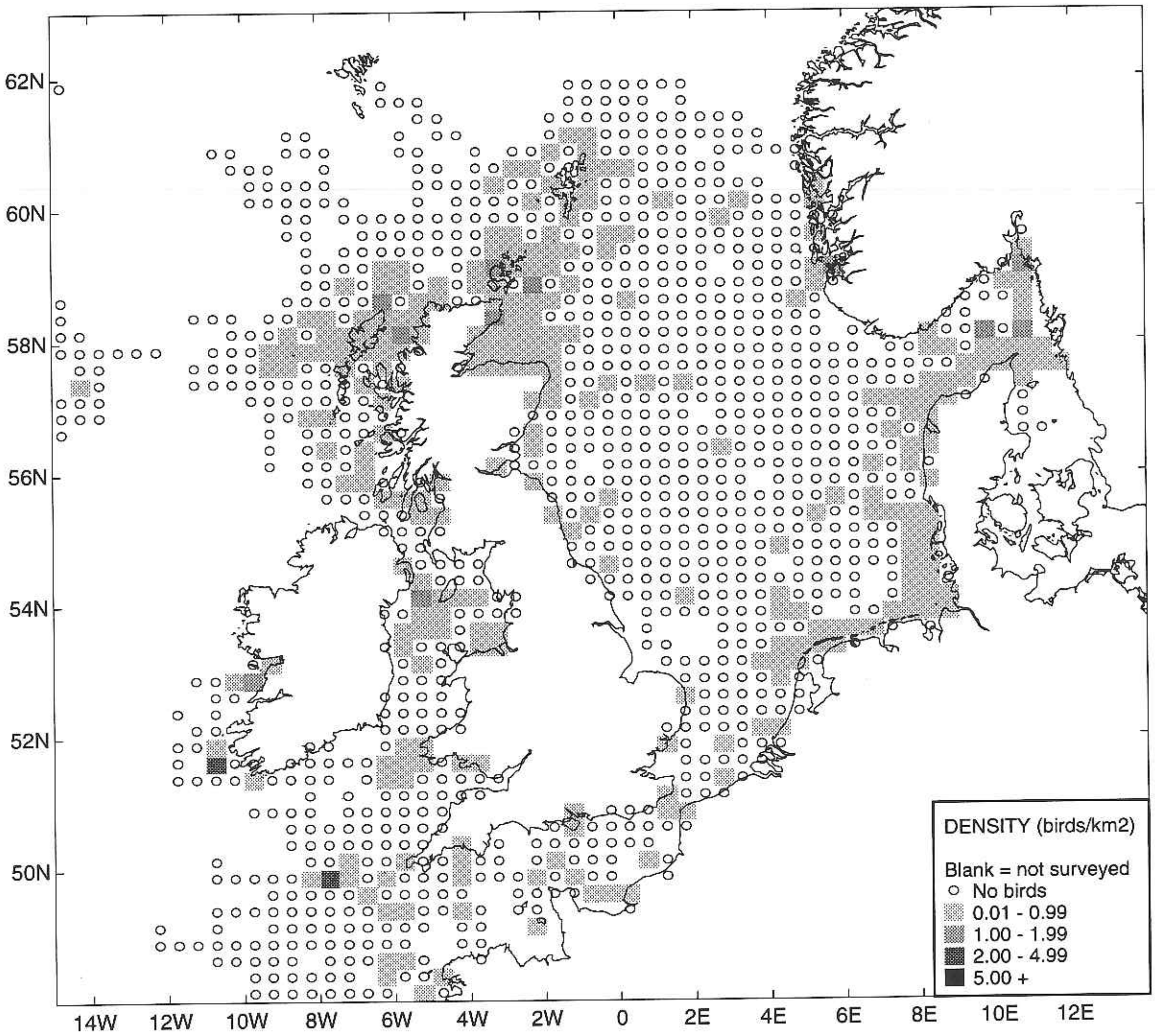

Figure 5.39.2 Distribution of great black-backed gulls from May to July

May to July (Figure 5.39.2)

The distribution of great black-backed gulls was very similar to that found in April and March but the densities were much lower (Table 5.39.1). At this time over-wintering birds return to their breeding areas in Fenno-Scandinavia and Iceland. Low densities were found in the vicinity of the Irish Sea front.

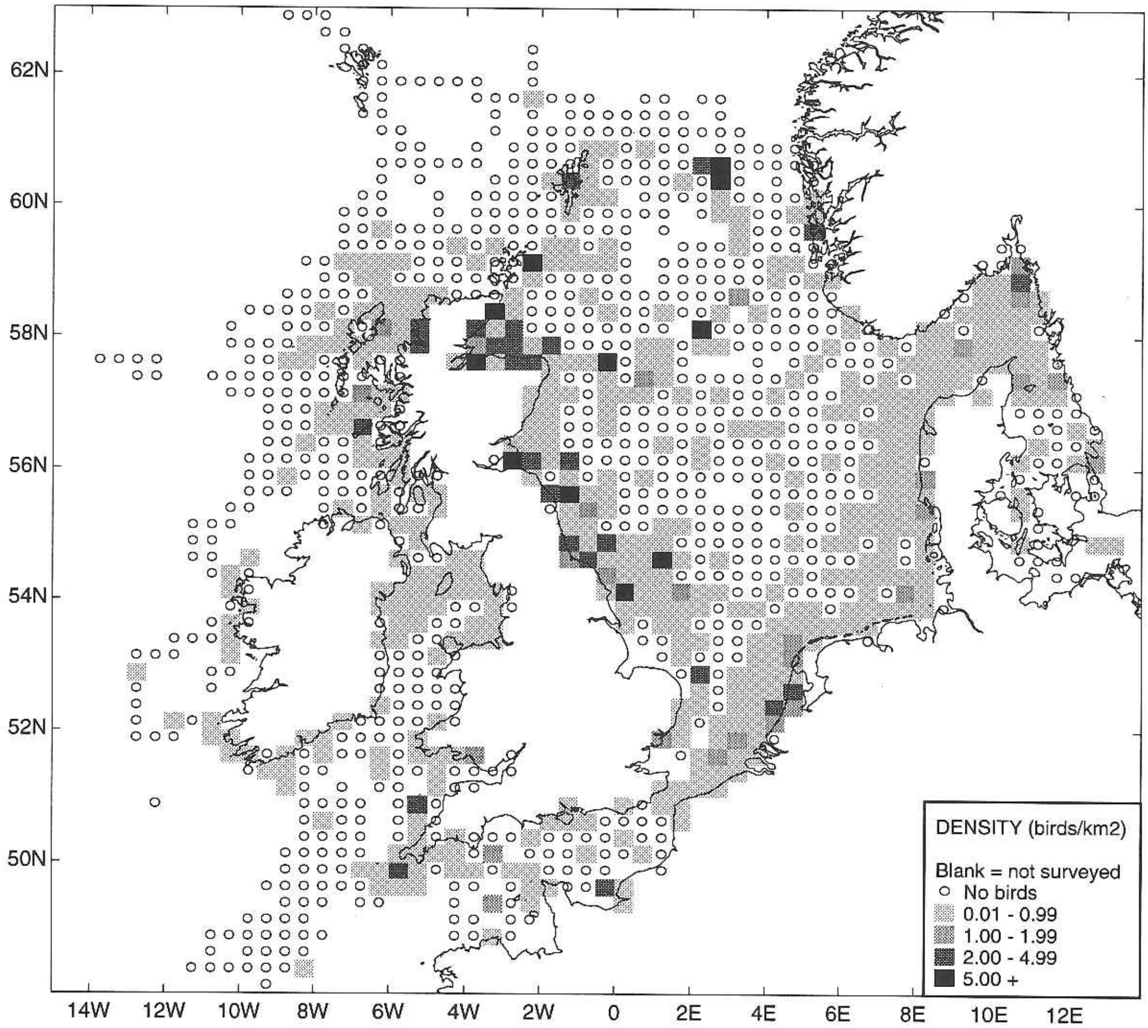

Figure 5.39.3 Distribution of great black-backed gulls from August to October

August to October (Figure 5.39.3)

The distribution of great black-backed gulls was more widespread along North Sea coasts, with some birds found in the central North Sea. Densities were higher than during the breeding season, especially along the east coast of England, in the Moray Firth and along the Netherlands coast. Low densities remained in the area of the Irish Sea front.

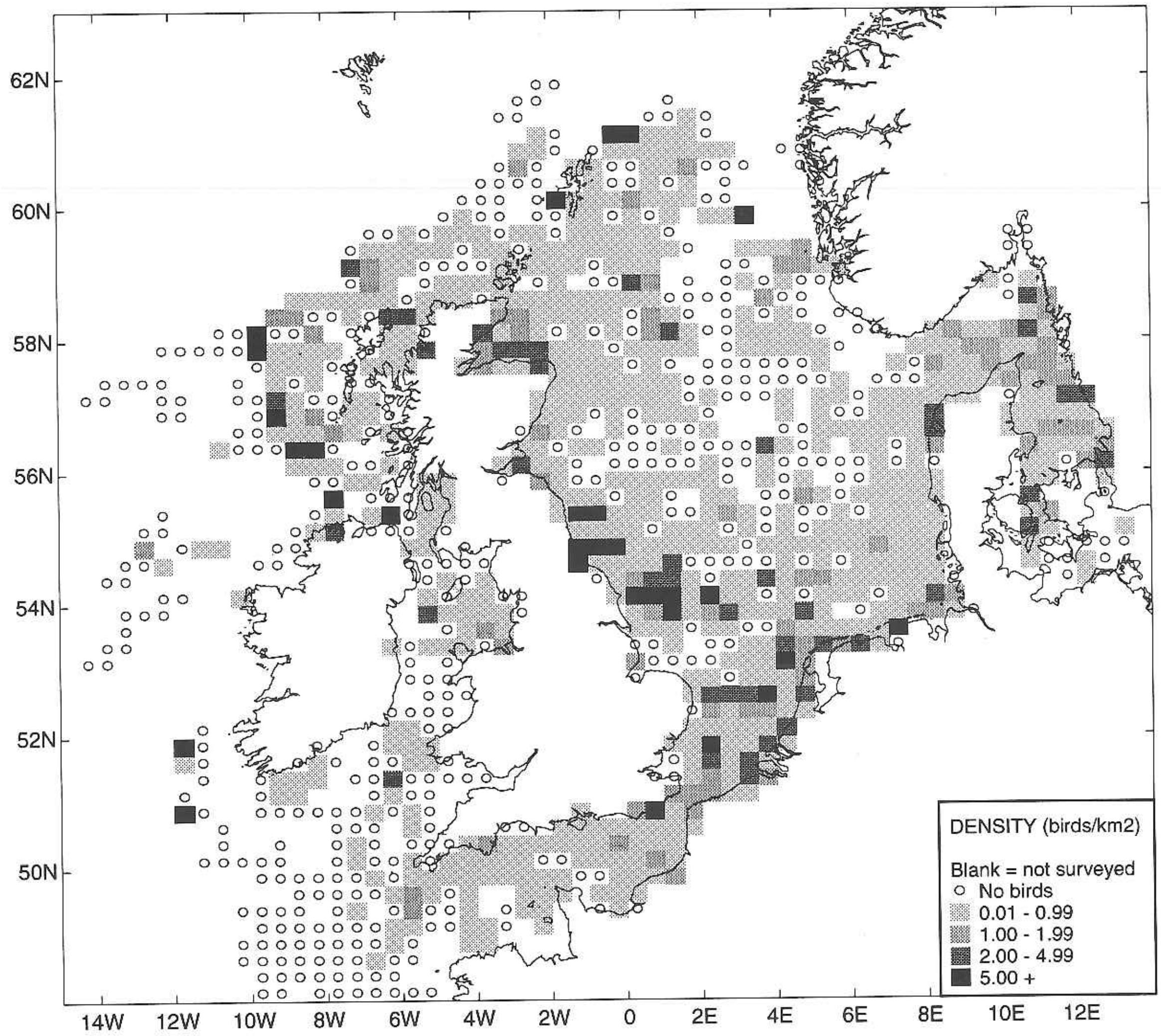

Figure 5.39.4 Distribution of great black-backed gulls from November to February

November to February (Figure 5.39.4)

The distribution during winter was widespread over much of the North Sea, English Channel, northern Irish Sea and the shelf to the north and west of Scotland. High densities occurred near the Dogger Bank, in the southern North Sea and at the outer shelf and shelf edge to the west of Scotland. Moderate densities were seen in the Skagerrak and Middelgrundene, and low densities in the Belt Sea. There were some birds in the Celtic Sea, and high densities at the shelf edge to the south-west of Ireland.

Summary and conservation implications

Great black-backed gulls are resident breeders in Britain and Denmark. During the pre-breeding season and breeding season their distribution was mostly coastal, but in winter it was more widespread. The aerial lifestyle and dispersed distribution of this species means that it is at low risk from oil pollution. Great black-backed gulls commonly scavenge at fishing vessels (Camphuysen 1993, Camphuysen *et al.* 1993), therefore populations of this species are more likely to be affected by a reduction in the availability of discards from trawlers due to changes in fisheries' practices.

Further reading

Bourne, W.P. & Harris, M.P. 1979. Birds of the Hebrides: seabirds. *Proceedings of the Royal Society of Edinburgh 77:* 445-475.

Camphuysen, C.J. 1993. *Scavenging seabirds behind fishing vessels in the Northeast Atlantic, with emphasis on the southern North Sea.* Nioz Report 1993-1, Netherlands Institute for Sea Research, Texel.

Camphuysen, C.J., Ensor, K., Furness, R.W., Garthe, S., Hüppop, O., Leaper, G., Offringa, H. & Tasker, M.L. 1993. *Seabirds feeding on discards in winter in the North Sea.* EC DG XIV research contract 92/3505. NIOZ Rapport 1993- 8, Netherlands Institute for Sea Research, Texel.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Furness, R.W.F., Hudson, A.V. & Ensor. K. 1988. Interactions between scavenging seabirds and commercial fisheries around the British Isles. In, Burger, J. (ed.) *Seabirds and other marine vertebrates*, Columbia University Press, New York.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Table 5.39.1 Overall density of great black-backed gulls (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	7.97	0.72	0.43	0.56	0.90	1.11	0.28	-	0.00	0.51
	km^2	96.0	690.9	540.3	785.0	914.6	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.59	1.07	0.42	2.06	0.33	0.87	0.34	0.74	0.85	0.62
	km^2	338.0	775.0	1063.3	1235.1	2379.6	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.07	0.25	1.25	0.03	0.49	0.40	0.10	0.24	0.08	0.08
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.78	2.36	1.34	0.19	0.44	0.24	0.03	0.00	0.01	0.05
	km^2	576.0	938.8	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.01	0.19	0.33	0.01	0.01	0.09	0.03	0.00	0.04	0.02
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.01	0.10	0.14	0.03	0.00	0.03	0.04	0.00	0.01	0.02
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	576.8
Jul	Density	0.00	0.14	0.13	0.03	0.01	0.08	0.05	0.00	0.11	0.04
	km^2	997.4	937.0	3582.7	1484.8	4780.7	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.20	0.38	0.27	0.11	0.15	0.05	0.02	0.02	0.14
	km^2	866.4	2468.6	1377.9	1592.9	3817.3	4473.2	1061.6	292.2	524.3	892.0
Sep	Density	0.00	0.04	0.83	1.01	0.53	0.56	0.10	0.00	0.10	0.25
	km^2	208.9	493.3	1364.7	2765.9	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.31	2.44	1.64	0.51	0.82	0.08	0.00	0.31	0.29
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.22	0.40	1.90	0.67	0.62	1.14	0.13	0.00	0.05	0.36
	km^2	116.3	425.6	871.3	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.21	0.43	1.70	2.18	1.43	1.44	0.17	0.00	0.04	0.36
	km^2	71.4	293.8	606.6	708.3	395.0	1579.3	279.2	97.9	459.2	1257.2

5.40 KITTIWAKE *Rissa tridactyla*

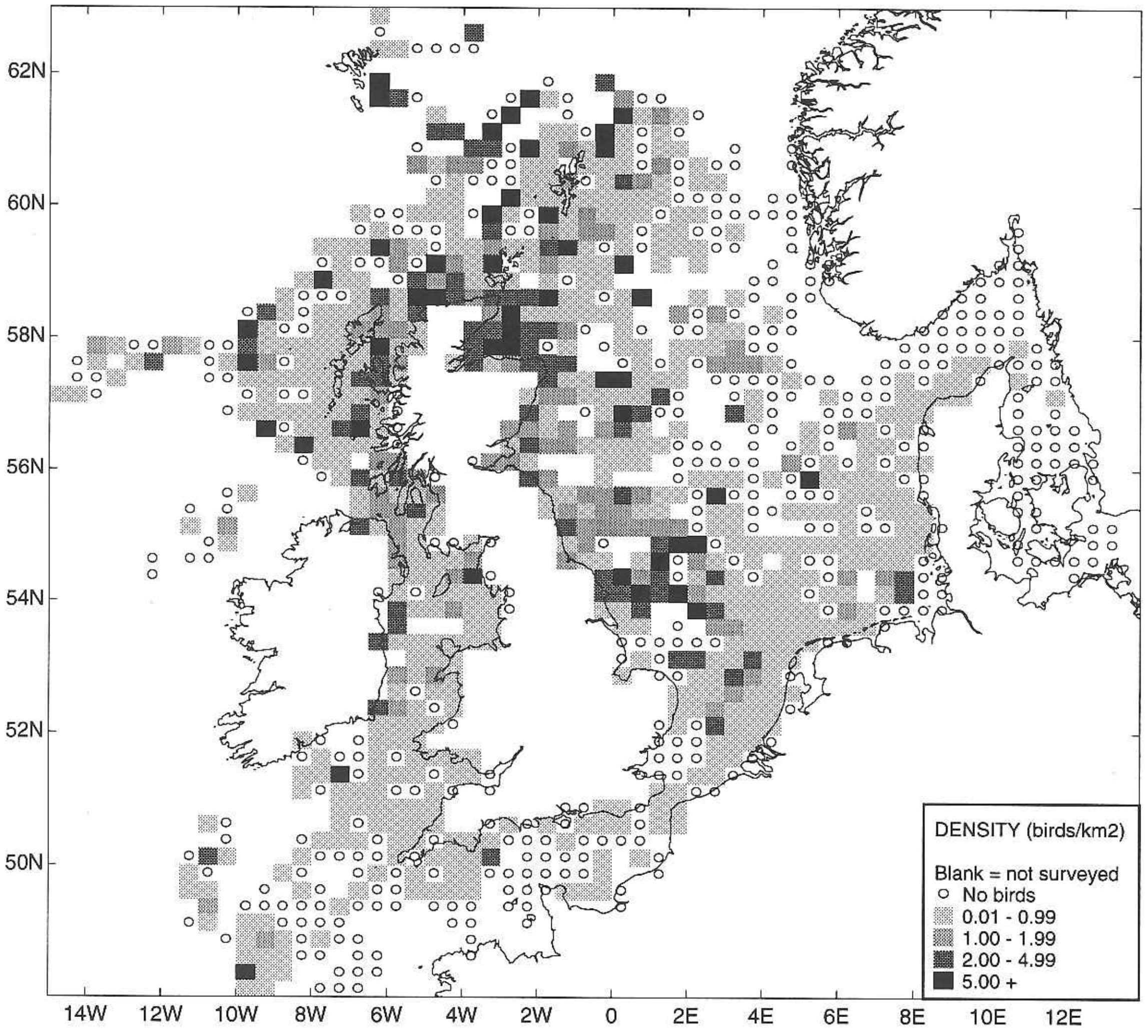

Figure 5.40.1 Distribution of kittiwakes in April and May

April to May (Figure 5.40.1)

Kittiwakes were dispersed widely around the coast of Britain with the highest densities around the coasts of Scotland, at the Dogger Bank and along the north-east coast of England. Lower densities occurred in the Irish Sea, the Celtic Sea and South-west Approaches, and throughout the southern North Sea. Low densities occurred along the south coast of England. A local concentration occurred in the German Bight around the breeding colony at Helgoland.

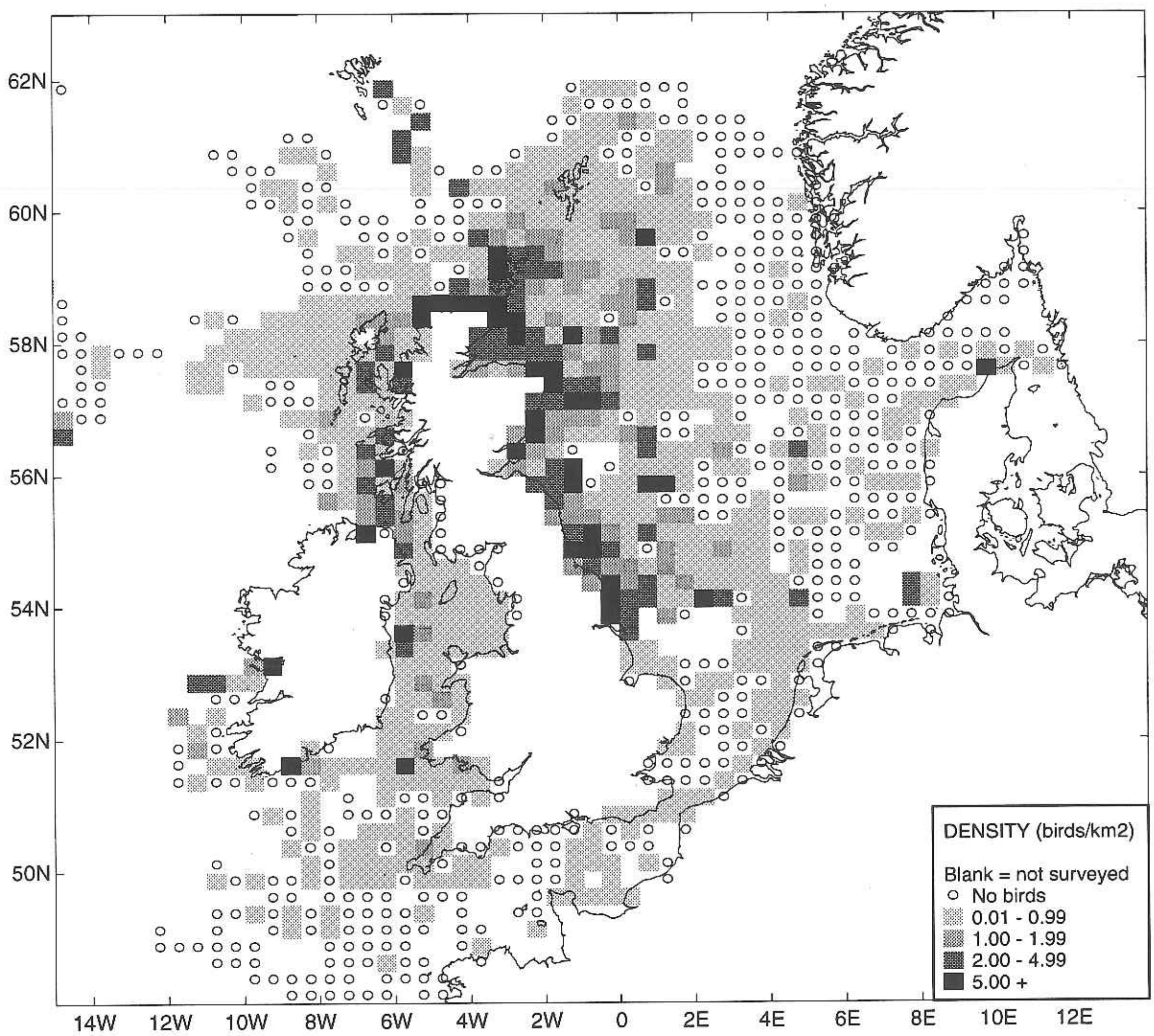

Figure 5.40.2 Distribution of kittiwakes in June and July

June to July (Figure 5.40.2)

During the breeding season the highest densities of kittiwakes occurred around the larger colonies in Orkney, north and east Scotland, north-east England and around the Inner Hebrides (Table 5.40.1). Low densities extended across the shelf to the west of Scotland and half-way across the North Sea. Kittiwakes were widespread in the Irish Sea at low densities, and low densities also occurred in the Celtic Sea, English Channel and southern North Sea. A local concentration occurred in the German Bight around the breeding colony at Helgoland.

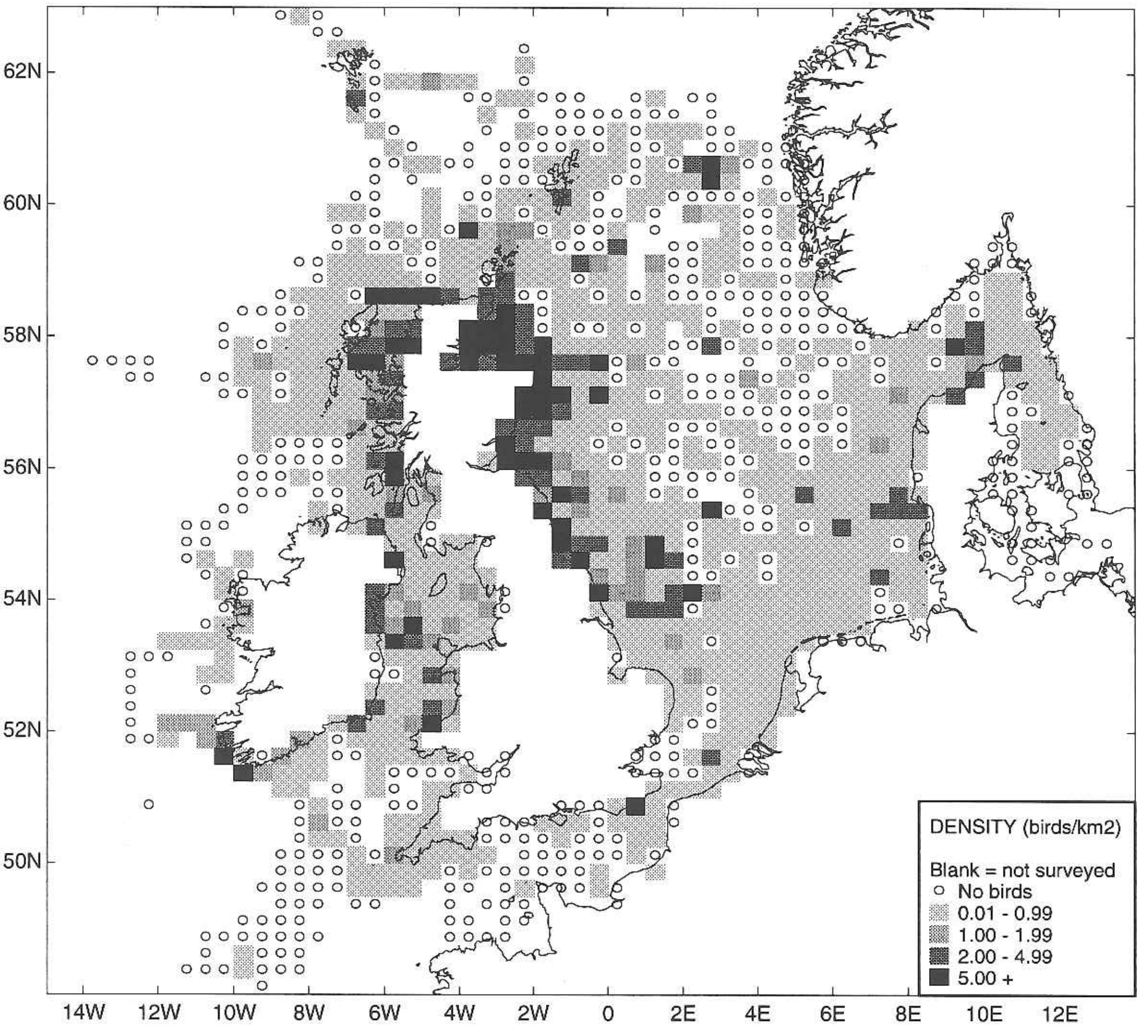

Figure 5.40.3 Distribution of kittiwakes from August to October

August to October (Figure 5.40.3)

Kittiwakes began to disperse in low densities over the North Sea following the breeding season, and were particularly widespread in the southern North Sea, Skagerrak and Kattegat. Local concentrations occurred around Jammerbugten, Skagen and Blåvandshuk. High densities were still evident around the north-east coast of Britain, and there was a concentration of birds over the Dogger Bank. High densities also remained along the west coast of Scotland, with low densities extending out over the shelf there. Kittiwakes were widespread in the Irish Sea, with highest densities in the area of the Irish Sea front. High densities were seen off south-west Ireland, and low densities were present in the Celtic Sea and around Cornish coasts.

