From: Dominika Phillips
To: Hornsea Project Three; KJ Johansson; Kay Sully
Cc: Andrew Guyton; Stuart Livesey
Subject: Hornsea Project Three (UK) Ltd response to Deadline 4 (Part 5)
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D4_HOW03_Appendix 13_Wisniewska et al 2016.pdf
D4_HOW03_Appendix 14_Bowgen_Cook 2018.pdf
D4_HOW03_Appendix 15_Furness 2015.pdf
D4_HOW03_Appendix 16_Cook et al 2014.pdf
D4_HOW03_Appendix 17_Dierschke and Garthe 2006.pdf
D4_HOW03_Appendix 18_Garthe and Huppop 2004.pdf

Dear Kay, K-J

Please find attached the 5th instalment of documents.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager

[redacted]

Environmental Management UK│ Wind Power
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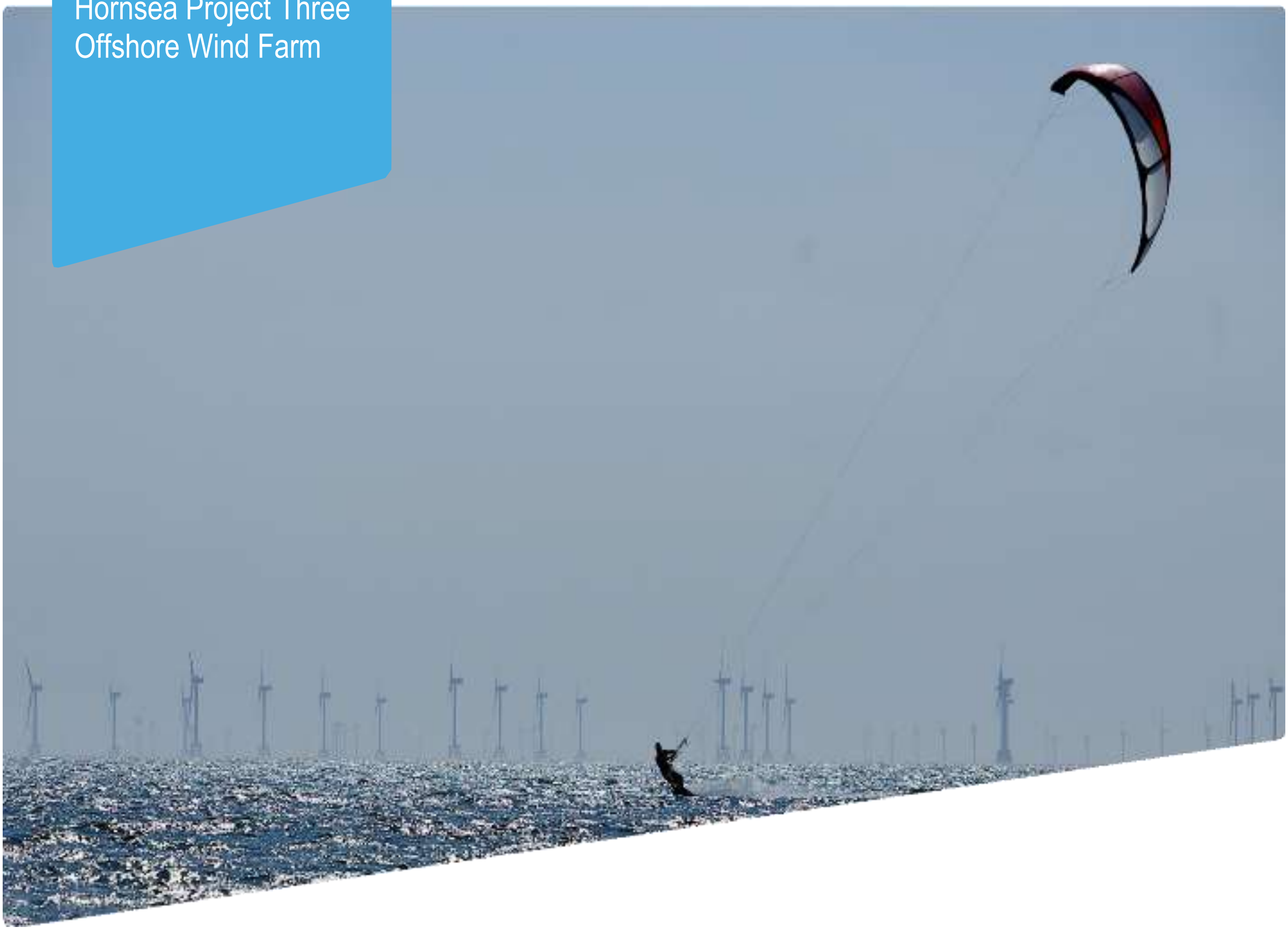
Orsted

Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 15 to Deadline 4 Submission – Furness 2015

Date: 15th January 2019

Hornsea 3
Offshore Wind Farm

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Natural England Commissioned Report NECR164

Non-breeding season populations of seabirds in UK waters

Population sizes for Biologically Defined Minimum Population Scales (BDMPS)

First published 22 January 2015

www.gov.uk/natural-england

Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The current, unprecedented amount of marine renewables development proposed in UK waters have the potential to impact on seabird populations.

Impact assessments for marine renewables have tended to focus on potential impacts to seabirds during the breeding season when breeding birds are closely associated with their colonies, and where impacts can more easily be attributed to breeding populations, for example, based on foraging ranges. However, impacts to seabirds may also occur outside the breeding season, and to address the impacts of marine renewables across each species' full annual cycle, we need to determine a method for assessing seabird impacts during the non-breeding season. At the moment this is limited as we do not have agreed population scales or population estimates relevant to the non-breeding season to consider in assessments, and against which to apportion any non-breeding season impacts to populations or sites.

The aim of this project was to address this limitation by reviewing and defining species-specific non-breeding season seabird populations at biologically defined minimum population scales (BDMPS) to enable the apportioning of potential impacts of marine renewable developments during the non-breeding season.

The findings will be used by those engaged in marine spatial planning and impact assessments, in particular the Statutory Nature Conservation Bodies (SNCBs), regulators and developers in the offshore sector who need to assess the potential impact of offshore development proposals on seabird populations and protected sites for seabirds across their annual cycle.

The results will be used by the SNCBs to develop agreed methodologies on how to use the outputs of the work in the context of our advice to developers on assessing impacts to seabird populations from offshore developments.

This report should be cited as:

FURNESS, R.W. 2015. *Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS)*. Natural England Commissioned Reports, Number 164.

MacArthur Green Ltd

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Keywords - environmental impact assessments (eia), habitats regulations assessment (hra), marine, non-breeding, offshore renewables, ornithology, populations, seabirds, special protection areas (spa)

Further information
This report can be downloaded from the Natural England website: **www.gov.uk/natural-england**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

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CONTENTS

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SUMMARY

This report reviews evidence concerning the populations of seabirds that are present in UK waters during the non-breeding period. It uses the literature to assess the sizes of seabird populations with the aim to use the most up to date available data (usually expressed in terms of numbers of breeding pairs in each country). It uses data on the demography of seabirds (survival rates, age of first breeding, productivity) to model population age structure in order to assess the numbers of immature birds that are associated with breeding populations, since it is not normally possible to census immature components of seabird populations. Data on the timing of breeding and of migration are used to assess the appropriate seasonal definitions to use in this project; this assessment was based on literature and on appropriate data compliations such as annual bird reports, and online databases presenting seabird migration statistics. For each key species, migratory movements are reviewed based on literature and web pages reporting ring recovery data, geolocator tracking (for the few species for which tracking data are available), seawatching, at-sea survey data, biometrics and other markers of origins of birds. Numbers thought to be present in UK waters were also reviewed from these sources. Data on numbers of breeding pairs in UK Special Protection Area (SPA) breeding populations were tabulated for each species. Data were used to present hierarchical scales that can be of use in assessment of impacts on populations; firstly the biogeographic population with connectivity to UK waters (defining which populations visit UK waters and the estimated total numbers of birds (adults and immatures) in that combined population); secondly the total number of birds present in all UK territorial waters during the defined season; thirdly the total number of birds in each spatially distinct biologically defined minimum population scales (BDMPS) population during that defined season. BDMPS population sizes were estimated from the information reviewed on migrations of each population, and the most up to date data were used in an apportioning of birds from each population into each BDMPS. Confidence in the assessments of BDMPS population sizes was expressed using a traffic light coding where green represents numbers thought likely to be accurate to no more than 30% less or 50% more than the estimated number, amber represents numbers thought likely to be accurate to no more than 50% less or 80% more than the estimated number, and red represents numbers where the true value may lie more than 50% below, or 80% above, the estimate presented. It is intended that the apportioning tables (69 tables presented as Appendix A) can be updated as new census data become available, and as new data on migrations and winter distribution are gathered that allow more precise and accurate quantifications of proportions of populations present within defined spatial areas. A summary of the BDMPS populations is given in the following table. For details of defined spatial areas named in Table 0.1 see maps in each individual species' account.

Table 0.1. Summary of the estimated numbers of birds (adults plus immatures) in each BDMPS spatial and seasonal population for each seabird species considered in this report. BDMPS are colour coded to indicate level of uncertainty about numbers (green low, amber moderate, red high). See species accounts for details of uncertainty, including issues about numbers of BDMPS to be defined which are in addition to uncertainty about numbers.

Red-throated diver						
	Winter (December-January)		**Migration seasons (Sept-Nov and Feb-April)**			
	NW North Sea	1,523	UK North Sea	13,277		
	West of Scotland	861	UK western waters & Channel	4,373		
	SW North Sea	10,177				
	NW England & Wales	1,657				
	SW England & Channel	1,153				
Great northern diver						
	Non-breeding season (Sept-May)					
	West of Scotland	2,000				
	NW North Sea	1,000				
	SW North Sea & Channel	200				
	NW England & Wales	300				
	SW England	500				
Northern fulmar						
	Winter (November)		**Migration seasons (Sept-Oct and Dec-Mar)**			
	UK North Sea	568,736	UK North Sea	957,502		
	Western waters & Channel	556,367	Western waters & Channel	828,194		
Manx shearwater						
	Migration seasons (Aug-early Oct and late Mar-May)					
	UK North Sea	8,507				
	Western waters & Channel	1,580,895				
Northern gannet						
	Autumn (Sept-Nov)		**Spring (Dec-Mar)**			
	UK North Sea & Channel	456,298	UK North Sea & Channel	248,385		
	Western waters	545,954	Western waters	661,888		
Great cormorant						
	Non-breeding season (Sept-Mar)					
	NW North Sea	6,012				
	SW North Sea & Channel	10,460				
	West of Scotland	7,049				
	SW England & Wales	9,602				
European shag						
	Non-breeding season (Sept-Jan)					
	NW North Sea	45,503				
	SW North Sea & Channel	4,346				
	West of Scotland	37,363				
	SW England & Wales	13,075				
Arctic skua						
	Autumn (Aug-Oct)		**Spring (Apr-May)**			
	North Sea & Channel	6,427	North Sea & Channel	1,227		
	Western waters	5,287	Western waters	5,111		
Great skua						
	Autumn (Aug-Oct)		**Winter (Nov-Feb)**		**Spring (Mar-Apr)**	
	North Sea & Channel	19,556	North Sea & Channel	143	North Sea & Channel	8,485
	Western waters	16,336	Western waters	1,398	Western waters	25,090

Lesser black-backed gull						
	Autumn (Aug-Oct)		**Winter (Nov-Feb)**		**Spring (Mar-Apr)**	
	North Sea & Channel	209,007	North Sea & Channel	39,314	North Sea & Channel	197,483
	Western waters	163,304	Western waters	41,159	Western waters	163,304
Herring gull						
	Non-breeding season (Sept-Feb)					
	North Sea & Channel	466,511				
	Western waters	173,299				
Great black-backed gull						
	Non-breeding season (Sept-Mar)					
	UK North Sea	91,399				
	West of Scotland	34,380				
	SW and Channel	17,742				
Black-legged kittiwake						
	Autumn (Aug-Dec)		**Spring (Jan-Apr)**			
	UK North Sea	829,937	UK North Sea	627,816		
	Western waters & Channel	911,586	Western waters & Channel	691,526		
Sandwich tern						
	Migration seasons (July-Sept & Mar-May)					
	North Sea & Channel	38,051				
	Western waters	10,761				
Roseate tern						
	Migration seasons (Aug-Sept & late Apr-May)					
	East coast & Channel	251				
	N & W Scotland	4				
	W England & Wales	2,100				
Common tern						
	Migration seasons (late July-early Sept & Apr-May)					
	North Sea & Channel	144,911				
	Western waters	64,659				
Arctic tern						
	Migration seasons (July-early Sept & late Apr-May)					
	North Sea & Channel	163,930				
	Western waters	71,398				
Little tern						
	Migration seasons (late July-early Sept & mid-Apr-May)					
	North Sea & Channel	3,524				
	Western waters	1,602				
Common guillemot						
	Non-breeding season (Aug-Feb)					
	North Sea & Channel	1,617,306				
	Western waters	1,139,220				
Razorbill						
	Migration seasons (Aug-Oct & Jan-Mar)		**Winter (Nov-Dec)**			
	North Sea & Channel	591,874	North Sea & Channel	218,622		
	Western waters	606,914	Western waters	341,422		
Black guillemot						
	Non-breeding season (September-March)					
	N within 20 km					
Atlantic puffin						
	Non-breeding season (mid-August-March)					
	North Sea & Channel	231,957				
	Western waters	304,557				

1. INTRODUCTION

1.1 Background to this project

The UK Statutory Nature Conservation Bodies (SNCBs) – the Joint Nature Conservation Committee (JNCC), Natural England (NE), Natural Resources Wales (NRW), Scottish Natural Heritage (SNH), the Department of the Environment, Northern Ireland (DOENI) and Marine Scotland (MS) – require agreed population estimates for seabird populations in the non-breeding season. With recent Crown Estate leasing rounds, there is now an unprecedented amount of marine renewables development proposed in UK waters, all of which has the potential to impact on seabird populations, to a greater or lesser degree.

Current impact assessments for marine renewables focus on potential impacts to seabirds during the breeding season when breeding birds are closely associated with their colonies, and where impacts can more easily be attributed to breeding populations (e.g. based on foraging ranges). However, there is a need to consider potential impacts to seabirds outwith the breeding season, for which there is current lack of agreement on population scale and non-breeding season population estimates. These are required in order that non-breeding season impacts can be assessed, against appropriate populations.

To address the impacts of marine renewables across each species' full annual cycle, we need to determine the origins and sizes of seabird populations during the non-breeding season, and agree how to combine assessment of non-breeding season impacts with breeding season ones. As a first step, we require population estimates, at an agreed scale, for key seabird species (those most likely to be affected by development) occurring in UK waters in the non-breeding season. These then need to be adjusted to take account of immature birds present since those can form a high proportion of the population in species with deferred maturity. These regionally defined populations are the appropriate ones to consider for Environmental Impact Assessment (EIA). For Habitats Regulation Assessment (HRA), it is then necessary to consider which Special Protection Areas (SPAs) contribute to each regionally defined population.

1.2 Overall Aim

The overall aim of the project is to review and define species-specific non-breeding season seabird populations at biologically defined minimum population scales (BDMPS) to enable the apportioning of potential impacts of marine renewable developments during the non-breeding season. Species included in this review are: red-throated diver, great northern diver, northern fulmar, Manx shearwater, northern gannet, great cormorant, European shag, Arctic skua, great skua, lesser black-backed gull, herring gull, great black-backed gull, black-legged kittiwake, Sandwich tern, roseate tern, common tern, Arctic tern, little tern, common guillemot, razorbill, black guillemot, and Atlantic puffin.

1.3 EIA and HRA non-breeding season assessments; project requirements

For EIA purposes, impacts need to be assessed against relevant regional populations, including not only birds from the UK but also birds from overseas populations that pass through UK waters on migration or winter in UK waters. This assessment can be at a range of spatial scales, from the biogeographic population downwards (biogeographic population scales have been well defined by JNCC and others – see for example Stroud et al. 2001; Kober et al. 2010, 2012; JNCC 2014). The largest spatial scale (the biogeographic population) is most easily defined in terms of seabird numbers and distribution, but would require cumulative assessment of all projects within the entire biogeographic population range which may be impractical. This report presents a smaller scale which is the biogeographic population with connectivity to UK waters. That population is the sum of numbers in the UK population plus each overseas population known to visit UK waters either to winter or during migration to winter quarters elsewhere. That population is therefore in most cases smaller than the biogeographic population since the latter may include populations of the species that do not ever visit UK waters so are not at risk from development within UK waters. However, in many cases, overseas populations are large yet only a very small fraction of the population visits UK waters. So assessing impacts against the biogeographic population with connectivity to UK waters might assess the impact against much larger numbers than are ever present in UK waters. So the next step may be to consider assessment against the total number of individuals of the species that are present in UK waters at a particular season (non-breeding season, autumn migration, winter etc). For each species this total number, and the contribution of birds from UK and from overseas, is presented as a reference value. However, for Habitats Regulations Assessment (HRA) and to make EIA more practical, it may be more appropriate to consider smaller spatial scales, hence the derivation of the BDMPS. In general, for many species there are two clear BDMPS in UK waters, one in the UK North Sea and one in UK western waters. The UK land mass separates these areas and does present a significant barrier to movement of seabirds so that for most species the birds in the North Sea mix very little with birds in UK western waters and vice versa. For some species there are also clear separations between populations in northern and southern parts of UK waters. For a few species, while the two BDMPS seem appropriate, there is limited movement of birds from specific colonies within a BDMPS, so that a smaller spatial scale than the BDMPS would be appropriate for assessment. In such cases a more appropriate Reference Area needs to be defined in relation to a proposed development, taking account of the limited mobility of birds from focal colonies within the BDMPS.

The smallest spatial scale makes identifying all relevant projects much simpler, but comes at a cost of less clearly defined seabird populations as the exact movements in time and space of each age class of each population are not well known for any seabird species. For EIA, it is therefore likely that the optimal compromise is to define regional populations at an intermediate spatial scale between biogeographic and local. HRA requires that impacts to the proportion of the population that are qualifying features at SPAs are considered. This includes assessing the potential impact of offshore projects on SPA population features throughout the whole year. Where evidence allows, impacts to non-breeding season populations should be linked to specific breeding colonies. Where this is not possible, potential impacts might need to be assessed against the overall UK SPA network population of the respective species.

This requires the definition of the wintering area of UK breeding populations and an understanding of the influx of birds breeding abroad but mixing with UK SPA breeding birds within UK waters during the non-breeding season. As our understanding of biogeographic populations is relatively advanced, and breeding and non-breeding range for those biogeographic population units are more or less defined, the biogeographic population, which includes UK breeding birds, might represent the largest reference unit to start with in the absence of more specific knowledge.

Based on population estimates of the overall biogeographic population (e.g. AEWA (2012)) and the UK population of a specific species within the SPA suite, the proportional contribution of the UK SPA birds to a biogeographic population can be derived. Assuming an equal mixing of birds from across the biogeographic breeding range during the non-breeding season, this allows apportioning of potential impacts on the overall UK SPA network, or even to individual SPAs.

Nonetheless, whenever evidence allows, the aim should be to define non-breeding season biologically relevant population scales (BDMPS) which are smaller than the biogeographic region. There could be a need to define different BDMPSs for different seasons. BDMPS may be appropriate for the entire non-breeding period for some species, or may need to be split into separate BDMPS for migration periods and for that part of winter when no migration occurs. The driver for all this is to generate a useful scale that allows us to determine what the impacts of an offshore project are on seabird populations and SPA populations. For this we need to be able to a) assign the birds that are predicted to be impacted by a project to a particular population and SPA; b) to calculate what proportion of the population and SPA population that number of birds represents.

With very few exceptions (such as penguins) seabird population sizes have never been counted. This is because, unlike penguins which moult communally with all age classes represented, most seabird species are never all in one place together. Data on seabird 'population' sizes are mainly presented in terms of numbers of breeding pairs, or in similar units (such as Apparently Occupied Territories) based on census work at colonies. However, these counts monitor only one part of the whole population (breeding adults). Seabird populations include not only these breeding pairs but also large numbers of sexually immature birds (because seabirds exhibit deferred maturity so immature birds can represent similar numbers to the breeding component), and in some cases some sexually mature non-breeding adults. Once the non-breeding season BDMPS is defined and the wintering population quantified, it is necessary to estimate the proportion of the population which do not contribute to the number of breeding pairs estimated at relevant breeding colonies. This will consist of large numbers of sexually immature sub-adults, and might in some cases also include sexually mature but non-breeding adults.

For the breeding season, the BDMPS is defined as the breeding population within foraging range from the project, plus non-breeders and immatures, which are likely to originate from a much wider range of colonies and may include young immature birds spending the summer in their wintering area as well as immatures loosely associated with local colonies. For the non-breeding season, the steps are as outlined above except for apportioning any impacts back to the SPA; separate BDMPS may need to be defined for the migration seasons as well as for the 'winter' period between migration seasons.

A literature review has been conducted to establish whether such proportions have been estimated for any of the priority species, and whether proportional estimates are appropriate to the BDMPS. Secondly, where such estimates have not been made, a review of demographic parameters has been undertaken to establish the most appropriate values to use for the BDMPS and indicate where data gaps exist, focussing on age at first breeding, productivity, and age/life stage-specific survival rates at suitable population scales. Thirdly, demographic parameters have been used to inform age-structured population models (e.g. Leslie matrices), to estimate a stable age distribution from which the proportion of breeding adults and of immature birds within the BDMPS can be estimated.

This report will soon become out of date. It will be necessary to update seabird population estimates and seabird movement patterns, to take account of new data and to take account of changes that are occurring as a consequence, for example, of changes in environmental conditions (such as distributions of fish stocks and fisheries management practices such as discarding). Furthermore, we will soon see new designations of Special Protection Areas for non-breeding seabirds. These new SPA designations are anticipated first to include inshore areas for non-breeding aggregations of divers, grebes and seaducks, and subsequently also marine areas for non-breeding offshore seabirds. Those designations have not been included in this report as the exact areas and species to be included remain uncertain at the present time.

2. METHODS

2.1 Breeding range and taxa

Information on the breeding range of the species, the number of sub-species that are recognised, and the breeding ranges of individual sub-species, was summarised from Forrester et al. (2007) and Brown and Grice (2005), with reference where necessary to Handbook of the Birds of the World (Hoyo et al. 1992-2011) and Birds of the Western Palearctic (Cramp et al. 1977-1994). Where sub-species are recognised, there is clearly scope to reduce the biogeographic population being considered to the relevant sub-species, and differences in the biometrics of different sub-species or populations within sub-species can also be informative about the origins of birds if their measurements can be obtained.

2.2 Non-breeding component of the population

Seabirds are generally long-lived animals which show deferred maturity. The species that are the focus of this project start to breed when, on average 2 (roseate tern) to 9 years old (northern fulmar). Therefore, a major part of the population will comprise immature birds. Seabirds are almost always censused in units of breeding pairs, so the population size based on breeding pairs provides only a partial census of the entire population. In this report the numbers of immature birds associated with breeding populations have been estimated by applying the simplest of Leslie matrix models to estimate the numbers of birds in each age class in a stable (equilibrium) model population (stable age distribution and immature survival rates adjusted to give a zero net rate of population change) with defined demographic parameters. Consistent as well as appropriate selection of demographic parameters is important. Therefore, for each species the age at first breeding and adult survival rate data presented by BTO Birdfacts (http://www.bto.org/about-birds/birdfacts accessed 11 March 2014) which presents the values considered to be most up to date and most appropriate for UK seabird populations were taken as the basis for modelling populations. This was done for consistency of approach and convenience, but with the caveat that BTO Birdfacts might not be the most appropriate source for all species and is only updated periodically. However, assessing all demographic data for all species would in itself represent a major project and was agreed to be outwith the scope of this project. Generally, most seabirds have been studied in enough detail to provide moderately precise measures of adult survival rate, although this can vary with colony size, food abundance and climate (Sandvik et al. 2012). Data on productivity (breeding success as chicks fledged per pair) were extracted as annual measures from each individual monitored colony from the JNCC seabird productivity monitoring database (http://jncc.defra.gov.uk/page-1550 accessed 11 March 2014) for the years 1986 to 2006 (the years for which data are presented in tables in annual reports). For the population model, data on age at first breeding, adult survival and mean productivity were used at face value. Data on juvenile or immature survival are not available for many seabird species, and those data reported in literature tend to be highly uncertain with very large confidence intervals and possible biases. So data on immature survival were used as a guide in constructing models, but survival rates input into the model were iteratively adjusted until the model produced approximate stability (a zero rate of population growth). This approach was considered to be precautionary in that an increasing population will tend to have a higher ratio of immatures to breeding adults than will be present in a stable population, whereas a declining population may or may not differ in ratio of immatures to adults depending on which age classes are exposed to elevated mortality rates that are causing the population decline. Adjustments of immature survival rates were made so that survival rates always increased with age up to the adult survival rate. Numbers in each age class were then used to estimate the ratio of immatures to breeding adults, making the (precautionary) assumption that no birds of breeding age took sabbatical years off breeding. In practice, it is known that in some seabird populations subject to extreme environmental stresses, some breeders will take sabbatical years, although for most species when conditions are normal or good, virtually all birds of breeding age do breed (Harris and Wanless 1995). The age composition of populations is, of course, strongly affected by the mean age at first breeding. The BTO Birdfacts web site does not indicate the published sources from which they obtained data on mean age of first breeding for each species. However, their presented values appear to match with the literature, except in the case of Atlantic puffin. For puffins, Harris and Wanless (2011) indicate a mean age of first breeding of 7 years old, whereas BTO Birdfacts cites a mean age of first breeding at 5 years old. Modelling the population using an age of first breeding of 5 years generates an estimated 0.82 immatures per breeding adult whereas for an age of first breeding of 7 years generates an estimated 1.08 immatures per breeding adult (making no changes to the productivity and adult survival rates used in the model). This is likely to be the largest uncertainty in the estimated ratio of immatures to adults, as the age of first breeding seems to be better known for most other seabirds.