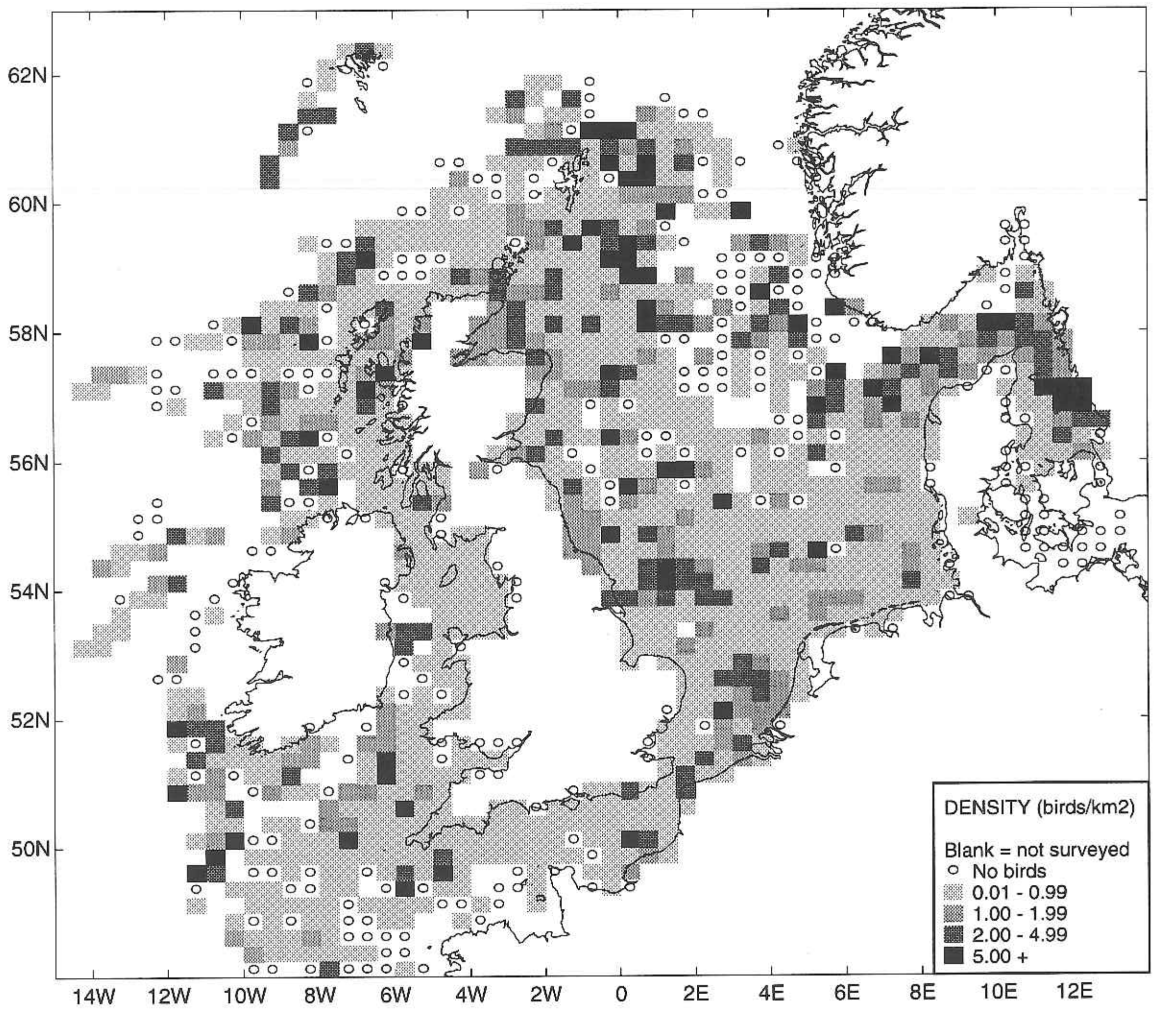

Figure 5.40.4 Distribution of kittiwakes from November to March

November to March (Figure 5.40.4)

During winter kittiwakes were dispersed over a large area of the shelf in north-west European waters. There were some concentrations of birds over the Dogger Bank and in the Skagerrak and Kattegat, particularly around Middelgrundene. High densities were scattered over much of the study area, particularly over the outer shelf to the west of Britain and in the central northern North Sea. This wide distribution over open maritime areas reflects the kittiwake's preference for pelagic habitats.

Summary and conservation implications

Kittiwakes are largely resident in the area, breeding mainly in north-east England and Scotland and dispersing widely over shelf waters of north-west Europe during winter. Kittiwakes are more vulnerable to oil pollution than other gulls because they are more marine. However, they are at less risk than diving birds because of their aerial lifestyle.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, C.J. 1993. *Scavenging seabirds behind fishing vessels in the Northeast Atlantic, with emphasis on the southern North Sea.* Nioz Report 1993-1, Netherlands Institute for Sea Research, Texel.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Joiris, C. 1978. Seabirds recorded in the northern North Sea in July: the ecological implications of their distribution. *Le Gerfaut 68:* 419-440.

Joiris, C. 1983. Seabirds recorded in the Fladenground area, Northern North Sea in April, May and June 1976. In, Sünderman & Lenz (eds.), *North Sea Dynamics*, Springer Verlag, pp. 676-685.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91:* 81-104.

Peterz, M., Olden, B., & Jonsson, P.E. 1988. Havsfagelrakning fran farjor i Kattegatt. *Pelagicus 3:* 17-39.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Wanless, S., Monaghan, P., Uttley, J.D., Walton, P. & Morris, J.A. 1992. A radio-tracking study of kittiwakes (*Rissa tridactyla*) foraging under suboptimal conditions. In, Priede, I.G. & Swift, S.M. (eds.), *Wildlife Telemetry: Remote monitoring and tracking of animals*, Ellis Horwood Ltd., Chichester, U.K., pp. 581-590.

Table 5.40.1 Overall density of kittiwakes (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Density	0.35	0.45	1.04	0.41	1.65	1.10	0.35	-	0.60	1.07
	km^2	96.0	1292.1	774.8	1097.2	1060.5	4048.0	896.7	0.0	71.2	899.0
Feb	Density	4.08	2.25	3.74	1.49	1.97	1.36	0.27	6.30	6.19	1.69
	km^2	338.0	775.0	1257.3	1235.1	2826.7	5770.6	476.2	113.5	191.0	563.2
Mar	Density	0.97	0.48	2.27	1.30	1.55	1.00	0.38	1.82	0.78	0.23
	km^2	374.7	1385.1	1388.4	597.0	1014.7	3101.8	581.6	148.9	609.3	780.0
Apr	Density	3.64	1.16	3.16	1.18	1.03	0.30	0.51	0.92	0.23	0.14
	km^2	576.0	944.6	1243.0	269.6	1743.2	4639.5	483.9	98.9	550.9	787.8
May	Density	1.21	1.45	4.44	1.61	0.58	0.18	0.64	0.17	0.29	0.08
	km^2	451.6	1512.7	1441.6	1232.9	2980.1	4024.2	978.9	253.2	501.1	1242.0
Jun	Density	0.35	0.60	2.71	2.64	0.24	0.18	1.40	0.00	0.14	0.07
	km^2	617.1	1763.0	1318.6	572.8	2113.5	2654.2	875.7	71.6	323.5	583.7
Jul	Density	0.26	1.85	2.34	4.54	0.64	0.43	0.69	0.32	0.96	0.13
	km^2	997.4	1512.4	3624.2	1794.0	4780.7	2615.8	1403.3	153.8	944.4	999.3
Aug	Density	0.22	1.20	5.79	4.37	0.14	0.18	1.34	0.10	0.10	0.06
	km^2	867.9	2468.6	1377.9	1662.5	4004.1	4952.2	1061.6	292.2	524.3	896.4
Sep	Density	0.07	1.47	6.50	3.28	0.65	0.26	1.31	0.00	0.16	0.24
	km^2	208.9	1059.6	1389.6	3097.4	3079.4	3613.2	1738.4	4.0	388.4	929.4
Oct	Density	2.16	3.22	5.14	2.29	1.21	1.19	0.79	0.48	1.87	0.20
	km^2	66.6	1354.6	572.7	745.6	1413.5	3335.5	356.6	12.6	297.6	811.0
Nov	Density	0.56	2.18	7.29	1.15	1.61	1.68	0.75	0.15	0.93	0.43
	km^2	116.3	561.5	1012.3	869.8	1578.6	3648.5	587.7	76.3	710.4	859.0
Dec	Density	0.15	2.24	0.89	1.00	0.87	1.84	1.03	1.08	1.25	0.64
	km^2	71.4	586.1	606.6	846.4	736.5	2869.1	280.7	97.9	460.5	1476.1

5.41 TERNS *Sterna* spp.

Tern identification at sea is difficult, so an initial analysis pooled records of all tern species. Most of these birds were Sandwich terns *Sterna sandvicensis*, common terns *S. hirundo* and Arctic terns *S. paradisaea*, with little terns *S. albifrons* and black terns *Chlidonias niger* being rare. There were occasional sightings of roseate terns *S. dougallii*, gull-billed terns *Gelochelidon nilotica* and one Caspian tern *S. caspia* (see section 5.52).

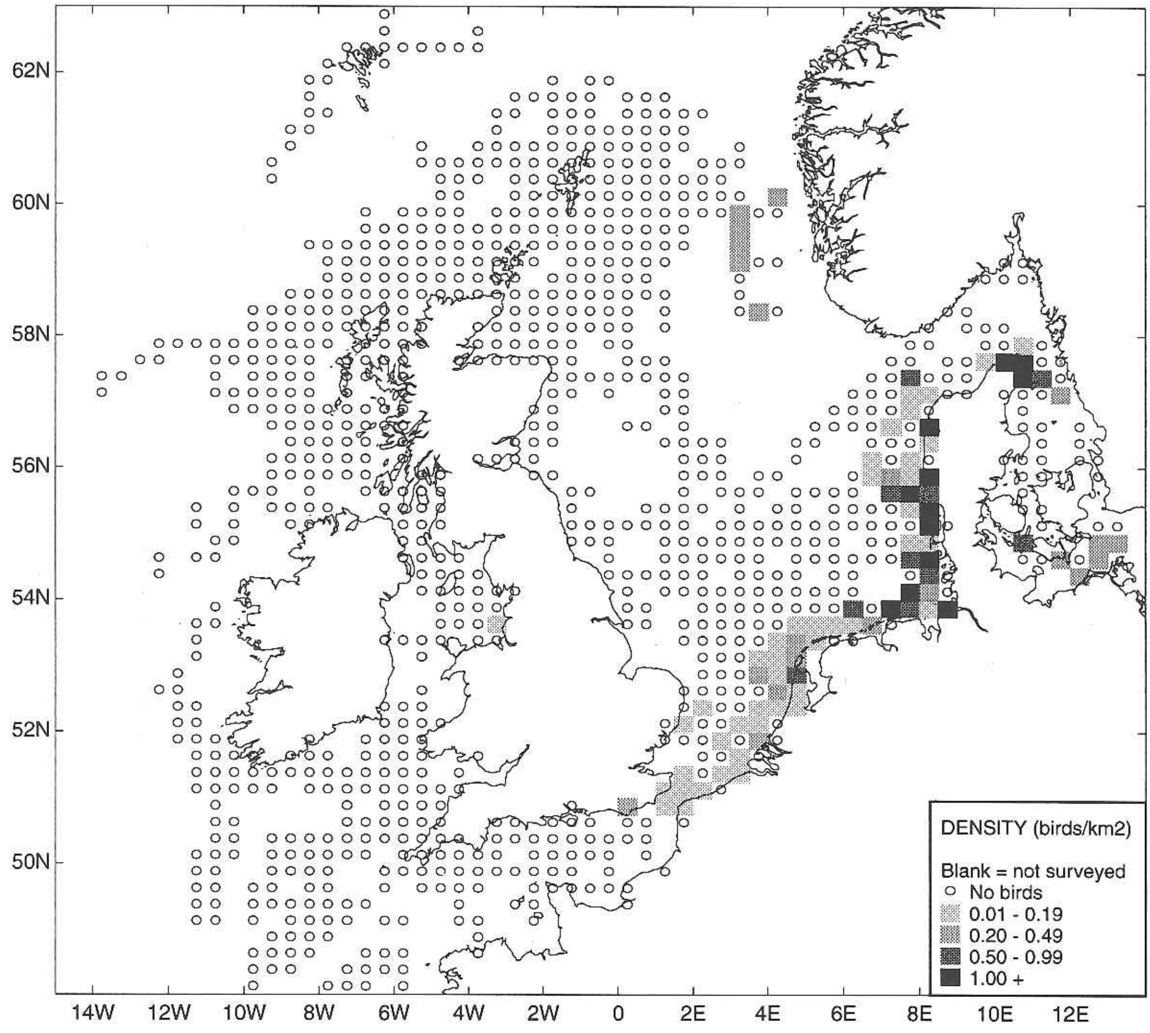

Figure 5.41.1 Distribution of terns in March and April

March to April (Figure 5.41.1)

The greatest density of terns was along continental coasts of the southern North Sea (Table 5.41.1), especially in the German Bight, at Blåvandshuk and Skagen. Moderate densities were found on the Netherlands and Belgian coasts, especially around Texel, in the Belt Sea, and along the western edge of the Rinne. Low densities were seen in the Dover Straits and in Liverpool Bay.

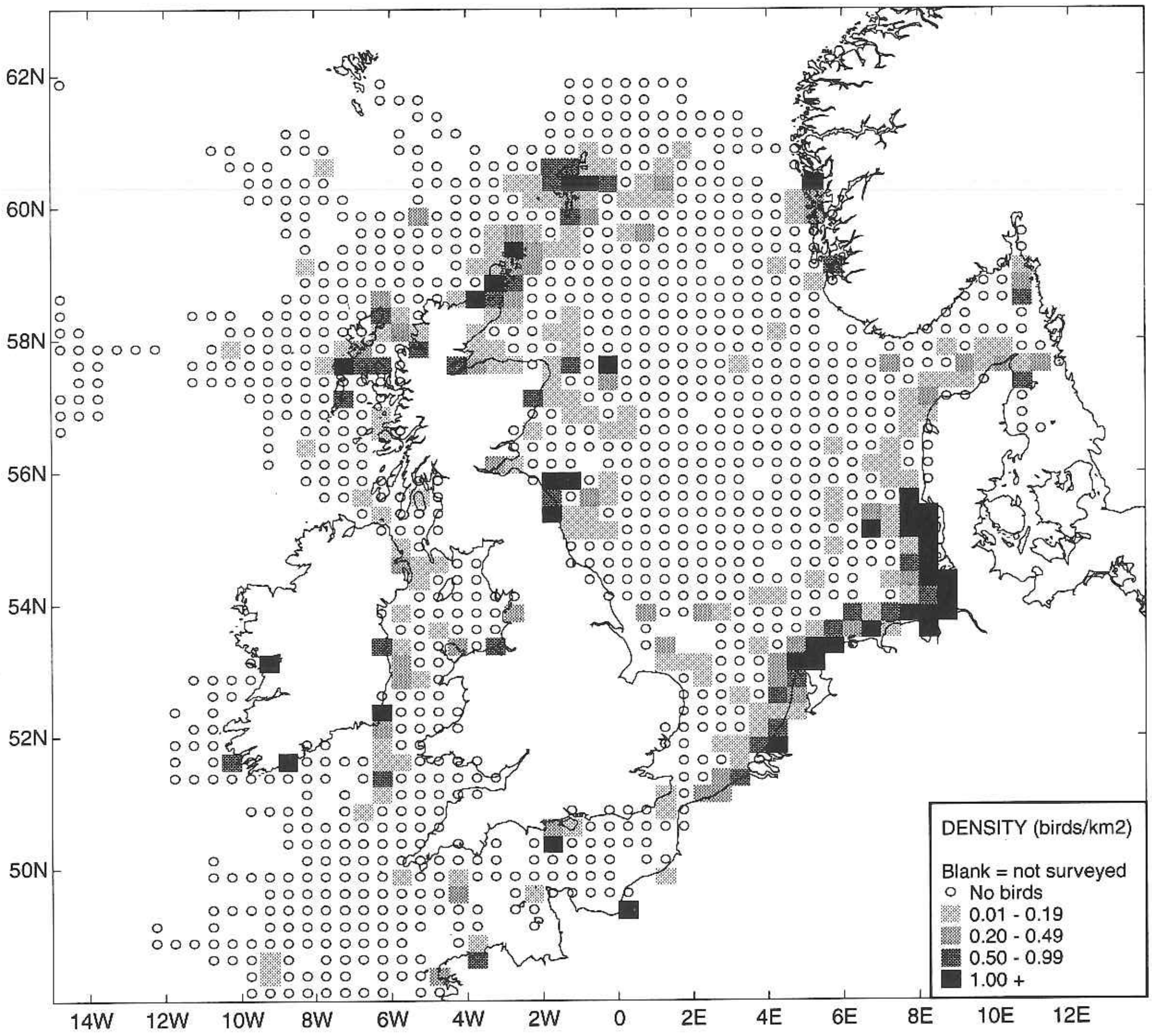

Figure 5.41.2 Distribution of terns from May to July

May to July (Figure 5.41.2)

Densities increased along the continental coasts of the southern North Sea, with the highest densities being found from Blåvandshuk south to the Delta Region. Significant densities of terns were also evident around the major British colonies in the Farne Islands, Shetland, Orkney and around south-west Ireland, with moderate densities around East Anglia, in the Irish Sea, in east Dorset and on the west coast of Norway. There were also low densities around the north-east and west coasts of Scotland, in the North Sea and in the English Channel.

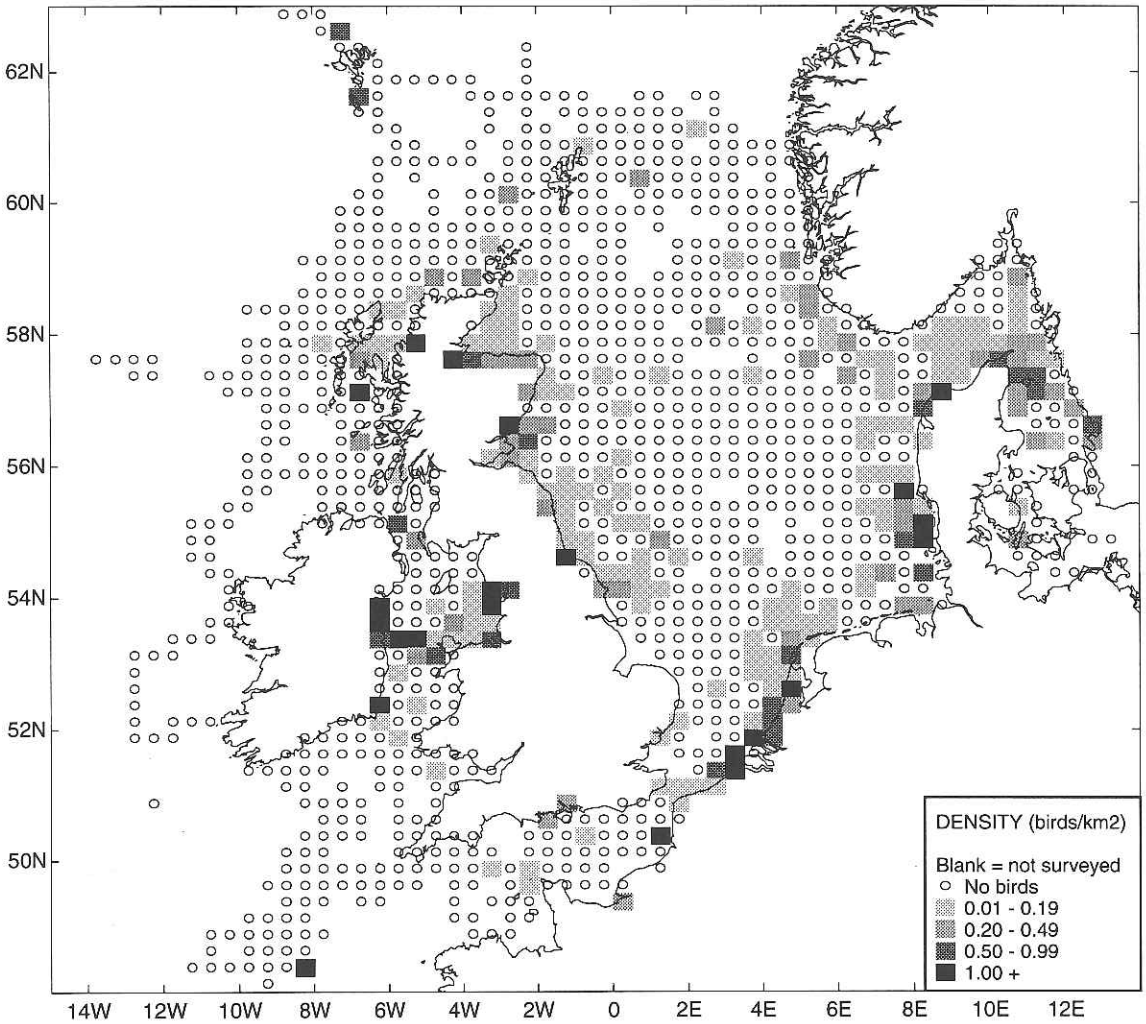

Figure 5.41.3 Distribution of terns in August and September

August to September (Figure 5.41.3)

High densities were found along the Belgian, Netherlands and west Danish coasts, in Liverpool and Morecambe Bays and along the east coast of Ireland. Moderate densities occurred in the Kattegat, in the Firth of Forth, and around the Faeroes. Low densities occurred in the Skagerrak, off southern Norway, in the English Channel and in the central North Sea. Shetland and Orkney were almost abandoned and there was evidence of a southward migration along the east and west coasts of Britain, with notably high densities in the Irish Sea and Morecambe Bay.

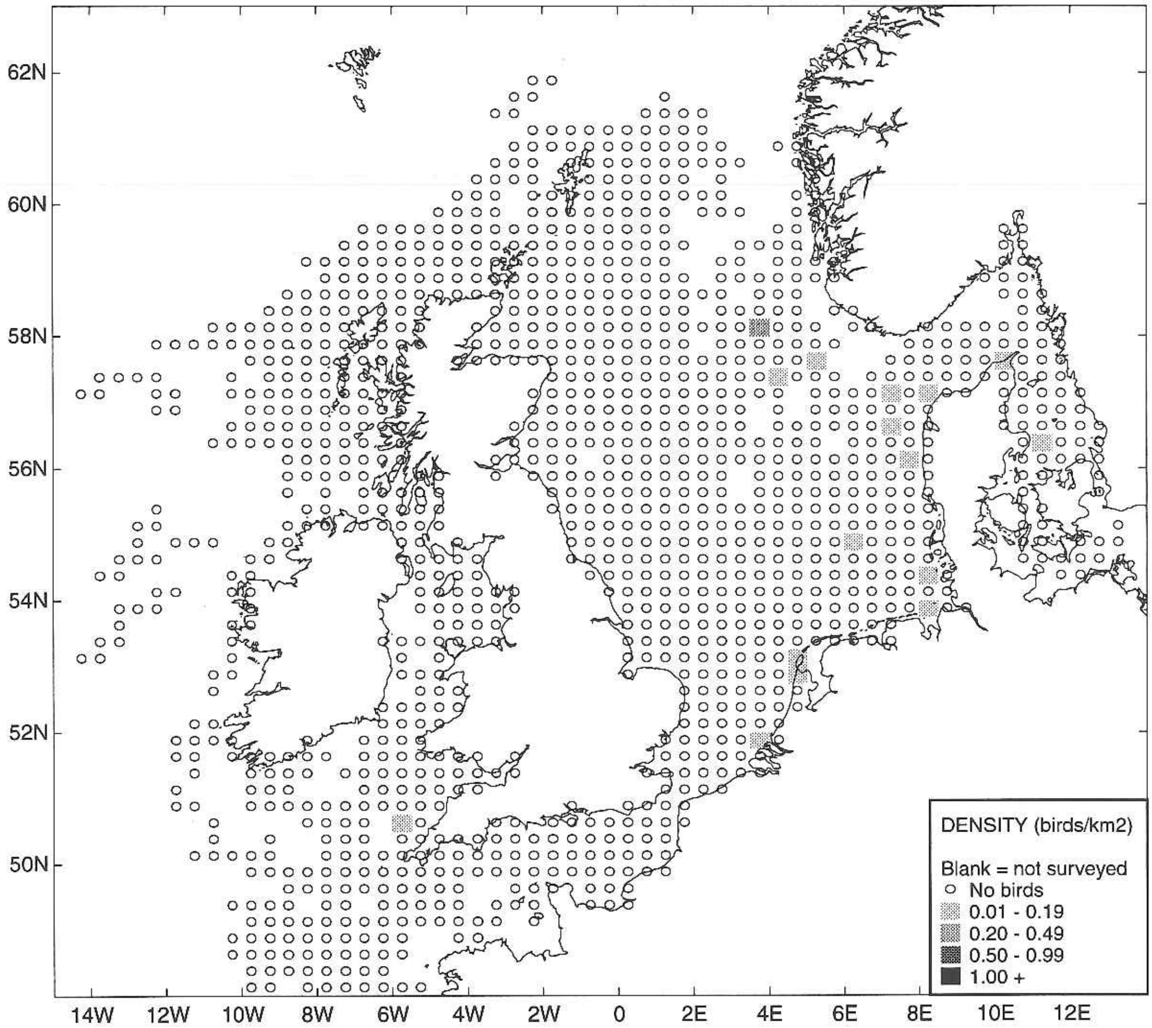

Figure 5.41.4 Distribution of terns from October to February

October to February (Figure 5.41.4)

There were very low densities in the study area during winter with a few isolated sightings in the south and east of the North Sea. Most terns have migrated to equatorial or south polar regions at this time of year and very few birds remain through winter.

Summary and conservation implications

Terns are summer visitors, breeding mainly along the south-eastern coasts of the area, although Arctic terns breed at much higher latitudes than other species. They tend to forage in shallow waters close to the shore, which was reflected in their mainly coastal distribution. During winter terns migrate south to wintering grounds and very few were seen in the study area. Terns are highly aerial and mobile species which are absent from north-west European waters for much of the year. For these reasons pollution is unlikely to cause major mortality. Greater threats to tern populations are presented by fluctuating food supplies (Monaghan, Uttley & Burns 1988).

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Meltofte, H., Blew, J., Frikke, J., Rösner, H.U. & Smit, C.J. 1994. Numbers and distribution of waterbirds in the Wadden Sea. *IWRB Publication 34/ Wader Study Group Bull. 74, Special Issue.*

Monaghan, P., Uttley, J. & Burns, M.D. 1988. The relationships between food supply, reproductive effort and breeding success in Arctic terns. In, Tasker, M.L. (ed.) *Seabird food and feeding ecology*, Proc. 3rd International Conference of the Seabird Group, Cambridge.

Table 5.41.1 Overall density of terns (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.00	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.00	0.00	0.01	0.56	0.00	0.00	0.00	0.01
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.01	0.07	0.12	0.04	0.02	0.77	0.07	0.02	0.03	0.05
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.26	0.19	0.25	0.03	0.39	0.03	0.00	0.01	0.01
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.01	0.05	0.13	0.11	0.02	0.12	0.05	0.00	0.06	0.01
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.02	0.06	0.11	0.08	0.02	0.30	0.37	0.16	0.00	0.02
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.01	0.01	0.04	0.01	0.10	0.26	0.00	0.00	0.00
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.42 SANDWICH TERN *Sterna sandvicensis*

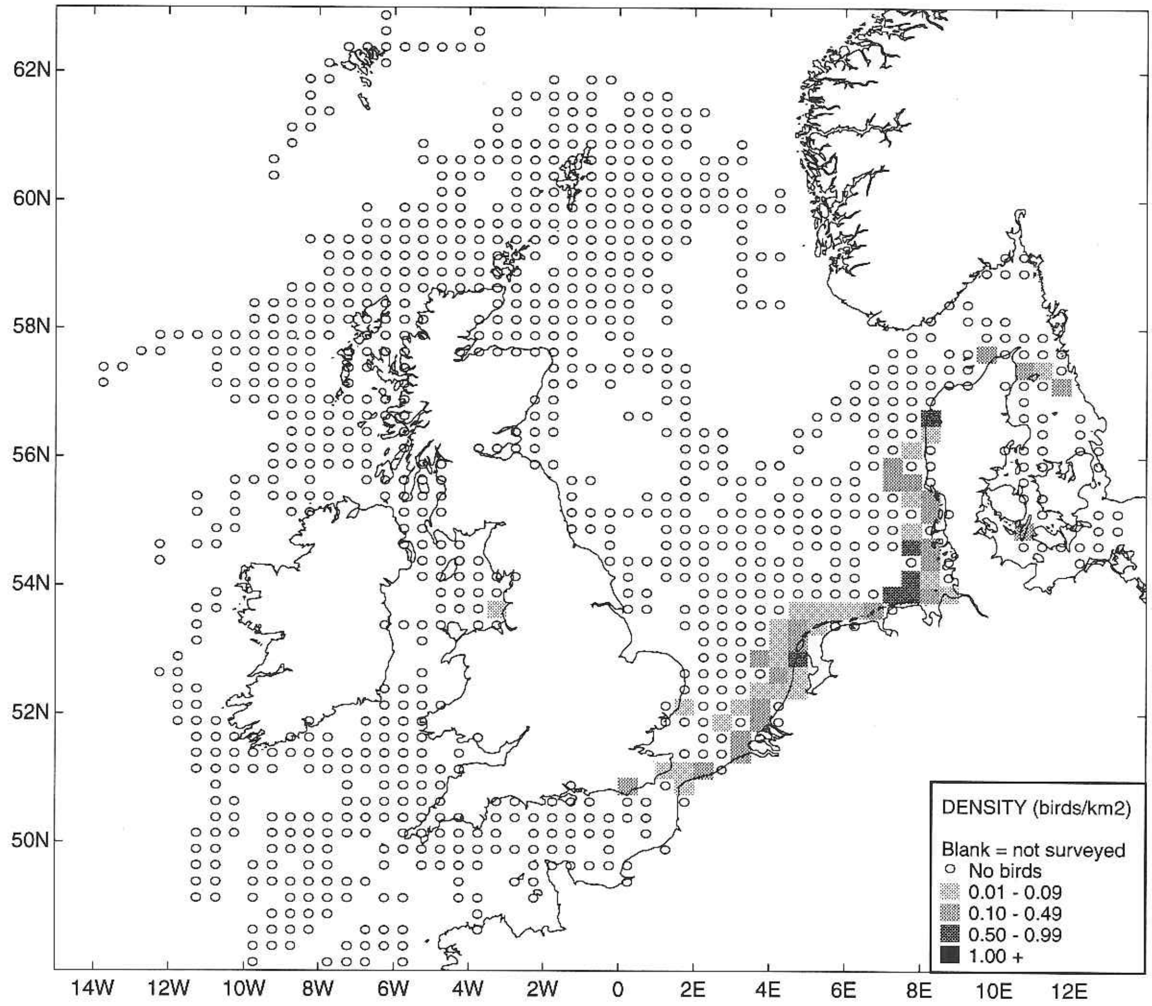

Figure 5.42.1 Distribution of Sandwich terns in March and April

March to April (Figure 5.42.1)

Sandwich terns were concentrated mainly along continental coasts of the southern North Sea with highest densities in the German Bight. There were smaller concentrations around Skagen and Middelgrundene, and occasional low densities around southern Britain.

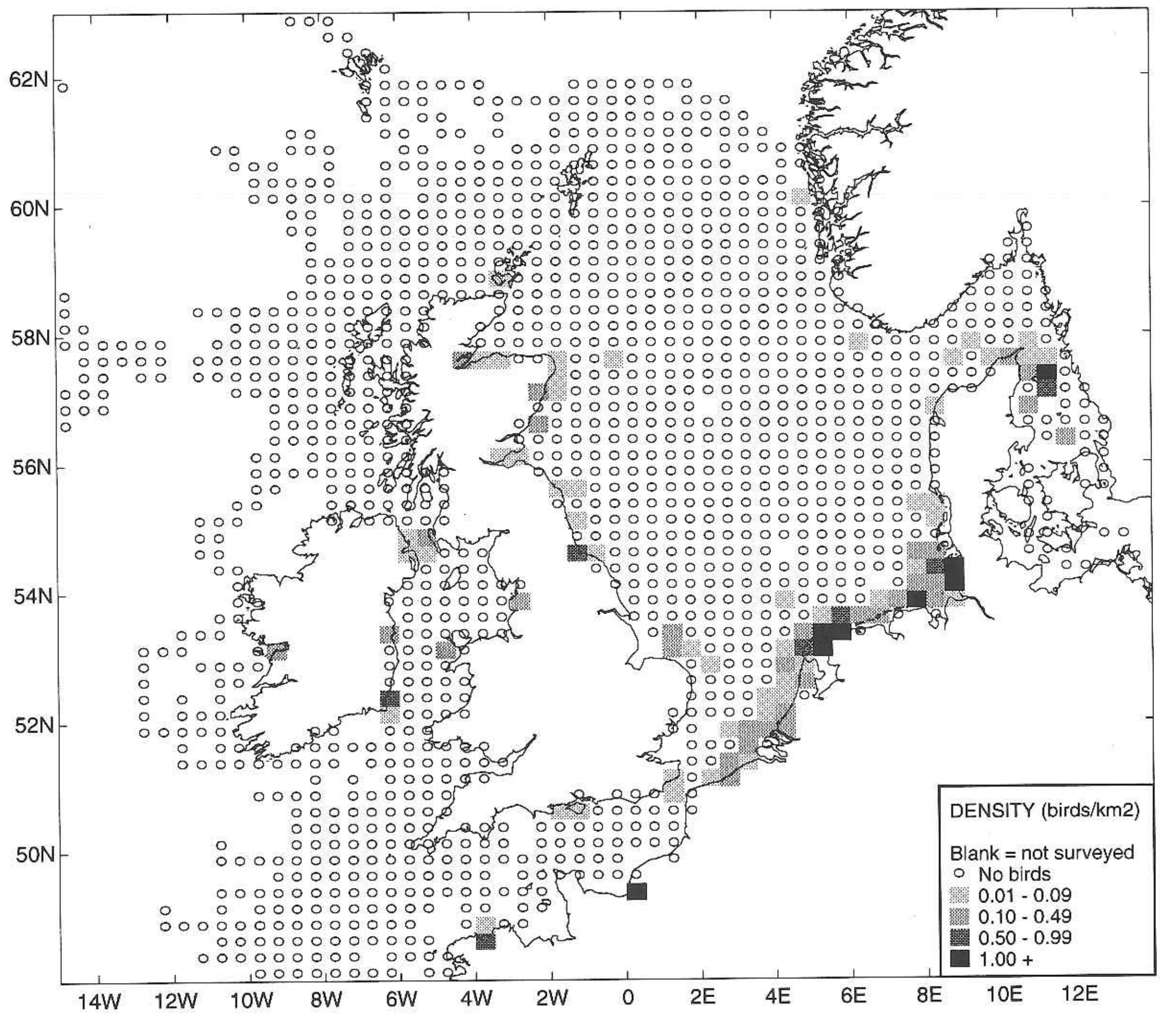

Figure 5.42.2 Distribution of Sandwich terns from May to August

May to August (Figure 5.42.2)

Densities of Sandwich terns increased along continental coasts of the southern North Sea, with highest densities around the Frisian Islands and in the German Bight. There were low densities around British coasts, with moderate densities near the colonies in East Anglia, Anglesey, and north-east and south-east Ireland. Low densities were seen elsewhere around Britain and in the Skagerrak, and moderate to high densities in the vicinity of large colonies in the northern Kattegat.

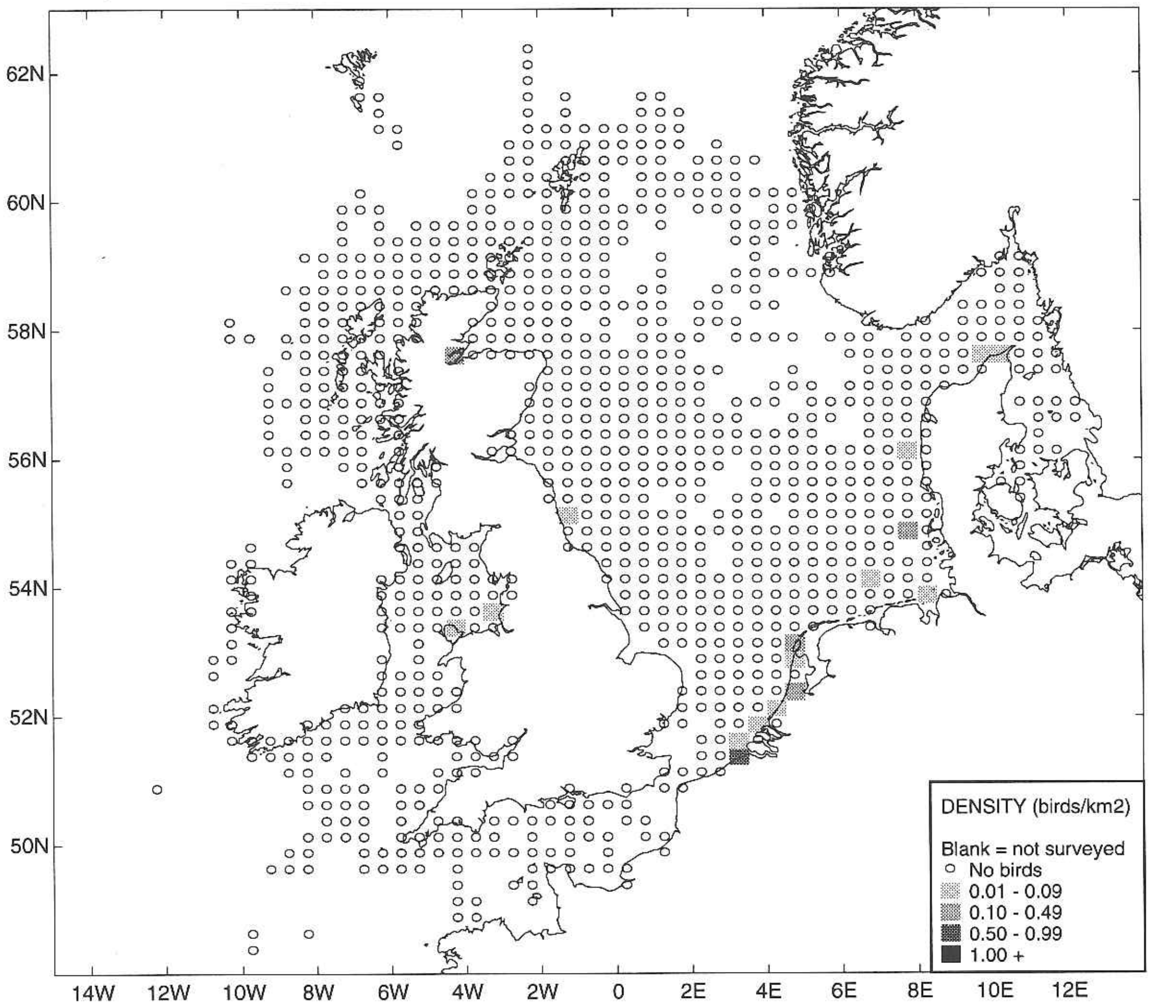

Figure 5.42.3 Distribution of Sandwich terns in September and October

September to October (Figure 5.42.3)

Densities of Sandwich terns were low in autumn (Table 5.42.1) as the birds migrated south to the west African coast for winter. Low densities were apparent along the Belgian and Netherlands coast and occasionally further north. Low densities occurred sporadically around Britain.

Very few Sandwich terns were seen from November to February. Only small numbers winter in the southern North Sea.

Summary and conservation implications

Sandwich terns are summer visitors to the main breeding colonies in the Netherlands, Denmark and Britain; their distribution was widespread along coasts. They were virtually absent in winter. Oil pollution is unlikely to have a great effect on Sandwich terns since they are highly aerial and are not present in large numbers in north-west European seas throughout the whole year.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Meltofte, H., Blew, J., Frikke, J., Rösner, H.U. & Smit, C.J. 1994. Numbers and distribution of waterbirds in the Wadden Sea. *IWRB Publication 34/ Wader Study Group Bull. 74, Special Issue.*

Platteeuw, M. & Stegeman, L. 1989. Voorjaarstrek van Grote Sterns *Sterna sandvicensis* langs de Nederlandse kust: interpretatie van seizoenspatroon. *Sula 3(2):* 51-59.

Table 5.42.1 Overall density of Sandwich terns (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density km^2	0.00 96.0	0.00. 690.9	0.00 540.3	0.00 810.7	0.00 932.9	0.00 3476.9	0.00 526.5	- 0.0	0.00 67.2	0.00 493.4
Feb	Density km^2	0.00 338.0	0.00 778.9	0.00 1181.1	0.00 1258.0	0.00 2546.4	0.00 4386.0	0.00 476.2	0.00 113.5	0.00 191.0	0.00 563.2
Mar	Density km^2	0.00 374.7	0.00 1254.5	0.00 1178.7	0.00 278.1	0.00 849.8	0.02 2229.6	0.00 322.4	0.00 148.9	0.00 605.8	0.00 407.3
Apr	Density km^2	0.00 576.0	0.00 939.9	0.00 1243.0	0.00 269.6	0.00 1367.3	0.16 3255.5	0.00 395.0	0.00 98.9	0.00 550.9	0.00 787.8
May	Density km^2	0.00 451.6	0.00 920.5	0.00 1243.0	0.01 938.1	0.00 2980.1	0.17 3914.0	0.02 600.8	0.00 253.2	0.00 498.6	0.01 842.3
Jun	Density km^2	0.00 617.1	0.00 1763.0	0.00 1318.6	0.01 572.8	0.00 1889.7	0.25 1975.4	0.01 875.7	0.00 71.6	0.00 323.5	0.00 583.7
Jul	Density km^2	0.00 997.4	0.00 937.0	0.00 3635.3	0.01 1486.7	0.00 4782.4	0.04 2483.8	0.00 1017.3	0.00 153.8	0.00 939.6	0.00 644.1
Aug	Density km^2	0.00 867.9	0.00 2468.6	0.00 1377.9	0.02 2017.6	0.00 3842.1	0.03 4473.2	0.01 1061.6	0.00 292.2	0.00 524.3	0.00 896.4
Sep	Density km^2	0.00 208.9	0.00 493.3	0.00 1364.7	0.00 2774.0	0.00 2825.7	0.03 2824.4	0.00 1354.1	0.00 4.0	0.00 383.0	0.00 519.3
Oct	Density km^2	0.00 66.6	0.00 1354.6	0.00 572.7	0.00 745.6	0.00 1292.3	0.00 2869.9	0.00 356.6	0.00 12.6	0.00 297.6	0.00 811.0
Nov	Density km^2	0.00 116.3	0.00 425.6	0.00 872.7	0.00 553.7	0.00 1355.5	0.00 2588.8	0.00 264.6	0.00 76.3	0.00 710.4	0.00 856.2
Dec	Density km^2	0.00 76.0	0.00 293.8	0.00 606.6	0.00 714.3	0.00 395.0	0.00 1583.3	0.00 279.2	0.00 97.9	0.00 459.2	0.00 1257.2

5.43 COMMIC TERNS *Sterna hirundo* and *Sterna paradisaea*

Due to the difficulty of distinguishing these two species, all records of common, arctic and "commic" terns have been pooled. The relative proportions of identified commic terns in each area are given.

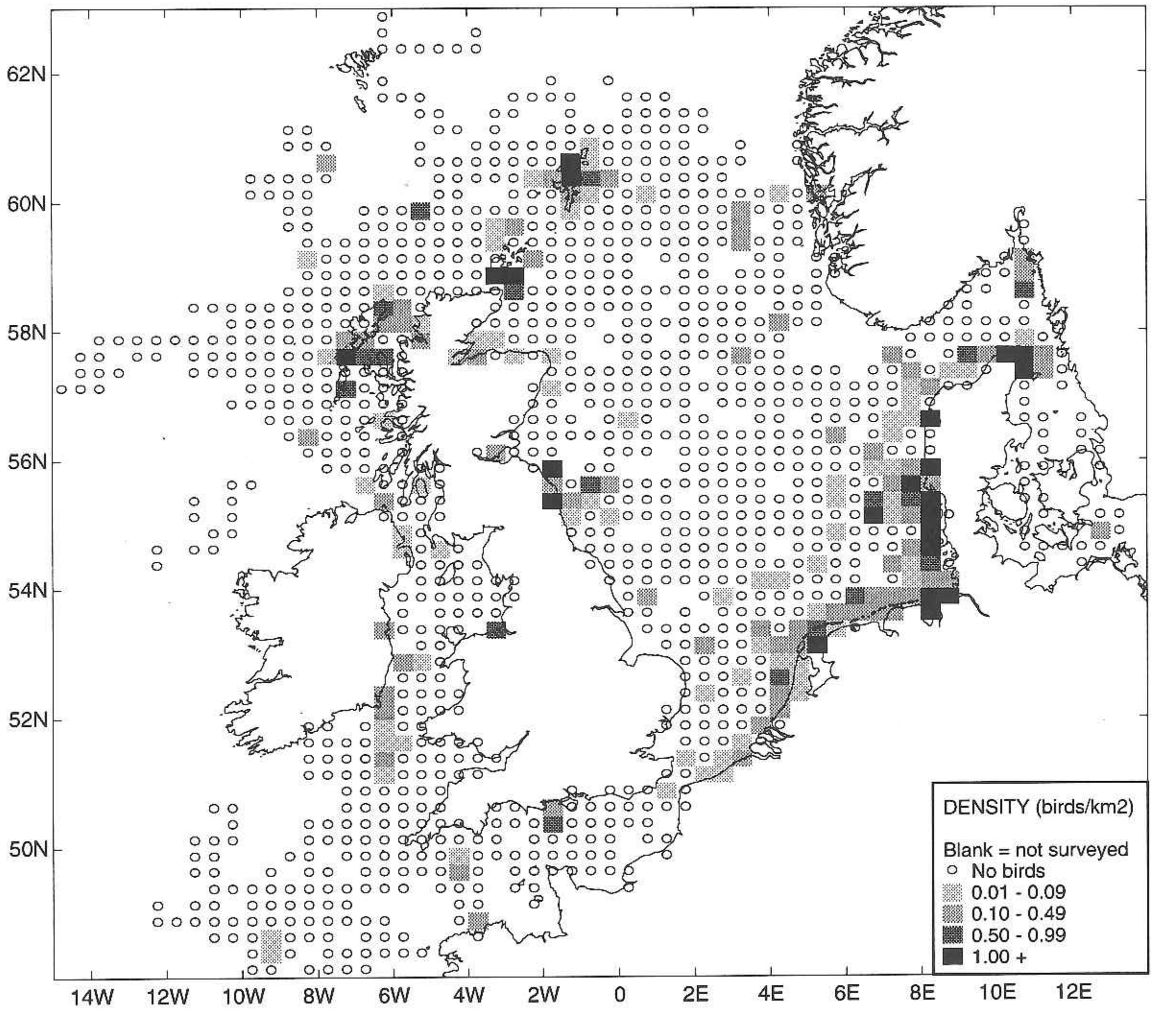

Figure 5.43.1 Distribution of commic terns from April to June

April to June (Figure 5.43.1)

Commic terns were found mainly along continental coasts of the southern North Sea (Table 5.43.1), with high densities in the German Bight, the Danish and Dutch Wadden Seas and around Skagen. There were approximately equal numbers of identified Arctic and common terns in these areas (Figure 5.43.4). High densities were also seen around the Farne Islands and the Northern Isles, these being mostly Arctic terns (Figure 5.43.4). Moderate densities were present around the Outer Hebrides, again mostly Arctic terns.

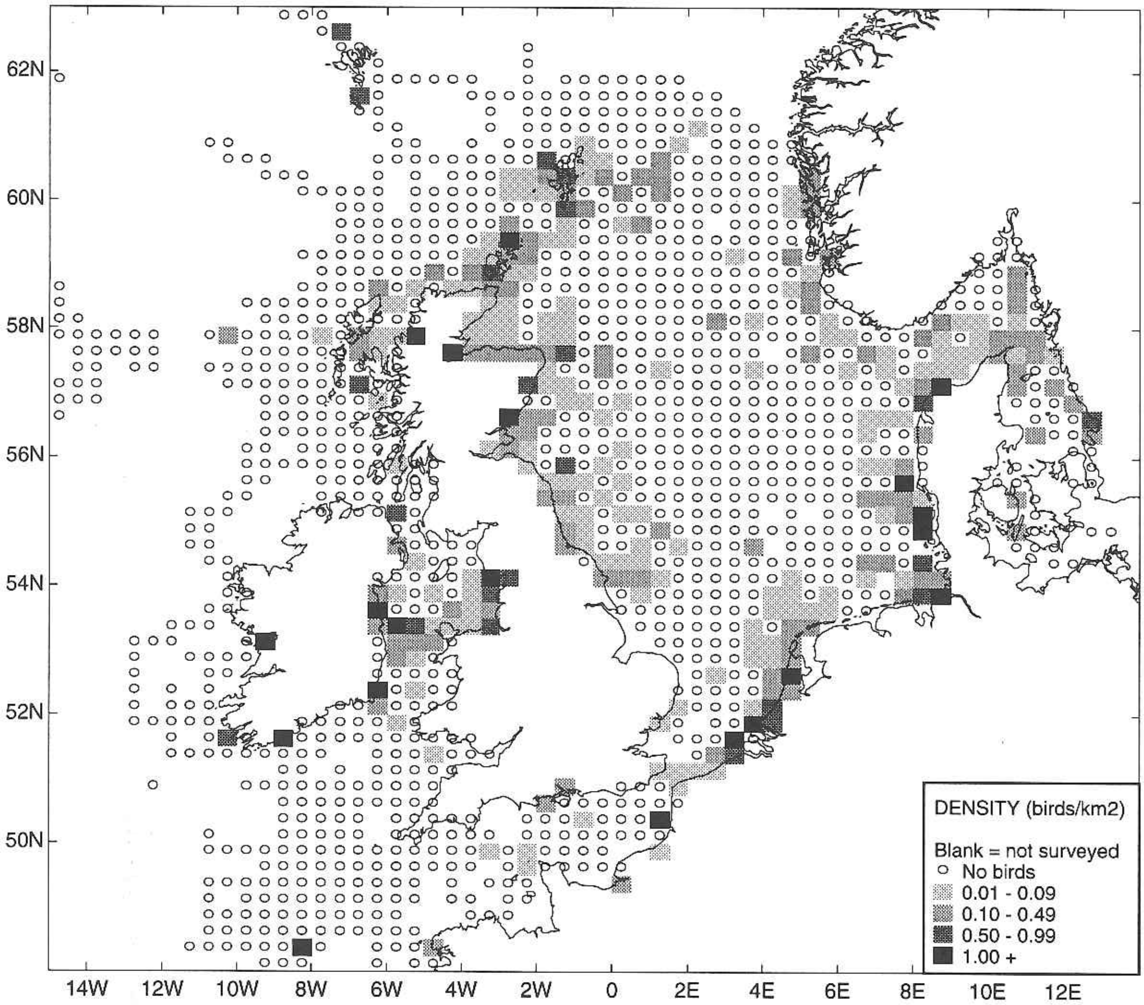

Figure 5.43.2 Distribution of commic terns from July to September

July to September (Figure 5.43.2)

Commic terns were more widespread than in previous months. Their distribution was mainly coastal, with highest densities in the Delta Region, the German Bight, the Danish Wadden Sea, the Baie de la Somme and along coasts of the central Irish Sea. There were more common terns than Arctic terns in these areas (Figure 5.43.5). Moderate to high densities along the north-east coast of England, the east coast of Scotland, around the Northern Isles and the Outer Hebrides had higher proportions of Arctic terns (Figure 5.43.5). There was some evidence of dispersal from the colonies into the North Sea.