Implications of altering adult survival rate for the ratio of immatures per adult are generally moderate (Figure 2.1), as are implications of altering age at first breeding (Figure 2.2) or productivity (Figure 2.3). The proportion of immatures tends to decrease with increasing adult survival rate, but tends to increase where age at first breeding increases, and tends to increase with productivity of the population.

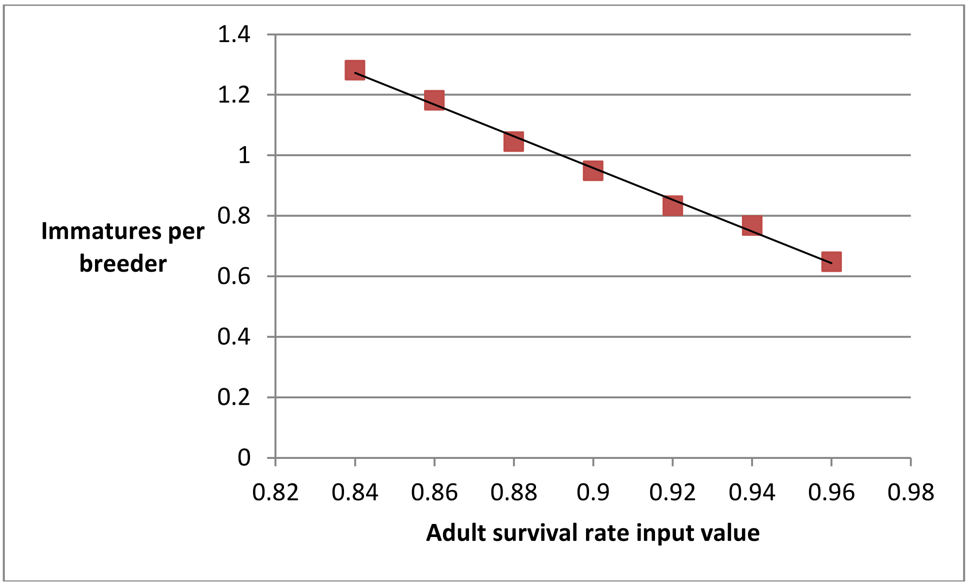

Figure 2.1. Model estimates of the numbers of immatures per breeder (ranging from 0.65 to 1.28) for a range of values of adult survival rate (from 0.84 to 0.96), values of productivity and age of first breeding being held constant at mean values.

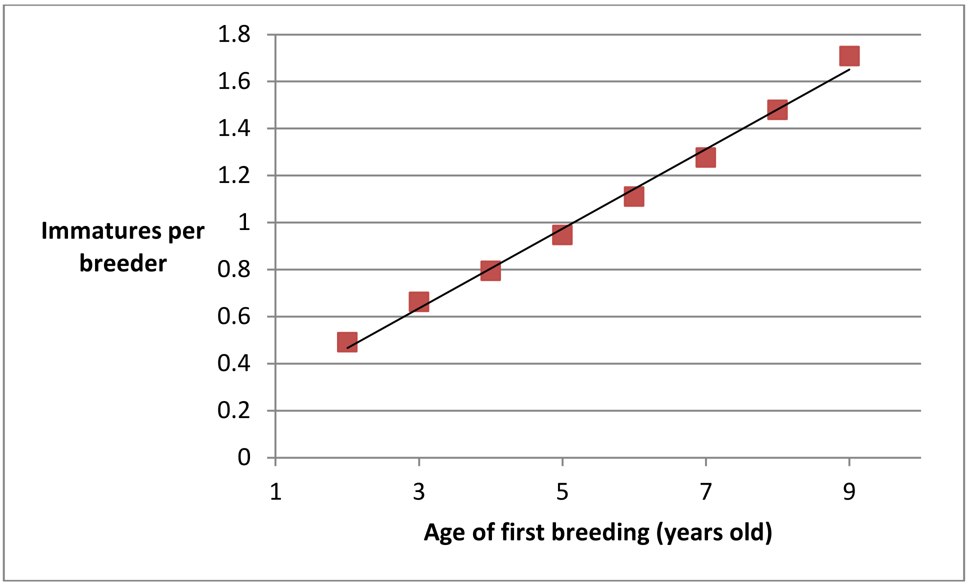

Figure 2.2. Model estimates of the numbers of immatures per breeder (ranging from 0.49 to 1.71) for a range of values of age of first breeding (from 2 to 9 years old), values of productivity and adult survival being held constant at mean values.

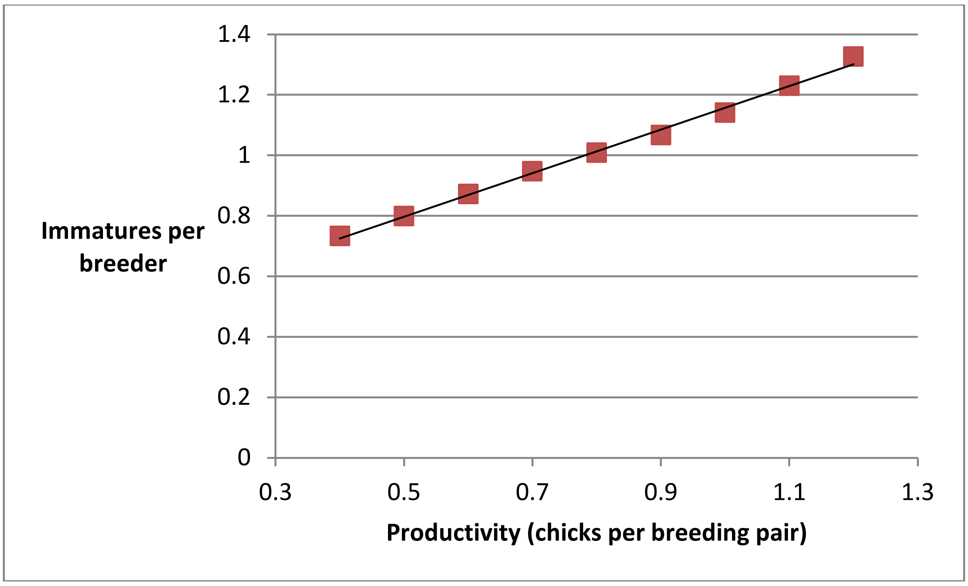

Figure 2.3. Model estimates of the numbers of immatures per breeder (ranging from 0.73 to 1.32) for a range of values of productivity (from 0.4 to 1.2 chicks per pair), values of age of first breeding and adult survival being held constant at mean values. Note that in all of these analyses, the ratio of immatures to breeders is close to 1, meaning that under a range of plausible demographic values seabird populations contain a similar total number of immature birds to the total number of breeding adults.

Age of first breeding, adult survival rate and productivity data input into the Leslie Matrix model are summarised below, together with the derived estimate of the number of immatures per breeding adult in a typical population of each species.

Species	**Age of first breeding (years)**	**Adult survival rate**	**Mean productivity**	**Estimated immatures per breeding adult in population**
Red-throated diver	3	0.84	0.635	0.74
Great northern diver	6	0.9	0.635	1.1
Northern fulmar	9	0.972	0.424	0.62
Manx shearwater	5	0.905	0.591	0.84
Northern gannet	5	0.92	0.684	0.81
Great cormorant	3	0.88	1.913	1.17
European shag	4	0.878	1.289	1.31
Arctic skua	4	0.886	0.522	0.71
Great skua	7	0.888	0.664	1.42
Lesser black-backed gull	4	0.913	0.517	0.68
Herring gull	4	0.88	0.936	1.09
Great black-backed gull	4	0.88	1.139	1.26
Black-legged kittiwake	4	0.882	0.672	0.88
Sandwich tern	3	0.898	0.656	0.63
Roseate tern	2	0.855	1.293	0.75
Common tern	3	0.9	0.721	0.67
Arctic tern	4	0.9	0.402	0.58
Little tern	3	0.899	0.521	0.56
Common guillemot	5	0.946	0.678	0.74
Razorbill	4	0.9	0.633	0.75
Black guillemot	4	0.87	1.295	1.32
Atlantic puffin	7	0.93	0.67	1.04

Although modelling shows that the ratio of immatures per adult is relatively robust to errors in demographic parameter estimates, it would be useful to be able to validate these ratios. Data on the proportions of different age classes of seabirds at sea might seem to be one way to try to do this. However, very few seabird species can be identified to age classes with confidence. For example, ageing of auks at sea is almost impossible. Kittiwakes can be identified as juvenile/first year or 'adult' based on plumage, but the 'adult' category will include many immatures as well as birds of breeding age. Large gulls can be more securely aged based on plumage, but there is considerable overlap in plumages between age classes and older immatures are not easy to separate from adults in the field so that survey fieldwork that is not specifically aimed at determining numbers of each age class is likely to mis-classify many individuals. Gannets have a sequence of plumages that allow fairly detailed classification of birds into ages, but again the older immatures can be mistaken for adults if not examined in detail. Moreover, the at sea distribution of seabirds differs between age classes, with youngest birds tending to spend their time in the winter quarters even during summer, breeding adults tending to stay closest to their breeding area, and immature birds probably at sea in areas that have good food supplies but are away from large colonies. So it is not clear that any at sea data on proportions of different age classes would provide a secure test of the estimated proportions based on demographic data.

2.3 Phenology

Information on the timing of seabird breeding seasons (initial arrival back at the colony in spring, modal return to colony in spring, modal departure from colony at the end of the breeding season, and final departure from the colony) was extracted from Forrester et al. (2007) and Pennington et al. (2004). In addition, data on modal arrival at colonies in spring, and modal departure from colonies in autumn were extracted from Orkney Bird Reports for 2008, 2009, 2011 and 2012, Shetland Bird Reports for 2008 to 2012, and Fair Isle Bird Observatory Reports for 2007 to 2012. These data were collated in an Excel spreadsheet and then used to describe the timing of seabird breeding seasons. Data on timing of seabird migrations were obtained from several sources. Timings for autumn and spring migrations (beginning/peak/end), were extracted from Cramp et al. (1977-1994), Wernham et al. (2002), Pennington et al. (2004), Brown and Grice (2005), Forrester et al. (2007) and Vanermen et al. (2013). The earliest spring sighting of the species, peak of spring migration, peak of autumn migration, and the last reported sighting of the autumn were extracted from Orkney Bird Reports for 2008, 2009, 2011 and 2012, Shetland Bird Reports for 2008 to 2012, Fair Isle Bird Observatory Reports for 2007 to 2012, Argyll Bird Reports for 2008 to 2012, and the Gibraltar migration watch website www.gonhs.org. In addition, data for each seabird species on the mean numbers per hour observed at UK migration sites for each week of the year (averaged over all years for which data were collected) were extracted from the Trektellen migration web site www.trektellen.nl. The Trektellen data were used to plot histograms describing the seasonality of observations at migration sites (most of which are located in E or SE England), to infer the timings of spring and autumn migrations. As with timing of breeding, extracted data on timing of migrations were entered into an Excel spreadsheet and these data were then used to describe phenology in individual species accounts. The timing of breeding seasons defined within this report is evidence-based from the literature, but does not replace SNCB guidance documents on seabird breeding seasons. Where SNCB guidance differs from the seasons presented in this report, the definitions of seabird breeding and non-breeding periods in assessments needs to be agreed with SNCBs in advance of assessments being made.

Accounts of phenology in Cramp et al. (1977-1994) differ somewhat from those in Wernham et al. (2002), Pennington et al. (2004), and Forrester et al. (2007), in that Cramp et al. consider the timings of migrations throughout the species' range and not specifically in UK waters. For that reason, less attention was given to details in Cramp et al. (1977-1994) except where this either did, or did not, match up with data in the other sources. Data on phenology in Wernham et al. (2002) were sometimes equivocal, as it was not always evident whether text was describing seabird phenology or the phenology of ring recoveries from seabirds; phenology indicated by the timing of ring recoveries is likely to be biased by the fact that recoveries may occur some days, or even weeks, after the death of the bird rather than at the exact time of death. For this reason, more weight was given to the phenology data in Pennington et al. (2004), Brown and Grice (2005), and Forrester et al. (2007). Data in Bird Reports provide accurate and detailed information on the first arrival dates of spring migrants, and fairly detailed and accurate data on the last sightings of the year of departing autumn migrants, but provide less information on modal migration dates. Data from Pennington et al. (2004) were compared with data from Forrester et al. (2007) and Brown and Grice (2005) to see whether there was a detectable progressive difference in timing between the north and south of the UK. Data from Gibraltar and Belgian migration studies reported in www.gonhs.org and Vanermen et al. (2013) were used as context, specifically to test whether there were clear differences in phenology between the UK, and regions south of the UK. For almost all species, differences in timing between years (Frederiksen et al. 2004, 2013), and differences reported by different authorities were as great as, or greater than, any slight differences in timing between latitudes within the UK, so to avoid excessive complexity, summaries of phenology were derived for all UK waters rather than for separate regions.

2.4 Defined seasons

Seasons were defined for each species as 'breeding season' and 'non-breeding season' in the context of UK breeding. Breeding season was defined as the period from modal return to the colony through to modal departure from the colony at the end of breeding, for birds at UK colonies. Breeding season was defined as the period between modal return of breeding adults to colonies in 'spring' to modal departure from colonies at the end of the breeding season. Modal date is roughly equivalent to mean or median date, but is used here for pragmatic reasons – mean or median dates are difficult to measure and are rarely reported in the literature, whereas modal date is frequently reported. Use of first or last dates was avoided since extreme cases can be very misleading and atypical, and tend to vary with sample size. Non-breeding season was defined as the remaining part of the year.

Post-breeding (autumn) dispersal/migration, and pre-breeding (spring) migration periods were also defined, based on the periods during which substantial migration of the species occurs through UK waters. Therefore, the migration periods may overlap with the UK breeding season and with the non-breeding season, since timing of migrations of birds from high latitude regions can differ from that of UK birds. Wherever possible, seasons were defined as a set of months rather than in any more precise terms. This reflects the fact that for many seabird species phenology can vary by several weeks from year to year, so that greater precision is inappropriate. It also acknowledges the fact that survey work is normally carried out by calendar month, so that splitting survey data by periods shorter than one month can be inconvenient and technically difficult. However, for some species, especially long distance migrants such as terns, phenology is highly predictable and occurs within a narrow window. In such cases subdivision into fractions of months is appropriate, and has been done where necessary.

Spring migration for each species was defined as the months during which migratory movements of the species through UK waters towards breeding colonies (whether UK colonies or colonies of overseas populations) was clearly evident. Thus, spring migration may overlap with either or both of the non-breeding season and breeding season. Autumn dispersal/migration for each species was defined as the months during which migratory movements of the species through UK waters away from breeding colonies (whether UK colonies or colonies of overseas populations) was clearly evident. Thus, autumn dispersal/migration may overlap with either or both of the non-breeding season and breeding season. Rationale for choice of months to define in each season is presented in the text for each individual species account, and each species' account is based on the extracted bird report phenology data tabulated in Excel, in addition to the broad literature review.

2.5 Movements of birds from the UK population through UK waters and from overseas populations into or through UK waters

A number of approaches can provide data on seabird migrations, including seawatching from coastal sites, recoveries of ringed birds, deployment of geolocators or other tracking devices, interpretation of biometrics, genetics, stable isotopes and other markers. The utility of these methods is outlined below.

2.5.1 Seawatching

Data from seawatching sites provides information on phenology of movements, but relatively little information on where birds come from or are going to. However, combined with other methods, seawatching data can provide supporting evidence of the seasonal movements of seabirds. The Trektellen web site www.trektellen.nl provides data on rates of movement of seabirds past UK (and other European) migration sites. Seawatching data are also used by Forrester et al. (2007) to assess numbers of seabirds migrating through Scottish waters. Seawatching data do not necessarily provide a good measure of numbers of birds as the counts one day may, or may not, involve the same individuals seen on a previous day. This can give a misleading impression. In general, numbers recorded on spring migration tend to be smaller than on autumn migration. While there will be smaller numbers migrating through UK waters in spring (in part because there will be many juveniles in the autumn passage but few in the spring return passage because most remain in winter quarters for their first summer and some do not survive the winter), another likely explanation of this is that migration in autumn can be a slow process with birds stopping off to feed at suitable sites on their way through UK waters, whereas in spring the adults migrate rapidly back to their breeding site because there is potentially competition for nest sites and a bird arriving back late may miss out. As a result, counts in autumn on any one day may be larger than in spring because birds remain on autumn passage for days or weeks, compared to the rapid flight through in spring. Tracking studies provide some support for this impression of more leisurely migration progress in autumn than in spring, but do not yet provide an accurate quantification of this difference.

2.5.2 Ringing data

Much of our understanding of seabird migrations is based on recoveries of ringed (and in some cases colour marked) seabirds. Ring recovery data were summarised for each bird species occurring in the UK by Wernham et al. (2002). A migration atlas has also been published for the Faroes (Hammer et al. 2013). Numerous papers have been published describing details of the seasonal movements of particular species of seabirds. Ring recovery data have many potential biases. Ringed birds are very unlikely to be recovered in the open ocean. Dead seabirds can be carried large distances by currents and can be deposited onto beaches far from where they died. Reporting probability can be high in countries (such as Greenland) where many seabirds are hunted for food. Recoveries of seabirds may be associated with fisheries bycatch or oil pollution incidents. Large numbers of seabirds may be ringed at a few colonies but none at other colonies (for example, most gannet ringing has been done on the Bass Rock, and for obvious reasons none or very few have been ringed at most of the gannet colonies where safe access to nests is impractical). Large numbers may be ringed in some countries but not in others. Interpretation of the migration routes and wintering areas of seabirds has to be done with great caution, trying to take account of these potential biases in data. Fortunately, these biases are well recognised and can mostly be taken into account, although the magnitude of the bias may not be easy to assess in some cases, especially in relation to the more pelagic seabird species. Ring recovery data have been used as key information in this project to assess movement patterns of UK seabirds and to assess origins of seabirds that winter in, or migrate through UK waters. The Migration Atlas (Wernham et al. 2002) has been used as the most important source of information on this topic for most species of seabird, supplemented by more recent publications on seabird migration (which are predominantly single-species studies). Other especially useful accounts providing coverage of most species of seabirds include the Faroese Migration Atlas (Hammer et al. 2013), and species accounts in the book on seabirds in the Barents Sea (Anker-Nilssen et al. 2000).

2.5.3 Geolocation data loggers and other tracking devices

In recent years, new technologies have become available that can be used to study seabird migrations and wintering areas. In particular, several studies have deployed geolocation data loggers on breeding seabirds at various colonies. Geolocation data loggers are very small devices that can be attached to a leg ring on a breeding seabird of moderate size. About a year later, if the bird can be recaptured, the logger can be removed and data downloaded for analysis. These loggers record light intensity, and usually also temperature, on a time base. In principle, analysis of location from these data is simple. In the northern hemisphere, daylength is longer further north in summer, shorter further north in winter. At any given latitude, sunrise occurs earlier further east. Using light intensity data recorded in the logger, the location of a bird can be estimated twice each day from the light data (Phillips et al. 2004). In some situations, temperature data can help with estimating location (Teo et al. 2004) since the temperature recorded will be sea surface temperature when the bird is sitting on the water (which many seabirds always do at night when away from the colony). Location estimates are imprecise. The average error is around 180 km (Phillips et al. 2004, Teo et al. 2004). But this is adequate to establish the general area in which the bird is present. Geolocation does not work at the equinoxes, but this results in the loss of only a few weeks of data at those times of year (although those periods may well be during active migration by many species). Logger data can also be used to infer behaviour of birds, especially amounts of time spent flying, and spent sitting on the water (Mackley et al. 2010).

2.5.4 Biometrics

Many seabirds show variation in biometrics between populations. In many cases birds breeding further north tend to be larger in size. Biometrics can be used to infer origins of those seabirds that show clear and known variation in measurements between populations. This has been used very successfully for great northern divers, and to some extent for auks. There are probably several species of seabird where biometrics could be informative but there has not yet been an assessment of the use of this approach. There are, however, some seabirds where biometric variation between populations appears to be too small to be useful. There are also difficulties created by post-mortem shrinkage (e.g. Harris 1980), and variability in measurements recorded by different researchers, some, but not all, of which are due to differences in measurement technique (Barrett et al. 1989).

2.5.5 Genetics

There are a few phenotypic features of seabirds that show clinal variation with latitude, and so have potential to provide information on the breeding season origins of birds sampled in winter. While most Arctic skuas at lowest latitude breeding areas are dark phase birds, the proportion of light phase increases northwards and reaches 100% on Arctic tundra. The proportion of dark phase fulmars increases with latitude in the North Atlantic. The proportion of 'bridled' common guillemots increases with latitude. Herring gulls from high latitude colonies tend to have more white on the tips of the outer primaries than seen on birds from low latitude colonies, and also have darker grey mantle plumage. A number of studies have investigated whether molecular genetic markers, such as mtDNA, can be used to identify breeding colony or regional origins of seabirds sampled outside the breeding season, but these studies have not generally been very successful in identifying specific genetic markers that can be used in this way. However, it seems likely that some suitable genetic markers might be identified in future.

2.5.6 Stable isotopes and other natural markers and pollutant markers

Stable isotopes of carbon and nitrogen can be measured in feather samples. These ratios tend to reflect diet at the time of feather growth, which for juvenile seabirds is at the breeding site, whereas for most species of seabirds the moult of adults occurs in the wintering area, though there are certain exceptions (Cherel et al. 2006). Leat et al. (2013) recently showed that the carbon isotope ratio in feathers of great skuas sampled at breeding colonies is indicative of whether individual breeding adults overwintered off west Africa, or off southern Europe, or off North America. That study also identified characteristic differences in the proportions of different persistent organic pollutants in birds, reflecting which of these three regions the individual used as its wintering area. Similar differences have been seen in feathers of gannets and lesser black-backed gulls that could be used to identify which individual birds had spent the winter off west Africa and which had wintered in European waters (the difference in carbon isotope being determined by the upwelling oceanography off west Africa which creates a distinct carbon isotopic signature in the food web that is clearly different from that found in European shelf seas). The use of isotopes, pollutants and other markers (such as heavy metals in feathers) as tracers of the origins of individual seabirds almost certainly has the potential to be developed in future, but has not yet been investigated in enough detail to be used to assess existing data except in a very few cases.