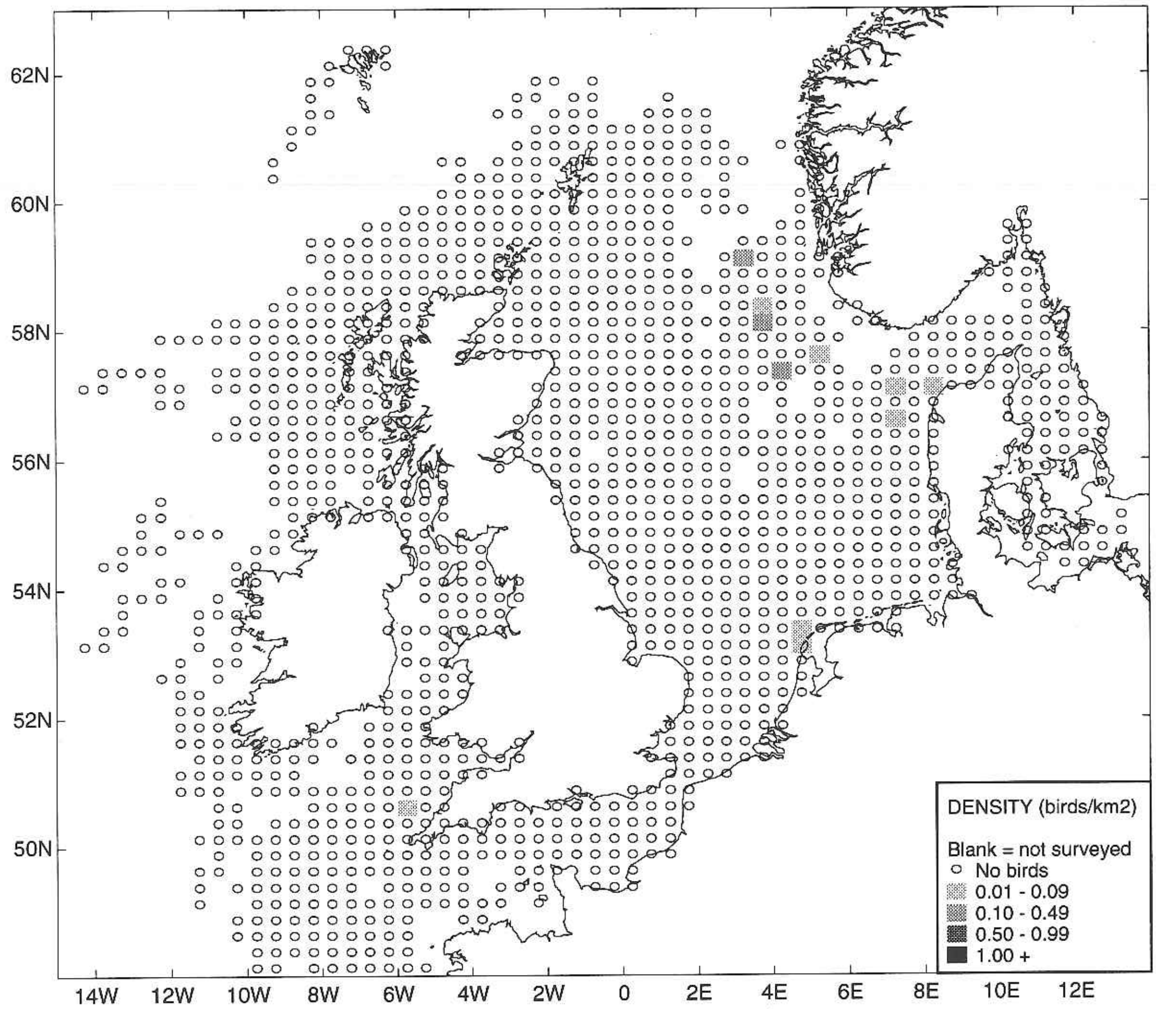

Figure 5.43.3 Distribution of commic terns from October to March

October to March (Figure 5.43.3)

Very few commic terns overwinter in European seas. A few were apparent around the edge of the Rinne, mostly in February and March, with isolated occurrences elsewhere.

Summary and conservation implications

Commic terns were widespread and common summer visitors to north-west European coasts; their distribution was mainly coastal. The north of the area held more Arctic terns than common terns, while common terns were more frequently encountered in the south of the area. Since both species are widespread and aerial, oil pollution will have little impact on the north-west European populations, although at a local level large concentrations of resting terns in areas such as the Danish Wadden Sea or Skagen could be threatened by an oil spill.

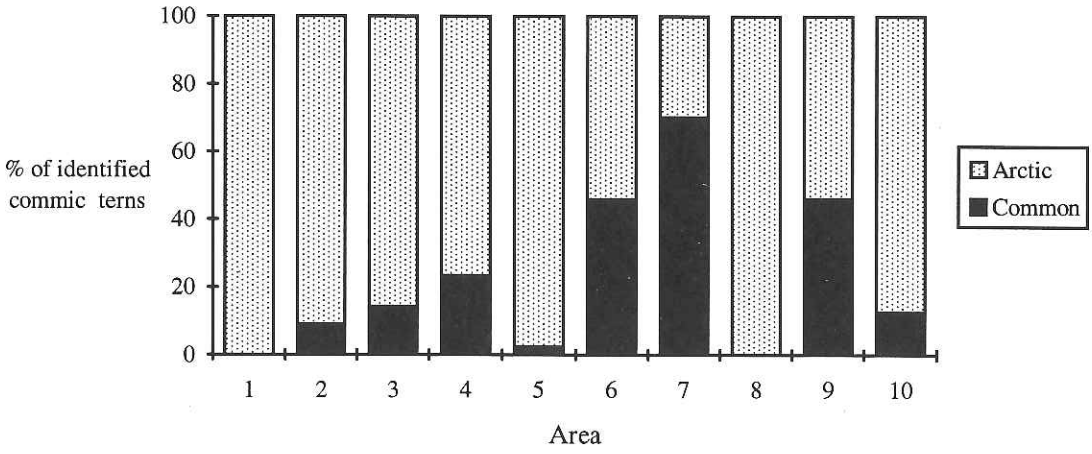

Figure 5.43.4 Relative proportions of identified common and Arctic terns in April to June in each of the ten areas.

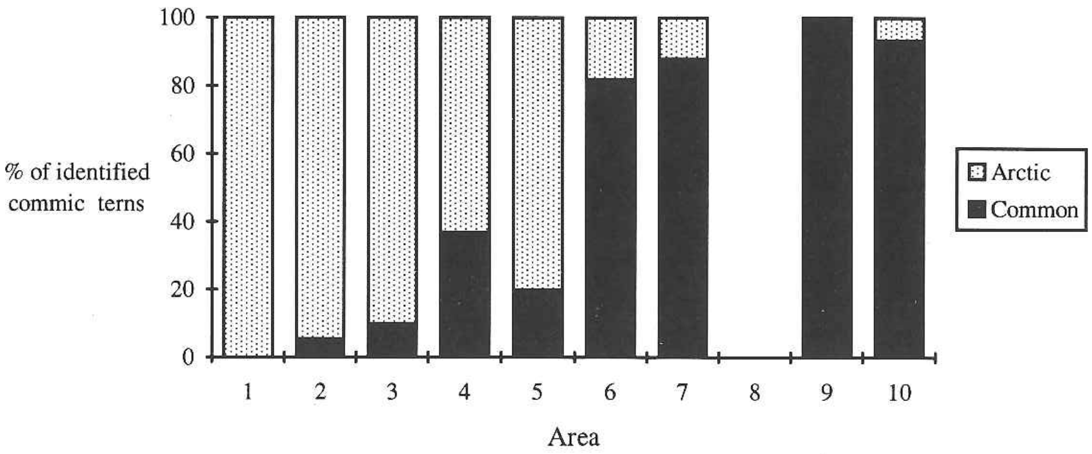

Figure 5.43.5 Relative proportions of identified common and Arctic terns in July to September in each of the ten areas.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

Joiris, C. 1976. Seabirds seen during a return voyage from Belgium to Greenland in July. *Le Gerfaut 66:* 63-87.

Meltofte, H., Blew, J., Frikke, J., Rösner, H.U. & Smit, C.J. 1994. Numbers and distribution of waterbirds in the Wadden Sea. *IWRB Publication 34/ Wader Study Group Bull. 74, Special Issue.*

Meltofte, H. & Faldborg, J. 1987. The occurrence of gulls and terns at Blåvandshuk 1963-77. *Dansk. Orn. Foren. Tidsskr. 81:* 137-166.

Table 5.43.1 Overall density of commic terns (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
	km^2	96.0	690.9	540.3	810.7	932.9	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	338.0	778.9	1181.1	1258.0	2546.4	4386.0	476.2	113.5	191.0	563.2
Mar	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	374.7	1254.5	1178.7	278.1	849.8	2229.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.00	0.00	0.01	0.36	0.00	0.00	0.00	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3255.5	395.0	98.9	550.9	787.8
May	Density	0.01	0.07	0.11	0.03	0.02	0.45	0.05	0.02	0.03	0.04
	km^2	451.6	920.5	1243.0	938.1	2980.1	3914.0	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.23	0.09	0.23	0.03	0.14	0.02	0.00	0.01	0.01
	km^2	617.1	1763.0	1318.6	572.8	1889.7	1975.4	875.7	71.6	323.5	583.7
Jul	Density	0.01	0.05	0.13	0.10	0.02	0.08	0.04	0.00	0.06	0.01
	km^2	997.4	937.0	3635.3	1486.7	4782.4	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.02	0.05	0.11	0.06	0.02	0.27	0.36	0.16	0.00	0.02
	km^2	867.9	2468.6	1377.9	2017.6	3842.1	4473.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.01	0.00	0.04	0.01	0.07	0.15	0.00	0.00	0.00
	km^2	208.9	493.3	1364.7	2774.0	2825.7	2824.4	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	745.6	1292.3	2869.9	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	116.3	425.6	872.7	553.7	1355.5	2588.8	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	76.0	293.8	606.6	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.44 LITTLE TERN *Sterna albifrons*

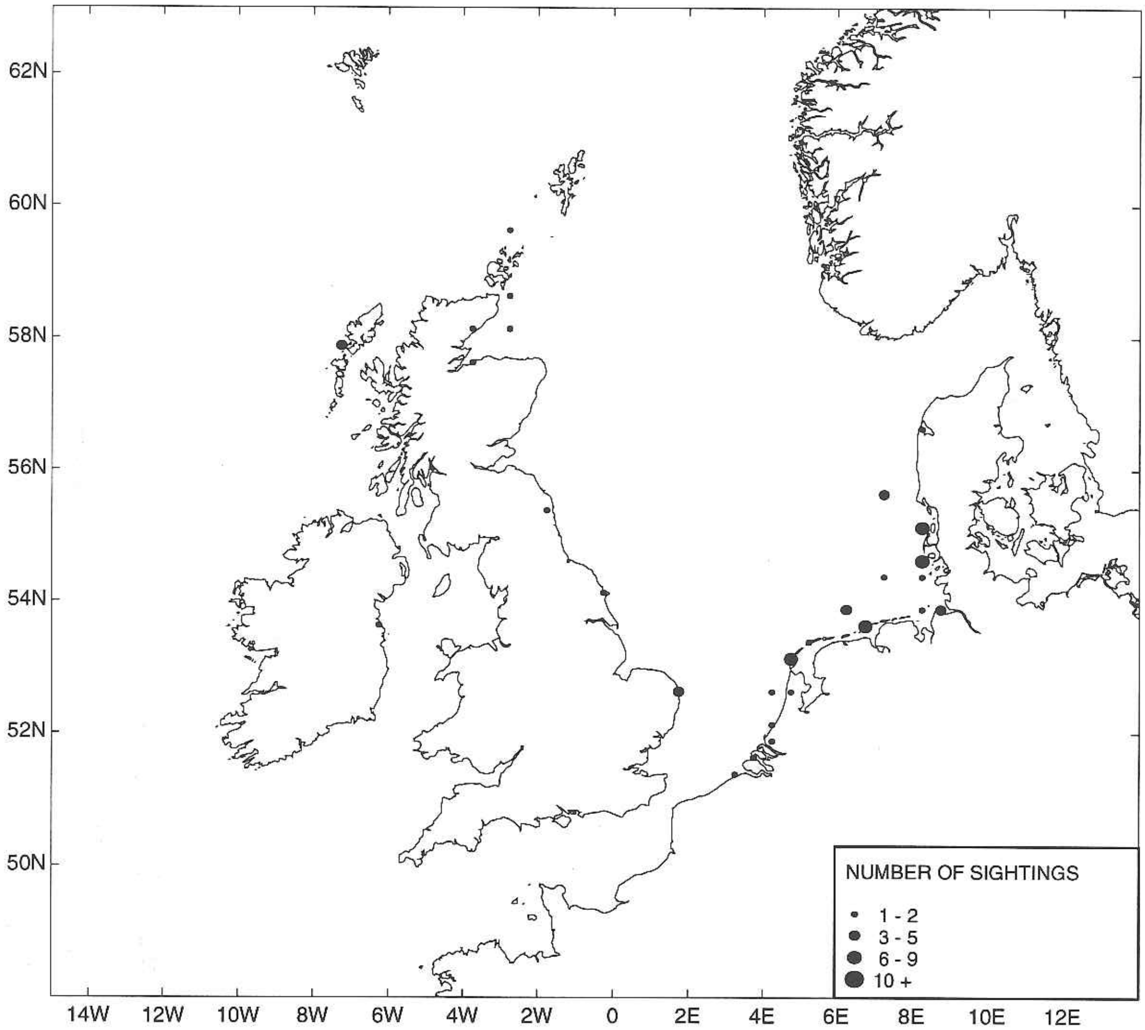

Figure 5.44.1 Sightings of little terns from April to October

April to October (Figure 5.44.1)

Little terns were found mainly along the Netherlands, German and Danish coasts, where many breeding colonies are located. Highest numbers were seen around the Frisian Islands and the Danish Wadden Sea. There were some sightings of little terns around the British colonies in East Anglia, the Moray Firth, Caithness and the Outer Hebrides. There was an isolated sighting off Flamborough Head. Little terns were seen mostly in April and June with fewer sightings from July to October (Figure 5.44.2).

No little terns were seen in the study area from November to March.

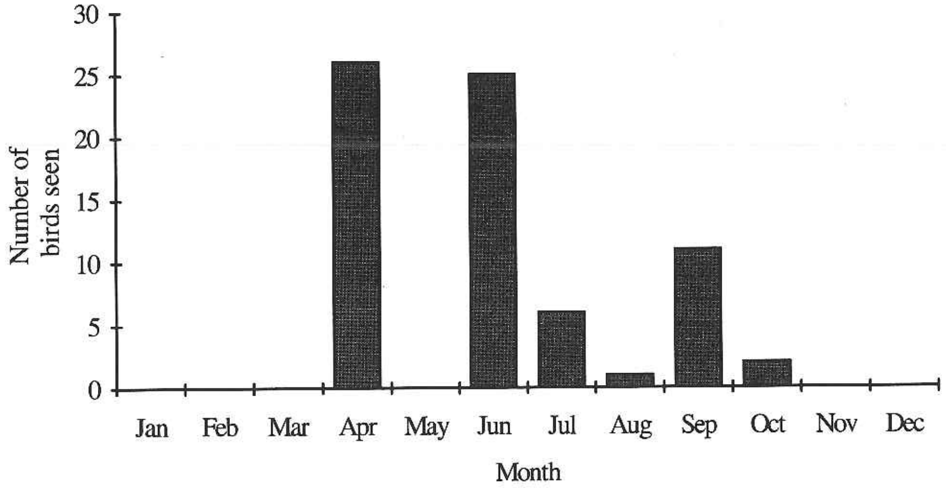

Figure 5.44.2 Number of little terns seen per month

Summary and conservation implications

Little terns are uncommon in the seas of north-west Europe, with more being seen outside the study area. Within the study area however, they were seen mostly in the near-coastal zone of the Netherlands, Germany and Denmark but also in small numbers around Britain. Little terns are not at great risk from oil pollution in these waters due to their aerial lifestyle and low numbers.

5.45 BLACK TERN *Chlidonias niger*

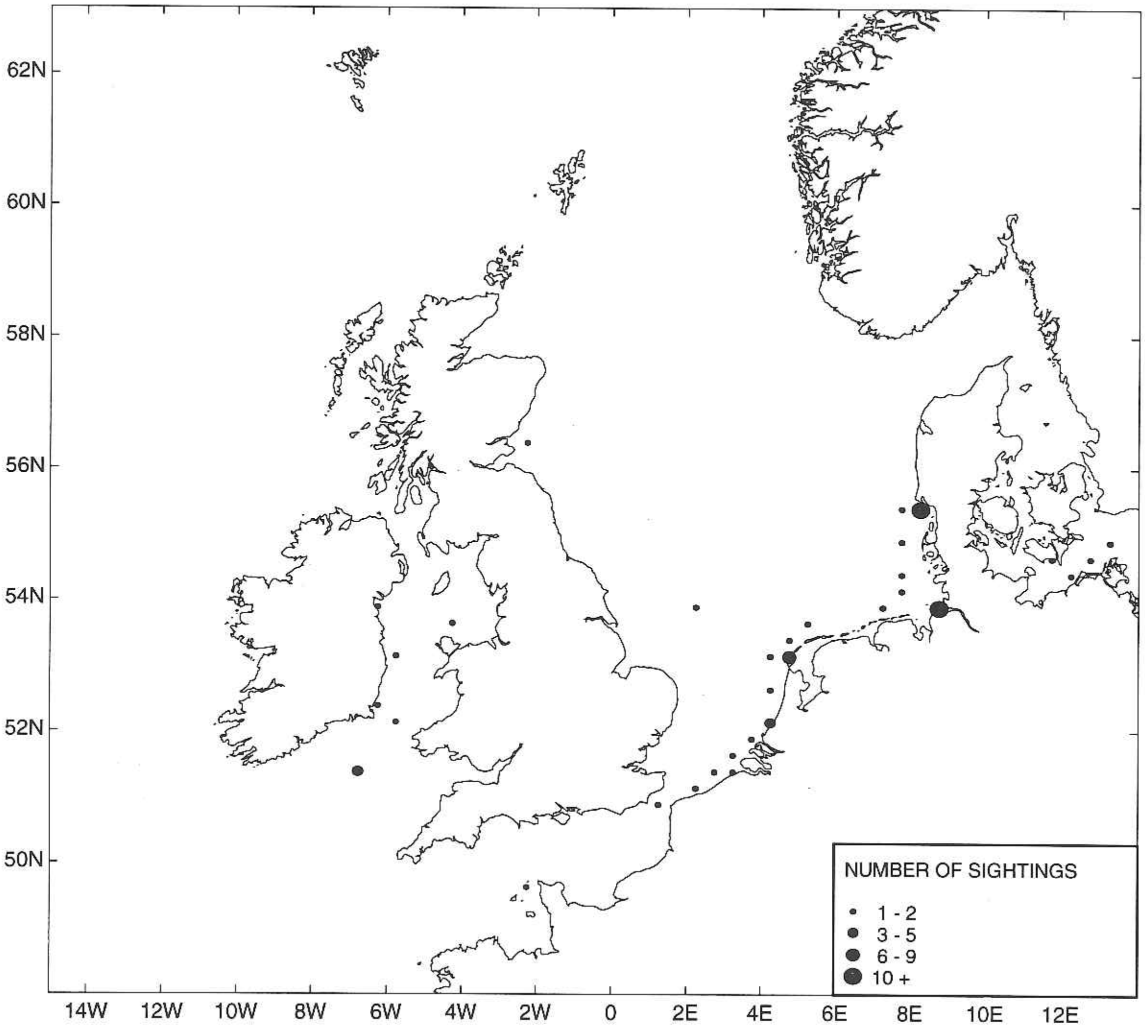

Figure 5.45.1 Sightings of black terns from April to October

April to October (Figure 5.45.1)

Black terns were seen mainly along continental coasts of the southern North Sea with a few sightings in the Belt Sea and Irish Sea. Highest numbers occurred around Blåvandshuk, the German Bight and the Frisian Islands. Other isolated sightings occurred in the Celtic Sea, off east Scotland and in the central North Sea. Most birds were seen during the spring passage in May with low numbers throughout the summer months (Figure 5.45.2).

No black terns were seen in the study area from November to March.

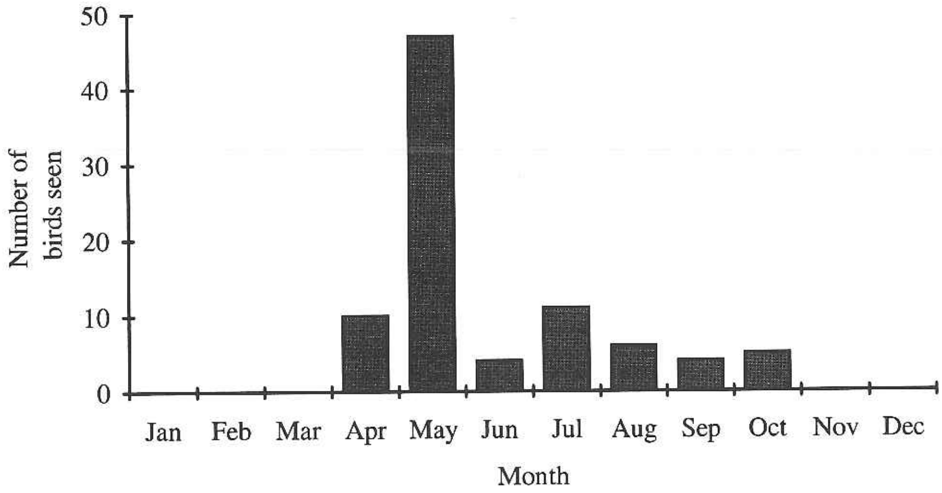

Figure 5.45.2 Number of black terns seen per month

Summary and conservation implications

Few black terns were seen in the study area, being a predominantly fresh or brackish water species. They occurred mainly during the spring passage along the continental coast of the North Sea. As black terns are found in the seas of the area for only a short period they are at little risk from oil pollution.

Further reading

Bourne, W.R.P. 1986. Late summer seabird distribution off the west coast of Europe. *Irish Birds 3:* 175-198.

5.46 UNIDENTIFIED AUKS

Like gulls, auks can be difficult to identify at sea. Densities of two categories of unidentified auks (birds identified only as auks, and those identified as either guillemots or razorbills) are presented below. Densities in the "auk species" category were generally low, with a slight increase in June (Tables 5.46.1). Distinguishing guillemots and razorbills proved to be more of a problem, particularly in the Northern Isles and Moray Firth and more so in August and September than in other months (Table 5.46.2). This is probably due to high concentrations of these species in this area at this time.

Table 5.46.1 Overall density of unidentified auks (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.03	0.02	0.00	0.02	-	0.00	0.01
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.00	0.01	0.07	0.03	0.00	0.01	0.00	0.13	0.00
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.03	0.00	0.08	0.01	0.01	0.00	0.08	0.00	0.01	0.00
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	0.08	0.02	0.02	0.01	0.01	0.00	0.02	0.00	0.00	0.01
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.00	0.02	0.03	0.02	0.01	0.00	0.02	0.00	0.01	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	0.01	0.13	0.03	0.25	0.00	0.00	0.01	0.00	0.00	0.00
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.01	0.02	0.03	0.08	0.01	0.00	0.01	0.00	0.00	0.00
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.02	0.09	0.13	0.01	0.00	0.00	0.0.0	0.00	0.00
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.02	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.00
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.01	0.09	0.02	0.02	0.02	0.00	0.01	0.00	0.00	0.01
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.05	0.03	0.04	0.03	0.00	0.01	0.00	0.05	0.01
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

Table 5.46.2 Overall density of unidentified guillemots/razorbills (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1	2	3	4	5	6	7	8	9	10
		North-west oceanic	North-west shelf	Shetland, Orkney & Moray Firth	Western North Sea	Central & north North Sea	South & east North Sea	Irish Sea	South-west oceanic	Celtic Sea	English & Bristol Channels
Jan	Density	0.00	0.02	0.13	0.12	0.05	0.22	0.10	-	0.02	0.03
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.11	0.08	0.25	0.09	0.13	0.09	0.00	0.34	0.19
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.01	0.47	1.19	0.11	0.01	0.06	0.12	0.00	0.02	0.01
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	0.01	0.10	0.93	0.06	0.00	0.01	0.21	0.00	0.03	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.01	0.04	0.91	0.08	0.01	0.00	0.17	0.00	0.01	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	0.02	0.23	1.05	0.36	0.00	0.00	0.07	0.00	0.01	0.00
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.23	0.39	0.26	0.00	0.00	0.27	0.00	0.00	0.00
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.14	5.64	1.63	0.03	0.00	0.59	0.00	0.00	0.00
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.02	0.35	5.37	0.15	0.01	0.00	0.18	0.00	0.01	0.00
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.38	2.32	0.45	0.20	0.08	0.04	0.00	0.75	0.00
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.25	1.31	0.67	0.13	0.51	0.30	0.02	0.01	0.02
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.12	0.69	0.09	0.15	0.16	0.20	0.00	0.01	0.03
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.47 GUILLEMOT *Uria aalge*

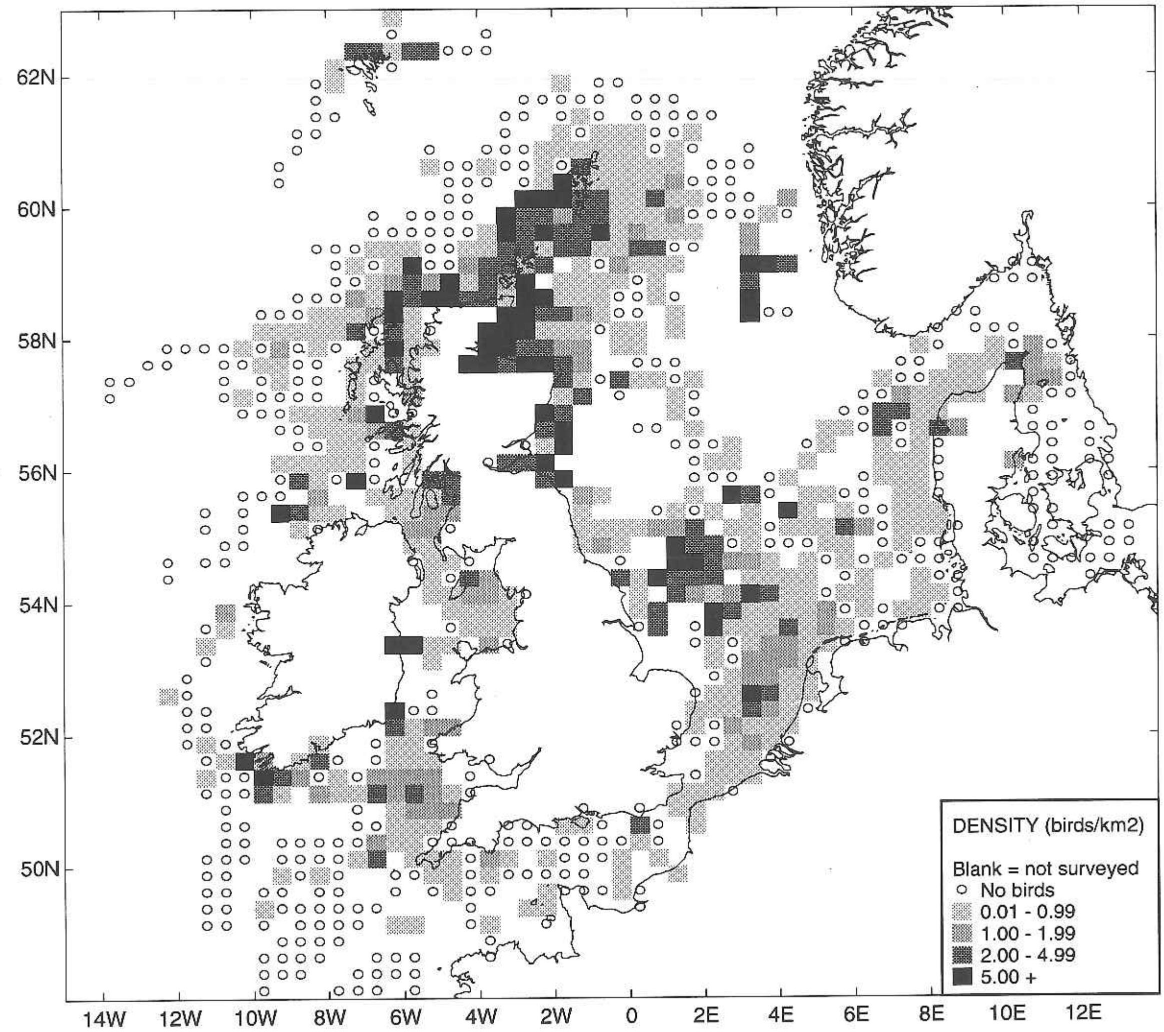

Figure 5.47.1 Distribution of guillemots in March and April

March to April (Figure 5.47.1)

Highest densities at this time were close to the main breeding colonies in Orkney, Shetland, the Moray Firth and the north-west coast of Scotland (Table 5.47.1). Other large colonies, such as along the north-east coast of Scotland, the Firth of Forth and south-west Ireland, also had high densities nearby. Guillemots do not visit the colonies every day at this time, and are potentially able to travel long distances to forage. This is reflected in the densities seen away from the colonies; high densities were seen at the Dogger Bank and moderate densities over the banks off the Netherlands and in the Celtic Sea. Guillemots were present in low densities in the English Channel at this time.