2.6 Numbers in UK waters

At sea surveys include the European Seabirds at Sea (ESAS) database which holds information on numbers of seabirds at sea counted using standardized methodology (Tasker et al. 1987). These data can be used to estimate seabird densities at sea in different months and locations and hence can provide evidence of seasonal changes in distribution (Tasker et al. 1985). ESAS data primarily relate to the North Sea and data are predominantly from the 1980s with fewer surveys in recent years, but ESAS methods have also been used in marine areas west and south of the UK and to some extent in years from the 1990s to the present. The ESAS data have been used to identify areas that may qualify as Special Protection Areas for seabirds on the basis of high densities of key species at particular times of year (Kober et al. 2010, 2012). However, Kober et al. (2010) were cautious about interpreting the absolute magnitude of density estimates from the ESAS data and chose to make corrections to absolute numbers of some species in order to make them match to ICES published data on numbers of seabirds in European waters. Some of the ‘rescaling’ factors quoted by Kober et al. (2010) were large. The accuracy of these ‘rescaling’ factors is rather uncertain, but suggests that the ESAS data provide only indications of relative abundance in different areas rather than meaningful measures of absolute abundance of seabirds at sea. WWT Consulting (2013) combined the ESAS data together with WWT aerial survey data to describe seabird distributions within English territorial waters. That exercise makes use of more recent survey data and allows aerial survey data to be included as well as boat-based survey data. That work also indicated significant discrepancies between data sets from aerial and from boat-based surveys (WWT Consulting 2013). However, the data were adequate to map seabird relative density across large areas of UK waters, and the methodology has recently been presented in Bradbury et al. (2014), and this represents the best available dataset for assessment of seabird distribution and relative abundance in UK waters during the non-breeding season. However, recognising the uncertainty about absolute numbers estimated from ESAS data and the somewhat out of date nature of that database, in this report, estimates of seabird density and distribution from ESAS and publications based on that database have been used primarily to provide a sense check on numbers considered to be in UK waters based on knowledge of population sizes and migration behaviour, rather than as a tool to define BDMPS totals.

2.7 Biogeographic populations

Starting from the Biogeographic population defined by Stroud et al. (2001) each species specific appropriate Biogeographic population was refined by considering only those populations with connectivity to UK waters at some time of year based on ringing and tracking data and the most recently available data on population sizes in the relevant countries (the latter primarily from Mitchell et al. 2004 but taking account of more recent publications where available – see individual species accounts for details). Estimates of breeding numbers in the UK were taken from Mitchell et al. (2004) as the most recent comprehensive surveys of most species, updated if possible by more recent survey data (such as national gannet surveys, skua surveys in Orkney), and data presented by SNH (Foster and Marrs 2012) or JNCC online seabird database. Amongst other sources, numbers were taken from the review by Lewis et al. (2012) but these data need to be treated with caution as SNH have found that numbers in that report are sometimes based on incorrect boundaries and population estimates. Numbers can be expressed in terms of the normal census unit (breeding pairs or equivalent such as (Apparently Occupied Territories (AOTs) or Apparently Occupied Nests (AONs)), or as the total population including numbers of immatures associated with a breeding population of the estimated size (based on the ratio of immatures to breeding adults estimated from the simple population model).

For those species where possible, data from the JNCC seabird population monitoring database were used to graph the breeding population trend from 1986 to 2012 in monitored UK colonies. As default, a linear trend line was fitted to these data, but where a non-linear trend provided a significantly better fit to the empirical data, a non-linear trend is presented, with the equation of the trend line and the amount of variance explained by the trend also presented on the graph. These trend lines have not been used to adjust count data for individual populations to bring it up to date, although such extrapolations would be possible if felt desirable in specific cases. The objective of presenting trends (which are shown for regions of the UK when the data allow and trends show different patterns in different regions) is to provide context that may be useful in the interpretation of BDMPS data and the understanding of how UK seabird populations may be changing in breeding numbers.

2.8 Proportion of UK population from UK breeding SPAs

The proportion of the UK population of each species that represents birds from UK SPAs with that species as a feature (including all those listed in JNCC 2014) was estimated by reviewing literature to obtain the most up to date available count of breeding numbers of each species at each SPA. JNCC (2014) provides an estimate of the proportion of the breeding population that is in SPA breeding sites, focused on the time period around 2000-2005 (since many colonies, especially non-SPA colonies, have not been counted since Seabird2000). However, for many SPAs, data are available for years since 2005. In many cases, the most up to date data were found on the JNCC Seabird Colony Monitoring web site database http://jncc.defra.gov.uk/smp/. Where there was evidently more recent data available for a site but those data were not entered into the SCM database, requests were made to access those data. For example, red-throated diver breeding numbers are not included in the SCM database but the SNH Sitelink web page indicated that Site Condition Monitoring data existed for some sites that were not available in published literature, and these were obtained from SNH staff. David Stroud at JNCC kindly provided access to the forthcoming JNCC SPA 2014 review to check that most recent survey data presented in this report match those used in the JNCC SPA 2014 review (JNCC 2014). That review also provides an estimate of the proportion of birds breeding in UK SPAs during the period around 2005. Where there have been no recent surveys of seabird numbers at particular SPAs, national, or where available regional, breeding population trends were obtained from the JNCC Seabird Numbers and Productivity database http://jncc.defra.gov.uk/page-1550. These trend data could be used to extrapolate numbers from the historical data to the present based on the estimated population trend at regularly monitored colonies; this approach could be used for individual SPA sites where recent count data are not available, and could be used for national/regional numbers. There are potential difficulties using data from a subset of sites to extrapolate either for individual SPA sites or regional population size, since the set of monitored sites may not be representative of an individual site or of the entire population. This approach may only be required for a small number of cases, as many populations have been surveyed regularly so up to date data are available. For example, almost all tern colonies are monitored annually. In a very few cases (for example for great skua), trend data were not available from the JNCC monitoring programme. In such cases a trend could be estimated from available data from other SPA populations of that species. Where relevant, such issues are detailed in individual species accounts. However, to provide transparency in this report, the most recent counts are used for each population (and are listed in detail) so that subsequent work could make use of these counts (updating them or applying trend data to refine estimates as felt appropriate). However, in this report the use of trend data to correct population estimates has generally been avoided because it is often uncertain which trend would be appropriate to use, and there is evidence that trends at individual colonies often do not follow national or regional trends. So applying corrections to update old survey data is tempting, but the temptation has been resisted in order to present best available data rather than adjusted data.

Therefore, numbers presented in Appendix A Tables 1 to 69 are the most recent available counts for each colony or national population. The key exception to this rule is the estimate of numbers of pairs at non-SPA colonies in the UK where census data are generally not available since Seabird2000. In that case, for a few species where large changes in numbers are known to have occurred, the total in non-SPA colonies has been estimated to a value that approximately retains the proportion breeding in SPA populations at the value defined by the JNCC 2014 SPA review (JNCC 2014), and is consistent with the national or regional trend in breeding numbers reported by Foster and Marrs (2012) and the JNCC Seabird Monitoring Programme. Where this correction has been applied it is clearly indicated as a footnote to the tables in Appendix A.

Adjustment of old SPA count data allowing for trends would alter the estimated BDMPS slightly, but in practice there are few seabird SPA populations in the UK that have not been counted since Seabird2000, and trend adjustment would make only rather small differences to BDMPS totals relative to the influence of other factors such as estimation of the proportions of overseas populations entering UK waters or the sizes of overseas populations. There may be a case for employing trend adjustments of old count data where HRA is assessing impacts on specific SPA populations where data are old, but for EIA and for HRA where the colony is not the focal colony in an assessment, correction of old data is probably undesirable in most cases.

2.9 Appropriate BDMPS populations

Where the proportion of each population that occurs in UK waters is known, the Biogeographic population estimate can be narrowed to the numbers occurring within defined UK waters, creating Biologically Defined Minimum Population Sizes (BDMPS). The BDMPS spatial area is from the UK coast to the edge of UK territorial waters, bounded by defined lines running from selected points on the coast to the UK waters limit. The justification for having more than one BDMPS in UK waters is that there may be good evidence that the overall number of birds or the population origins of a particular species differ between areas. In that case estimating the impact that might be attributed to a particular SPA population whose birds occur within a development area depends upon identifying and using in apportionment the estimate of the appropriate number of birds which may be represented at a particular time of year in that sea area. Using different figures in different parts of UK waters is justified only if the overall suite of birds passing through the area is known to be different to that in another area. Thus, for example, red-throated divers in the southwestern

North Sea originate predominantly from continental European populations with only a small minority of birds from UK populations, whereas red-throated divers in the northwestern North Sea originate predominantly from UK populations, with only a minority of birds coming from overseas populations. These areas are therefore more appropriately considered as separate BDMPS.

Where the BDMPS is over an inconveniently large area, and especially where it is known that birds from specific colonies tend to remain within only a part of the BDMPS, it may be possible to define geographical reference regions that are convenient but not necessarily distinct in terms of the biogeographic populations present. That approach may be necessary for a few species, where populations are not very mobile but are distributed in overlapping areas across a much larger spatial scale. An example of this is common guillemot, where there are numerous SPA populations distributed from northern Shetland to the southern North Sea in a continuum, yet birds from particular SPA colonies are not distributed over the whole region but tend to remain nearer to their colony. It is therefore difficult to establish BDMPS boundaries within the whole region, but an assessment of impact needs to consider the localised movements of birds from particular colonies. In these cases, it may be necessary for HRA assessment to consider only the part of the BDMPS which would have connectivity with any particular development site rather than the entire BDMPS (so defining a specific ‘reference region’ that would be project-specific). The proportions of birds of a particular species present in each BDMPS or reference region can be estimated from information in the literature on seabird numbers and distribution, and from the evidence on the migrations of birds from defined populations. The allocation of numbers of seabirds from overseas populations migrating through, or wintering in different regions is rather uncertain for most seabird species, and in almost all species is much less well known than for UK populations. In a few cases, there are clear distribution patterns and well defined numbers of birds, but in most cases the numbers in different regions are not well defined, and movement patterns of immature birds are not known except in a very general way. This represents a major constraint on assessing the proportions of birds in UK waters from different overseas populations. Although numbers are often uncertain, calculations need to be made using best available data and explicit assumptions. Therefore the computations involved in establishing BDMPS totals are presented in Appendix A Tables 1 to 69. It is assumed that these working tables can be updated as new information becomes available to make estimates of BDMPS and the contributions of individual SPA populations to these BDMPS more up to date and more accurate. It has to be recognised however, that while numbers can be added together to achieve a total for the BDMPS, there is much uncertainty about the values being summed, and that the resulting BDMPS has a large, but also uncertain, confidence interval. For this reason, BDMPS estimates in the report are colour coded green, amber or red, according to the uncertainty, with a narrative explanation of the colour coding given below the summary table at the start of each species account. For estimates that are coded green, the numbers are likely to be no more than 30% less or 50% more than the estimate presented. For estimates that are coded amber the numbers are likely to be no more than 50% less or 80% more than the estimate presented. For estimates coded red the numbers might be more than 50% less or 80% more than the estimate presented. While these ranges are expert judgement based on the literature reviewed in this project, it is impossible to measure the uncertainty and so no confidence limits can be quantified. Therefore, the colour coding itself can only be considered indicative based on available knowledge, and should not be used to estimate confidence limits for BDMPS population estimates.

For some seabirds, such as Arctic skuas, terns and Manx shearwaters, there is no need to derive winter BDMPS on the grounds that to all intents and purposes these species are absent from UK waters at that time of year.

2.10 Proportions of birds from UK SPA populations in each BDMPS

Using the best available data of numbers of birds in UK SPA populations and taking account of associated numbers of immature birds, numbers in non-SPA colonies and numbers from overseas populations, once the size of a BDMPS population has been estimated, it is possible to estimate the proportion of those birds in the BDMPS originating from each individual UK SPA population, as required for HRA. This estimate will be very imprecise where details of population sizes or migratory movements are not well known, which unfortunately is the case for many seabird species.

2.11 Spatial distribution of UK breeding SPA birds across the BDMPS

For most seabirds, SPAs have been selected to give a good geographical representation of the species' protected breeding sites within the UK, so that the distribution of SPAs reflects the distribution of the population as a whole. This is particularly the case where the SPA populations sum to a high proportion of the total population. For relatively few seabird species, the distribution of SPA populations may not closely reflect the overall distribution pattern. Where this might be the case the distribution of SPA populations is assessed in relation to the overall distribution of the breeding population.

2.12 Presentation of BDMPS data in this report

Each of the species accounts that follows in this report starts with presentation of summary data outlining:

a) The biogeographic population with connectivity to UK waters (total number of birds including adults and immatures) and the contribution from UK and from overseas populations;
b) The number of birds (adults and immatures) in the whole of UK territorial waters within each distinct seasonal period relevant for that species and the contribution from UK and from overseas populations;
c) The number of birds (adults and immatures) in each separate BDMPS defined for that species in each distinct seasonal period relevant for that species and the contribution from UK and from overseas populations.

This hierarchical approach provides the opportunity to consider the relevant population scale for EIA, from biogeographic to BDMPS. It seems likely that the BDMPS population would be the most appropriate scale for use in EIA assessment in most cases, though the greater confidence in numbers at higher levels in the hierarchy could provide grounds for considering use of a higher level population scale in some cases.

Each of these totals is colour coded using the traffic light system, with reasons for the colour coding outlined in text below the summary table. For estimates that are coded green, the numbers are likely to be no more than 30% less or 50% more than the estimate presented. For estimates that are coded amber the numbers are likely to be no more than 50% less or 80% more than the estimate presented. For estimates coded red the numbers might be more than 50% less or 80% more than the estimate presented. The data on which these totals are based is presented in detailed tables (Appendix A Tables 1 to 69) which give the most recent count of each SPA population size, non-SPA population or overseas population (breeding pairs) on which the BDMPS numbers are based, the computed total number of adults, the corresponding total number of immatures, and the proportion of each population estimated to be present in each BDMPS and the resulting total number of individuals (adults, immatures and all ages). These data tables are likely to be used in assessments apportioning impacts of developments on particular populations for EIA and especially for HRA assessments. The data could be updated in each table as new data become available, and updates could include not only updating of population counts but also updating of proportions present in the BDMPS as new information on migrations becomes available.

Numbers in the BDMPS population estimate are given to the nearest individual bird because those totals are the sum of calculations presented in Appendix A Tables 1 to 69. However, the presentation of those totals to the nearest bird does not indicate high accuracy and comments on uncertainty in the BDMPS estimates should be considered with care.

3. RED-THROATED DIVER *Gavia stellata*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in winter (December-January) (adults and immatures)	Numbers in UK waters in migration seasons (September-November and February-April) (adults and immatures)
Overseas	**22,600**	**12,079**	**13,375**
UK	**4,400**	**3,292**	**4,275**
Total	**27,000**	**15,371**	**17,650**

Winter BDMPS (December-January)	**Total number of birds in BDMPS (adults plus immatures)**	**Number from overseas populations (adults plus immatures)**	**Number from UK population (adults plus immatures)**
NW North Sea	1,523	365	1,158
West of Scotland	861	195	666
SW North Sea	10,177	9,398	779
NW England & Wales	1,657	1,271	386
SW England & Channel	1,153	850	303
Migration BDMPS (September-November and February-April)			
UK North Sea	13,277	10,623	2,654
UK Western waters plus Channel	4,373	2,752	1,621

Colour coding is green for UK numbers and totals because UK breeding numbers have been counted several times in recent decades and are considered to be well known and moderately stable, while wintering numbers off UK coasts have also been surveyed and because red-throated divers tend to occur relatively close to shore their numbers are easier to survey at sea than for species dispersed over larger areas. Numbers from overseas populations are less certain (classified amber except for SW North Sea) but since totals at sea are moderately well known and breeding numbers are well known, numbers from overseas can be assessed against those numbers. Numbers from overseas in the SW North

Sea are thought to be rather well known based on surveys of coastal waters in the southern North Sea which indicate large totals in a region where relatively few UK adults overwinter, and so it can be inferred (supported by ring recovery data) that those birds are predominantly from the Fennoscandian population.

Colour coding is amber for migration numbers, as the numbers and distribution during migration are less well known than for mid-winter, and the migration routes used are only broadly known from the relatively limited ring recovery data for this species. However, colour coding is amber rather than red because population sizes and breeding distributions are well known and largely stable, and the available evidence indicates consistent numbers and migrations from year to year with evidence for birds consistently returning to the same sites by the same routes in successive years, but for immature birds to migrate further south than adults.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 1 to 7.

3.1 Breeding range and taxa

This circumpolar species is monotypic, with Scotland at the southern edge of its breeding range. There appears to be little information about use of biometrics to identify origins of individuals.

3.2 Non-breeding component of the population

Red-throated divers start to breed when 3 years old (BTO Birdfacts). Adult survival rate is 0.84 (BTO Birdfacts), juvenile survival estimated at 0.61 (BTO Birdfacts) and mean productivity is 0.635 chicks per pair (JNCC database, n=136 measurements). To obtain a stable population, survival of immatures was adjusted to 0.72 for juveniles, 0.84 for older age classes. The model population comprised 60% adults, 19% juveniles, 11% 1-year olds, and 10% 2-year olds. There are 0.74 immatures per adult.

3.3 Phenology

Red-throated diver breeding season ends by September-October (Forrester et al. 2007), or the end of September (Pennington et al. 2004), but most birds have left their breeding sites by August-September (Forrester et al. 2007) or mid-August (Pennington et al. 2004). Autumn migration starts in August (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007) or mid-August (Cramp et al. 1977-94). Peak autumn migration occurs in September in Shetland (Pennington et al. 2004), September-October in the UK (Wernham et al. 2002; Forrester et al. 2007), September-November in English waters (Brown and Grice 2005), or October-November in Belgium (Vanermen et al. 2013) or throughout Europe (Cramp et al. 1977-94). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in September-December (Figure 3.1). Autumn migration is completed by November (Pennington et al. 2004; Forrester et al. 2007) or mid-December (Cramp et al. 1977-94). Spring migration starts in February (Pennington et al. 2004; Forrester et al. 2007) or early March (Cramp et al. 1977-94) or March (Wernham et al. 2002). Peak spring migration occurs in February-April in Belgium (Vanermen et al. 2013), in late February and early March in English waters (Brown and Grice 2005), in April (Cramp et al. 1977-94), or in April-May (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak rate of change in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in February-March (Figure 3.1). Spring migration is completed by June (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007) or mid-June (Cramp et al. 1977-94). The first spring records of red-throated diver in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from 1 January and the last records were predominantly at 31 December, as large numbers of red-throated divers overwinter, while peak autumn migration was reported in September or October in most years, and peak spring migration was reported in March, April or May in most years. Birds reoccupy nest sites from as early as February, but most return to breeding sites in the UK in mid-March (Pennington et al. 2004; Forrester et al. 2007). Orkney and Shetland Bird Reports indicate modal return to nest sites in February (4 cases), and March (5 cases).

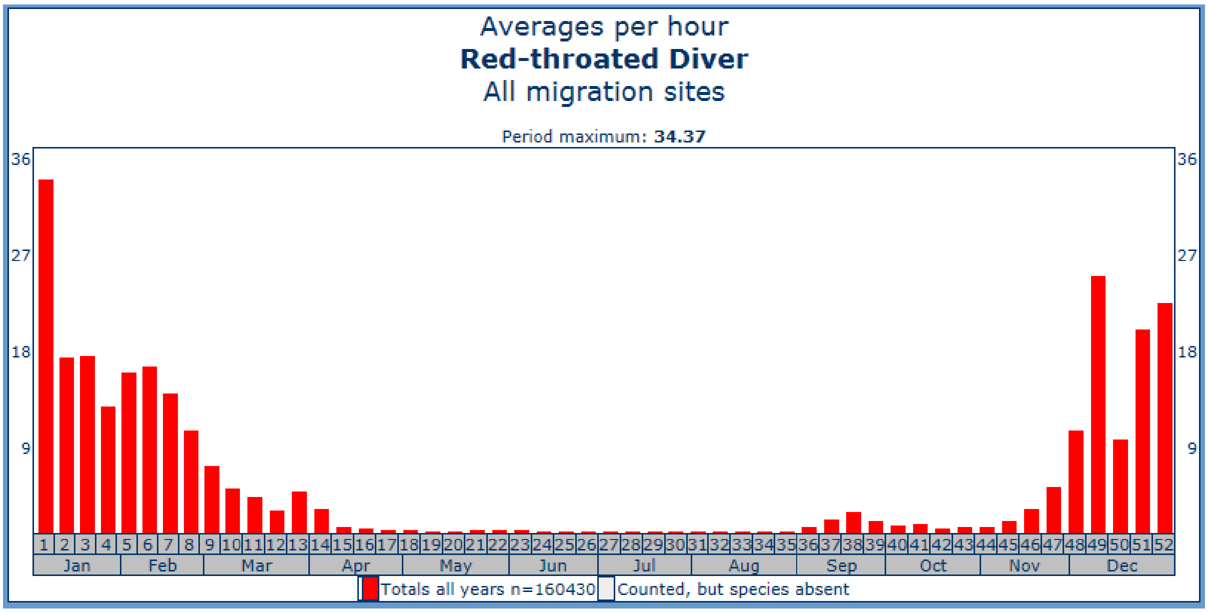

Figure 3.1. Average numbers of red-throated divers counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

3.4 Defined seasons

- UK Breeding season — March-August
  - Migration-free breeding season — May-August
- Non-breeding season
  - **Post-breeding migration in UK waters (migration BDMPS**[1]) — **September-November**
  - **Migration-free winter season BDMPS)** — **December-January (winter**
  - **Return migration through UK waters BDMPS**) — **February-April (migration**

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for red-throated diver:

Migration seasons BDMPS (September-November and February-April); and

Winter BDMPS (December-January).

3.5 Movements of birds from the UK population

Red-throated divers breed at freshwater pools close to the coast, but feed in the sea on small fish, and winter inshore on sheltered coasts. The young make their first flight to the sea attended by their parents and then move away from the breeding areas within a few days (Wernham et al. 2002). Scandinavian birds winter in the southern North Sea and southwards

[1] Seasons for which BDMPS have been generated are annotated (BDMPS).

to central France (Eriksson 2000). The Scottish population (of about 1,255 pairs; Gibbons et al. 1997; Dillon et al. 2009) travels shorter distances to winter than more northerly birds (Wernham et al. 2002). Recoveries of birds ringed in Orkney and Shetland show a southerly movement in autumn. Juveniles move furthest, reaching as far south as northwest France (Okill 1994). Adults from Shetland mostly overwinter along Scottish coasts, with some remaining in Shetland (Okill 1994; Wernham et al. 2002). One quarter of one-year olds return to natal areas in their first summer while three quarters remain in wintering areas (Okill 1994). Among two year olds, two-thirds return to natal areas in summer but about one-third remain along northern Scottish coasts, whereas by their third summer all birds return in summer to their breeding area (Wernham et al. 2002).

3.6 Movements of birds from overseas into UK waters

Foreign-ringed birds found in Britain in winter originated from Greenland (3), Finland (4), and Sweden (3) (Wernham et al. 2002). Most were recovered in south-east England (in contrast to most Scottish birds being recovered on Scottish or Irish coasts) (compare Figures 4 and 5 in the chapter on red-throated diver in Wernham et al. 2002). There is no evidence to suggest that red-throated divers from the Russian population (which winters in the Baltic Sea) ever reach the UK (Wernham et al. 2002). No red-throated divers ringed in Iceland (where there are about 1,500 breeding pairs; Hagemeijer and Blair 1997) have been recovered in Britain or Ireland (Wernham et al. 2002), but one Icelandic bird was recovered in the Faroes in its first winter (Hammer et al. 2013). This suggests that Icelandic red-throated divers probably mostly remain in Icelandic waters throughout the year, a suggestion supported by recent geolocator deployments on red-throated divers breeding in Iceland (Ib Krag Petersen pers. comm.). That would make red-throated diver an example of ‘leap-frog migration’ with birds from the Greenland population migrating past the relatively sedentary populations of Iceland, Faroes and Scotland. Winter populations in Scottish waters seem most likely to be predominantly birds from the Scottish population (and especially adults from that population), with a minority coming from Greenland (where there are about 1,000 pairs; Wetlands International 2006) and Fennoscandia (where there are about 5,500 pairs; Hagemeijer and Blair 1997), and possibly a few from Iceland. Birds wintering in English waters apparently include birds from Scotland (with a high proportion of those being juveniles and immatures rather than adults), Greenland, and Fennoscandia, possibly including small numbers from Iceland. There are only 25 pairs breeding in the Faroes (Hammer et al. 2013) so that population is very small and may well remain in Faroese waters or migrate to Scottish waters, but no birds have been ringed there.

3.7 Numbers in UK waters

O’Brien et al. (2008) estimated that 17,000 red-throated divers overwinter in Great Britain, updating previous estimates from Lack (1986) and Batten et al. (1990) that were underestimates due to lack of knowledge of numbers in the Outer Thames in particular. Of these, just over 10,000 winter between Flamborough Head and Dungeness. In Scottish territorial waters, there were 2,270 in winter, mostly inshore and with larger numbers on the east coast than on the west coast. The UK summer population is estimated to total 4,146 birds (Dillon et al. 2009), and most of these overwinter in British waters (Okill 1994), with adults predominantly in Scottish waters and immatures often further south. This suggests that most of the red-throated divers wintering in Scottish waters are likely to be from the UK population if the estimated numbers present in winter are moderately accurate. In contrast, the much larger numbers overwintering off south-east England could only be explained by presence of large numbers from overseas populations. Given evidence from ring recoveries, these appear to be predominantly birds from Fennoscandia, plus substantial numbers from Greenland. Based on population size it seems likely that no more than about 2,000 of these birds in English waters originate from Scottish breeding areas, whereas about 12,000 are probably from Fennoscandia and Greenland. About 48,000 red-throated divers winter in the area from the Kattegat to the River Elbe, about 43,000 in the Baltic Sea (Danielsen et al.

1993; Brown and Grice 2005). In English waters, wintering red-throated divers are scarce off SW England, uncommon off the south coast, present in large numbers off NW England, but in highest numbers off E England (Brown and Grice 2005).

3.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of Europe, comprising 7,158 pairs, and the biogeographic winter population of Europe as 75,000 individuals (based on data in Rose and Scott 1997), but updated to an estimate of 100,000 to 1,000,000 by Delaney and Scott 2002 (see also Musgrove et al. 2011). Red-throated divers in UK waters originate almost entirely from UK, Fennoscandia or Greenland, so populations outside those areas can be discounted as not occurring in UK waters (e.g. Iceland, Russia), or too small to be relevant (e.g. Faroe), or both. Thus a limited biogeographic population could be defined as birds from UK (1,255 pairs), Greenland (1,000 pairs), and Fennoscandia (5,500 pairs), a total of 7,755 pairs. This is equivalent to a total of 15,500 breeding adults and an associated 11,500 immatures, so a total of 27,000 birds. BirdLife International (2004) suggests a population of 5,000 to 30,000 pairs in Greenland, but this number, which is not supported by any original reference, seems highly unlikely given that previous estimates for Greenland were all around 1,000 pairs.

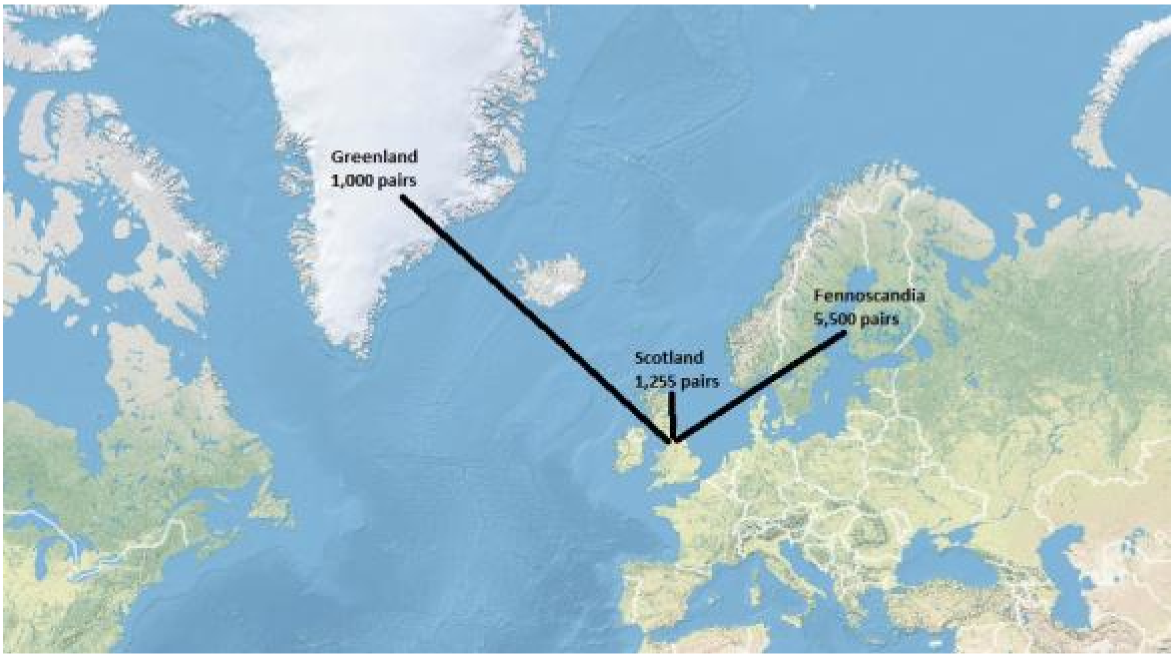

Figure 3.2. Breeding population origins of red-throated divers in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap ©OpenStreetMap contributors.

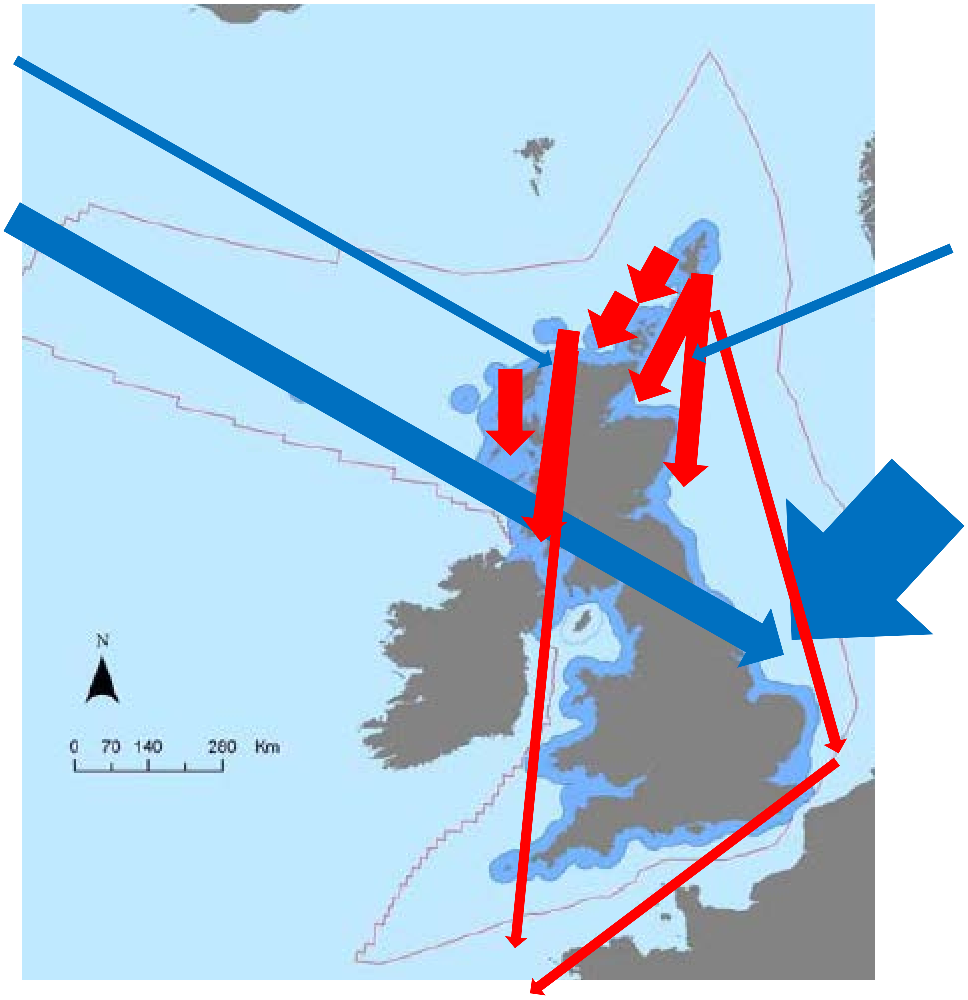

Figure 3.3. Main movements of red-throated divers from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure. Counts of numbers of red-throated divers in winter in different areas around the UK are thought to be moderately accurate (although this represents a change from the past as large numbers have been 'discovered' in recent years in some areas). Those counts, combined with knowledge of movements from ringing studies, give moderate confidence in the fact that relatively few birds from overseas winter in Scottish waters, and that most birds wintering in English waters of the southern North Sea originate from Fennoscandia.

3.9 Proportion of UK population from UK breeding SPAs

The 10 SPAs with breeding red-throated divers as a feature together held 395 pairs at designation, estimated to represent 31% of the UK breeding population of 1,255 pairs (Stroud et al. 2001). Breeding numbers at UK SPAs appear to have generally remained stable (Table 3.1). Breeding numbers in the UK in total also appear to have remained approximately stable over recent decades or increased slightly (Gibbons et al. 1997; Stone et al. 1997; BirdLife International 2004; Baker et al. 2006; Forrester et al. 2007; O'Brien et al. 2008; Musgrove et al. 2013). UK SPAs with red-throated diver as a breeding feature are distributed predominantly in Shetland, Orkney, Caithness, and the western islands of

Scotland (Western Isles and Inner Hebrides) (Figure 3.4). Seven of the SPA populations lie within the NW North Sea region, and three lie in the West of Scotland region (Table 3.1). The SPA populations in the NW North Sea region held a total of 237 pairs in the most recent census at each SPA (Table 3.1). The SPA populations in the West of Scotland region held a total of 108 pairs in the most recent census at each SPA (Table 3.1). It is therefore likely that SPA populations now represent about 27% of the UK Breeding population based on these data. Stroud et al. (2014) estimated that SPA populations represented 30.5% of the GB population in 2006.

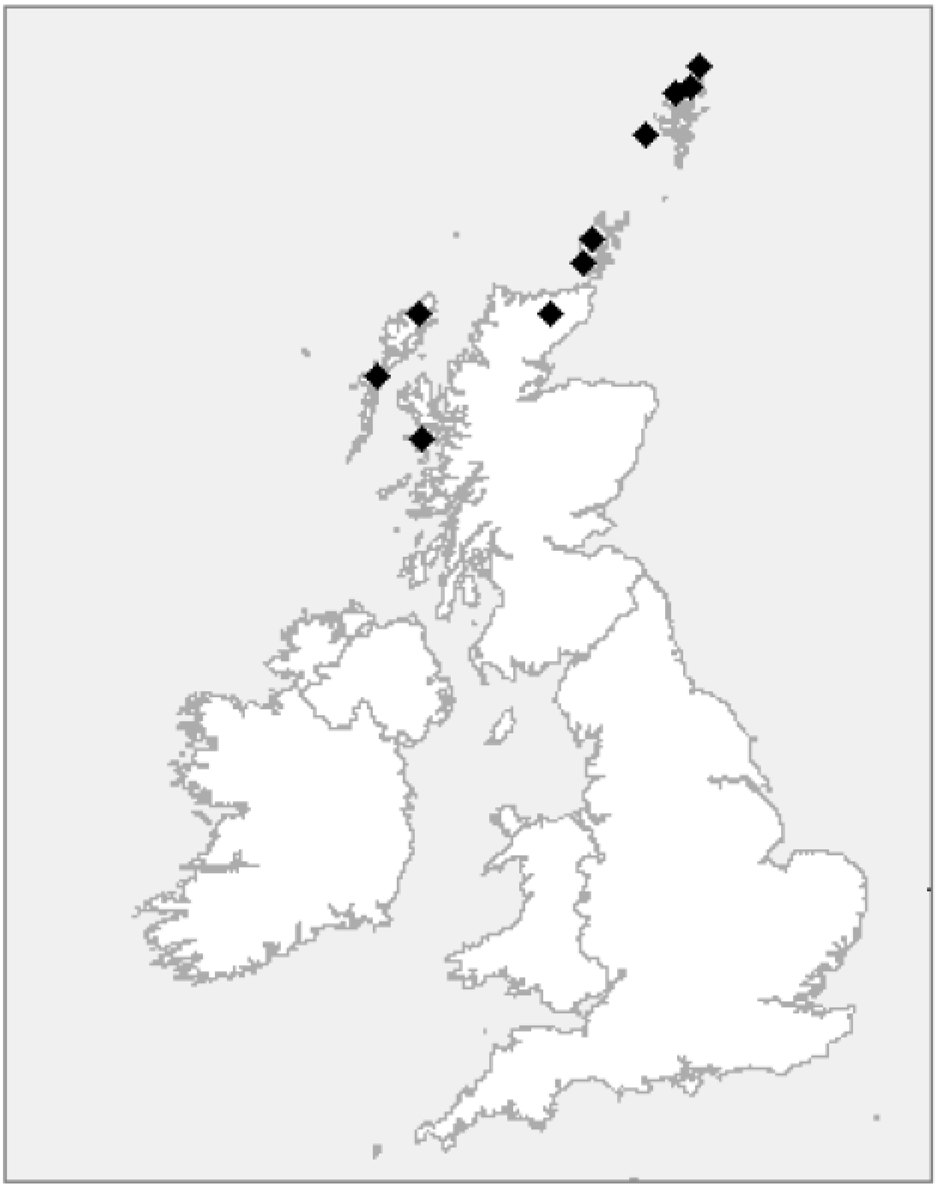

Figure 3.4. Locations of the 10 UK SPAs with red-throated diver as a breeding feature. These SPA populations are listed in Table 3.1. From Stroud et al. 1990.

Table 3.1. The UK SPA suite for breeding red-throated diver.

SPA	Location	Pairs	Year desig-nated	Site condition monitoring*	Latest counts (pairs)	Year	Reference
NW North Sea							
Hermaness, Saxavord & Valla	Shetland NE	28 (1994-1996)	1994	Declined 2013	16	2013	SNH (Bob Bryson in litt.)
Otterswick and Graveland	Shetland NE	27 (1992-1996)	2001	Maintained 2006	>25	2006	SNH (Bob Bryson in litt.)
Ronas Hill North Roe Tingon	Shetland NE	50 (1994)	1997	Maintained 2006	50	2006	SNH (Bob Bryson in litt.)
Foula	Shetland NE	11 (1994)	1995	Maintained 2013	10 12	2012 2013	Gear 2012 Gear 2013
Orkney Mainland Moors	Orkney NE	15 (1994-1996)	2000	Maintained 2007	>28	2007	SNH (Bob Bryson in litt.)
Hoy	Orkney NE	56 (1994)	2000	Maintained 2007	60	2007	SNH (Bob Bryson in litt.)
Caithness & Sutherland Peatlands	N Scotland NE	89 (1993-1994)	1999	Maintained 2006	46	2006	Stroud et al. 2014
West of Scotland							
Lewis Peatlands	Western Isles NW	60 (mid-1990s)	2000	Declined 2004	80	2006	Stroud et al. 2014
Mointeach Scadabhaigh	Western Isles NW	48 (1994)	1999	Maintained 2004	33-35 17	2004 2006	SNH (Bob Bryson in litt.) Stroud et al. 2014
Rum	Inner Hebrides NW	11 (1992-1996)	1982	Maintained 2007	11	2013	SNH (Bob Bryson in litt.)

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

3.10 BDMPS

There are thought to be about 15,300 birds in UK waters in winter, with most birds from the UK population included (about 3,300 birds, allowing for small numbers of immatures wintering further south), and about 12,000 birds from the overseas populations. During migration, there will be marginally larger numbers passing through UK waters as some birds winter further south in Europe; during migration around 17,300 birds, about 4,300 from the UK and about 13,000 from overseas populations.

It makes biological sense to consider Scottish North Sea waters separately from English North Sea waters, since it seems that most birds wintering in Scottish North Sea waters are from the UK population, whereas most birds wintering in English North Sea waters are from Fennoscandia. It also makes sense to separate the populations to the west and east of mainland UK. Most red-throated divers from SPA populations in the Western Isles and Inner Hebrides winter to the west of the UK mainland, whereas probably most of those from SPA populations in the NW North Sea winter in the North Sea. Red-throated divers wintering off NW England may be a mixture of birds from UK populations and from Greenland. Only small numbers winter in the English Channel and SW England, but probably include a mixture of mainly immatures from the UK population and birds from Greenland and Fennoscandia. Therefore, proposed BDMPS regions are as shown in Figure 3.5.

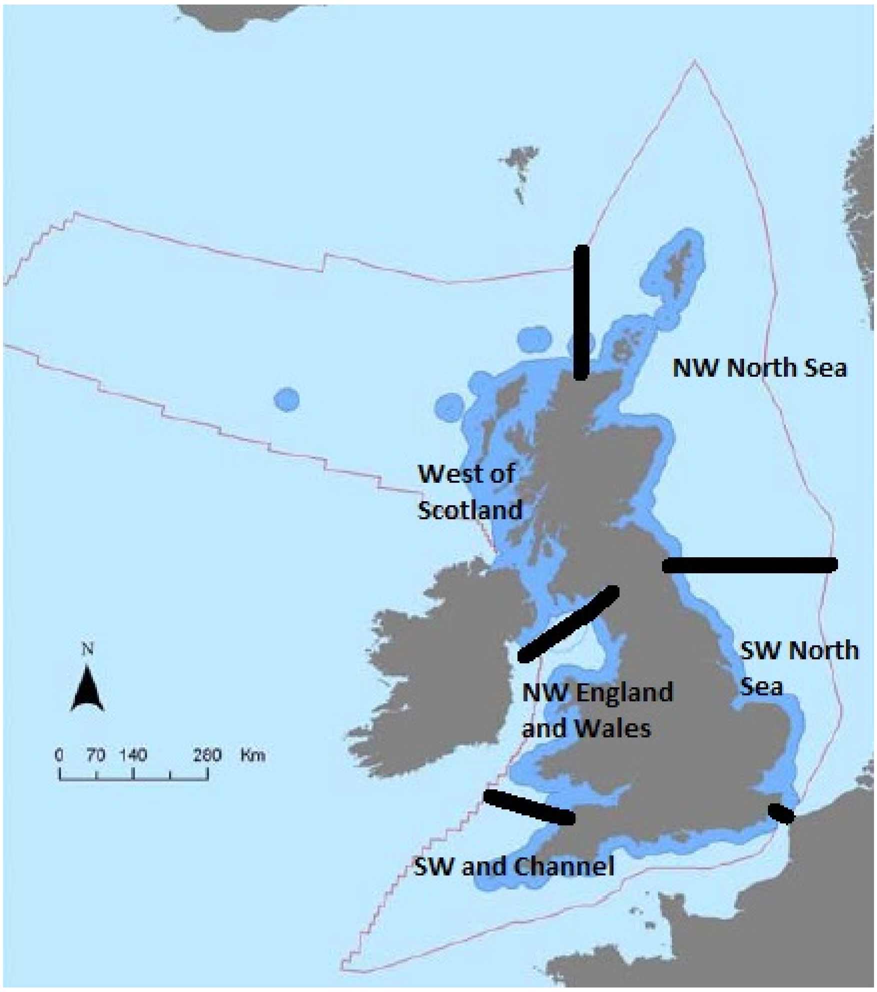

Figure 3.5. Five defined BDMPS spatial areas for red-throated divers in UK waters in winter. Limits of UK waters are shown by red line. BDMPS spatial areas extend from the UK coast to the red limit, bounded by the thick black lines marking the sides of each BDMPS area. The five BDMPS are 'NW North Sea', 'SW North Sea', West of Scotland', NW England & Wales' and 'SW and Channel'. For migration seasons there are two BDMPS, 'North Sea' (NW and SW North Sea combined) and 'Western waters plus Channel' (West of Scotland, NW England & Wales, and SW & Channel areas combined).

It is estimated that about 50% of adults from breeding areas in the northern isles and North Sea coast of Scotland winter in the NW North Sea whereas only a very few (perhaps 5%) of those from western UK breeding areas winter in the NW North Sea (based on literature reviewed in section 3.5). Very few birds from Greenland or Fennoscandia have been recovered in the NW North Sea (section 3.6) but it seems likely that some birds from Greenland will stop in the NW North Sea rather than continuing to the SW North Sea so the proportions wintering in this area are estimated at 5% and 1% respectively. There is apparently very little movement of adults from western breeding areas to winter in the NW North Sea (section 3.5), so this proportion is estimated at 5%. The same percentages are applied for immature birds from western UK, Greenland and Fennoscandia as for adults. There is evidence for birds from the northern isles that many immatures winter further south so the proportion of those in the NW North Sea in winter is estimated at 20% with most moving further south. These combinations of proportions result in an estimated winter BDMPS in NW North Sea of 1,523 birds, a number that is consistent with the counts of red-throated divers wintering in NW North Sea (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Table 1.

It is estimated that about 20% of adults from breeding areas in the northern isles and North Sea coast of Scotland winter in the SW North Sea whereas only a very few (perhaps 5%) of those from western UK breeding areas winter in the SW North Sea (based on literature reviewed in section 3.5). Ringed birds from Greenland and Fennoscandia have been recovered in the SW North Sea (section 3.6) and the numbers in that area in winter require a substantial movement of birds from those populations to winter there. Based on the observation that divers are likely to avoid migrating overland, it seems likely that birds from Greenland make up a higher proportion of the overseas birds wintering in UK western waters and that most overseas birds in North Sea waters originate from Fennoscandia rather than Greenland, so the proportions wintering in this area are estimated at 2% and 40% respectively. Similarly, there is apparently very little movement of adults from western breeding areas to winter in the SW North Sea (section 3.5), so this proportion is estimated at 5%. The same percentages are applied for immature birds from western UK. For Fennoscandia it is estimated that 60% of immatures winter in the SW North Sea because it is generally the case that immature red-throated divers winter further south than adults. For Greenland it is estimated that 5% of immatures winter in the SW North Sea because it is generally the case that immature red-throated divers winter further south than adults. There is evidence for birds from the northern isles that many immatures w*i*nter further south so the proportion of those in the SW North Sea in winter is estimated at 30% for immatures compared to 20% for adults. These combinations of proportions result in an estimated winter BDMPS in SW North Sea of 10,177 birds, a number that is consistent with the counts of red-throated divers wintering in SW North Sea (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Table 2.

It is estimated that about 5% of adults from breeding areas in the northern isles and North Sea coast of Scotland winter in West of Scotland waters whereas 40% of adults from western UK breeding areas winter in West of Scotland waters (based on literature reviewed in section 3.5). There is evidence for birds from the northern isles that many immatures w*i*nter further from the breeding area so the proportion of those in West of Scotland waters in winter is estimated at 20% for immatures compared to 40% for adults for birds from western populations. Immatures from North Sea UK populations are likely to be more represented in west of Scotland waters than adults, so the proportion is estimated at 10% for immatures compared to 5% for adults. Based on the observation that divers are likely to avoid migrating overland, it seems likely that birds from Greenland make up a small proportion of the overseas birds wintering in UK western waters, so the proportions wintering in this area are estimated at 2% and 5% respectively for adults and immatures. There is no evidence from ringing that birds from Fennoscandia winter west of Scotland, so proportions from that population are set at zero for adults but 1% for immatures. That is also consistent with total numbers wintering west of Scotland being relatively small, and can be accounted for by the proportions estimated above. These combinations of proportions result in an estimated winter BDMPS for the West of Scotland area of 861 birds, a number that is consistent with the counts of red-throated divers wintering in the West of Scotland area (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Table 3.

It is estimated that about 2% of adults from breeding areas in the northern isles and North Sea coast of Scotland winter in NW England and Wales waters whereas 20% of adults and immatures from western UK breeding areas winter in NW England and Wales waters (based on literature reviewed in section 3.5). Immatures from North Sea UK populations are likely to be more represented in NW England and Wales waters than adults, so the proportion is estimated at 5% for immatures compared to 2% for adults. Based on the observation that divers are likely to avoid migrating overland, it seems likely that birds from Greenland make up a small proportion of the overseas birds wintering in NW England and Wales waters, so the proportions wintering in this area are estimated at 10% and 30% respectively for adults and immatures. Probably few birds from Fennoscandia winter in NW England and Wales (but there is one ring recovery), so proportions from that population are set at 2% for adults but 5% for immatures. These combinations of proportions result in an estimated winter BDMPS for the NW England and Wales area of 1,657 birds, a number that is consistent with the counts of red-throated divers wintering in the NW England and Wales area (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Table 4.

It is estimated that about 2% of adults and 5% of immatures from breeding areas in the northern isles and North Sea coast of Scotland winter in SW England and Channel waters whereas 10% of adults and 20% of immatures from western UK breeding areas winter in SW England and Channel waters (based on literature reviewed in section 3.5). Immatures from North Sea UK populations are likely to be more represented in SW England and Channel waters than adults, so the proportion is estimated at 5% for immatures compared to 2% for adults. Based on the observation that divers are likely to avoid migrating overland, it seems likely that birds from Greenland make up a proportion of the overseas birds wintering in SW England and Channel waters, so the proportions wintering in this area are estimated at 10% and 20% respectively for adults and immatures. Probably few birds from Fennoscandia winter in SW England and Channel waters (but there is one ring recovery in the area), so proportions from that population are set at 1% for adults but 3% for immatures. These combinations of proportions result in an estimated winter BDMPS for the SW England and Channel waters of 1,153 birds, a number that is consistent with the counts of red-throated divers wintering in SW England and Channel waters (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Table 5.