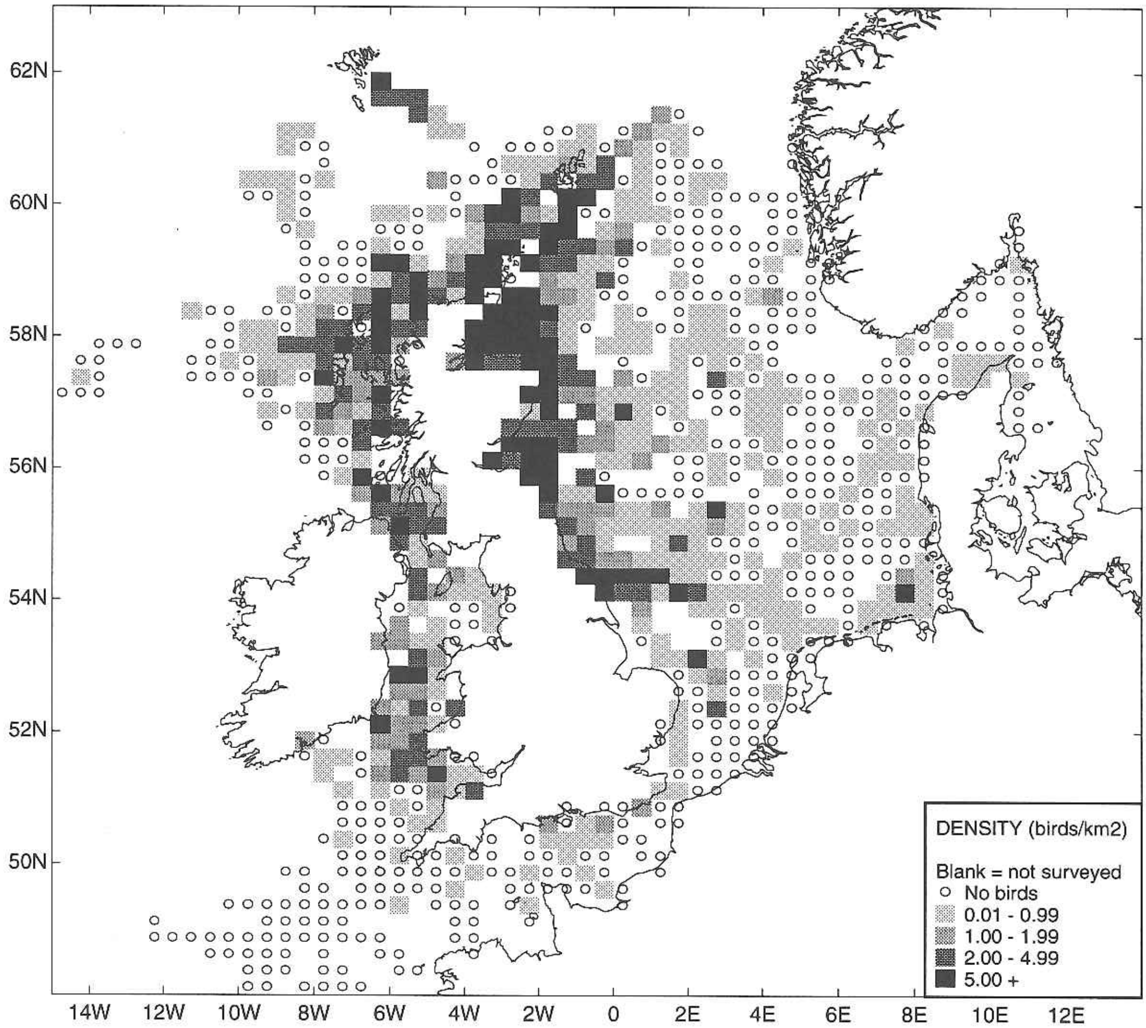

Figure 5.47.2 Distribution of guillemots in May and June

May to June (Figure 5.47.2)

Guillemots are occupied with egg-incubation or chick-rearing during this period. The need to remain close to the colony is evident in their distribution at sea at this time. Direct observations at sea have shown that guillemots carry fish back to the colonies from up to 55 km away (Leaper *et. al* 1988), but most are likely to forage much closer to the colonies than this. Highest densities occurred close to the coasts, with only low numbers (probably immatures or non-breeders/failed breeders) further away from land. The highest densities again occur around the main breeding areas of the Moray Firth, Orkney, Shetland and the Firth of Forth. Other colonies, such as those in north-west Scotland, at Flamborough Head and on the Pembrokeshire Islands also have high densities associated with them. Low densities were seen in the English Channel, and very few birds were seen in the Skagerrak and Kattegat.

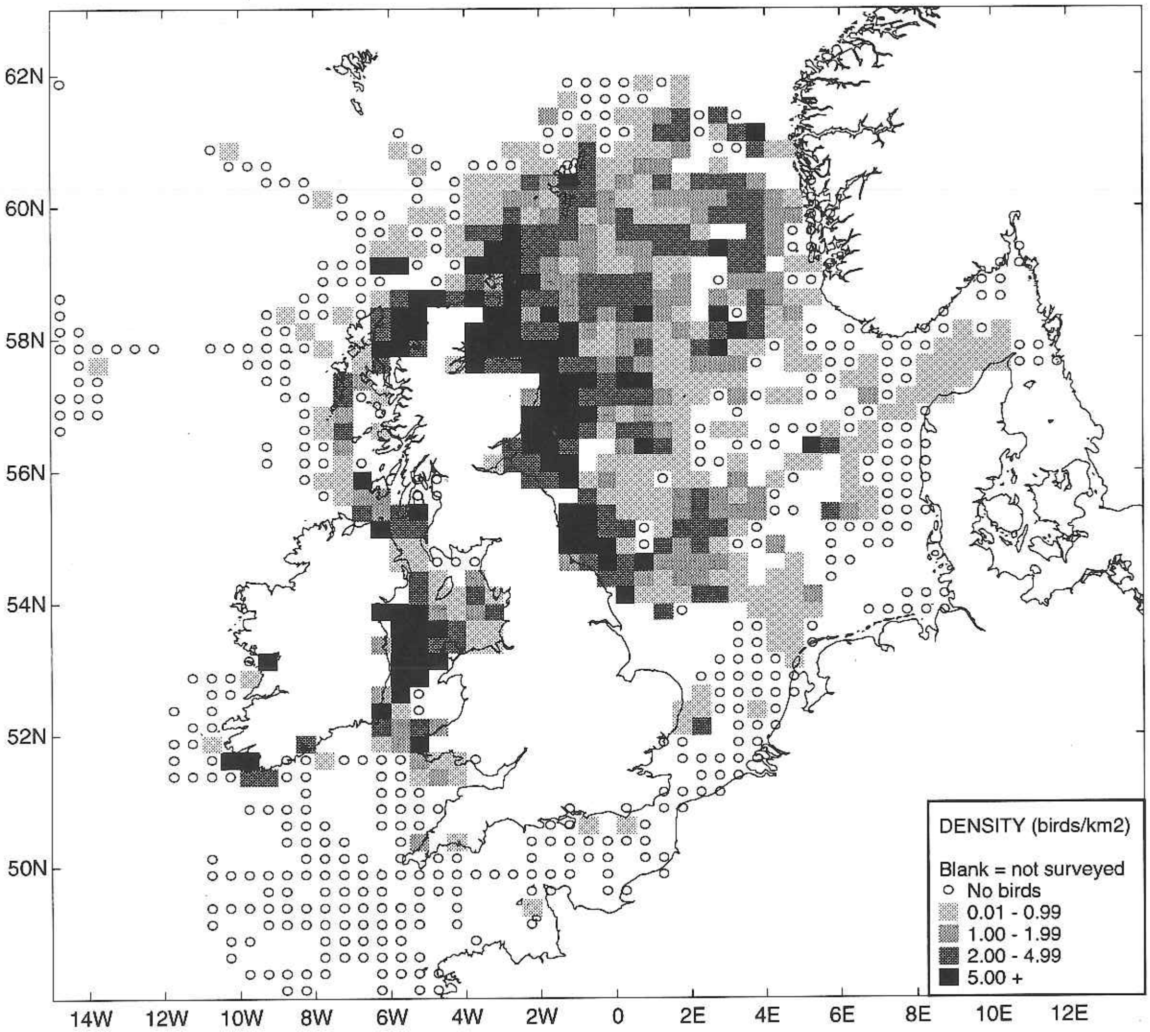

Figure 5.47.3 Distribution of guillemots in July

July (Figure 5.47.3)

The first chicks to leave the colony do so in late June, when they depart with the male parent. This departure continues throughout July, resulting in a much wider distribution than in the previous months. Although high densities remained close to the colonies, particularly in Orkney, north-east and north-west Scotland and north-east England, moderate to high densities were found across the entire northern North Sea and around the Dogger Bank. High densities were also found in the Irish Sea, around the position of the Irish Sea front, and moderate densities spanned the St. George's Channel. At this time many adults have begun a moult immediately after breeding, and thus are flightless.

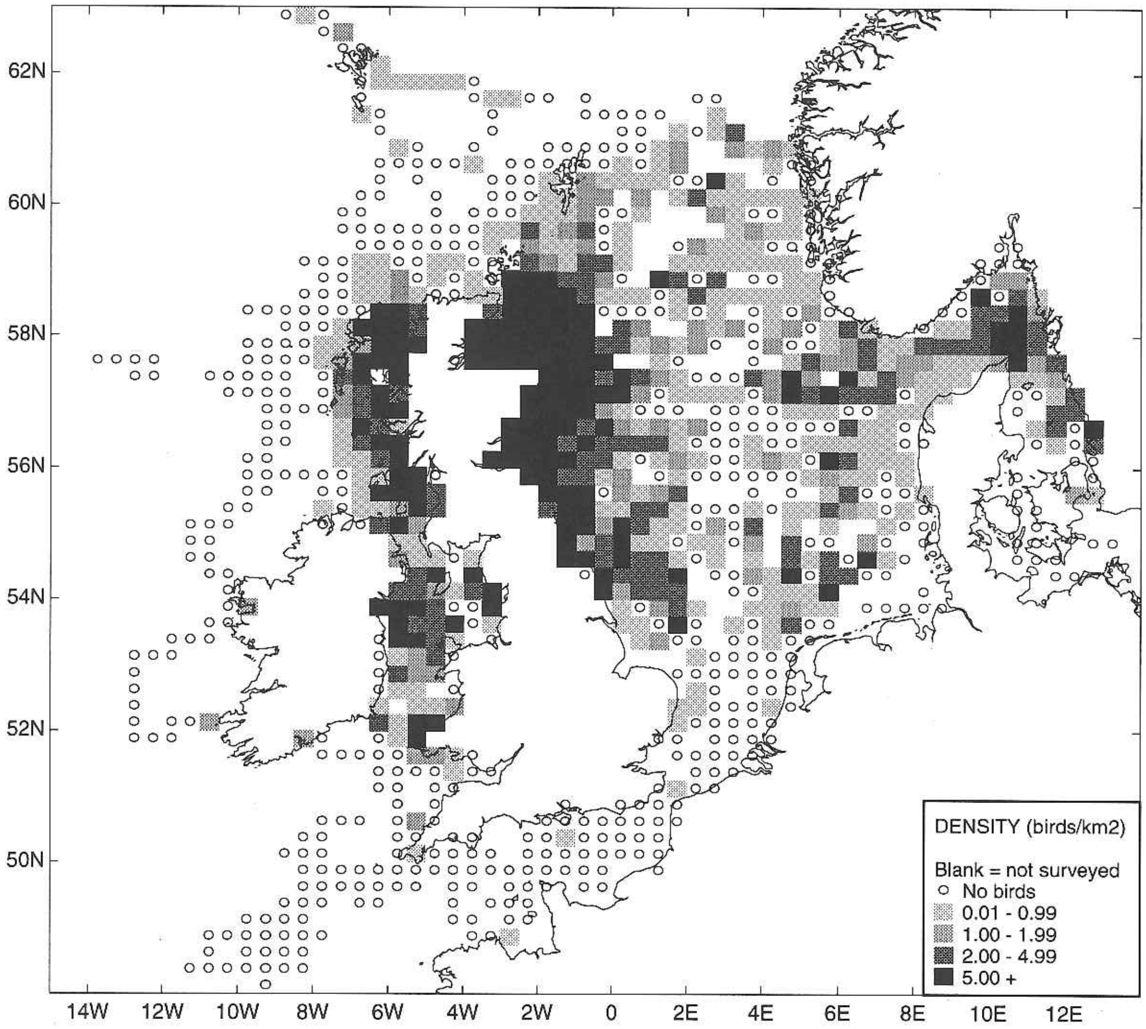

Figure 5.47.4 Distribution of guillemots in August

August (Figure 5.47.4)

By the end of August, fledging has finished and the colonies are deserted. Huge concentrations were found off the north-east coast of Scotland at this time, with other high densities found in the Minch, around the position of the Irish Sea front and between Flamborough Head and the Dogger Bank. Densities in the middle of the northern North Sea were lower than in July, but higher densities were found in the Skagerrak and Kattegat, and along the southern edge of the Rinne.

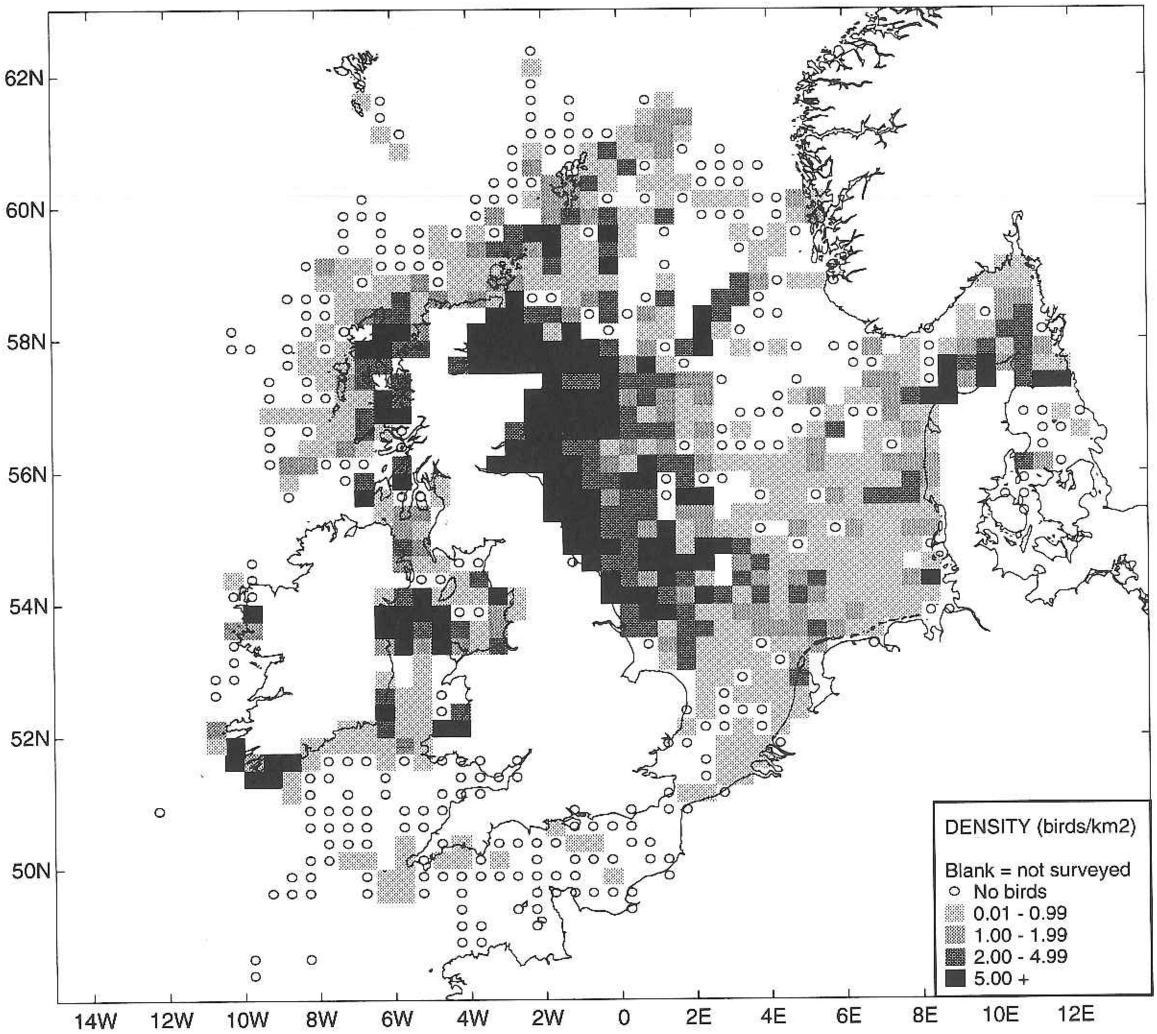

Figure 5.47.5 Distribution of guillemots in September and October

September to October (Figure 5.47.5)

High densities remained off the north-east coasts of Scotland and England, in the Minch, around the position of the Irish Sea front, and at the Dogger Bank. Moderate to high densities were found in the Skagerrak and Kattegat, and low to moderate densities in the south-eastern North Sea. High densities remained around south-west Ireland. High densities were also seen around the Welsh and Irish coasts bordering the St. George's Channel, with low densities across this channel. Low densities were seen in the English Channel.

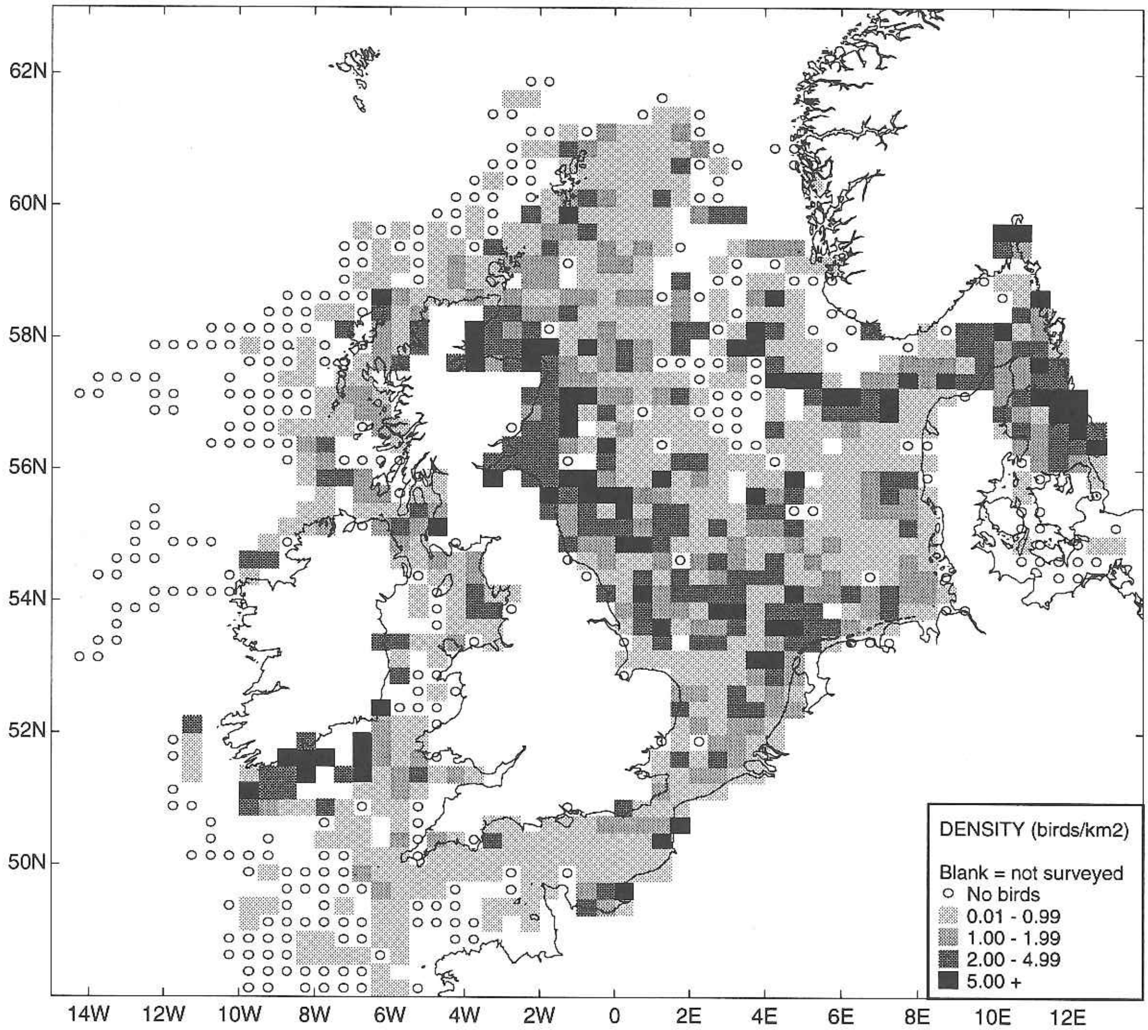

Figure 5.47.6 Distribution of guillemots from November to February

November to February (Figure 5.47.6)

Guillemots were found throughout the North Sea in winter, with highest densities typically occurring away from land, off the eastern coast of Scotland and England, along the southern edge of the Rinne, over the Dogger Bank and just offshore along the continental margin of the North Sea. High densities were also found in the Skagerrak and Kattegat, particularly around Middelgrundene, with birds concentrated in this region more than at any other time of year. A few birds were seen in the Belt Sea. Moderate densities persisted in the Firth of Forth and the Moray Firth, with high densities in the inner regions of the Moray Firth. To the west of Britain high densities were seen off southern Ireland. Moderate densities occurred in the Minch and on the continental shelf to the west of Scotland, and in the Solway Firth and Morecambe Bay. Low densities were widespread in the English Channel at this time of year.

Summary and conservation implications

Guillemots spend much of their time sitting on the surface of the sea, and are thus vulnerable to oil and other surface pollutants. This is especially so during the period of their autumn moult, when they are flightless and therefore unable to escape such pollution. Some areas were important for guillemots at all times of year, and an incident in these areas could have serious consequences for this species. Such areas included the Moray Firth and the Firth of Forth, Shetland and Orkney, and the Minch. Offshore areas such as the central northern North Sea were less important during the egg-incubating and chick-rearing period of May and June, but were more important at other times of year such as July and over winter. The Skagerrak and Kattegat were important from August to April, but became less so in the breeding season. The western Irish Sea was important from July to October, and the English Channel, whilst it held very few guillemots during the summer, became more important over winter. Overwintering guillemots in the southern North Sea are at risk from chronic oil pollution. Conservation planning should take account of these seasonal variations in the importance of different areas for this species.

Further Reading

Blake, B.F., Tasker, M.L., Hope Jones, P., Dixon, T.J., Mitchell, R. & Langslow, D.R. 1984. The distribution and feeding ecology of guillemots *Uria aalge* at sea around Fair Isle, Shetland, during the breeding season. Appendix C in Blake, B.F., Tasker, M.L., Hope Jones, P., Dixon, T.J., Mitchell, R. & Langslow, D.R. 1984, *Seabird distribution in the North Sea,* Huntingdon, Nature Conservancy Council.

Burton, C.A., Tasker, M.L., Benn, S., Webb, A. & Leaper, G.M. 1987. The distribution of seabirds off north-west Scotland, August 1986. *Nature Conservancy Council, CSD Report,* No. 758.

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H. & Danielsen, F. 1991. Fødevalg hos overvintrende Lomvier *Uria aalge* i Skagerrak. *Dansk. Orn. Foren. Tidsskr. 85:* 145-150.

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Harrison, N.M., Webb, A., Leaper, G.M. & Steele, D. 1989. Seabird distributions and the movements of moulting auks west of Scotland and in the northern Irish Sea (late summer 1988). *Nature Conservancy Council, CSD Report,* No. 994.

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report,* No. 804.

Leopold, M.F. 1987. Zeevogels op zee: Een onderzoek naar verspreiding en kwalititsverschillen van zeevogels binnen een deel van het Nederlandse Continentale Plat. *NIOZ Report 1987 - 2.*

Netherlands Institute for Sea Research.

Leopold, M.F. 1989. Verspreiding van Alkachtigen Alcidae voor Britse oostkust, nazomer 1987 en '88. *Sula 3:* 89-105.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91B:* 81-104.

Skov, H., Durinck, J. & Danielsen, F. 1992. Udbredelse og antal af Lomvie *Uria aalge* i Skagerrak i sensommerperioden. *Dansk. Orn. Foren. Tidsskr. 86:* 169-176.

Skov, H., Durinck, J., Leopold, M.F. & Offringa, H. 1994. *Habitats at sea: "Action preparatory to the establishment of a protected areas network in the southeastern North Sea and the southern Baltic".* EU DG XI ACE contract no. 445-45 Final Report, NIOZ Report 1994-6, Netherlands Institute for Sea Research, Texel.

Stone, C.J., Harrison, N.M., Webb, A. & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Tasker, M.L., Webb, A., Greenstreet, S.P.R., Uttley, J. & Griffiths, A. 1985. Concentrations of auks off the north-east coast of Britain, August 1984. *Nature Conservancy Council, CSD Report,* No.589.

Tasker, M.L., Webb, A., Murray, S. & Holt, R. 1986. The dispersal of auks in the northern North Sea, June to September 1985. *Nature Conservancy Council, CSD Report,* No. 627.

Webb, A., Tasker, M.L. & Greenstreet, S.P.R. 1985. The distribution of guillemots (*Uria aalge*), razorbills (*Alca torda*) and puffins (*Fratercula arctica*) at sea around Flamborough Head, June 1984. *Nature Conservancy Council, CSD Report,* No. 590.