Ringing data indicate that most red-throated divers from the northern isles move southwards in autumn through the North Sea and that birds from western UK populations mostly move south through western waters (Section 3.5) but there is some evidence from ringing of small numbers moving between western waters and North Sea and vice versa. In computing BDMPS for these two areas for the migration seasons it is therefore estimated that 95% of adults and 80% of immatures from UK North Sea populations are in UK North Sea waters (NW plus SW North Sea areas) during migration seasons (September-November and February-April), while possibly 5% of western UK red-throated divers (adults and immatures) also pass through North Sea waters on migration. Similarly it is estimated that 95% of adults and 80% of immatures from western populations migrate through western waters (West of Scotland to Channel) while 5% of North Sea adults and 20% of North Sea immatures (birds from the northern isles) migrate through western waters. Large numbers from Fennoscandia migrate through the North Sea but ring recoveries indicate that few reach western waters, so proportions estimated for this population are 45% of adults and 65% of immatures migrating through UK North Sea waters, with 5% and 10% respectively in western waters. Conversely it seems likely that birds from Greenland migrate more through western waters than through the North Sea, so proportions were estimated at 8% of adults and 15% of immatures migrating through UK North Sea waters and 25% of adults and 60% of immatures through western waters. These percentages result in estimated numbers in the migration season BDMPS that are consistent with diver count data and estimates in the literature (Section 3.7). Details of apportioning and estimated numbers are in Appendix A Tables 6 and 7.

3.11 Proportion of UK SPA birds in each BDMPS

Proportions of each BDMPS that are adults from UK SPA breeding populations can be calculated directly from Appendix A Tables 1 to 7. For example, in the UK NW North Sea area in winter (Appendix A Table 1) there are 248 adults from SPA populations in the winter BDMPS of 1,523 birds, so approximately 16% of birds in that BDMPS are adults from SPA populations. In contrast, for the UK SW North Sea area in winter (Appendix A Table 2) there are 105.6 adults from SPA populations in the winter BDMPS of 10,177 birds, so approximately 1% of birds in that BDMPS are adults from SPA breeding populations (SPA populations for wintering birds are not considered in this calculation).

3.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Red-throated divers migrate primarily through coastal waters, and winter in shallow coastal waters. Their distribution across the regions will therefore be far from uniform, with almost all birds close to the coast and predominantly in more sheltered areas. Birds from SPA populations may tend to winter relatively close to their SPA breeding sites, but this is uncertain. Given that the spatial distribution of SPAs is similar to the spatial distribution of the broader breeding population of the species in Scotland, it is likely that the proportion of birds from SPAs will be fairly consistent throughout Scottish waters. In England, it is likely that a high proportion of the birds from Scottish SPAs will be immatures rather than breeding adults, since the immatures winter further south than adults. However, most birds in southern North Sea waters are likely to be from Fennoscandia rather than the UK population, and birds from UK SPA populations are likely to be fairly randomly distributed amongst these.

4. GREAT NORTHERN DIVER *Gavia immer*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (September to May) (adults and immatures)
Overseas	430,000	4,000
UK	0	0
Total	430,000	4,000

Non-breeding season BDMPS (September to May)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK breeding population (adults plus immatures)
West of Scotland	2,000	2,000	0
NW North Sea	1,000	1,000	0
SW North Sea & Channel	200	200	0
NW England & Wales	300	300	0
SW England	500	500	0

Breeding numbers in overseas populations are not well known so are coded red. Colour coding is green for numbers from UK breeding population because great northern divers do not normally breed in Britain. Colour coding is amber for numbers of birds from overseas and in total because the species is not easy to count at sea, but there have been dedicated surveys of wintering divers in UK waters that appear to provide moderately accurate numbers in each region. Great northern divers are apparently highly faithful to the same wintering site in successive years and numbers appear to be fairly stable across years. There is, however, a possibility that wintering numbers are higher than counts indicate (for example numbers oiled in Shetland in one oil spill exceeded the numbers thought at the time to be present). There is also some uncertainty about numbers migrating through UK waters, although those numbers are likely to be similar to the wintering numbers as relatively few great northern divers winter further south in Europe than UK waters. Migration routes are also uncertain, but it seems likely that birds arrive directly at, and depart directly from, winter areas rather than necessarily moving northwards through UK waters, since their breeding sites lie far to the west or north-west and migrations must involve long trans-Atlantic flights. Origins of birds from overseas in UK waters have been quite well established from biometric analysis. Because there is no clear evidence for numbers migrating through UK waters being significantly different from numbers wintering in UK waters, a single BDMPS has been defined for the non-breeding period (September to May). If knowledge of migrating numbers improves in future there might be merit in separating this into seasonal BDMPS for migration seasons and for winter.

4.1 Breeding range and taxa

Great northern diver is a monotypic species with a predominantly Nearctic breeding range, from Alaska to Greenland and Iceland, where it nests at large freshwater lakes. Although monotypic, there is variation among populations in biometrics which can be used to identify origins of individuals (Weir et al. 1996).

4.2 Non-breeding component of the population

Great northern divers start to breed when 6 years old (BTO Birdfacts). Adult survival rate is unknown (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is unknown. Assuming an adult survival rate of 0.9 (typical of birds recruiting when 6 years old) and productivity of 0.635 chicks per pair (as in red-throated diver), to obtain a stable population, survival of immatures was adjusted to 0.7 for juveniles, 0.8 for 1 and 2 year olds, 0.88 for 3 year olds and 0.9 for older age classes. The model population comprised 48% adults, 15% juveniles and 37% older immatures. There are 1.1 immatures per adult.

4.3 Phenology

Autumn migration starts in August (Wernham et al. 2002), late-August (Cramp et al. 1977-94), September (Forrester et al. 2007) or late September (Pennington et al. 2004). Peak autumn migration occurs in late October in Shetland (Pennington et al. 2004) and in English waters (Brown and Grice 2005), October-November in the UK (Wernham et al. 2002; Forrester et al. 2007), or throughout Europe (Cramp et al. 1977-94). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in September-November (Figure 4.1). Autumn migration is completed by December (Pennington et al. 2004; Forrester et al. 2007) or late December (Cramp et al. 1977-94).

Spring migration starts in early March (Cramp et al. 1977-94), March (Pennington et al. 2004; Forrester et al. 2007) or late April (Wernham et al. 2002). Peak spring migration occurs in early April from English waters (Brown and Grice 2005), in April (Cramp et al. 1977-94), in April-May (Forrester et al. 2007), or May (Wernham et al. 2002; Pennington et al. 2007). Peak rate of change in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in February-March but with a smaller but distinct peak in May (Figure 4.1). Spring migration is completed by early June (Cramp et al. 1977-94), or June (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007).

The first spring records of red-throated diver in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from 1 January and the last records were predominantly at 31 December, as large numbers of great northern divers overwinter, while peak autumn migration was reported in October in most years, and peak spring migration was reported in April-May or May in most years.

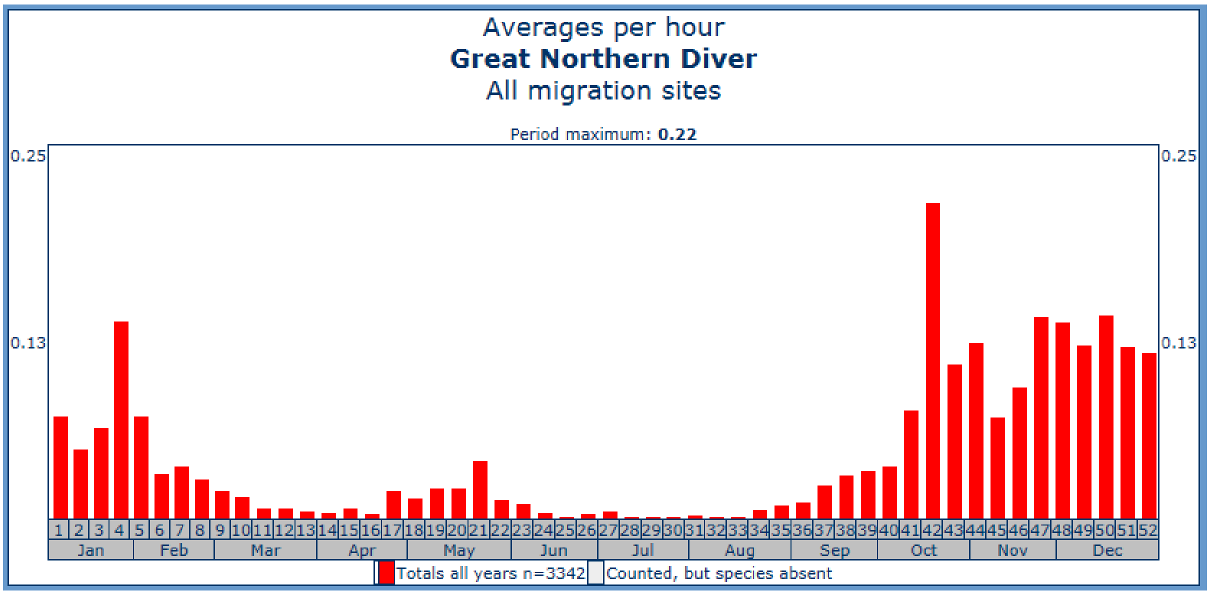

Figure 4.1. Average numbers of great northern divers counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

4.4 Defined seasons:

- UK Breeding season — not applicable
- Post-breeding migration in UK waters — September-November
- **non-breeding season** — **September-May** (**BDMPS**)
- Return migration through UK waters — March-May
- Migration-free breeding season — not applicable
- Migration-free winter season — December-February

Apart from the breeding season, one seasonal BDMPS period was considered to be appropriate for great northern diver:

Non-breeding season (September-May).

4.5 Movements of birds from the UK population

With the very rare exception of the odd pair, or individual, in occasional years, the species does not breed in the UK.

4.6 Movements of birds from overseas into UK waters

Relevant breeding populations are 300-500 pairs in Iceland, 400-1,800 pairs in Greenland, and around 100,000 pairs in Canada (Wernham et al. 2002; Wetlands International 2006). Birds mostly leave breeding areas in September-October, but some arrive in NW Scotland in August. Spring migration occurs in April-May, but substantial numbers of immature birds remain in British waters through the summer. Measurement of great northern diver study skins in the National Museums of Scotland suggested, on the basis of biometric differences between populations, that 45% of those wintering in Scotland were from the Icelandic population, 45% from Greenland and Baffin Island, and only 10% from mainland Canada (Weir et al. 1996). Camphuysen et al. (2010) looked at a sample killed by the Prestige oil spill in Galicia, and concluded that most birds wintering off Spain appear to be juveniles, but that biometrics suggest those birds also come from Iceland and Greenland rather than mainland Canada. Most Canadian birds therefore appear to overwinter in North America rather than migrating to Europe.

4.7 Numbers in UK waters

While many great northern divers winter inshore off coasts of North America, about 6,000 winter inshore from northern Norway to northern Spain (Pennington et al. 2004), of which about 3,500-4,500 individuals winter off Britain and Ireland (Wernham et al. 2002). Wintering birds in British waters are mostly found in shallow sea off the west and north coasts of Scotland and adults seem to predominate in those areas (Weir et al. 1996). Numbers wintering in English waters are unlikely to exceed 1,000 birds, most of which winter off SW England (Brown and Grice 2005). Given the predominance of adults in Scottish waters it is likely that most birds wintering in English waters are immatures (since numbers of immatures are similar to numbers of adults, and in almost all seabirds the immatures winter further from the source population than do the adults).

4.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of Iceland and Greenland, comprising 700-2,300 pairs (BirdLife International 2004 suggests 500 to 2,000 pairs in Greenland but provides no reference to support this), and the biogeographic winter population of Europe as 5,000 individuals (based on data in Rose and Scott 1997). A population of 700-2,300 pairs will have an associated component of immature birds numbering about 1,400 to 4,600 individuals. So the total population size can be estimated at 1,400 to 4,600 birds (Iceland plus Greenland). Since the UK also receives birds from eastern Canada that overwinter in UK waters, it could be appropriate to include that population in the biogeographic population with connectivity to UK waters (and that has been done in this report). However, the Canadian population is very large (perhaps 100,000 pairs) and only a very small proportion of birds wintering in the UK originate from that population (about 10% of birds wintering in UK waters), so it may be appropriate (and precautionary) to omit that population from consideration. The numbers wintering in UK waters (about 3,500 to 4,500 birds) appear to represent the vast majority of the populations from Iceland and Greenland, based on this comparison of breeding numbers, population demography, and wintering numbers.

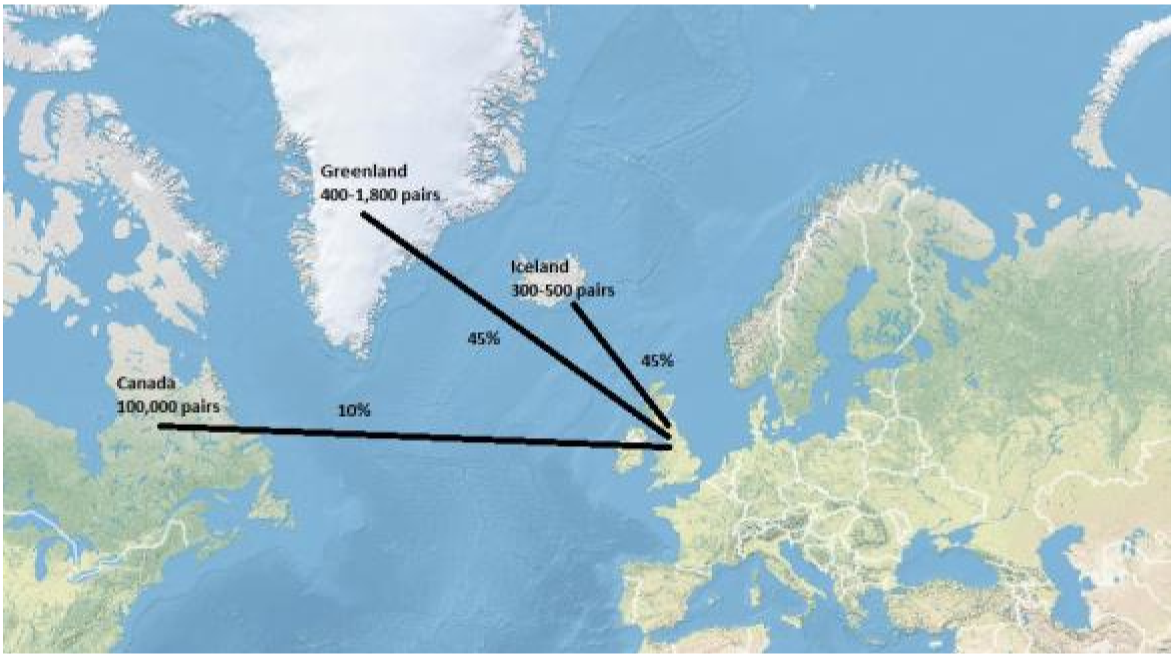

Figure 4.2. Breeding population origins of great northern divers in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given, as are the proportions from each source population represented in non-breeding populations in UK waters. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors

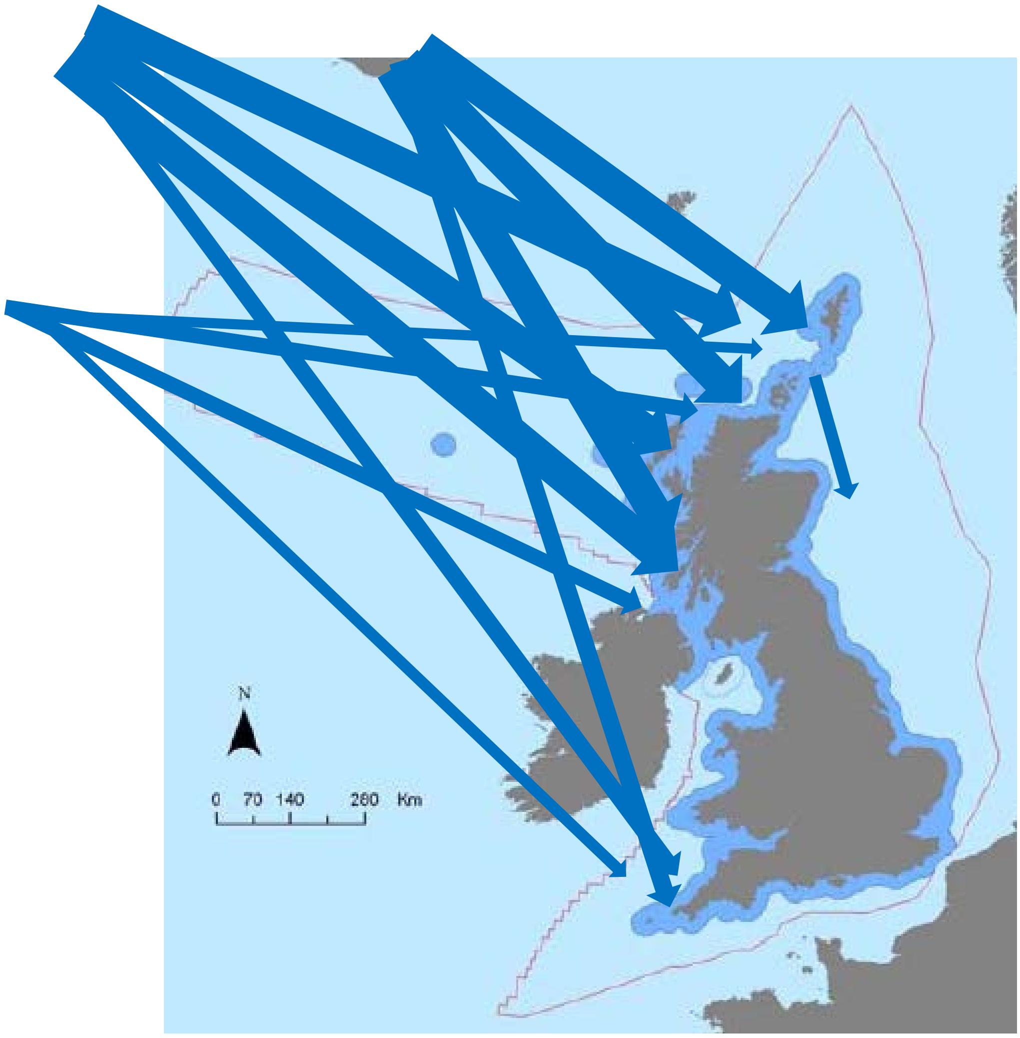

Figure 4.3. Main movements of great northern divers from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure. Museum based studies of biometrics of great northern divers collected from sites in UK waters suggest that the proportions of birds from Iceland (45%), Greenland (45%) and eastern Canada (10%) are consistent across regions, and therefore that there is little or no difference in the use of UK regions between these source populations. The proportions of the source populations wintering in UK waters probably do vary considerably, since the Canadian population is much the largest but represents only 10% of birds wintering in the UK. Wintering numbers are highest in the north and west of the UK.

4.9 Proportion of UK population from UK breeding SPAs

There are no breeding great northern divers in the UK in most years, and no SPAs in the UK include breeding great northern diver as a feature.

4.10 BDMPS

Since great northern divers from all three source populations appear to be similarly represented in different regions, the entire UK waters could be treated as a single BDMPS for this species. However, numbers wintering in different regions are moderately well known, and are much higher in West of Scotland than elsewhere. Numbers are higher in the NW North Sea than in English waters, where the main concentration of the species is found in SW England. Division into the 5 regions shown in Figure 4.4 may therefore be useful.

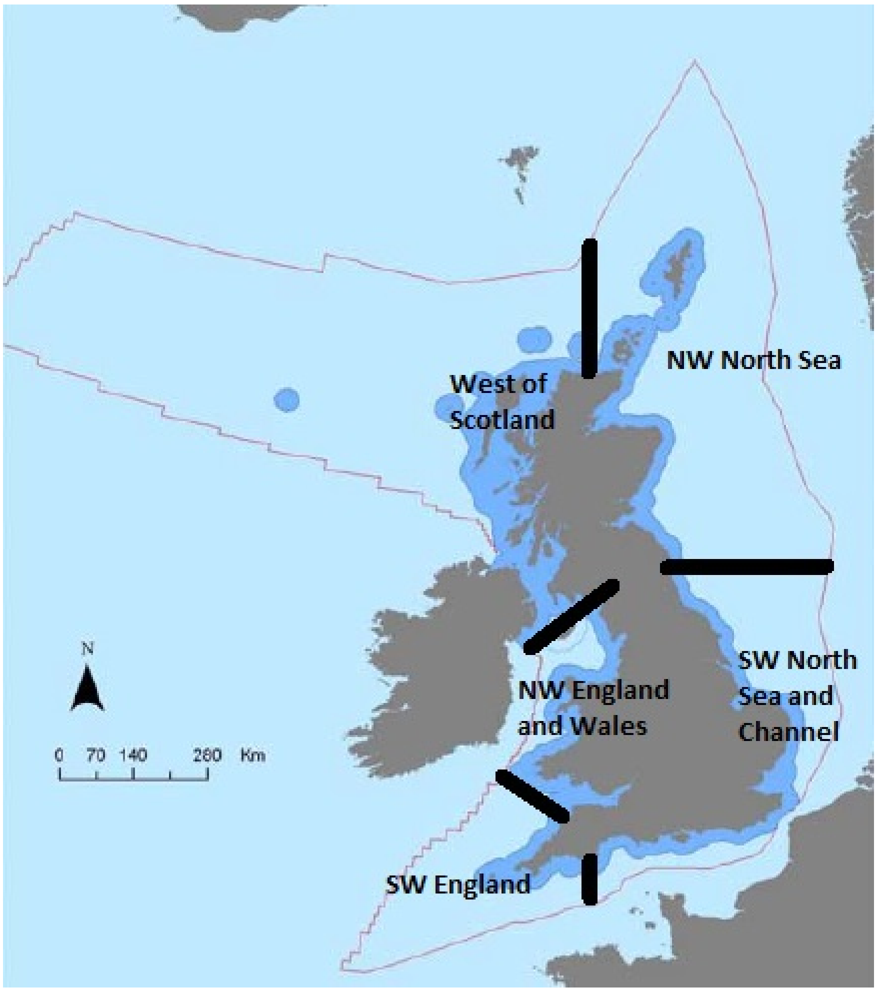

Figure 4.4. Five defined BDMPS spatial areas for great northern divers in UK waters; ‘NW North Sea’, SW North Sea & Channel’, West of Scotland’, NW England & Wales’, and ‘SW England’.

It appears that the proportions from each source population are similar in all the defined regions: 45% from Iceland, 45% from Greenland, and 10% from eastern Canada. About 3,000 of these birds winter in Scottish and Northern Irish waters, with perhaps 2,000 in the West of Scotland region and 1,000 in the NW North Sea region. About 1,000 birds winter in English and Welsh waters, with perhaps 500 of those in the SW England region, 300 in NW England and Wales and 200 in SW North Sea and Channel. Confidence in these numbers is moderate. None of these birds originate from UK breeding SPA populations.

5. NORTHERN FULMAR *Fulmarus glacialis*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in winter (November) (adults and immatures)	Numbers in UK waters in migration seasons (September-October and December-March) (adults and immatures)
Overseas	6,435,000	192,826	385,652
UK	1,620,000	932,277	1,400,044
Total	8,055,000	1,125,103	1,785,696

	Total number of birds in BDMPS (adults and immatures)	Number from overseas populations (adults and immatures)	Number from UK population (adults and immatures)
'Winter' BDMPS (November)			
UK North Sea waters	568,736	96,413	472,323
UK Western waters plus Channel	556,367	96,413	459,954
'Migration seasons' BDMPS (September & October, December to March)			
UK North Sea waters	957,502	192,826	764,676
UK Western waters plus Channel	828,194	192,826	635,368

Colour coding for numbers from overseas populations is red since these overseas populations are very large and while only a very small proportion of those birds pass through or winter in UK waters, this makes estimating numbers very difficult. Although there are ring recovery data, fulmar recoveries provide only a very weak picture of migrations and winter distribution (as with other highly pelagic species), and there are very few tracking studies of this species up until now. Colour coding for UK numbers is amber as these are moderately well documented from breeding colony surveys, but some counts are relatively old (from 1999-2002) and there is evidence for declines in numbers at some colonies though this appears patchy and may partly reflect changes in breeding effort rather than population size.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 8 to 11.

5.1 Breeding range and taxa

The fulmar has a circumpolar breeding range, with two subspecies; *rodgersii* which is found in the northern North Pacific, and nominate *glacialis* which is found in the northern North Atlantic. In the North Atlantic, there are two colour phases of plumage. Birds at colonies at low latitude are all pale phase birds, whereas in the high Arctic most birds are dark phase 'blue' fulmars. Biometrics do not seem to be useful in identifying origins of individuals.