Table 5.47.1 Overall density of guillemots (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.69	2.30	1.89	1.85	1.53	0.76	-	0.33	0.33
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.07	1.15	1.81	4.04	1.73	2.70	0.66	0.00	0.68	0.40
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.29	2.70	4.19	2.43	1.15	0.94	0.87	0.07	0.77	0.30
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	1.16	1.40	7.21	1.03	0.97	0.37	1.33	0.00	0.56	0.13
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.54	2.61	8.82	1.86	0.34	0.24	2.04	0.00	0.16	0.12
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	0.87	5.20	9.31	7.65	0.07	0.34	1.99	0.00	0.01	0.05
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.34	2.58	5.00	7.51	1.45	0.17	6.47	0.00	1.12	0.02
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.09	4.70	11.69	14.38	1.47	1.31	6.32	0.00	0.06	0.05
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.10	1.21	8.61	10.32	2.83	0.45	4.59	0.00	0.44	0.01
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.12	2.19	2.53	10.48	2.01	1.59	0.71	0.00	2.78	0.05
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.02	1.47	4.17	4.45	2.80	2.52	2.33	0.14	0.84	0.26
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.01	0.69	3.27	1.81	0.40	2.23	1.36	0.00	0.66	1.08
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.48 RAZORBILL *Alca torda*

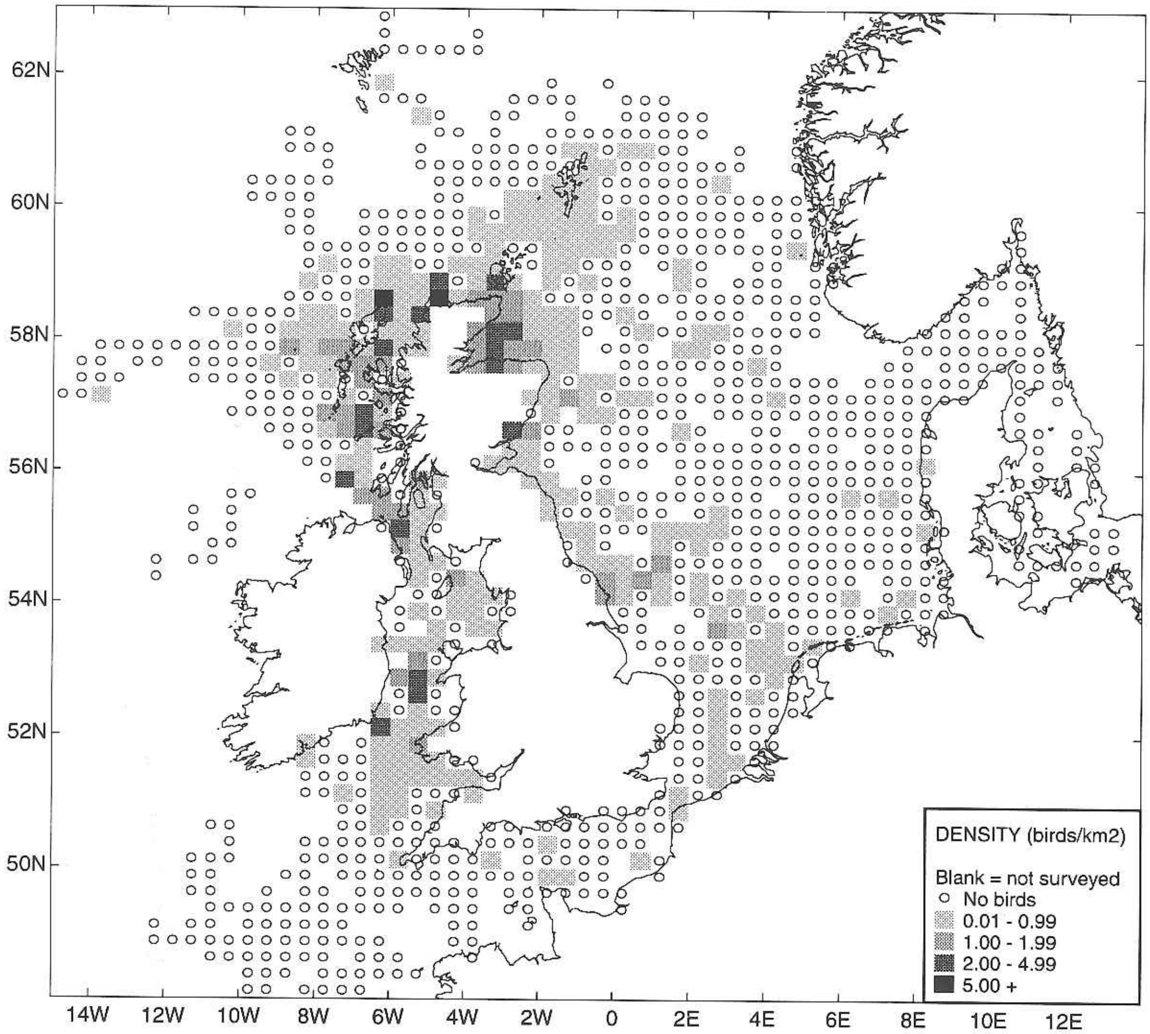

Figure 5.48.1 Distribution of razorbills from April to June

April to June (Figure 5.48.1)

Razorbills were mostly confined to the coasts of the United Kingdom during the incubating and chick-rearing seasons, from Flamborough Head northwards on the eastern side, and from South Wales northwards on the western side. Razorbills remain close to the colonies at this time; adults have been recorded carrying fish to the colonies from up to 38 km away (Leaper *et. al* 1988). Densities were higher in north-west Scotland, the Minch and the Moray Firth than elsewhere, with other localised concentrations occurring around Flamborough Head and in the Irish Sea between North Wales and Ireland. Densities were only low to moderate around the Orkneys and Shetlands, in spite of the large number of razorbills breeding on these islands. Low densities occurred off the Netherlands coast.

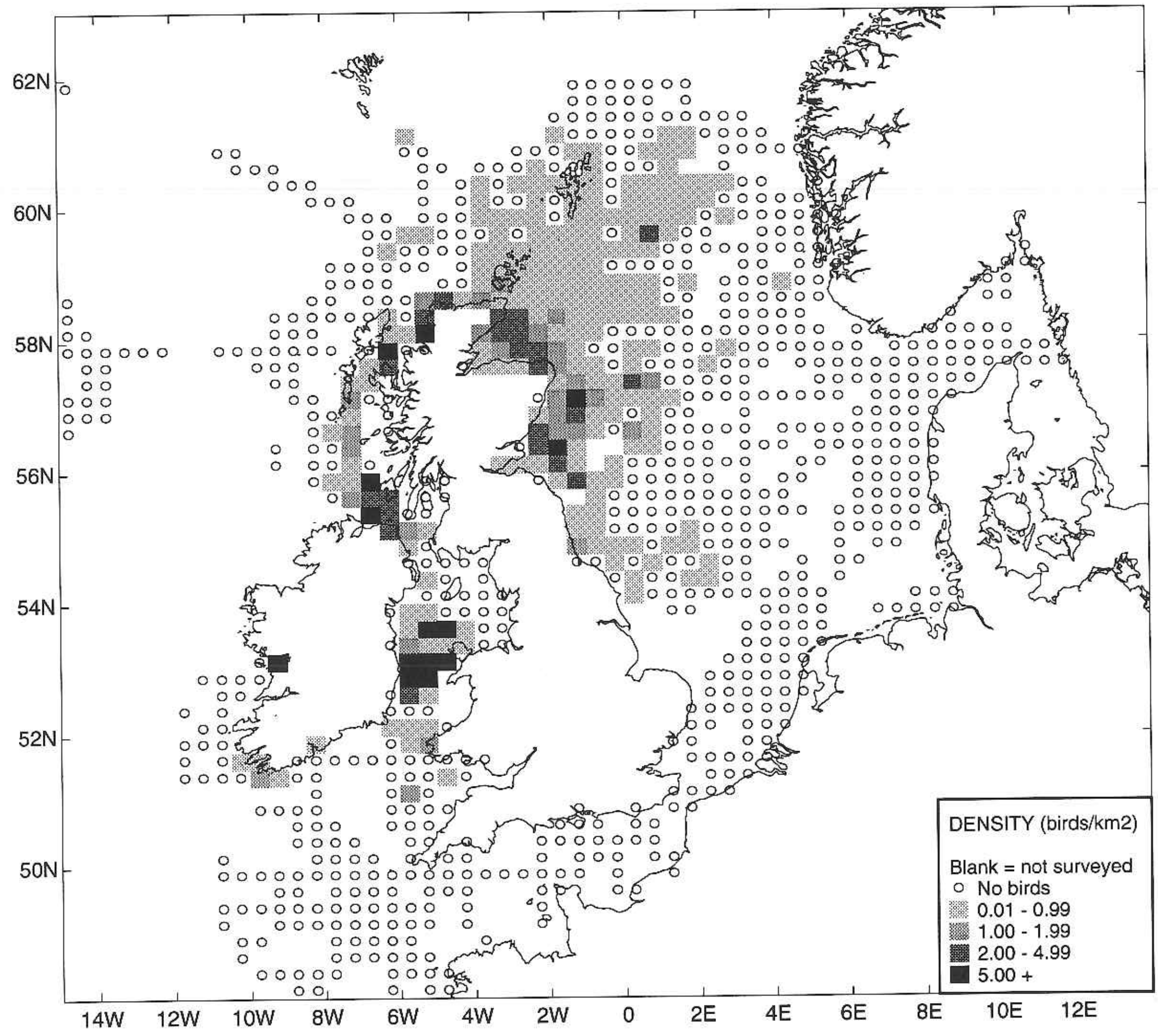

Figure 5.48.2 Distribution of razorbills in July

July (Figure 5.48.2)

High densities spanned the Irish Sea between North Wales and Ireland, and were also found off Northern Ireland, in the position of the Islay front. Razorbills remained in the Minch, and off the north-west coast of Scotland. The bulk of the distribution, however, was around the north-eastern Britain, with concentrations offshore of the Firth of Forth, in the outer Moray Firth, and off the Grampian coast. Razorbill chicks are fledging at this time, and low densities extended further out to sea than in April to June.

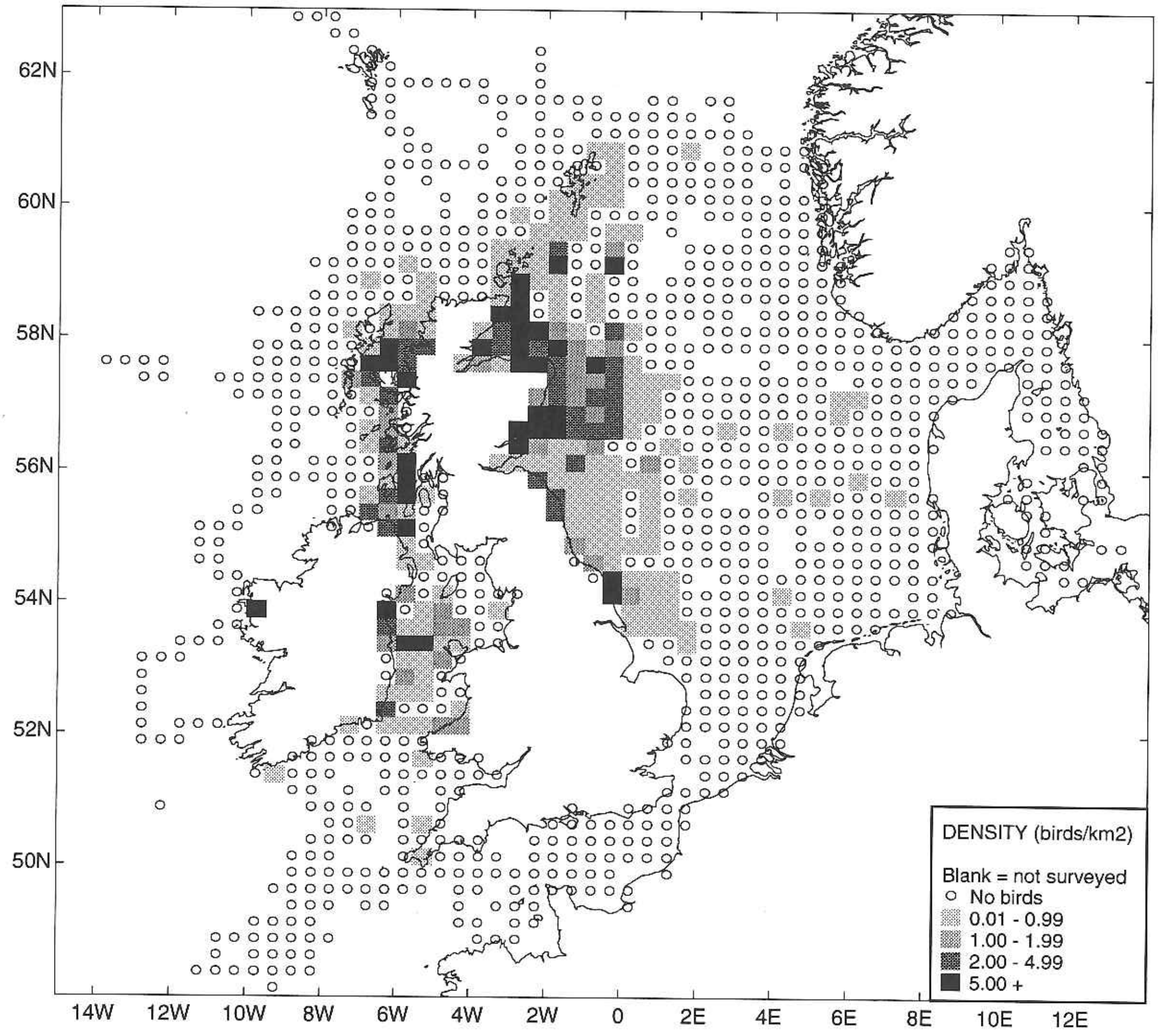

Figure 5.48.3 Distribution of razorbills in August and September

August to September (Figure 5.48.3)

Densities increased to the east of Scotland (Table 5.48.1) and razorbill distribution here extended further out to sea than in July. Low densities occurred in the eastern North Sea towards Denmark. This reflects a dispersal away from the colonies following breeding, during the moult period when razorbills are flightless. High densities remained off the west coast of Scotland, and in the Irish Sea between North Wales and Ireland.

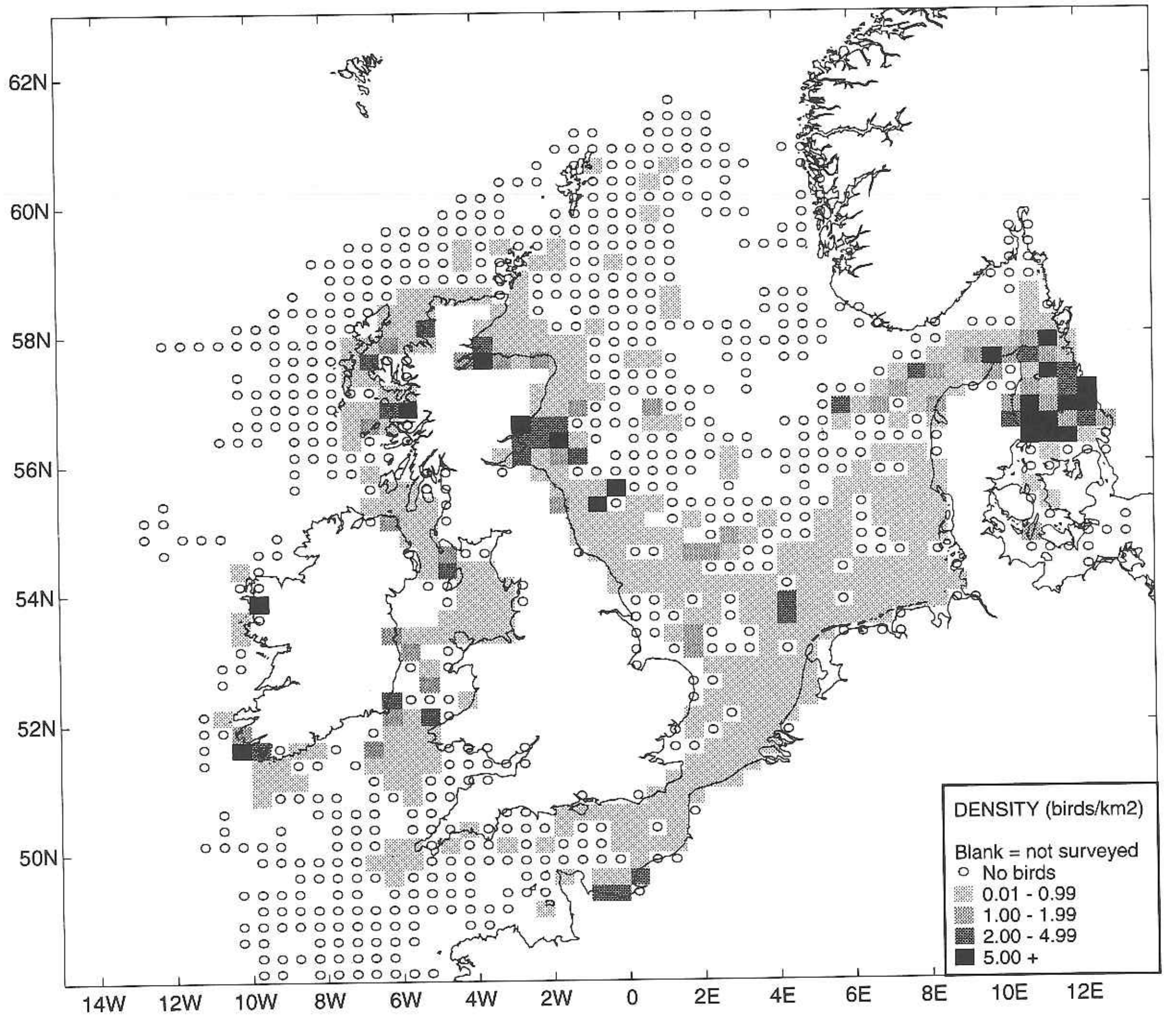

Figure 5.48.4 Distribution of razorbills from October to January

October to January (Figure 5.48.4)

Razorbills were widely dispersed throughout the autumn and winter, with low densities covering most of the southern North Sea and the eastern English Channel. High densities remained off the Firth of Forth in October but from November onwards high densities were found in the Kattegat. Low densities remained elsewhere around North Sea coasts, with the exception of Norway, where there was little coverage. A few razorbills were seen in the Belt Sea. Low to moderate densities also occurred off western Scotland and south-west Ireland, and low densities in the eastern Irish Sea and the Celtic Sea.

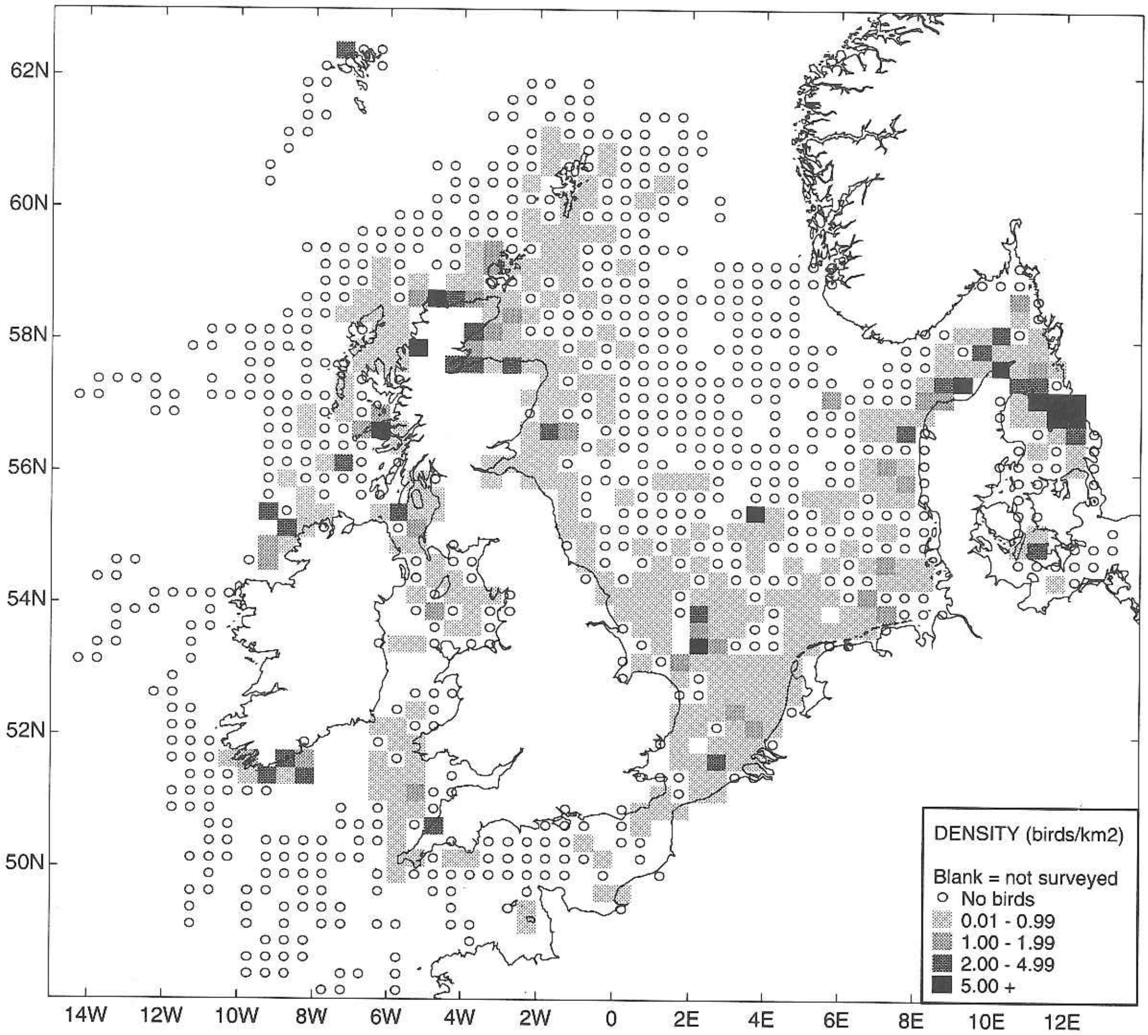

Figure 5.48.5 Distribution of razorbills in February and March

February to March (Figure 5.48.5)

Razorbills were found at high densities around Middelgrundene and moderate densities in the Skagerrak at this time, with a few birds seen in the Belt Sea. Low or moderate densities were found in the southern half of the North Sea and low densities off east British coasts. The north and west coasts of Scotland and north-west Ireland held low or moderate densities. Low densities were also seen in the eastern Irish Sea, the St. George's Channel and the Celtic Sea. South-west Ireland had moderate densities of razorbills. Few razorbills remained in the English Channel at this time.

Summary and conservation implications

Razorbills spend much time on the surface of the sea, making them vulnerable to pollution. The north-western North Sea was important for razorbills throughout the year, but especially from July to September, during which time many razorbills would have been flightless. The Irish Sea and the west coast of Scotland were important from April to September, while the Skagerrak and the Kattegat were important from October to March. Overwintering razorbills in the southern North Sea were widespread at low densities; this species is at risk from chronic oil pollution in this area.

Further reading

Burton, C.A., Tasker, M.L., Benn, S., Webb, A. & Leaper, G.M. 1987. The distribution of seabirds off north-west Scotland, August 1986. *Nature Conservancy Council, CSD Report,* No. 758.

Camphuysen, C.J. & Leopold, M.F. 1994. *Atlas of seabirds in the southern North Sea.* IBN Research Report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Dutch Seabird Group and Netherlands Institute for Sea Research, Texel, 126pp.

Durinck, J., Danielsen, F. & Skov, H. 1987. Havfugle og sæler i danske farvande optalt fra skibe i oktober og november 1987. *Statusrapport til Skov - og Naturstyrelsen, Miljøministeriet. Udarbejdet af Ornis Consult.*

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Harrison, N.M., Webb, A., Leaper, G.M. & Steele, D. 1989. Seabird distributions and the movements of moulting auks west of Scotland and in the northern Irish Sea (late summer 1988). *Nature Conservancy Council, CSD Report,* No. 994.

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report,* No. 804.

Leopold, M.F. 1989. Verspreiding van Alkachtigen Alcidae voor Britse oostkust, nazomer 1987 en '88. *Sula 3:* 89-105.

Mudge, G.P. & Crooke, C.H. 1986. Seasonal changes in the numbers and distributions of seabirds at sea in the Moray Firth, northeast Scotland. *Proceedings of the Royal Society of Edinburgh 91B:* 81-104.

Stone, C.J., Harrison, N.M., Webb, A. & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Tasker, M.L., Webb, A., Greenstreet, S.P.R., Uttley, J. & Griffiths, A. 1985. Concentrations of auks off the north-east coast of Britain, August 1984. *Nature Conservancy Council, CSD Report,* No.589.

Tasker, M.L., Webb, A., Murray, S. & Holt, R. 1986. The dispersal of auks in the northern North Sea, June to September 1985. *Nature Conservancy Council, CSD Report,* No. 627.

Webb, A., Tasker, M.L. & Greenstreet, S.P.R. 1985. The distribution of guillemots (*Uria aalge*), razorbills (*Alca torda*) and puffins (*Fratercula arctica*) at sea around Flamborough Head, June 1984. *Nature Conservancy Council, CSD Report,* No. 590.

Table 5.48.1 Overall density of razorbills (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.17	0.30	0.18	0.12	0.96	0.42	-	0.10	0.04
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.00	0.40	0.33	0.29	0.07	1.62	0.13	0.00	0.29	0.12
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.06	0.64	0.53	0.22	0.07	0.27	0.30	0.00	0.20	0.03
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	0.02	0.47	1.36	0.04	0.07	0.03	0.48	0.00	0.03	0.02
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.02	0.51	0.95	0.12	0.03	0.01	0.92	0.00	0.04	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	0.03	1.18	0.70	0.46	0.01	0.00	0.59	0.00	0.00	0.02
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.02	0.89	0.57	0.98	0.08	0.00	1.69	0.00	0.18	0.00
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	2.38	4.66	2.07	0.04	0.00	1.28	0.00	0.14	0.01
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.31	1.65	1.19	0.38	0.01	0.46	0.00	0.02	0.00
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.51	0.48	2.70	0.17	0.32	0.51	0.00	1.52	0.04
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.31	0.80	0.60	0.19	5.43	0.64	0.00	0.04	0.05
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.13	0.64	0.17	0.05	3.19	0.85	0.00	0.05	0.20
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.49 BLACK GUILLEMOT *Cepphus grylle*

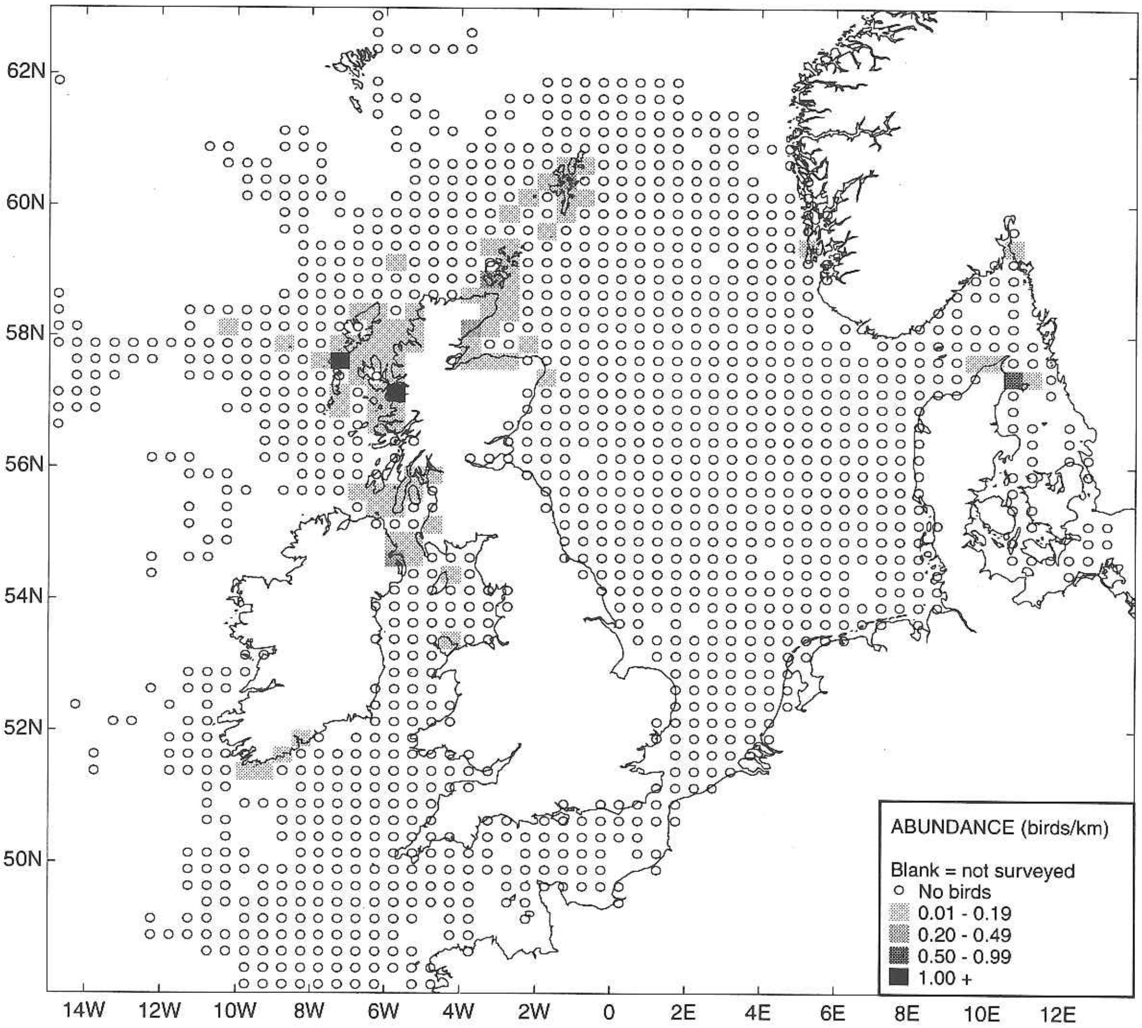

Figure 5.49.1 Distribution of black guillemots from April to July

April to July (Figure 5.49.1)

Black guillemots remained close to the colonies during the pre-breeding and breeding seasons. The main colonies are found in Shetland, Orkney, north-east and west coasts of Scotland, and the coasts of Northern Ireland (Lloyd, Tasker & Partridge 1991), and their distribution reflects this. Smaller concentrations were seen around the coasts of south-west Ireland and Norway, and around Skagen.

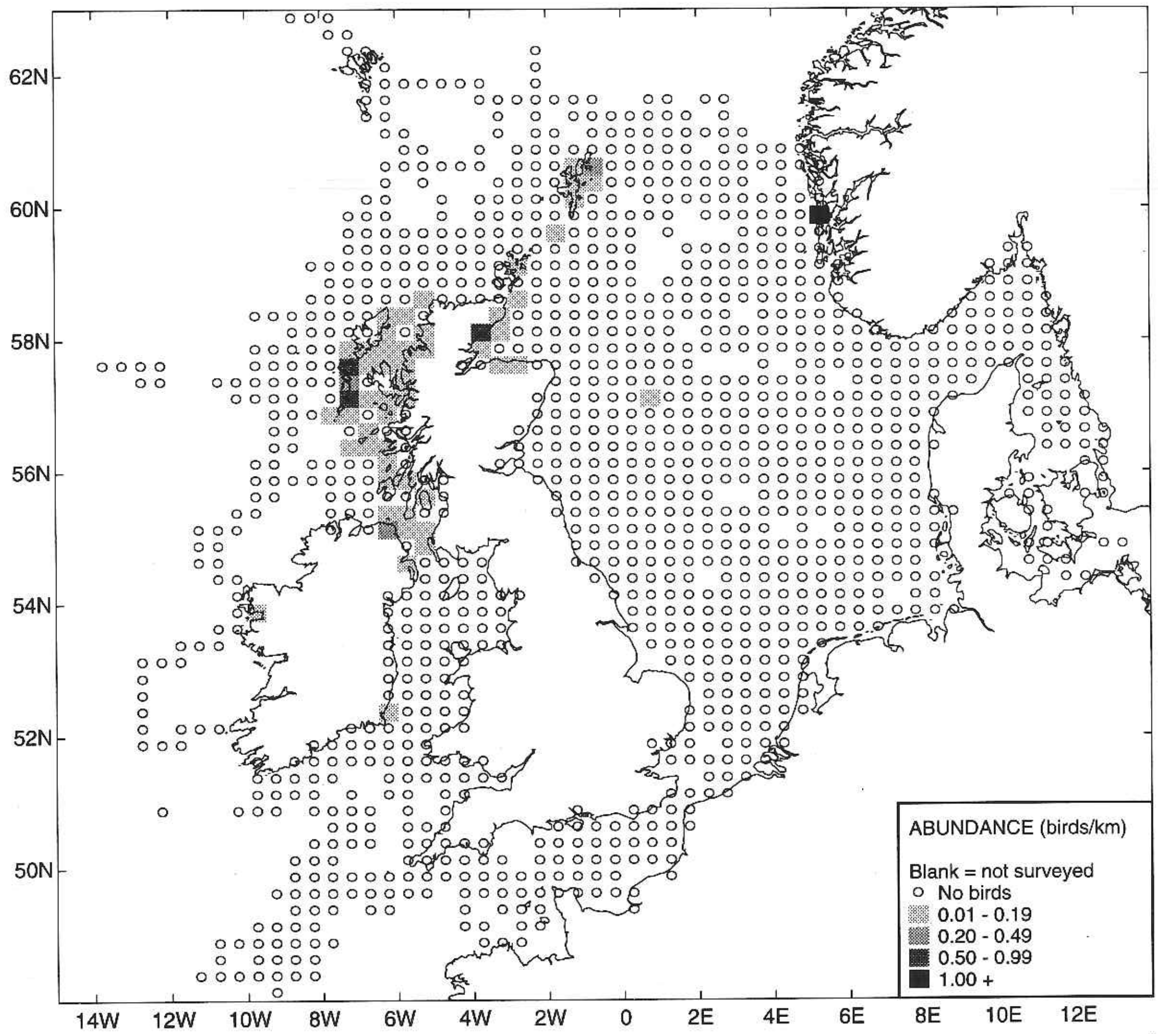

Figure 5.49.2 Distribution of black guillemots in August and September

August to September (Figure 5.49.2)

The distribution of black guillemots was mainly northern. They were widespread in low numbers around the west coast of Scotland, the Hebrides, Shetland and the Moray Firth (Table 5.49.1). In addition low numbers were seen off Northern Ireland, Orkney, Fair Isle, south-east Ireland, and the west coast of Ireland. A single bird was observed far offshore in the North Sea in August.

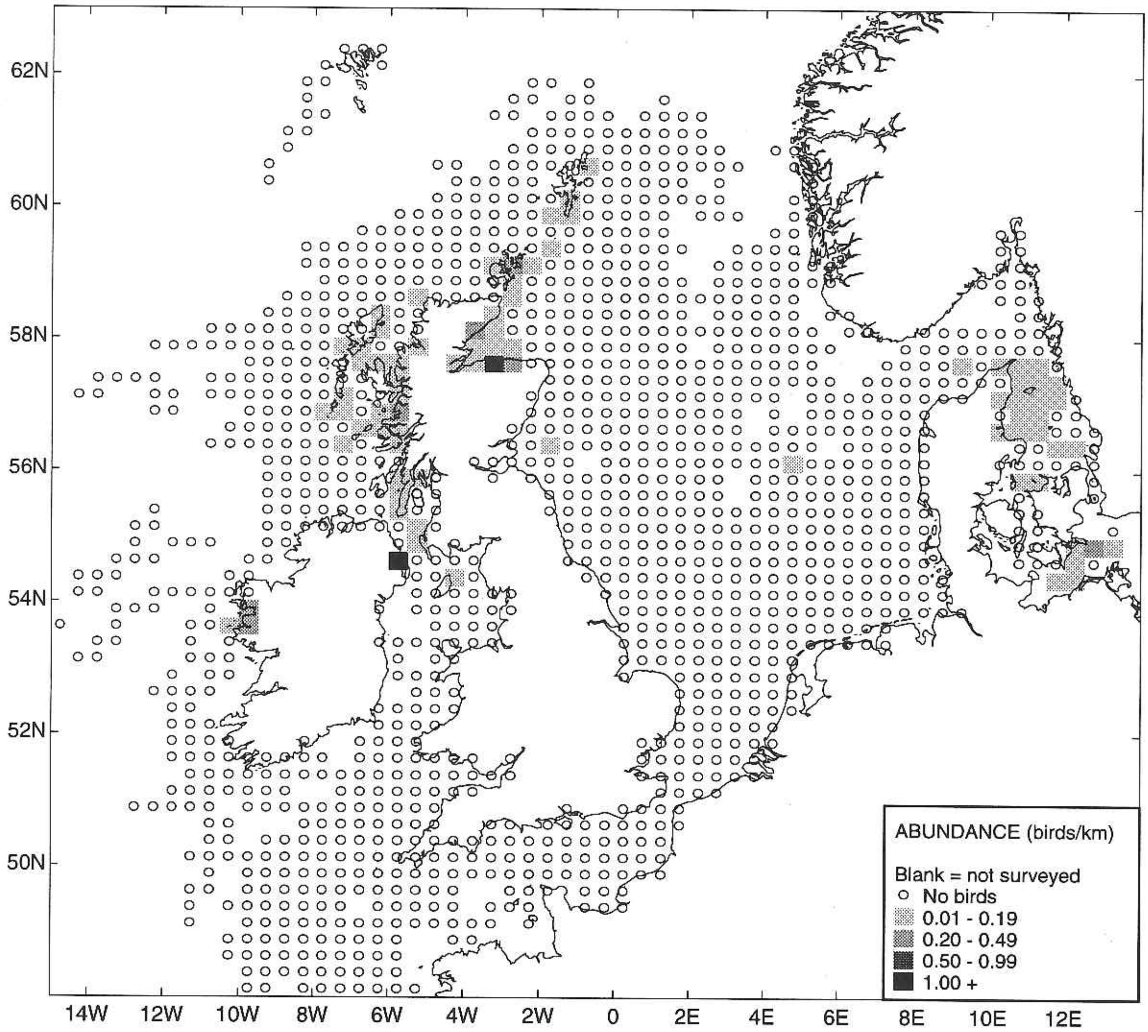

Figure 5.49.3 Distribution of black guillemots from October to March

October to March (Figure 5.49.3)

Low numbers were again found around the west coast of Scotland, Shetland, Orkney, the Moray Firth and the west coast of Ireland. In addition, black guillemots were widespread at low numbers in the Kattegat and Belt Sea, those in the Belt Sea being the Baltic form *C.g. grylle*. Only two birds were seen far offshore, these occurring to the west of Denmark in November.

Summary and conservation implications

Black guillemots remain inshore throughout the year and are therefore only vulnerable to oil spills in inshore waters. However, their restricted distribution makes them particularly vulnerable to pollution in these areas.

Further reading

Durinck, J., Skov, H., Jensen, F.P. & Pihl, S. 1994. *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI Research Contract no. 2242/90-09-01, Ornis Consult Report 1994, Copenhagen, 110pp.

Ewins, P.J. & Kirk, D.A. 1988. The distribution of Shetland black guillemots *Cepphus grylle* outside the breeding season. *Seabird 11:* 50-61.

Lloyd, C., Tasker, M.L. & Partridge, K. 1991. *The status of seabirds in Britain and Ireland.* T. & A.D. Poyser, London.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Table 5.49.1 Overall abundance of black guillemots (birds.km^{-1}) in each of ten areas (Figure 3.1), with total distance travelled whilst surveying (km).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Abundance km	0.00 405.3	0.00 2302.8	0.02 1897.5	0.00 2906.0	0.00 3429.6	0.00 14424.8	0.00 1765.7	- 0.0	0.00 223.8	0.00 1938.2
Feb	Abundance km	0.00 1186.0	0.01 2681.3	0.01 4535.2	0.00 4638.5	0.00 10444.6	0.01 16704.2	0.01 1594.8	0.00 378.2	0.00 636.7	0.00 1966.8
Mar	Abundance km	0.00 1372.7	0.01 4486.3	0.02 4193.2	0.00 1127.8	0.00 3082.5	0.00 8369.8	0.00 1074.7	0.00 603.8	0.00 2060.7	0.00 1453.0
Apr	Abundance km	0.00 1923.7	0.03 3268.0	0.02 4298.0	0.00 1040.3	0.00 4994.1	0.01 12052.6	0.00 1316.7	0.00 423.8	0.00 1982.2	0.00 2771.3
May	Abundance km	0.00 1720.5	0.01 3716.3	0.01 4328.5	0.00 3325.5	0.00 10357.4	0.00 14355.5	0.00 2403.5	0.00 844.0	0.00 1744.7	0.00 2807.7
Jun	Abundance km	0.00 2123.3	0.06 6186.1	0.02 4620.2	0.00 4380.1	0.00 7102.9	0.00 7388.8	0.00 2950.8	0.00 240.1	0.00 1078.2	0.00 1945.5
Jul	Abundance km	0.00 3576.3	0.01 3529.2	0.01 12939.6	0.00 5756.8	0.00 17353.3	0.00 8890.9	0.00 3675.7	0.00 514.0	0.00 3209.6	0.00 2152.2
Aug	Abundance km	0.00 2893.0	0.02 8275.0	0.01 5849.3	0.00 9182.0	0.00 14084.3	0.00 15952.0	0.00 3600.3	0.00 929.7	0.00 1905.3	0.00 3074.4
Sep	Abundance km	0.00 696.3	0.01 1644.3	0.02 4738.0	0.00 10524.0	0.00 10039.8	0.00 10250.8	0.00 4515.7	0.00 13.3	0.00 1383.1	0.00 1730.8
Oct	Abundance km	0.00 222.0	0.02 4531.3	0.04 2042.0	0.00 3681.2	0.00 4821.9	0.00 11282.0	0.00 1196.0	0.00 42.0	0.02 1196.0	0.00 2703.3
Nov	Abundance km	0.00 387.5	0.00 1418.8	0.06 2931.0	0.00 1966.3	0.00 5379.6	0.00 10069.7	0.00 916.6	0.00 327.2	0.00 2550.9	0.00 3040.3
Dec	Abundance km	0.00 340.5	0.00 1111.5	0.01 2093.2	0.00 2383.7	0.00 1370.9	0.00 5921.5	0.00 940.5	0.00 335.6	0.00 1553.8	0.00 4586.5

5.50 LITTLE AUK *Alle alle*

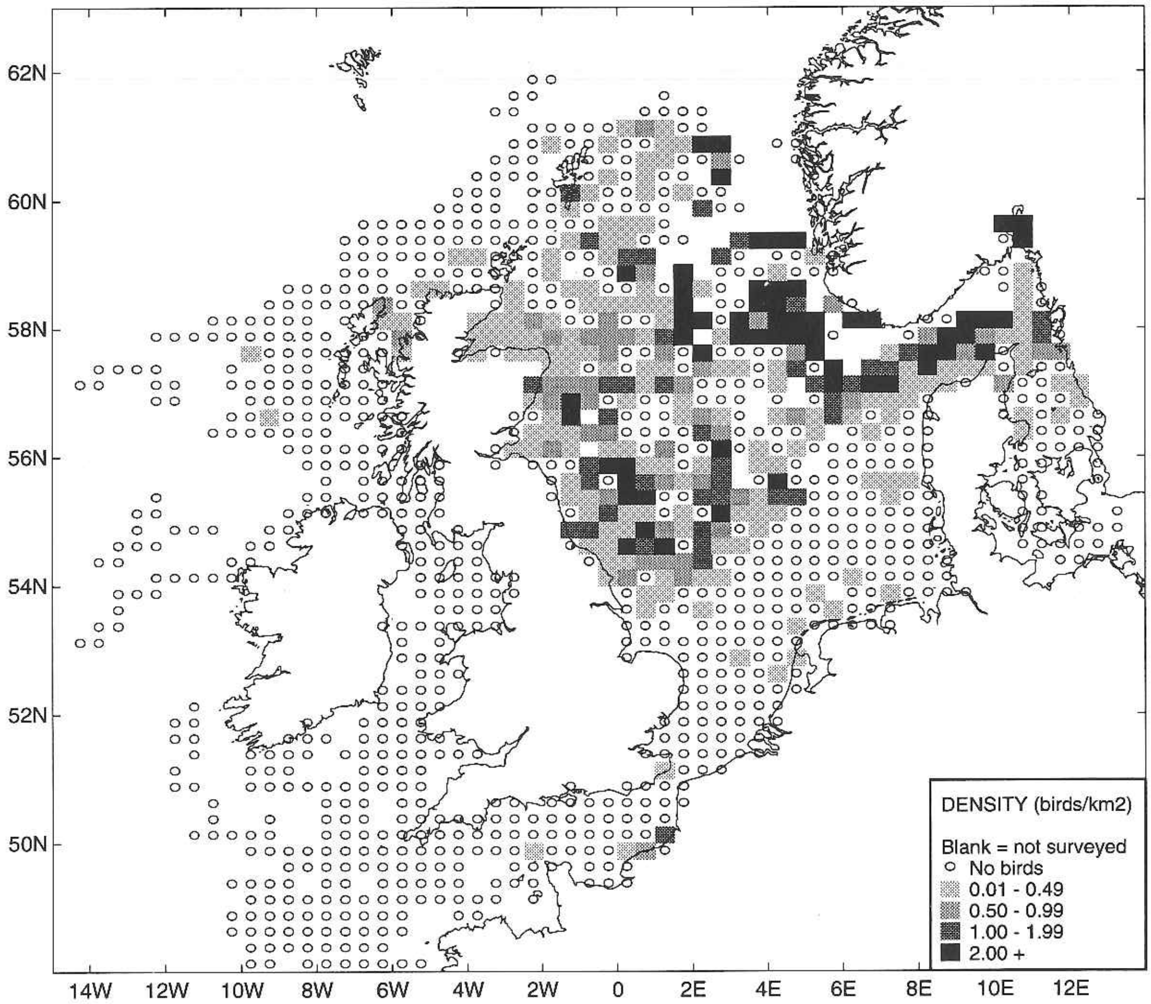

Figure 5.50.1 Distribution of little auks from November to February

November to February (Figure 5.50.1)

Little auks were widespread in the northern North Sea over winter. Highest concentrations were found offshore, particularly around the western and southern edges of the Rinne, extending into the Skagerrak, and off north-east England. Low densities were seen in the Kattegat, off the Netherlands coast, in the eastern English Channel, in the Minch, off north Scotland, and offshore to the west of Scotland.

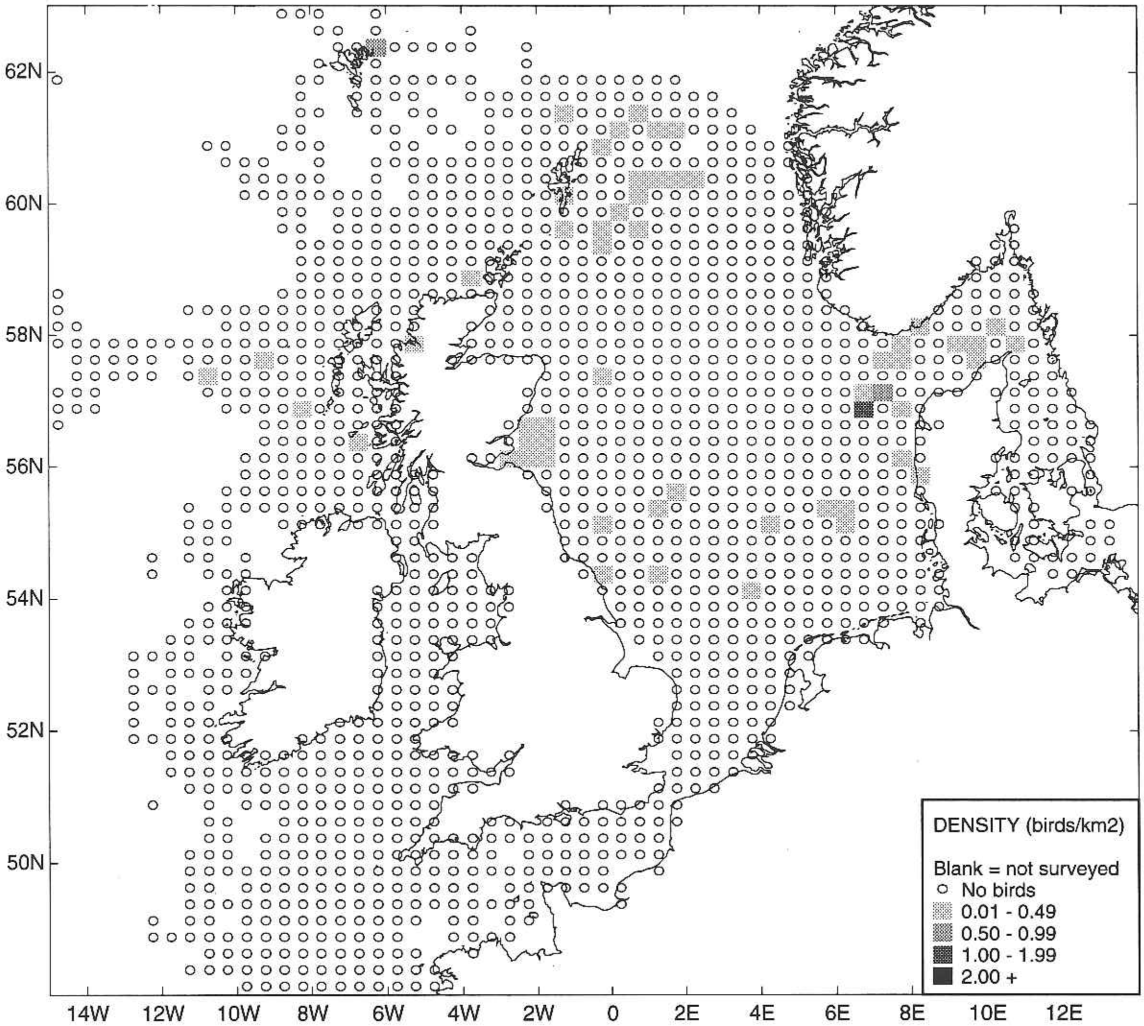

Figure 5.50.2 Distribution of little auks from March to October

March to October (Figure 5.50.2)

Few little auks were seen during these months (Table 5.50.1). Low densities were seen off the Firth of Forth, in the Skagerrak and to the east of Shetland. A few remained in the central North Sea.

Summary and conservation implications

Little auks only occurred in the study area as winter visitors, when their distribution was mainly confined to the northern North Sea. In this area they would be vulnerable to oil pollution in winter, but incidents outside this area and season are unlikely to affect this species.

Further reading

Follestad, A. 1990. The pelagic distribution of little auk *Alle alle* in relation to a frontal system off central Norway, March/April 1988. *Polar Research 8:* 23-28.

Ham, N.F. van der, Stegeman, L. & Platteeuw, M. 1991. Influx van Kleine Alken *Alle alle* in Nederland in winter 1990/91. *Sula 5(3):* 92-100.

Skov, H., Durinck, J. & Danielsen, F. 1989. Sammenfaldende forekomst mellem Søkonger *Alle alle* og Glaskutling *Aphya minuta* i Flekkefjord, Sydnorge november 1988. *Pelagicus 4:* 22-24.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Table 5.50.1 Overall density of little auks (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.03	0.10	0.21	0.37	0.24	0.00	-	0.00	0.02
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.01	0.07	0.07	0.38	0.56	2.87	0.00	0.00	0.00	0.00
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.02	0.01	0.02	0.01	0.11	0.05	0.00	0.00	0.00	0.00
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.00	0.00	0.01	0.10	0.01	0.01	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.02	0.02	0.33	1.08	2.71	0.17	0.00	0.00	0.00	0.00
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.02	0.21	0.34	0.73	0.49	0.00	0.00	0.00	0.02
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.51 PUFFIN *Fratercula arctica*

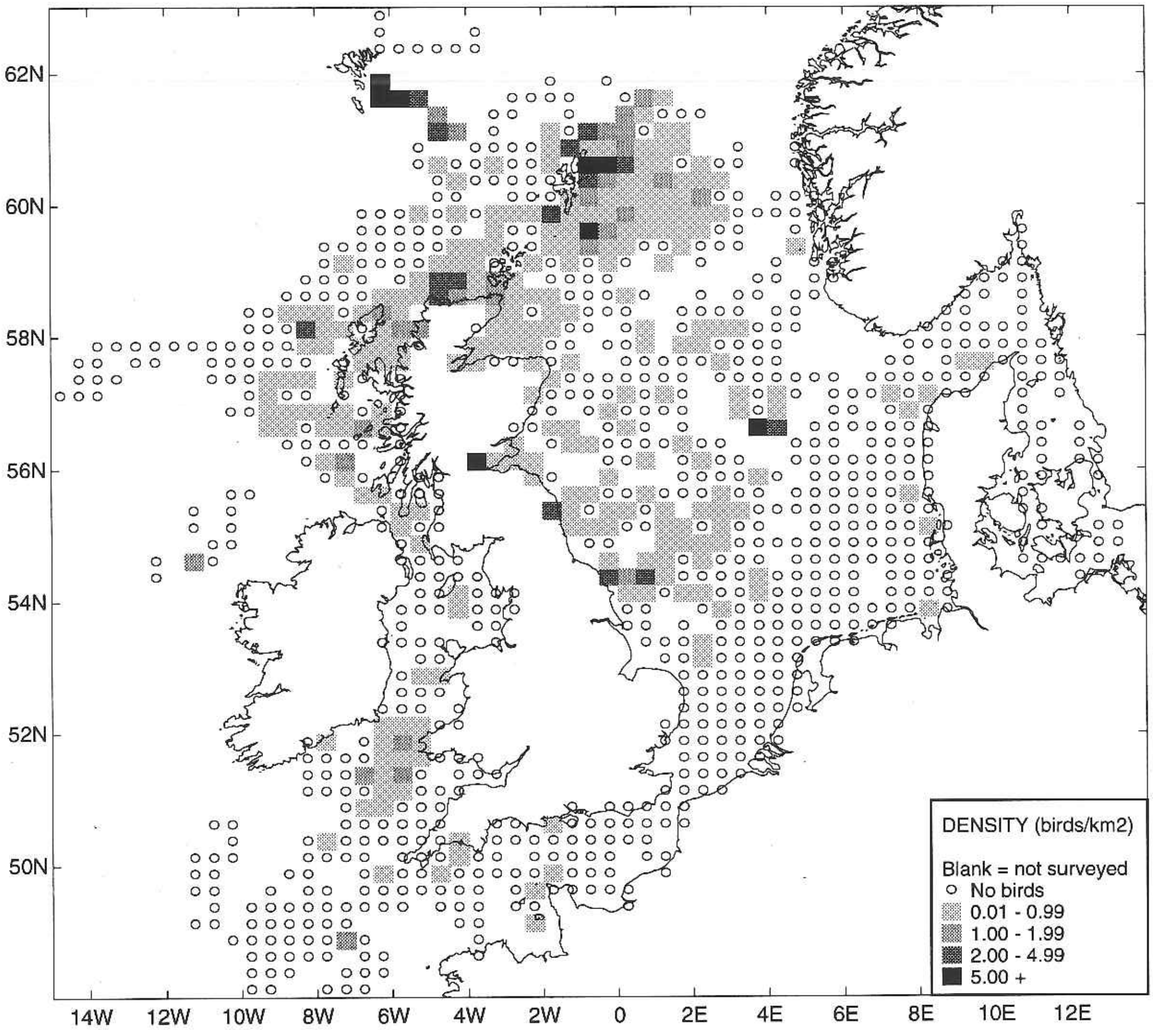

Figure 5.51.1 Distribution of puffins in April and May

April to May (Figure 5.51.1)

Breeding pairs of puffins are each incubating their single egg at this time; high densities were found around the colonies at Shetland and the Faeroes. Moderate densities were also found off north Scotland, near St Kilda, near Flamborough Head and in the Celtic Sea. Low densities were found over the shelf to the west of Scotland and in the middle of the North Sea. A few puffins were seen in the western English Channel and off the coast of Denmark.