5.2 Non-breeding component of the population

Fulmars start to breed when 9 years old (BTO Birdfacts). Adult survival rate is 0.972 (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is 0.424 chicks per pair (JNCC database, n=455 measurements). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.6 for 1-year olds, 0.8 for 2-year olds, 0.9 for 3-6 year olds, 0.92 for 7-year olds and 0.95 for 8-year olds. The model population comprised 62% adults, 13% juveniles and 25% older immatures. There are 0.62 immatures per adult.

5.3 Phenology

The end of the breeding season is described as late August (Forrester et al. 2007) or early September (Pennington et al. 2004). Modal departure from colonies is in August (Pennington et al. 2004; Forrester et al. 2007). However, autumn migration starts in July (Cramp et al. 1977-94), August (Wernham et al. 2002; Forrester et al. 2007) or early September (Pennington et al. 2004). Peak autumn migration occurs in September-October (Cramp et al. 1977-94; Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in September-October but was not clearly pronounced (Figure 5.1). Autumn migration is completed by November (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007) or November-December (Cramp et al. 1977-94).

Spring migration starts in November (Forrester et al. 2007), January (Cramp et al. 1977-94; Pennington et al. 2004) or February (Wernham et al. 2002). Peak spring migration occurs in January-March (Forrester et al. 2007), January-April (Pennington et al. 2004), February-March (Cramp et al. 1977-94), or in March-April (Wernham et al. 2002). Peak rate of change in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late January-March (Figure 5.1). Spring migration is completed by April (Cramp et al. 1977-94; Forrester et al. 2007) or May (Wernham et al. 2002; Pennington et al. 2004).

Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 reported fulmars present from 1 January to 31 December, but peak autumn migration was reported in September in most years, and peak spring migration was reported in January in most years. The breeding season (birds returning to nest sites) starts from October, but modal return is in November-January (Pennington et al. 2004; Forrester et al. 2007).

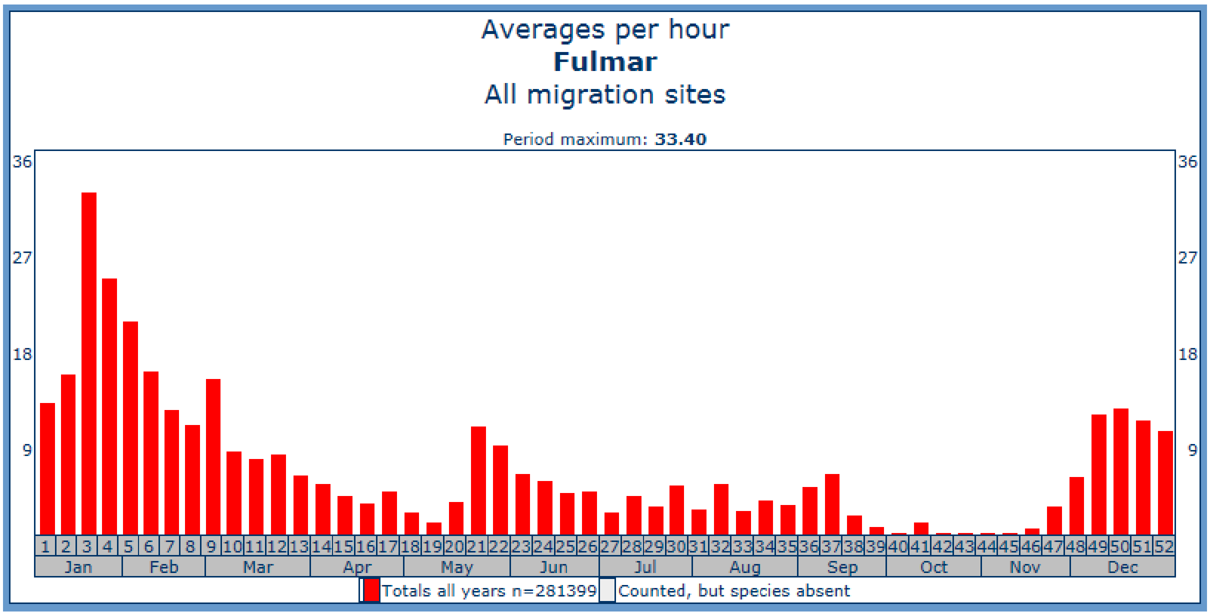

Figure 5.1. Average numbers of fulmars counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as March-July, non-breeding season August-February. However, from the data reviewed above, a more appropriate definition would be breeding season January-August, non-breeding season September-December.

5.4 Defined seasons:

- UK Breeding season — January-August
- Post-breeding migration in UK waters — September-October (**migration BDMPS**)
- non-breeding season — September-December
- Return migration through UK waters — December-March (**migration BDMPS**)
- Migration-free breeding season — April-August
- Migration-free winter season — November (**winter BDMPS**)

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for northern fulmar:

Migration seasons BDMPS (September-October and December-March); and

Winter BDMPS (November).

5.5 Movements of birds from the UK population

After fledging, young fulmars from colonies in the British Isles spend about four years at sea, during which time they disperse widely over the eastern and western North Atlantic, Norwegian and Barents Seas and the Arctic (Macdonald 1977; Wernham et al. 2002). As older immatures, they tend to return to their natal area in summer but for shorter periods than the breeding birds (Forrester et al. 2007). When chicks fledge in August-September, breeders disperse away from the colony and complete moult at sea before returning to re-occupy nest sites only about two to six months later. Breeders attend nest sites from early winter through to chick fledging in August-September. However, fulmars can travel hundreds of kilometres during foraging trips while breeding, and nest site attendance in winter is sporadic so even longer trips may occur at that time of year. Nest attendance in winter seems to be mainly by males (Wernham et al. 2002) and so females may range over larger areas in winter than males. ‘Spring’ (i.e. pre-breeding) migration back to colonies must occur in October-February. Many (apparently between 100 and 200) fulmars ringed as chicks at colonies in Britain have been recovered in the Faroes (Hammer et al. 2013). Most (over 80%) of those were deliberately harvested for food, and predominantly caught as immatures. However, recoveries of fulmars ringed at British colonies provides a very incomplete picture of migrations and wintering areas as the chances of ringed birds being recovered are extremely low in many areas such as the mid-Atlantic or high Arctic.

5.6 Movements of birds from overseas into UK waters

Up to publication of the Migration Atlas, 22 foreign-ringed fulmars had been recovered in the British Isles. Seven of these had been ringed at sea so were of uncertain population of origin. The others came from the Faroes, Iceland, Denmark, and Norway (Wernham et al., 2002). Given the very uneven distribution of ringing effort among fulmar populations, these data provide only a very crude indication of the origins of fulmars that are present in British waters (Wernham et al. 2002), but suggest that most may come from Faroes, Iceland, and Norway. Fulmars from high Arctic populations are predominantly of the dark colour morph ‘blue fulmars’. These birds are occasionally seen in British waters, especially in winter, but represent a very small proportion of the fulmars present, suggesting that numbers of fulmars from high Arctic populations reaching British waters are negligible and that the vast majority of birds seen in British waters are either from British colonies, or from populations in Faroe, Iceland or Norway. There are around 500,000 pairs in the UK, 600,000 in Faroe, 1.5 million pairs in Iceland (though numbers breeding there declined by 30% from 1983-86 to 2005-08; Gardarsson 2006, Gardarsson et al. 2011), and 386,000 pairs in Norway. All of these populations will have large numbers of immature birds associated with them. The tendency for breeding age birds to attend colonies from October-November through to August-September suggests that most fulmars in British waters are likely to be from UK colonies, but the high numbers in populations in Faroe, Iceland and Norway, together with the relatively mobile nature of immature fulmars, suggests that an unknown but potentially moderately high proportion of birds in British waters could originate from those populations, especially in early winter.

5.7 Numbers in UK waters

ESAS data suggest that there are about 2 to 50 birds per km^2 in Scottish territorial waters in winter (Forrester et al. 2007). From surveys in 2007 and 2008, Fauchald and Tveraa (2009) reported mean densities at sea of 80-400 birds per km^2 in the Norwegian Sea in spring/summer, and 25-300 birds per km^2 in the Barents Sea in autumn, suggesting much higher densities than found around the UK. Only low densities occur in English waters (Stone et al. 1995; Brown and Grice 2005). However, Forrester et al. (2007) suggest that about 1,000,000 fulmars are in Scottish waters during winter (defined in that work as December-February so note that much of that period would involve breeding birds already being back at nest sites). During migration periods, densities of fulmars are higher than in winter, and suggest that closer to 2,000,000 birds are present at sea in UK waters during peak migration seasons, a number that is still only slightly greater than the total population of the UK (including immatures) so does not indicate that there are necessarily large numbers of birds from overseas populations passing through UK waters even during the migration period.

5.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *glacialis* which breeds around the North Atlantic, comprising 7,540,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 2,700,000-4,000,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 10,000,000 individuals. Based on ringing data, it appears that some birds from Iceland, Faroe and

Norway visit UK waters. Therefore, a biogeographic population with connectivity to UK waters is the sum of numbers in UK, Iceland, Faroe and Norway (2,486,000 pairs). When accounting for immature birds, this represents a total of almost 5,000,000 adults and about 3,000,000 immatures; i.e. a total of about 8,000,000 birds.

Figure 5.2. Breeding population origins of fulmars in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

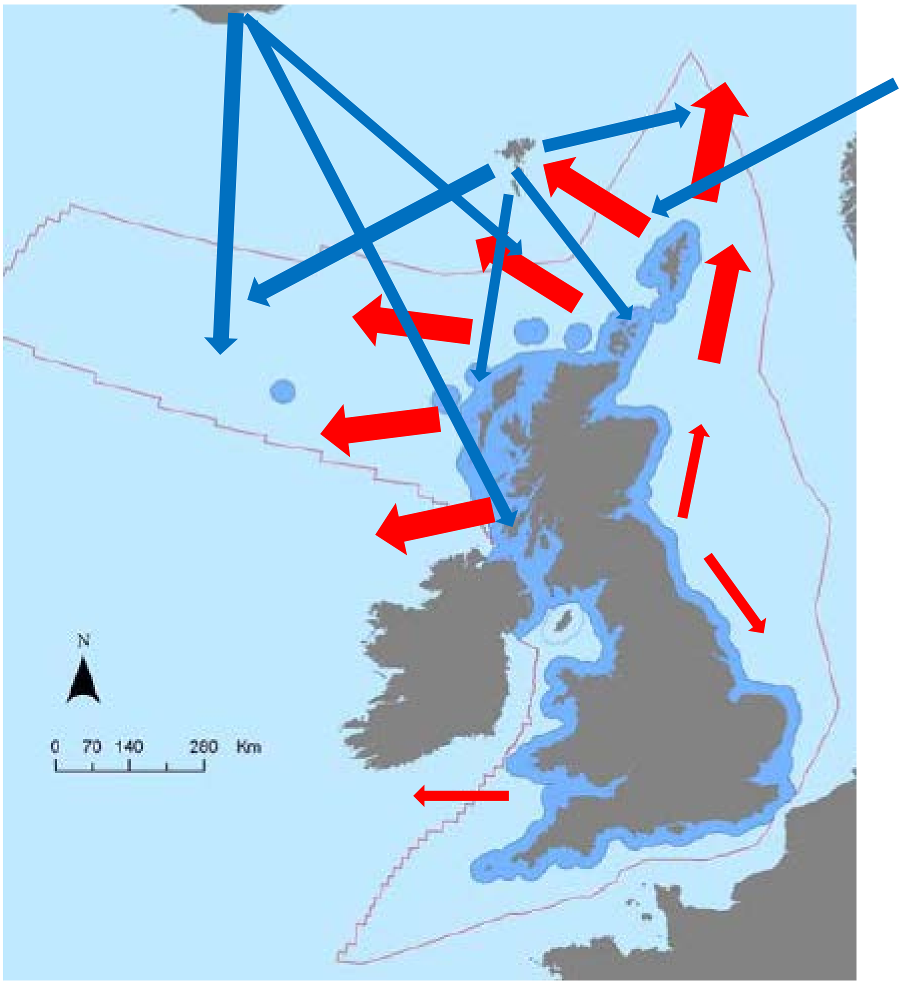

Figure 5.3. Main movements of fulmars from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure. There is only low to moderate confidence in these data, since none of these populations have been studied by tracking (apart from a very small number of birds in Orkney for which no data are yet in the public domain), and fulmar movements are not easy to determine because the species is so widely distributed and predominantly pelagic.

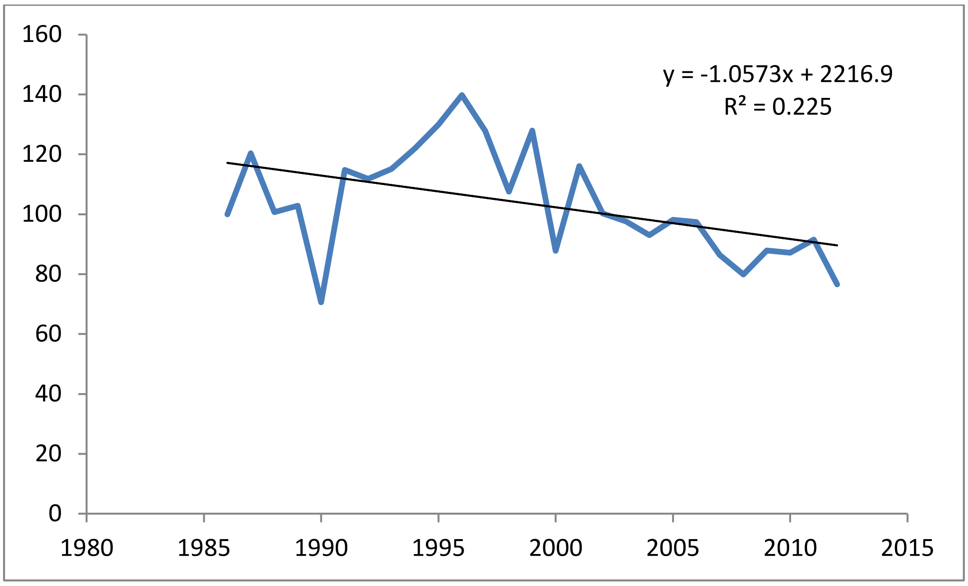

Figure 5.4. Trend in the fulmar breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

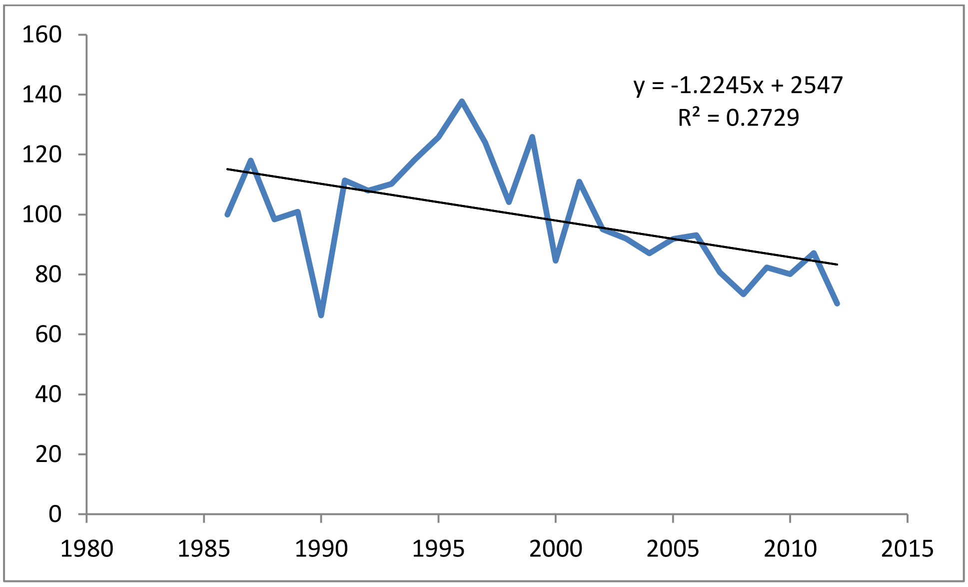

Figure 5.5. Trend in the fulmar breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

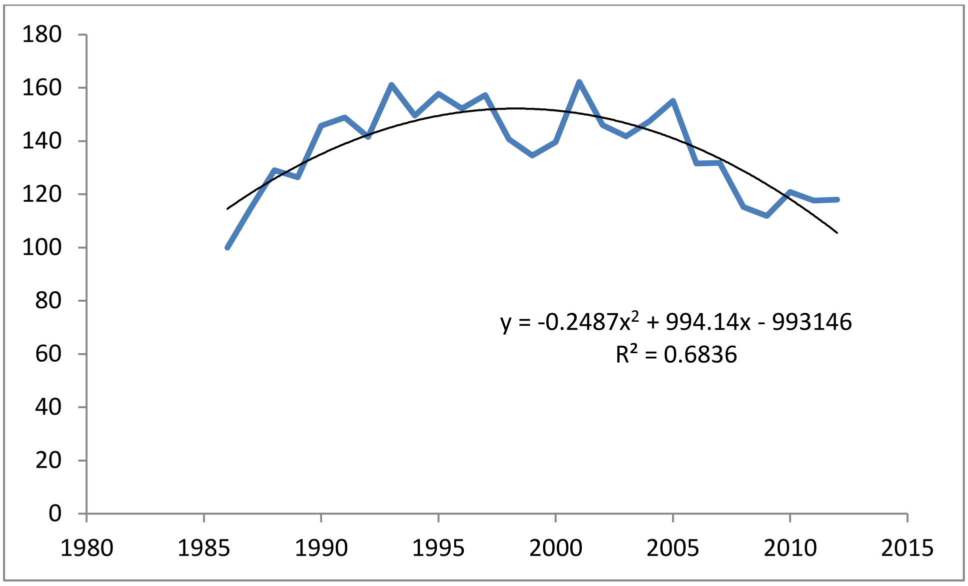

Figure 5.6. Trend in the fulmar breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

5.9 Proportion of UK population from UK breeding SPAs

The 25 SPAs with breeding fulmars as a feature together held 310,279 pairs at designation, estimated to represent ca. 57% of the British breeding population (Stroud et al. 2001). Given that the geographical distribution of SPAs (Figure 5.7) reflects the geographical distribution of the population as a whole, it is likely that this percentage remains a valid estimate for the current population. Breeding numbers have declined since 2000 (by about 10% between 2000 and 2012) in the UK, Scotland and Wales (Figures 5.4 to 5.6). However, that decline is likely to have affected SPA and non-SPA populations, so should not greatly alter the proportion within SPAs. It is likely that larger populations (which are predominantly the SPA populations) may have declined more, which would reduce the proportion within the SPA suite. Stroud et al. (2014) estimated that the SPA suite held about 49.7% of the GB population in the early 2000s.

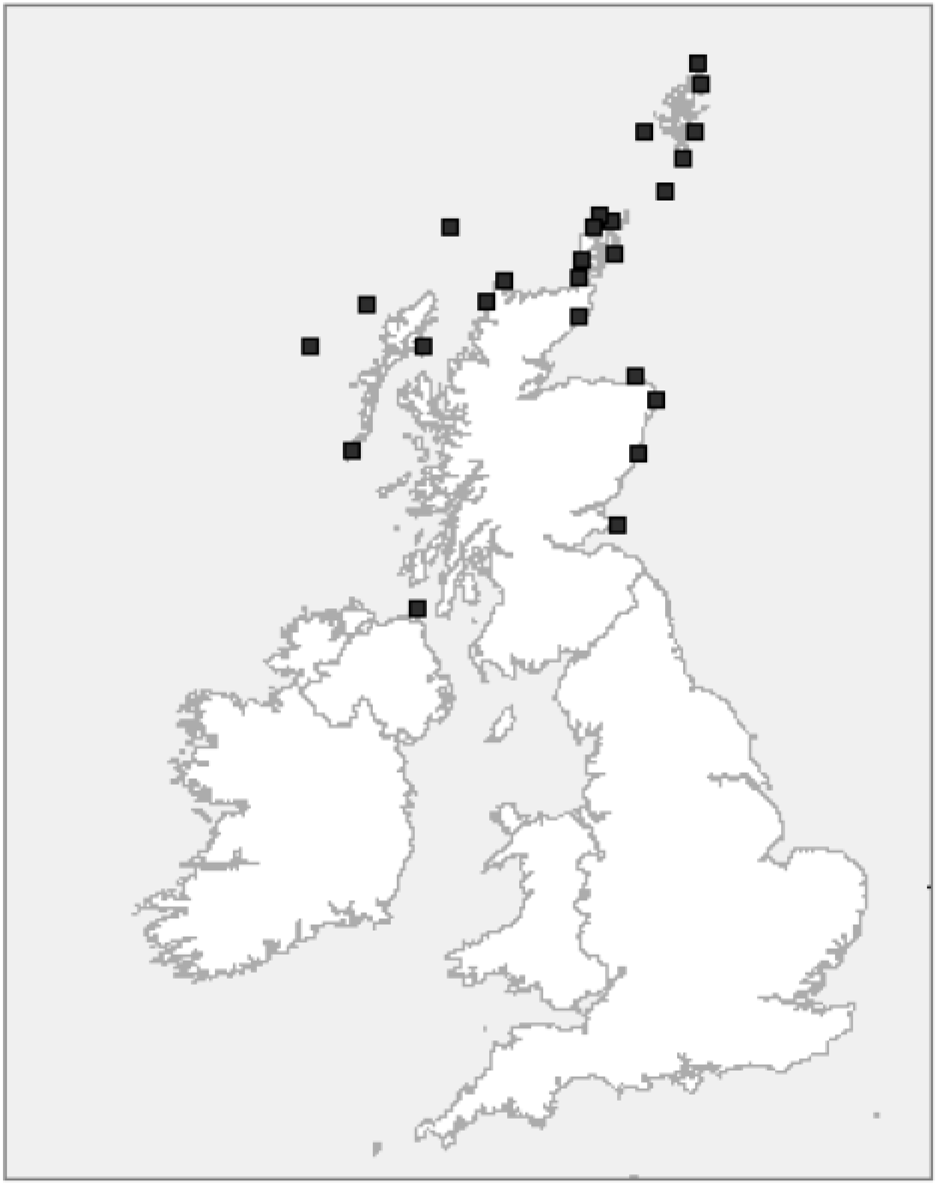

Figure 5.7. Locations of the 25 UK SPAs with fulmar as a breeding feature. These SPA populations are listed in Table 5.1. From Stroud et al. 1990.