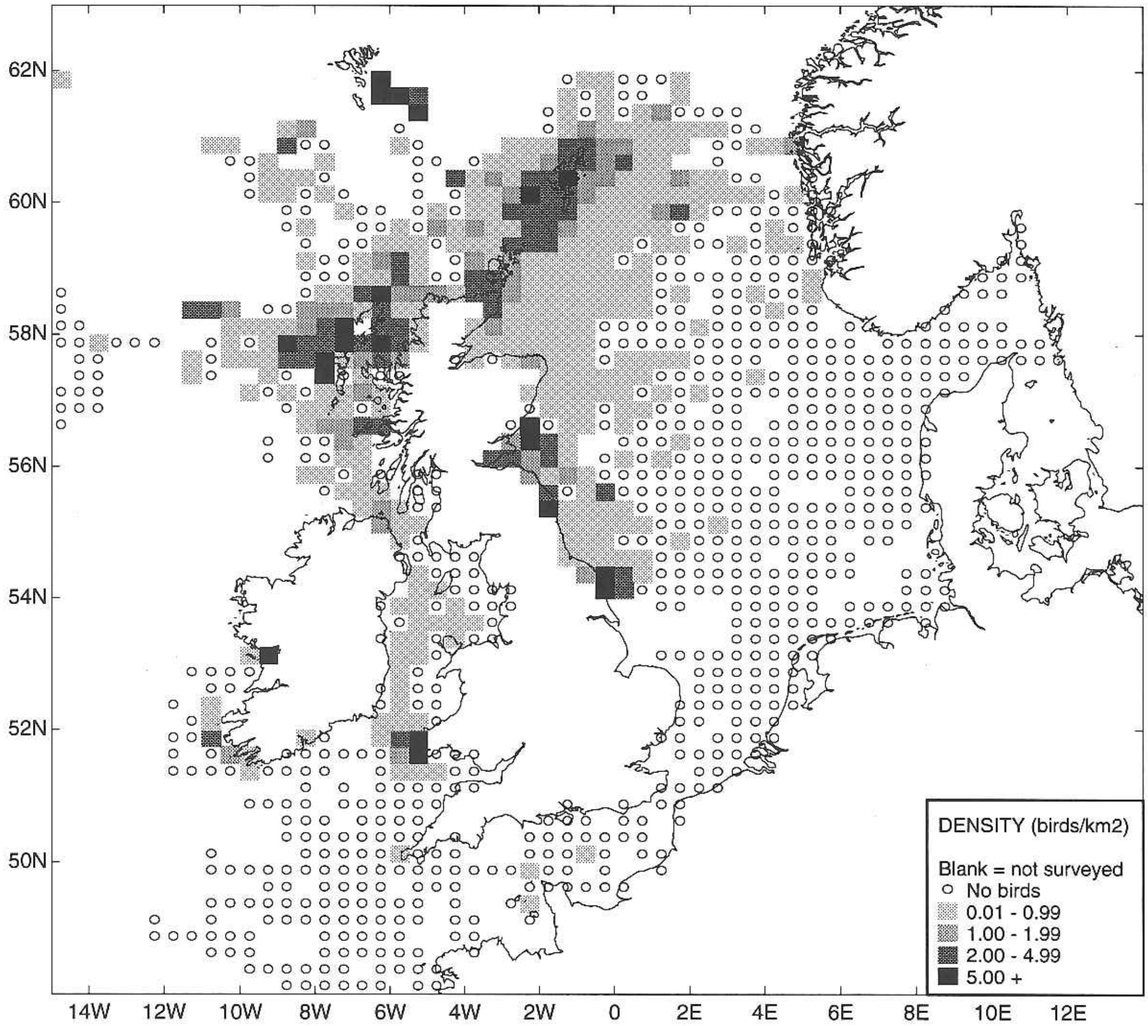

Figure 5.51.2 Distribution of puffins in June and July

June to July (Figure 5.51.2)

The need to return to the colony regularly is apparent in the distribution of puffins during this chick-rearing period. High densities were found around the colonies at Shetland, Orkney, the Faeroes, the Firth of Forth, Flamborough Head, the Outer Hebrides and St Kilda, Skomer (Pembrokeshire Islands) and south-west Ireland. Adult puffins have been observed carrying fish to the colonies from distances of up to 40 km (Webb, Tasker & Greenstreet 1985, Leaper *et. al* 1988). Low densities further away from the colonies extending towards the middle of the North Sea mostly occurred in July, when the chicks have started to fledge. Low densities were also found to the west of Scotland and in the Irish Sea.

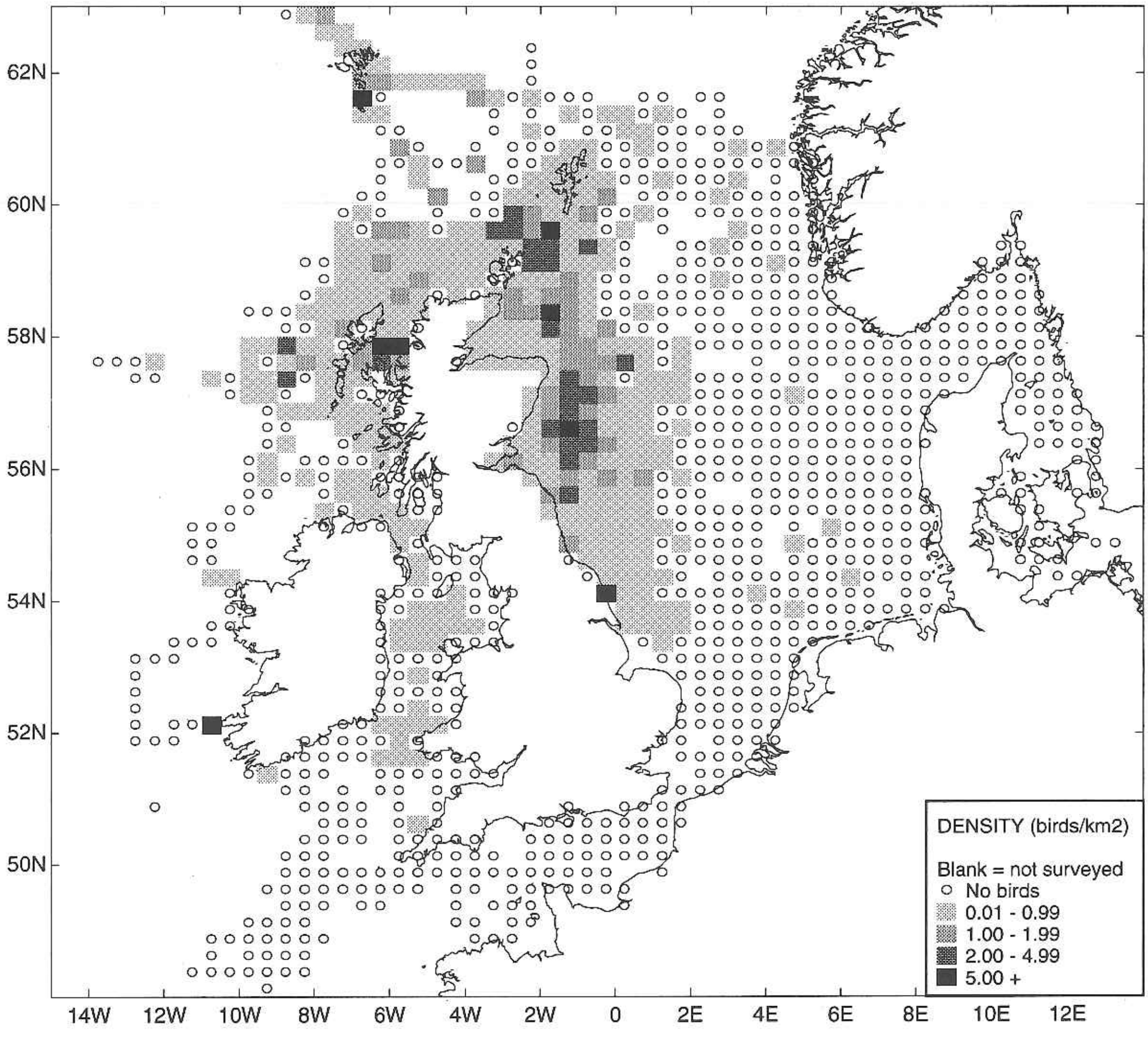

Figure 5.51.3 Distribution of puffins in August and September

August to September (Figure 5.51.3)

By this time puffins have left the colonies. They were concentrated a little way offshore off the north-eastern coast of Britain, but few were found to the east of 2°E. Low to moderate densities remained to the north and west of Scotland and around the Faeroes, with high densities in the Minch. Low densities were found in the North Channel, the Irish Sea and the St. George's Channel.

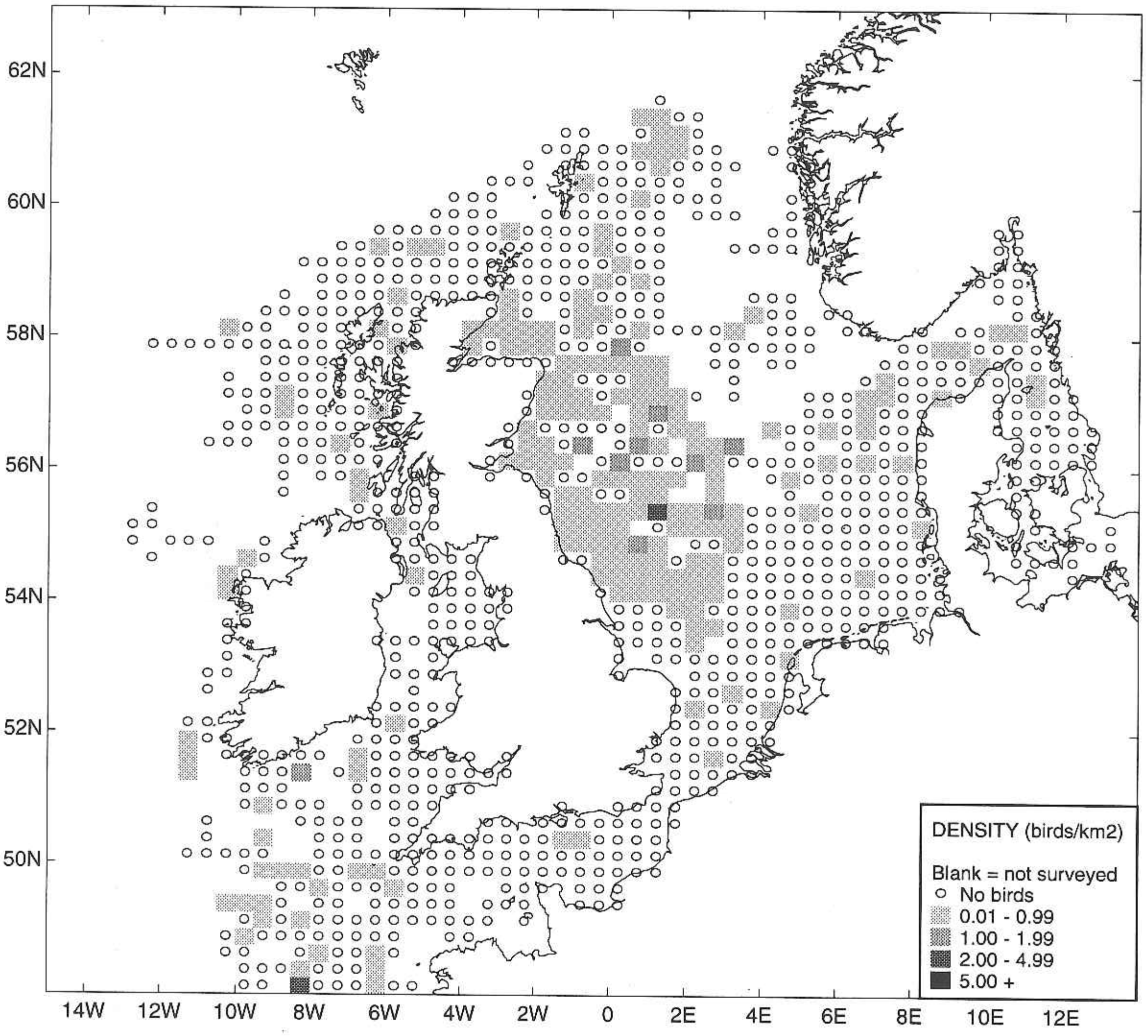

Figure 5.51.4 Distribution of puffins from October to January

October to January (Figure 5.51.4)

Densities were mostly low at this time (Table 5.51.1). Puffins were found over a wide area along the east coast of Britain as far south as Flamborough Head, extending into the middle of the North Sea, where they were sometimes found in moderate densities. A few were found in the eastern North Sea and in the Skagerrak and Kattegat. Few puffins remained to the west of Britain; those that were found here were mostly on the outer shelf in the South-west Approaches.

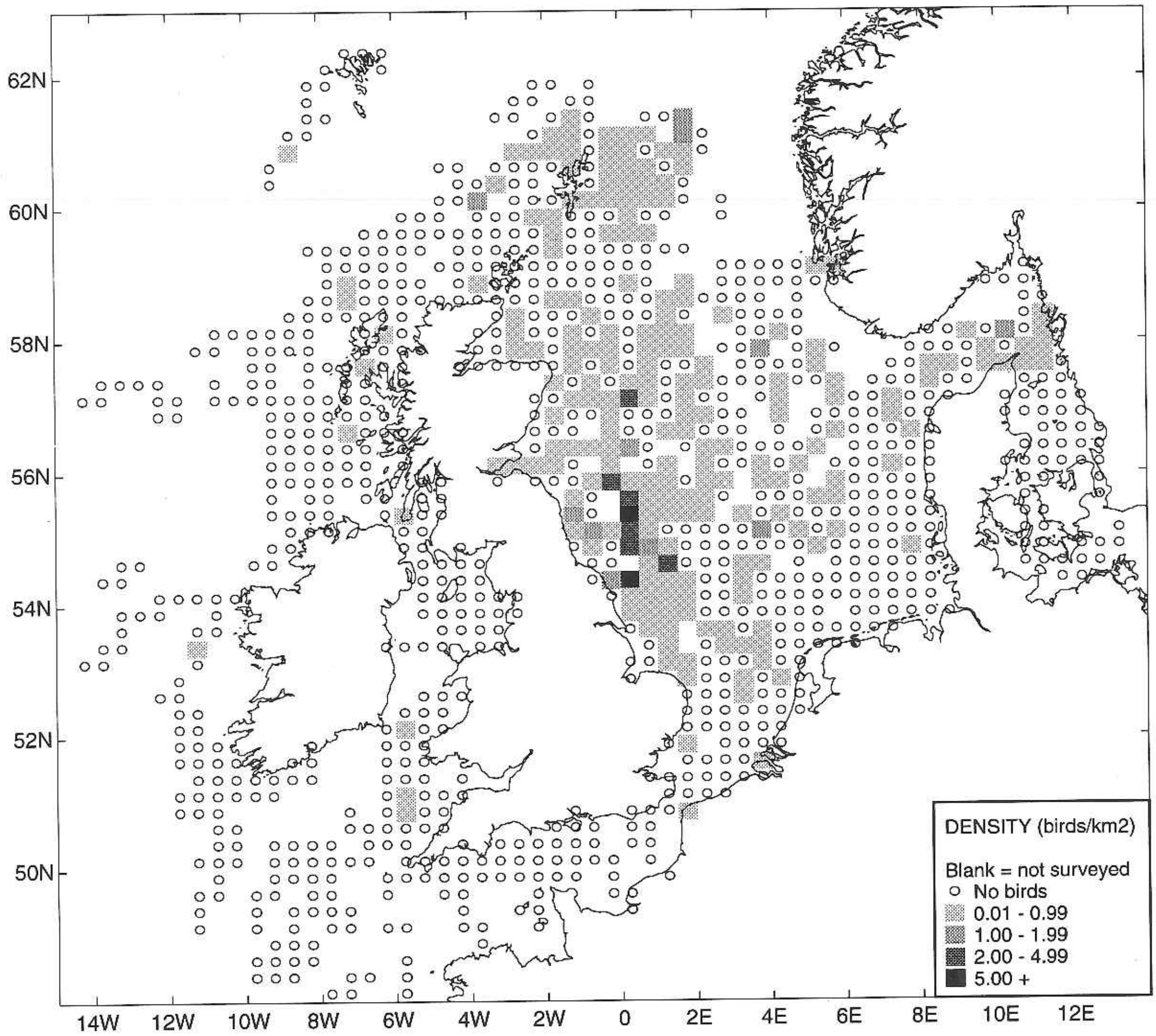

Figure 5.51.5 Distribution of puffins in February and March

February to March (Figure 5.51.5)

Adult puffins undergo a complete moult at this time and are flightless. Low densities were widespread in the North Sea, although they were more frequently encountered on the western side than on the eastern side and in the Skagerrak. Some moderate to high densities were seen offshore of north-east England. Very few were seen to the west of Britain.

Summary and conservation implications

Like the other auks, puffins are vulnerable to oil pollution due to the amount of time they spend on the water. This is especially so during late winter when they are flightless; the whole of the North Sea held low densities of puffins at this time. During the breeding season the areas around the colonies at Shetland, Orkney, the Faeroes, the Outer Hebrides, the Firth of Forth, Flamborough Head and the Pembrokeshire Islands became important. After breeding their distribution was concentrated in the north-western North Sea, not far from land, before dispersing through the winter.

Further reading

Burton, C.A., Tasker, M.L., Benn, S., Webb, A. & Leaper, G.M. 1987. The distribution of seabirds off north-west Scotland, August 1986. *Nature Conservancy Council, CSD Report,* No. 758.

Danielsen, F., Skov, H., Durinck, J. & Bloch, D. 1990. Marine distribution of seabirds in the Northeast Atlantic between Iceland and Scotland, June-September 1987 and 1988. *Dansk. Orn. Foren. Tidsskr. 84:* 45-63.

Harrison, N.M., Webb, A., Leaper, G.M. & Steele, D. 1989. Seabird distributions and the movements of moulting auks west of Scotland and in the northern Irish Sea (late summer 1988). *Nature Conservancy Council, CSD Report,* No. 994.

Leaper, G.M., Webb, A., Benn, S., Prendergast, H.D.V., Tasker, M.L. & Schofield, R. 1988. Seabird studies around St Kilda, June 1987. *Nature Conservancy Council, CSD Report,* No. 804.

Leopold, M.F. 1989. Verspreiding van Alkachtigen Alcidae voör Britse oostkust, nazomer 1987 en '88. *Sula 3:* 89-105.

Stone, C.J., Harrison, N.M., Webb, A. & Best, B.J. 1992. Seabird distribution around Skomer and Skokholm Islands, June 1990. *JNCC Report* No. 30

Stone, C.J., Webb, A., Barton, T.R. & Gordon, J.R.W. 1993. Seabird distribution around Skomer and Skokholm Islands, June 1992. *JNCC Report* No. 152.

Stone, C.J., Webb, A. & Tasker, M.L. 1995. The distribution of auks and Procellariiformes in north-west European waters in relation to depth of sea. *Bird Study 42:* 50-56.

Tasker, M.L., Webb, A., Greenstreet, S.P.R., Uttley, J. & Griffiths, A. 1985. Concentrations of auks off the north-east coast of Britain, August 1984. *Nature.Conservancy Council, CSD Report,* No.589.

Tasker, M.L., Webb, A., Murray, S. & Holt, R. 1986. The dispersal of auks in the northern North Sea, June to September 1985. *Nature Conservancy Council, CSD Report,* No. 627.

Webb, A., Tasker, M.L. & Greenstreet, S.P.R. 1985. The distribution of guillemots (*Uria aalge*), razorbills (*Alca torda*) and puffins (*Fratercula arctica*) at sea around Flamborough Head, June 1984. *Nature Conservancy Council, CSD Report,* No. 590.

Table 5.51.1 Overall density of puffins (birds.km^{-2}) in each of ten areas (Figure 3.1), with total area surveyed (km^2).

	Area	1 North-west oceanic	2 North-west shelf	3 Shetland, Orkney & Moray Firth	4 Western North Sea	5 Central & north North Sea	6 South & east North Sea	7 Irish Sea	8 South-west oceanic	9 Celtic Sea	10 English & Bristol Channels
Jan	Density	0.00	0.00	0.00	0.05	0.13	0.01	0.00	-	0.00	0.00
	km^2	96.0	690.9	540.3	832.9	953.5	3476.9	526.5	0.0	67.2	493.4
Feb	Density	0.03	0.00	0.04	0.47	0.14	0.02	0.00	0.00	0.00	0.00
	km^2	353.0	778.9	1224.7	1271.7	2561.0	4391.4	476.2	113.5	191.0	563.2
Mar	Density	0.04	0.02	0.06	0.38	0.13	0.01	0.00	0.01	0.01	0.01
	km^2	378.7	1278.1	1183.2	278.1	859.6	2234.6	322.4	148.9	605.8	407.3
Apr	Density	0.08	0.34	0.53	0.33	0.19	0.01	0.14	0.00	0.08	0.00
	km^2	576.0	939.9	1243.0	269.6	1367.3	3256.4	395.0	98.9	550.9	787.8
May	Density	0.94	0.32	0.38	0.19	0.16	0.00	0.17	0.00	0.05	0.01
	km^2	451.6	920.5	1243.0	938.1	2980.1	3915.2	600.8	253.2	498.6	842.3
Jun	Density	1.01	4.49	1.00	1.95	0.02	0.00	2.54	0.00	0.01	0.01
	km^2	625.8	1763.0	1318.6	858.1	1895.2	1983.4	875.7	71.6	323.5	583.7
Jul	Density	0.38	1.44	1.23	0.61	0.11	0.00	0.19	0.01	0.24	0.00
	km^2	1002.1	937.0	3693.8	1496.3	4797.8	2483.8	1017.3	153.8	939.6	644.1
Aug	Density	0.77	0.91	1.15	1.12	0.05	0.00	0.10	0.00	0.08	0.00
	km^2	867.9	2472.9	1753.9	2525.2	3865.7	4484.2	1061.6	292.2	524.3	896.4
Sep	Density	0.10	0.02	0.06	0.79	0.20	0.00	0.03	0.00	0.01	0.00
	km^2	208.9	493.3	1382.7	2969.3	2856.0	2829.0	1354.1	4.0	383.0	519.3
Oct	Density	0.02	0.02	0.01	0.10	0.04	0.00	0.00	0.00	0.00	0.00
	km^2	66.6	1354.6	572.7	1081.8	1322.3	2956.0	356.6	12.6	297.6	811.0
Nov	Density	0.00	0.01	0.05	0.26	0.09	0.00	0.00	0.06	0.07	0.01
	km^2	116.3	425.7	872.7	553.7	1368.9	2598.0	264.6	76.3	710.4	856.2
Dec	Density	0.00	0.01	0.02	0.08	0.14	0.02	0.00	0.37	0.02	0.00
	km^2	102.2	333.4	609.0	714.3	395.0	1583.3	279.2	97.9	459.2	1257.2

5.52 RARE SPECIES

The following species were seen only occasionally whilst surveying in the study area. The positions and times of year of the sightings are as follows:

Species	Month	Number	Latitude	Longitude
WHITE-BILLED DIVER	February	1	57°29'N	11°14'E
Gavia adamsii	April	1	54°20'N	02°19'E
SLAVONIAN GREBE	January	1	53°17'N	04°55'E
Podiceps auritus	February	1	54°32'N	06°42'E
		1	54°32'N	06°44'E
		1	56°10'N	07°36'E
		1	56°10'N	07°38'E
	March	2	52°45'N	04°35'E
		1	52°58'N	04°43'E
	April	1	53°09'N	04°43'E
	October	1	55°49'N	08°09'E
		1	57°38'N	09°50'E
	November	2	56°49'N	10°29'E
		1	57°20'N	11°15'E
BLACK-NECKED GREBE	January	1	53°35'N	05°24'E
Podiceps nigricollis	April	1	56°35'N	08°33'E
	April	1	56°35'N	08°34'E
BLACK-BROWED ALBATROSS	September	1	57°51'N	02°50'W
Diomedea melanophris	October	1	53°52'N	06°19'E
KING EIDER	January	1	56°35'N	10°52'E
Somateria spectabilis	November	1	55°22'N	08°12'E
SURF SCOTER	March	1	53°28'N	05°13'E
Melanitta perspicillata				
RED-NECKED PHALAROPE	July	2	55°32'N	03°47'E
Phalaropus lobatus	August	4	58°28'N	10°51'E
		4	58°29'N	10°51'E
	September	1	55°35'N	01°11'W
GLAUCOUS GULL/	January	1	54°52'N	01°04'W
HERRING GULL HYBRID	September	1	60°44'N	02°30'E

Species	Month	Number	Latitude	Longitude
IVORY GULL	January	1	56°58'N	01°59'W
Pagophila eburnea	September	1	56°05'N	00°36'W
GULL-BILLED TERN	May	3	54°05'N	07°59'E
Gelochelidon nilotica	May	1	56°14'N	07°33'E
	May	1	54°38'N	08°06'E
	June	1	53°44'N	08°04'E
CASPIAN TERN	May	1	58°10'N	02°45'E
Sterna caspia				
ROSEATE TERN	May	2	52°53'N	05°30'W
Sterna dougallii		2	52°55'N	05°21'W
	August	1	53°08'N	05°20'W
	September	1	54°45'N	00°02'W
BRUNNICH'S GUILLEMOT	February	2	56°49'N	12°18'E
Uria lomvia	February	1	58°09'N	03°46'E
	April	1	58°16'N	03°05'W
	August	1	58°32'N	05°03'E
	December	1	53°40'N	04°26'E