Table 5.1. The UK SPA suite for breeding fulmars.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site condition monitoring***	**Recent counts (pairs)**	**Year**	**Reference**
UK North Sea							
Hermaness, Saxavord & Valla F	Shetland	14,890	1994	Declined 2007	13,958 >6,723	1999 2011	SMP database SMP database
Fetlar	Shetland	9,800	1994	Maintained 2002	8,912	1999-2002	Stroud et al. 2014
Foula	Shetland	46,800	1995	Declined 2007	21,106 19,758	2000 2007	Seabird2000 SMP database
Noss	Shetland	5,870 (1993)	1996	Maintained 1998	4,999 5,169 6,144 5,248	1998 2002 2006 2011	Seabird2000 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012

Sumburgh Head	Shetland	2,542	1996	Maintained 2001	1,487 230 233	2001 2007 2009	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
Fair Isle	Shetland	43,320	1994	Maintained 2000	29,649	2011	Lewis et al. 2012
West Westray	Orkney	1,400	1996	Declined 2007	4,270 677	2000 2007	Seabird2000 Lewis et al. 2012
Calf of Eday	Orkney	1,955	1998	Maintained 2002	1,842	2002	Lewis et al. 2012
Rousay	Orkney	1,240	2000	Recovering 2009	712 1,030	2000 2009	Seabird2000 Lewis et al. 2012
Hoy	Orkney	35,000	2000	Declined 2007	19,586	2007	Lewis et al. 2012
Copinsay	Orkney	1,615	1994	Recovering 2008	1,630	2008	Lewis et al. 2012
North Caithness Cliffs	N Scotland	14,700 Or 16,310 (Stroud et al. 2001)	1996	Maintained 2000	14,250	2000	Seabird2000
East Caithness Cliffs	N Scotland	15,000	1996	Maintained 1999	14,202	1999	Seabird2000
Buchan Ness to Collieston Coast	NE Scotland	1,765 (1986)	1998	Declined 2007	1,389 1,367	2007 2007	Lewis et al. 2012 Stroud et al. 2014
Troup, Pennan and Lion's Heads	NE Scotland	4,400 (1995)	1997	Declined 2007	2,900 1,795	2001 2007	Lewis et al. 2012 Lewis et al. 2012
Fowlsheugh	NE Scotland	1,170	1992	Maintained 1999	246 193	2006 2009	Lewis et al. 2012 Lewis et al. 2012
Forth Islands	E Scotland	798 (1985) or 1,600 (Stroud et al. 2001)	1990	Maintained 2004	1,364 676 832	2004 2005-2009 2010	Lewis et al. 2012 Stroud et al. 2014 Lewis et al. 2012
Flamborough and Filey Coast pSPA	E England	Not stated	Not yet		1,355 878	2000 2008	SCM database SCM database
Western waters & Channel							
Cape Wrath	NW Scotland	2,300	1996	Maintained 2000	2,115	2000	Seabird2000
Handa	NW Scotland	3,500 (1986)	1990	Declined 2008	4,323 3,550 2,119 1,915 1,870	1996 2000 2004 2008 2012	SMP database Seabird2000 Lewis et al. 2012 Lewis et al. 2012 SMP database
Flannan Isles	Western Isles	4,700 (1988)	1992	Recovering 2013	7,328	1998	Seabird2000
North Rona and Sula Sgeir	N Scotland	11,500	1985-1986	Declined 2012	North Rona only: 3,738 3,520 2,616 1,438	 1986 1998 2005 2012	 SMP database SMP database SMP database SMP database

Shiant Isles	Western Isles	6,820	1992	Maintained 1999	4,387	1999	Seabird2000
St Kilda	Western Isles	62,800	1992	Maintained 2000	66,055	1999	Seabird2000
Mingulay and Berneray	Western Isles	12,500 (1994)	1994	Maintained 1998	15,023 9,046	2003 2009	Lewis et al. 2012 Lewis et al. 2012
Rathlin Island	N Ireland	1,482 (1985)	1999		2,032 1,072 1,518	1999 2007 2011	SCM database SCM database SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

5.10 BDMPS

Given that breeding fulmars from Scotland may make foraging trips while breeding to as far as the mid-Atlantic ridge, and non-breeding birds may disperse over thousands of kilometres, this pelagic species cannot readily be subdivided into local regional populations. It seems more appropriate to consider all UK waters as a single BDMPS for this species. However, if it is convenient to work on a smaller spatial scale, division into UK North Sea waters and UK Western waters plus Channel would be practical, based on the fact that there appears to be relatively low movement of birds between UK North Sea and UK western waters (Figure 5.8). The following interpretation is based on the review of literature presented in Sections 5.5, 5.6 and 5.7. In UK waters there are about 1,000,000 fulmars at sea on average during the winter. The vast majority of these occur in Scottish waters rather than further south. Approximately half of these occur in the BDMPS 'UK North Sea waters' and approximately half in 'UK Western waters plus Channel'. However, the contributions of SPA breeding populations differ strongly between these two BDMPS, with most birds from North Sea SPA populations in North Sea waters and most birds from western SPA populations in western waters. Details of apportioning used in computing these BDMPS are given in Appendix A Tables 8 and 9 for winter BDMPS, and Appendix A Tables 10 and 11 for migration season BDMPS. The numbers of birds from overseas populations contributing to these BDMPS is particularly uncertain. It is clearly a very low proportion as estimates of the numbers of fulmarsv at sea in UK waters would not allow for large numbers from overseas in addition to the better known numbers from UK populations. In the BDMPS calculations the proportion coming from Iceland, Norway and Faroe has been estimated at 1% of the adult population and 2% of the immature population (3% for Faroe) in winter in the UK North Sea and in UK western waters, and at twice these values for the migration seasons.

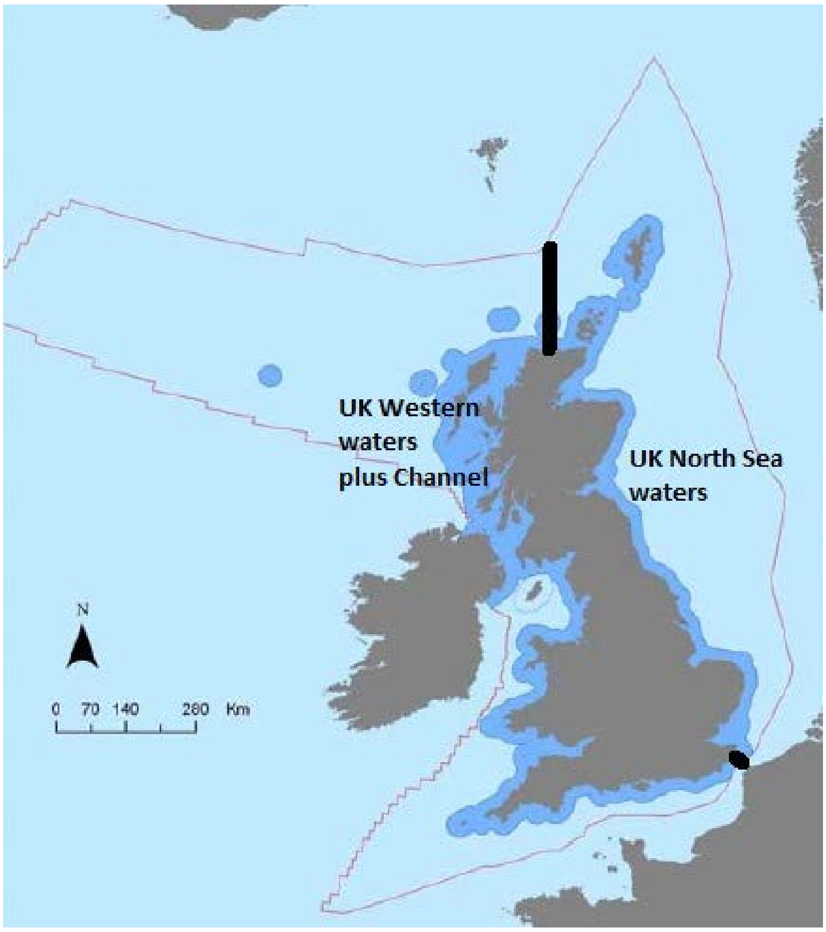

Figure 5.8. Two defined BDMPS spatial areas for fulmar; the two defined areas are 'UK North Sea' and 'UK Western waters plus Channel'.

5.11 Proportions of UK SPA birds in each BDMPS

Proportions of each BDMPS represented by adults from UK breeding SPA populations can be computed from the data in Appendix A Tables 8 to 11. For example, the UK North Sea winter BDMPS holds an estimated 96,413 birds from overseas populations and 472,323 birds from UK populations, a total of 568,736 birds. Of these, 184,608 are adults from SPA breeding populations, so these represent 32.5% of the UK North Sea winter BDMPS total. In UK western waters the winter BDMPS holds an estimated 96,413 birds from overseas populations and 459,954 birds from UK populations, a total of 556,367 birds. Of these, 162,063 are adults from SPA breeding populations, so these represent 29.1% of the UK western waters plus Channel winter BDMPS total.

5.12 Spatial distribution of UK breeding SPA birds across the BDMPS

The 25 UK SPAs with fulmar as a feature are almost all in Scotland (Figure 5.7), but this also reflects the broader breeding distribution of the species in the UK: Seabird 2000 (Mitchell et al. 2004) reported 485,852 pairs in Scotland, 9,755 in England, 3,474 in Wales and nearly 6,000 in Northern Ireland, so the Scottish population represents over 96% of the UK total. Within Scottish waters, the spread of fulmar SPAs is also distributed much as the overall breeding population, so that the at sea distribution of birds from SPA populations is likely to be very similar to that of birds from colonies that are not SPAs. Furthermore, about 50% of the fulmar population breeds on SPAs with fulmar as a designated feature, so the high proportion of the population in designated sites also makes it likely that the geographic spread of birds from SPAs matches closely that of the general population. The high mobility of this pelagic species also means that birds are likely to be well mixed at sea during migration seasons and in winter.

6. MANX SHEARWATER *Puffinus puffinus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (August to early October and late March to May)
Overseas	242,000	11,206
UK	1,700,000	1,578,196
Total	2,000,000	1,589,402

Migration season BDMPS (August to early October, late March to May)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
UK North Sea waters	8,507	111	8,396
UK Western waters plus Channel	1,580,895	11,095	1,569,800

Colour coding is amber for western waters as numbers in colonies in the UK and overseas are moderately well known and have in most cases not been censused since Seabird 2000 (and there are some issues with estimated numbers at Skomer where recent census suggests surprisingly large increase in numbers), most birds in UK waters originate from UK colonies so the influence of uncertain numbers coming from overseas is relatively small, and movement patterns of this species appear to be consistent from year to year. Colour coding for the North Sea migrating BDMPS is red because numbers entering the North Sea are low, are not well documented, and seem to vary somewhat from year to year, possibly in response to variable weather conditions.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 12 and 13.

6.1 Breeding range and taxa

Manx shearwaters are monotypic, with a core breeding range in the British Isles, smaller populations in Faroe and Iceland, and very small colonies in eastern Canada, France, Azores, Madeira and Canaries. Biometric variation appears to be of no value in assessing origins of individuals. Manx shearwaters are trans-equatorial migrants, wintering off the coast of Brazil (Brooke 1990).

6.2 Non-breeding component of the population

Manx shearwaters start to breed when 5 years old (BTO Birdfacts). Adult survival rate is 0.905 (BTO Birdfacts), juvenile survival 0.25 up to 5 years old (BTO Birdfacts) and mean productivity is 0.591 chicks per pair (JNCC database, n=56 measurements). To obtain a stable population, survival of immatures was adjusted to 0.6 for juveniles, 0.8 for 1-year olds, 0.85 for 2-year olds, 0.88 for 3-year olds, and 0.9 for 4-year olds. The model population comprised 54% adults, 16% juveniles and 30% older immatures. There are 0.84 immatures per adult.

6.3 Phenology

Some chicks may still be emerging and fledging from burrows on Rum in mid-October after adults have departed. However, most adults leave the breeding colonies by late September or early October (Pennington et al. 2004; Forrester et al. 2007). The literature indicates that autumn migration starts in July (Cramp et al. 1977-94; Pennington et al. 2004), August (Forrester et al. 2007), or mid-August (Wernham et al. 2002). Peak autumn migration occurs in August in Shetland (Pennington et al. 2004), August-October throughout the range from Europe to South America (Cramp et al. 1977-94) or in September in the UK (Wernham et al. 2002; Forrester et al. 2007). Argyll Bird Reports indicate very large movements of Manx shearwaters through Argyll waters in August each year (flocks of tens of thousands of birds) but only small numbers in September and very few in October. It is unclear whether this means that migration mainly occurs in August (whenm chicks are still in burrows) or whether these very large movements are foraging by breeding adults rather than migration movements. If the latter, this would imply that migration occurs rather directly into the Atlantic so is not evident from coastal Argyll for example. Numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) suggest that autumn migration occurred mainly in September with a little in early October (Figure 6.1). Autumn migration is completed by late September (Pennington et al. 2004; Forrester et al. 2007) or early October (Cramp et al. 1977-94; Wernham et al. 2002; Brown and Grice 2005).

Spring migration starts from South America in mid-January (Cramp et al. 1977-94), and in UK waters in February-March (Wernham et al. 2002) or early March (Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in February-March through in the entire range of the species (Cramp et al. 1977-94), but in mid-March in English waters (Brown and Grice 2005), in late March according to Forrester et al. (2007), April according to Wernham et al. (2002), or May in Shetland (Pennington et al. 2004). Numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) suggest that spring migration occurred in April-May (Figure 6.1). Spring migration is completed by April (Cramp et al. 1977-94), late April (Wernham et al. 2002), May (Forrester et al. 2007) or as late as June in Shetland (Pennington et al. 2004).

The first spring records of Manx shearwater in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from late March to late April, and the last records were predominantly in late September or October, while peak autumn migration was reported in July, August or September in most years, and peak spring migration was reported in May in most years. Breeding colonies are first re-occupied in March or April, with modal arrival at colonies in late March or April (Pennington et al. 2004; Forrester et al. 2007).

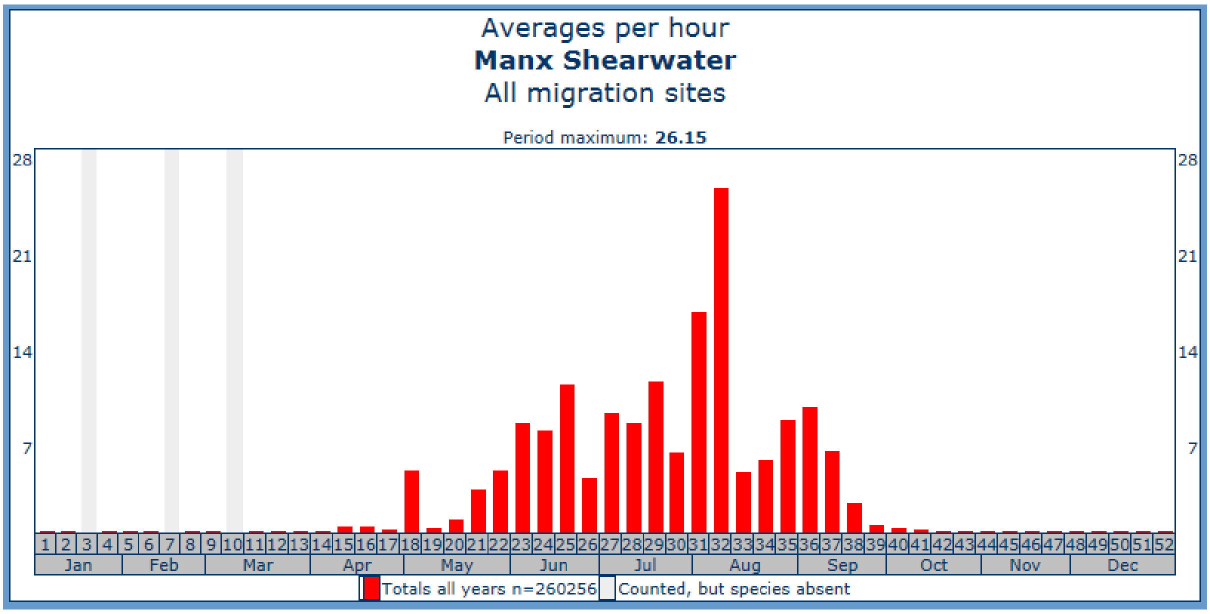

Figure 6.1. Average numbers of Manx shearwaters counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-September, non-breeding season birds absent from UK waters. However, from the data reviewed above, a more appropriate definition would be breeding season April-August, non-breeding season September-March.

6.4 Defined seasons:

• UK Breeding season	April-August
• Post-breeding migration in UK waters **BDMPS**)	August-early October (**migration**
• non-breeding season	September-March
• Return migration through UK waters	late March-May (**migration BDMPS**)
• Migration-free breeding season	June-July
• Migration-free winter season	November-February

Apart from the breeding season, one seasonal BDMPS periods is considered to be appropriate for Manx shearwater:

Migration seasons BDMPS (August-early October and late March-May).

6.5 Movements of birds from the UK population

Birds from UK colonies depart in August to October, apparently predominantly in September, and most reach South America by October (Brooke 1990; Wernham et al. 2002). Indeed, there are recoveries of chicks that have reached South America within two to three weeks of the date of ringing at the nest (Brooke 1990). Birds from Rum are thought to migrate predominantly past the west of Ireland rather than through the Irish Sea (supported by the records of Argyll Bird Club that very large numbers of Manx shearwaters feed in Argyll waters in August but rather few tende to be seen in Argyll waters in September and hardly any in October), and then past France and Spain and probably past west Africa before crossing to South America (Wernham et al. 2002). Spring migration appears to follow a more westerly route (Brooke 1990). Large numbers are seen off North Carolina in February-March (Wernham et al. 2002). There is some evidence to suggest that the use of waters off the United States is a feature that has developed since the 1950s, as the species was largely unknown there in earlier decades (Brooke 1990), suggesting some flexibility in migration route, perhaps in response to changing environmental conditions. Some immature birds, predominantly birds that are only one year old, remain in wintering areas or off the southeastern United States rather than returning to British waters (Wernham et al. 2002). Movements of adults through the South and North Atlantic have been tracked by geolocator deployment, but although these provide clear evidence of the large scale pattern they give only very little indication of directions of migration movements through UK waters (Guilford et al. 2009).

6.6 Movements of birds from overseas into UK waters

Of the 1,036 birds ringed in the Faroes (357 as chicks) none have been recovered in Britain (Hammer et al. 2013). According to Wernham et al. (2002), there is no evidence from ringing, or from any other sources, to suggest that birds from colonies in other countries apart from Ireland pass through British waters during migration, although a small number of birds reared in French colonies have recruited into colonies in the UK. However, it seems highly likely that most birds from the Faroes pass through the NW area of UK territorial waters on migration, and some from Iceland may do so. Most birds from Irish colonies probably migrate directly between the open Atlantic Ocean and Irish waters rather than moving through UK waters. There are probably about 400,000 pairs in UK colonies (numbers being somewhat uncertain due to variations in recent counts at the largest colonies), 32,600 pairs in Ireland, 25,000 pairs in Faroes, and 8,500 pairs in Iceland (Mitchell et al. 2004). These data would suggest that all, or almost all, of the Manx shearwaters occurring in British waters during migration are from British colonies. Although there are occasional records of Manx shearwaters in British waters as late as November or December, these are highly unusual, and no birds are thought to overwinter successfully in British waters.

6.7 Numbers in UK waters

Very high densities occur in summer (May-August) in Irish and Celtic Sea, whereas the species is scarce in the Channel and in the North Sea (Brown and Grice 2005). Forrester et al. (2007) suggest that passage of Manx shearwaters through Scottish waters is ‘minimal’ apart from the arrival and departure of birds to and from the large colonies on Rum and St Kilda. This is supported by the very small numbers of migrant Manx shearwaters seen at Shetland or Orkney or along the east coast of the Scottish mainland, where the species has no significant breeding colonies (Annual Bird Reports and Pennington et al. 2004).

6.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the entire species’ population, comprising 265,100 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 340,000-410,000 pairs. Since then, the estimated large increase in numbers at Skomer suggests that a more appropriate total may be at least 400,000 pairs for the UK, possibly slightly more. Kober et al. (2010) presented an estimated biogeographic population of 1,130,000 individuals. Since populations in the UK, Iceland, Faroe and Ireland have possible connectivity with UK waters, the appropriate biogeographic breeding population with connectivity is a total population of ca. 2,000,000 birds. However, given that there is no evidence that Manx shearwaters from Ireland, Iceland and Faroe pass though UK coastal waters, and these birds are considerably outnumbered by the UK population, it would be a reasonable first approximation to consider all Manx shearwaters occurring in UK waters to be birds from the UK population, comprising ca. 400,000 pairs (800,000 adults) and an associated 672,000 immatures. Some of the younger immatures spend the entire year in the wintering area (off South America) so that perhaps 1,580,000 birds from UK colonies plus about 11,200 from overseas colonies may be in UK waters during the migration periods. Numbers breeding at Rum are not known with confidence as that (very large) colony is very difficult to census, and trends in breeding numbers are unclear for Rum, and for other major colonies (Table 6.1). Numbers at Skomer are also somewhat uncertain due to the estimated large increase in numbers there when a new census methodology was adopted (Perrins et al. 2012).

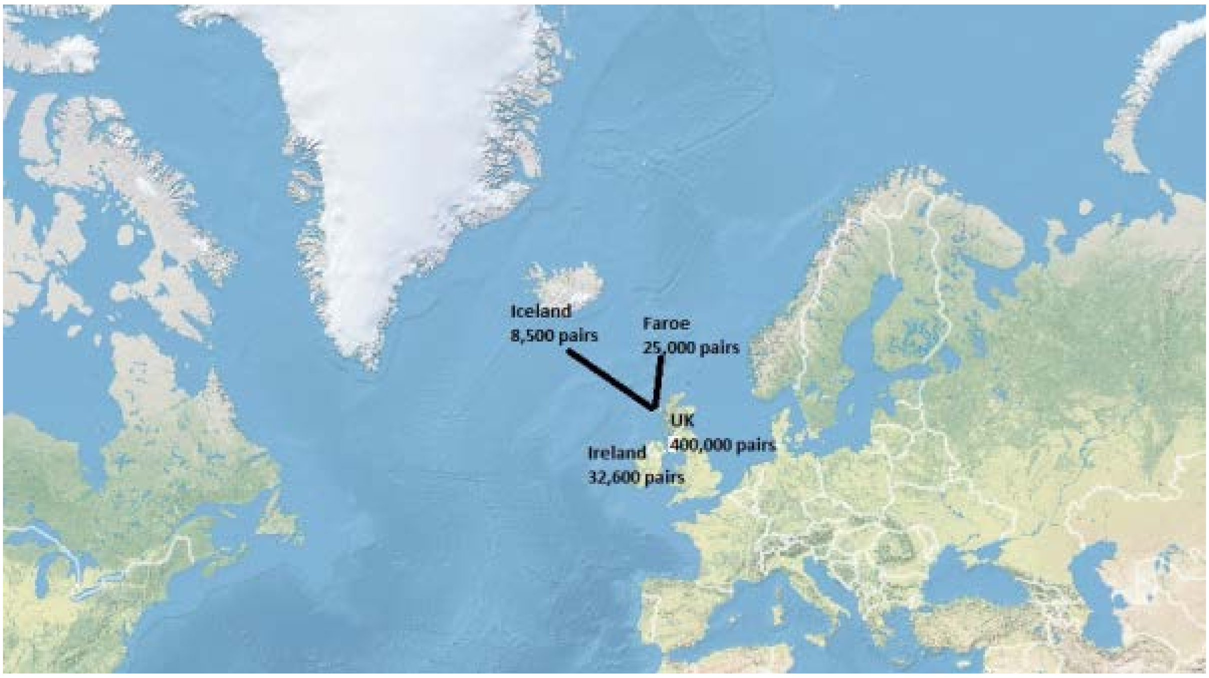

Figure 6.2. Breeding population origins of Manx shearwaters in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

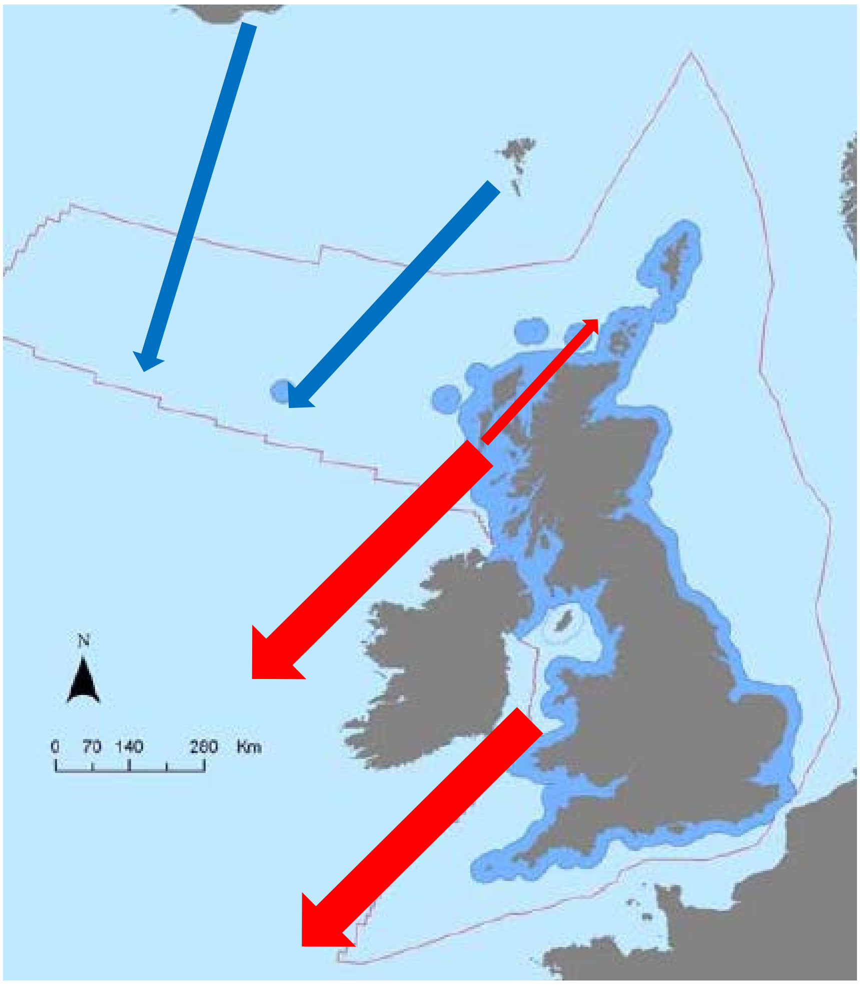

Figure 6.3. Main movements of Manx shearwaters from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure, except that in spring it is thought that birds tend to arrive from further west, crossing the North Atlantic from the Grand Banks area.

6.9 Proportion of UK population from UK breeding SPAs

The 4 SPAs with breeding Manx shearwaters as a feature together held 219,898 pairs at designation, estimated to represent ca. 100% of the British breeding population (Stroud et al. 2001). These SPA populations continue to represent almost the entire UK population. Stroud et al. (2014) estimated that GB SPAs held 96.2% of the GB population in the early 2000s. However, a recent census of Skomer found an estimated 316,070 breeding pairs on that island, more than twice the expected number (Perrins et al. 2012), suggesting that the total for the Skokholm, Skomer and Middleholm SPA is likely to have reached about 350,000 pairs, considerably increasing the total estimated UK (and world) population size. If this recent census is confirmed to be accurate (it used a new census method but is thought by Perrins et al. 2012 to be appropriate) this implies that the UK population of Manx shearwaters is at least 400,000 pairs, and possibly higher. The UK SPA suite for breeding Manx shearwaters still certainly holds very near to 100% of the UK breeding population.

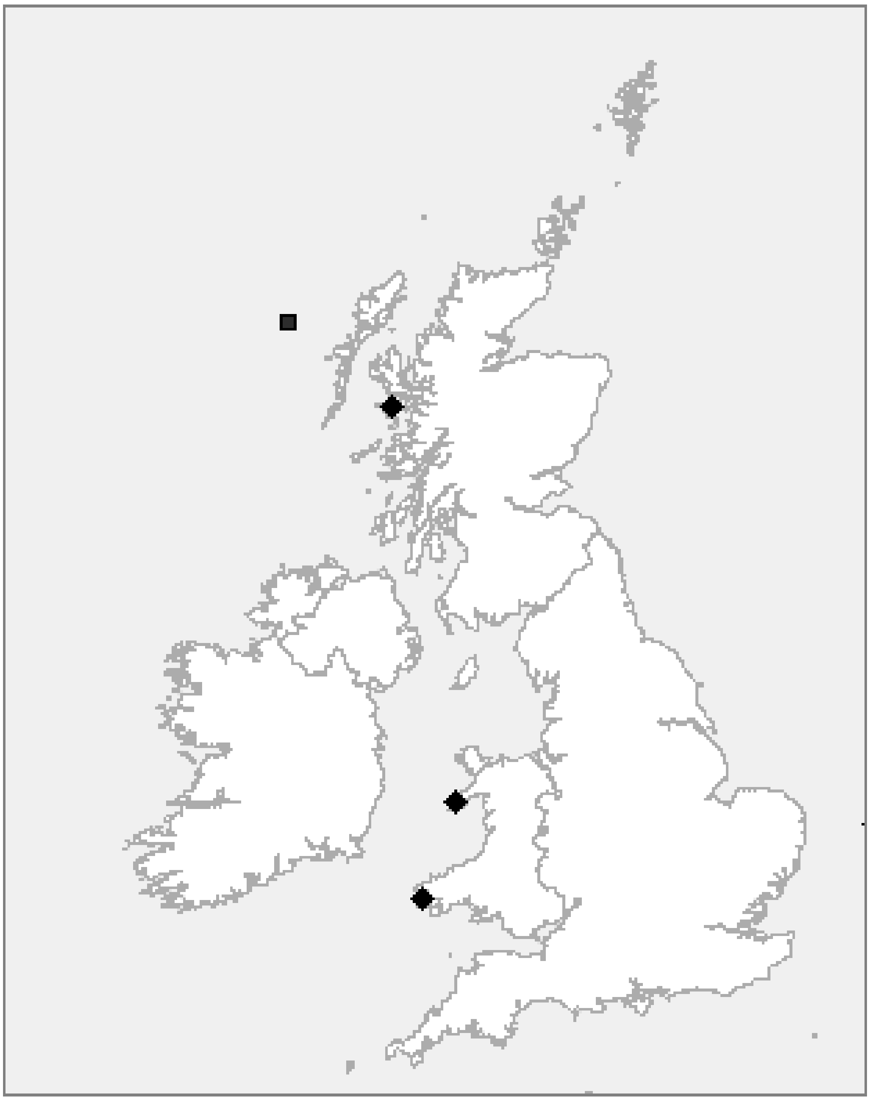

Figure 6.4. Locations of the 4 UK SPAs with Manx shearwater as a breeding feature. These SPA populations are listed in Table 6.1. From Stroud et al. 1990.

Table 6.1. The UK SPA suite for breeding Manx shearwaters.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site condition monitoring***	**Recent counts (pairs)**	**Year**	**Reference**
Western waters & Channel							
St Kilda	Western Isles NW	<5,000 or 1,000 (Stroud et al. 2001)	1992	Maintained 2000	4,802	1999	Seabird2000
Rum	Inner Hebrides NW	61,000 (1995)	1982	Maintained 2003	120,000	2001	Seabird2000
Aberdaron Coast & Bardsey Island	Wales SW	6,930 (1996)	1992		16,183	2001	SCM database
Skomer, Skokholm & Middleholm	Wales SW	150,968 (1998)	1982		350,000	2011	Perrins et al. 2012 and in litt.

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

6.10 BDMPS

The following interpretation is based on the review of literature summarised in sections 6.5, 6.6 and 6.7. Although Manx shearwater is a highly pelagic species, the migration of this species out of, and back into UK waters appears to take place fairly quickly and directly. The BDMPS ‘UK Western waters plus Channel’ holds the large colonies in Wales, on Rum and St Kilda and a few small colonies. The BDMPS ‘UK North Sea waters’ holds no large colonies and no SPA breeding populations of the species and has very few migrant Manx shearwaters passing through. All these areas hold no birds in winter, so the BDMPS of concern is that for migration seasons. During migration, there will be about 1.6 million passing through the ‘UK Western waters plus Channel’ area. Numbers passing through the ‘UK North Sea waters’ are low, possibly around 8,000-9,000 birds but varying from year to year and often much less than this. Details of apportioning are given in Appendix A Tables 12 and 13. It is estimated that only about 1% of immatures and no adults from UK SPA colonies, 1% of adults and immatures from UK non-SPA colonies, and 0.1% of immatures and no adults from Iceland, Faroe and Ireland migrate through UK North Sea waters, while 100% of adults and 70% of immatures from UK SPA colonies migrate through UK western waters, together with 80% of adults and 60% of immatures from UK non-SPA colonies (numbers in these colonies being trivial by comparison to numbers in SPA colonies), and 1% of adults and 3% of immatures from Iceland and Faroe, 5% of adults and 10% of immatures from Ireland. Numbers of immatures in UK waters (and so components of these two BDMPS) do not sum to 100% because many of the youngest immatures remain in South American waters until at least their second year.

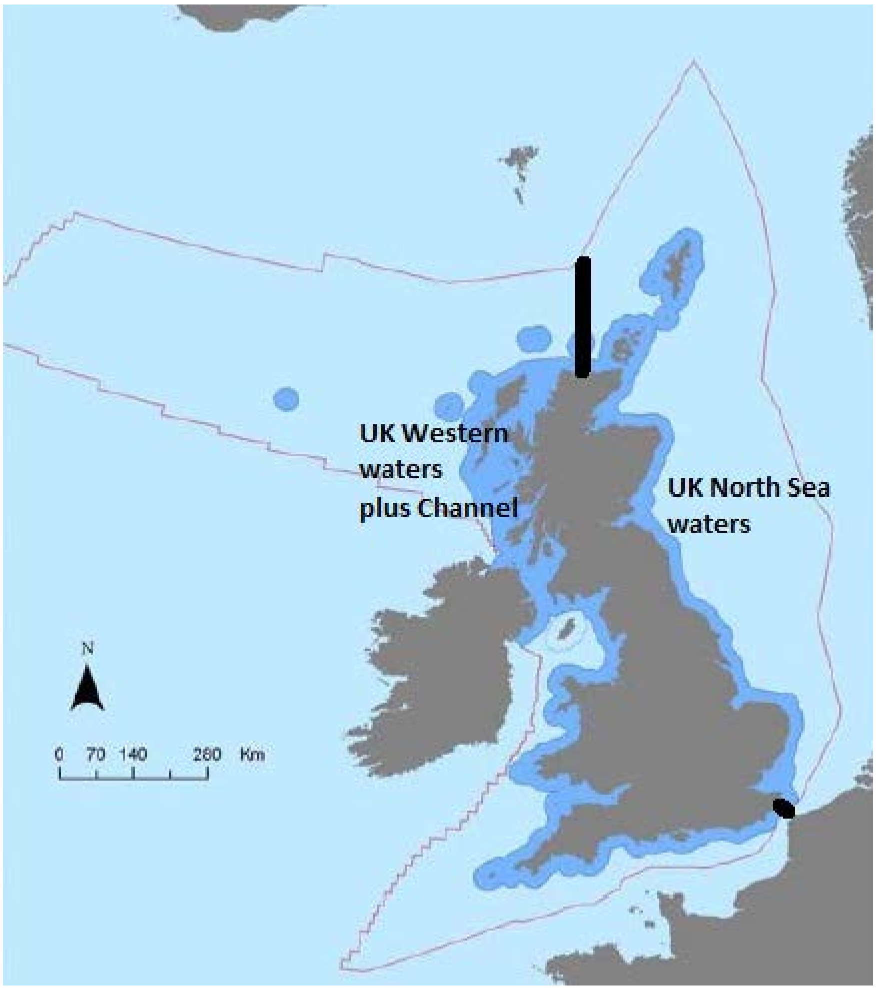

Figure 6.5. Two defined BDMPS spatial areas for Manx shearwater. The two areas are: 'UK North Sea waters' and 'UK Western waters plus Channel'.

6.11 Proportions of birds from BDMPS in reference regions

The vast majority of all birds found in these two BDMPS are associated with UK colonies. A very small number of birds migrate through from or towards colonies in Ireland, Iceland or Faroe, but those numbers are trivial based on the limited evidence. Almost all of the birds are from UK colonies and almost all birds in UK colonies are in SPA populations. The proportion of the BDMPS that comprises adults from SPA populations can be computed from Appendix A Tables 12 and 13. In the UK North Sea BDMPS of 8,507 birds, none are thought to be adults from SPA populations since the small numbers passing through the North Sea are most likely to be immatures rather than breeders, or birds from Faroe and Iceland. In the UK Western Waters plus Channel BDMPS of 1,580,895 birds, 981,970 are estimated to be adults from SPA breeding populations, or 62% of the total (most of the rest being immatures that originated from these SPA colonies).

6.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Since virtually 100% of Manx shearwaters in UK colonies are in SPAs with Manx shearwater as a feature, the spatial distribution of SPA birds is virtually identical to that of the population as a whole.

7. NORTHERN GANNET *Morus bassanus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in autumn (September-November) (adults and immatures)	Numbers in UK waters in spring (December-March) (adults and immatures)
Overseas	260,000	108,522	87,606
UK	923,000	893,730	822,667
Total	1,180,000	1,002,252	910,273

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK breeding population (adults plus immatures)
'Autumn migration' BDMPS (September to November)			
UK North Sea and Channel	456,298	45,173	411,125
UK Western waters	545,954	63,349	482,605
'Spring migration' BDMPS (December to March)			
UK North Sea and Channel	248,385	21,903	226,482
UK Western waters	661,888	65,703	596,185

Colour coding is green for numbers of birds in UK waters since the numbers are based on rather accurately known breeding numbers in UK colonies, and match quite well with estimates of numbers at sea from ESAS and general literature (such as Forrester et al. 2007). Movements of UK gannets are well known from ringing and are less subject to recovery bias than for more pelagic seabird species. Numbers visiting UK waters from overseas populations are certainly much smaller than numbers from UK colonies, but are less certain. There have been studies tracking migrating gannets (deploying geolocators) from colonies in Norway and Iceland which indicate movement of adults from those populations into and through UK waters, and ringing data also show connectivity, but the proportion of birds from those populations visiting UK waters is rather uncertain. However, given that numbers from overseas populations coming into UK waters are undoubtedly small relative to numbers from UK colonies, overall total numbers are coded green because those are mainly determined by numbers from UK colonies. Due to extensive tracking studies of breeding adults from many different colonies in different countries, confidence in the movement patterns of gannets is high. However, details of the movements of immature birds are less well known, although the general pattern appears to be similar to that of adults but with immatures moving further south on average, and migrating later in spring, with youngest immatures remaining in wintering areas. There is some uncertainty about numbers at sea because much survey work that was boat-based involved data that appear to be biased by the stong attraction of gannets towards boats.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 14 to 17.

7.1 Breeding range and taxa

Gannet is a monotypic species with core breeding range within the British Isles, but colonies also in Norway, Russia, Faroe, Iceland, eastern Canada, Germany and France. Biometrics do not seem to vary significantly among populations.

7.2 Non-breeding component of the population

Gannets start to breed when 5 years old (BTO Birdfacts; WWT 2012). Adult survival rate is 0.92 (BTO Birdfacts; WWT 2012), juvenile survival 0.42 (BTO Birdfacts) and mean productivity is 0.684 chicks per pair (JNCC database, n=97 measurements). Survival of immatures was retained at 0.42 for juveniles, 0.83 for 1-year olds, 0.89 for 2-year olds, and 0.92 for older age classes. The model population comprised 55% adults, 19% juveniles and 26% older immatures. There are 0.81 immatures per adult.

7.3 Phenology

Breeding colonies are not completely deserted until mid-November, but modal departure occurs in late September (Pennington et al. 2004; Forrester et al. 2007). However, autumn dispersal/migration starts in August (Cramp et al. 1977-94; Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak autumn migration occurs in September in Shetland (Pennington et al. 2004) and in English waters (Brown and Grice 2005), late September in Scotland (Forrester et al. 2007), September-October in the UK (Wernham et al. 2002), September-November throughout Europe (Cramp et al. 1977-94), and October in Belgium (Vanermen et al. 2013). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in mid-September although seasonal pattern was not very pronounced in that data set (Figure 7.1). Autumn migration is completed by November (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007) or December if considering southern areas of Europe as well (Cramp et al. 1977-94).

Spring migration starts in December- January (Wernham et al. 2002; Pennington et al. 2004) early January (Forrester et al. 2007) or January (Cramp et al. 1977-94). Peak spring migration occurs in February-March (Pennington et al. 2004), February-April in Belgium (Vanermen et al. 2013), early March (Forrester et al. 2007), March (Wernham et al. 2002) or March-April (Cramp et al. 1977-94). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late-January and February (Figure 7.1). Spring migration is completed by late March (Pennington et al. 2004; Forrester et al. 2007) or early May (Wernham et al. 2002) or May (Cramp et al. 1977-94).

The first spring records of gannet in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly in early January and the last records were predominantly in late December, as some gannets overwinter, while peak autumn migration was reported in August to October in most years, and peak spring migration was reported in March or March-April in most years, but sometimes in January or February. Breeding sites are re-occupied from early January, with modal re-occupation in mid-February to mid-March (Pennington et al. 2004; Forrester et al. 2007).

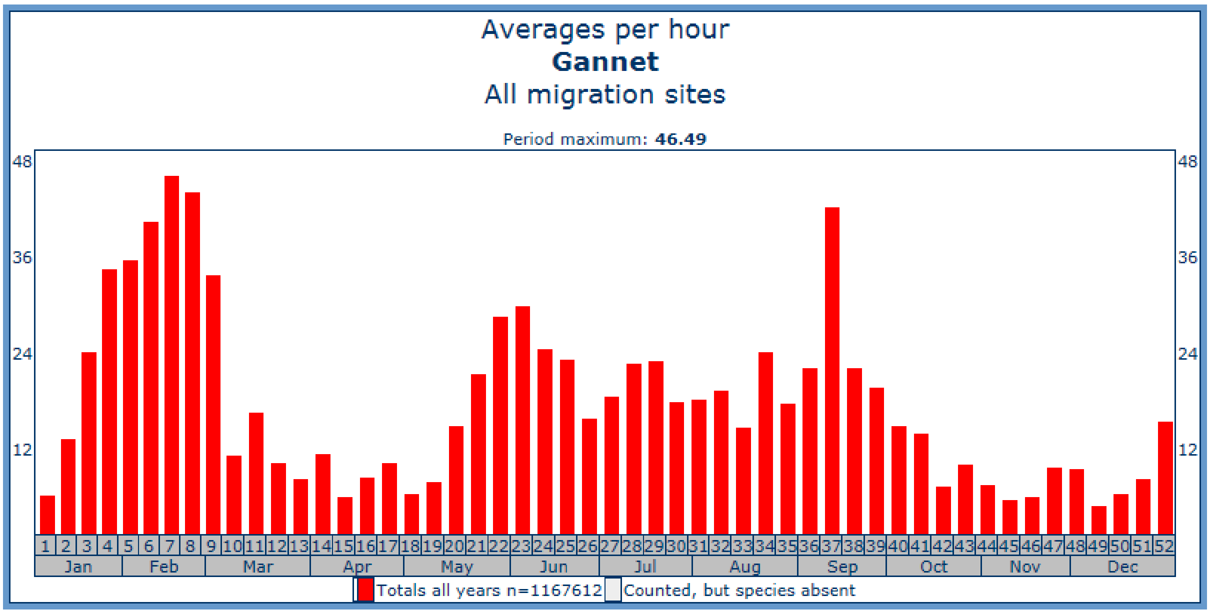

Figure 7.1. Average numbers of gannets counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-September, non-breeding season October-April. However, from the data reviewed above, a more appropriate definition would be breeding season March-September, non-breeding season October-February.

7.4 Defined seasons:

- UK Breeding season — March-September
  - Migration-free breeding season — April-August
- Non-breeding season — October-February
  - Post-breeding migration in UK waters — September-November (**autumn BDMPS**[2])
  - Migration-free winter season — None
  - Return migration through UK waters — December-March (**spring BDMPS**)

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for northern gannet:

'Autumn' (post-breeding) migration season BDMPS (September-November); and

'Spring' (pre-breeding) migration season BDMPS (December-March).

7.5 Movements of birds from the UK population

Gannets leave colonies mainly in August-October. Chicks fledge with large fat stores and begin migration by swimming, independent from their parents (Wernham et al. 2002) until their fat load is reduced. Fledglings generally move south quite rapidly; for example, birds ringed on the sea below the colony on Noss moved an average of 60 km per day during their

[2] Seasons for which BDMPS have been generated are annotated (BDMPS).

first 10-16 days (Wanless and Okill 1994) so clearly do not remain flightless for long. Adults from colonies in the UK do not necessarily move directly southwards in autumn, but may move to areas with abundant food for some time in late summer before heading towards their wintering area. On the basis of ring recovery data and observations of gannets on migration and in winter, Nelson (1978, 2002) suggested that most gannets breeding at the Bass Rock probably spend the winter in the North Sea or no further south than the Channel. Geolocators were fitted to experienced breeding gannets on the Bass Rock in 2002 and 2003 (Kubetzki et al. 2009). Birds attended the colony until between 24 September and 16 October (median 5 October). Although gannets fly at an average speed of about 58 km per hour (Garthe et al. 2007), migration took up to four weeks to complete, as birds spent considerable amounts of time sitting on the water or foraging locally rather than travelling consistently towards their goal, so net movement was often only 200 to 400 km per day. Of the 22 birds tracked until at least December, 18% wintered in the North Sea and the English Channel, 27% in the Bay of Biscay and the Celtic Sea, 9% in the Mediterranean Sea and 45% off West Africa. Birds wintering off West Africa migrated to their wintering areas mostly within 3 to 5 weeks, usually starting between early and late October. Most of these birds stayed off West Africa for a period of about 3 months, where they remained in a relatively restricted area. Individual winter home ranges as measured by the 75% kernel density contours varied between 8100 and 308 500 km^2 (mean = 134 000 km^2). Return migration was initiated between the end of January and mid-February, and took about as long as autumn migration. Kubetzki et al. (2009) inferred that the migration habits of gannets may be changing in response to human impacts on marine ecosystems, as the proportion of Bass Rock breeding adults that wintered within the North Sea was much smaller than appears to have been the case in earlier decades, whereas increased proportions were wintering off west Africa, where adult plumaged gannets had previously been relatively scarce. This trend was even more evident when loggers were deployed on Bass Rock gannets in 2008; none of the birds overwintered as far north as the North Sea that year (Garthe et al. 2012). These results are in strong contrast to the previously established view that adult gannets from the Bass Rock predominantly winter in the North Sea and only extremely exceptionally travel as far as Africa. Kubetzki et al. (2009) suggest that gannet migration behaviour may have changed in recent years, in response to changes in fish stocks and fisheries. In particular, amounts of fish discarded in the North Sea have been drastically reduced in recent years, whereas large fisheries have developed on the west African continental shelf and large quantities of discards are generated in that region (Meraz Hernando 2011). Almost all gannets (over 88%) seen on the west African shelf occur behind fishing vessels (Camphuysen and van der Meer 2005). In support of this suggested change in gannet winter distribution, Garthe (unpublished) analysed the ESAS database and found that the numbers of adult-plumaged gannets present in the North Sea in winter have declined since the 1980s despite very large increases in the gannet population. None of the birds carrying loggers wintered over deep water; all were on the continental shelf sea, wintering in areas where there are large fisheries as well as large stocks of pelagic fish (Meraz Hernando 2011). For birds where the logger data indicated migration routes used by breeding adults from the Bass Rock, twelve individuals migrated southwards through the English Channel, and eight left the North Sea around the north coast of Scotland and flew southwards west of the British Isles. On spring northward migration, only three birds moved back into the North Sea through the English Channel, while six moved into the North Sea around the north of Scotland (some loggers failed to record spring migration route because battery power was depleted). Birds that left in autumn through the Channel did not consistently return by the same route but in several cases moved north by a westerly route. A further deployment of loggers on Bass breeding adults in summer 2008 showed similar results (Garthe et al. 2010). On southward migration, 14 left the North Sea through the English Channel, and seven around the north of Scotland (apparently none of these birds flew overland from the North Sea to the Irish Sea or Atlantic). On northward migration in early spring, five entered the North Sea through the English Channel, and 16 flew up the west coast of Ireland and into the North Sea around the north of Scotland. Wernham et al. (2002) concluded that distributions of gannet ring recoveries from different areas of Britain and Ireland, and recoveries from other European countries, show that gannets from all east Atlantic colonies intermingle in winter, distributed over a large area from the North Sea to west Africa. There is no clear evidence from ringing data that gannets from colonies in Britain and Ireland show differences among colonies in their wintering areas (Thomson 1974; Veron 1988; Wernham et al. 2002; Veron and Lawlor 2009). However, ringing effort has been high at the Bass Rock, moderate at Ailsa Craig, Hermaness, Grassholm and Great Saltee, and low or non-existent at other colonies. In particular, very little gannet ringing has been done at St Kilda, Sule Stack or Sula Sgeir, long-established and large colonies that represent a high proportion of the population and that are all located in the NW of the British Isles.

7.6 Movements of birds from overseas into UK waters

Ring recoveries from Faroese gannets suggest that those birds also share much the same winter distribution, but half of those birds were recovered as juveniles and wintering areas of adults were thought to be further north than most of these recoveries (Hammer et al. 2013). Deployment of geolocation loggers on breeding adult gannets from a variety of colonies showed evidence of different wintering areas used by birds from particular populations (Fort et al. 2012), although birds from all studied colonies were in UK waters in October. Their analysis showed that maximum distance between the colony and wintering area was similar across colonies despite their wide latitudinal range, strongly suggesting oriented chain migration (a pattern in which populations move uniformly southward). About 50% of the winter position fixes of birds from two Norwegian colonies were in UK waters (in the North Sea, west of Scotland, Channel, and Celtic Sea; see also Pettex et al. 2010). About 15% of the winter position fixes of birds from the Bass Rock were in UK waters (in the southern North Sea, Channel, and Celtic Sea). About 15% of the winter position fixes of birds from Rouzic (France) were in UK waters (almost all in the Celtic Sea). Less than 5% of the winter position fixes of birds from Grassholm were in UK waters. More recently, 12 loggers deployed on gannets at a colony in Iceland in summer 2010 were recovered in summer 2011 and preliminary analysis of these loggers indicates that the Icelandic gannets wintered from west Africa to west of Scotland (Garthe, Furness, Montevecchi and Halgrimsson unpublished data). During autumn migration, some of these birds passed through the North Sea and English Channel (5 out of 12) whereas in spring all returned northwards past the west of Ireland. Ringing studies indicate that immature gannets tend to winter further south than adults from the same population (Wernham et al. 2002). Wintering areas used by gannets breeding at colonies in Shetland and off NW Scotland have not been determined; no birds from those colonies have been equipped with geolocators and very few have been ringed. However, it seems likely that they will show patterns intermediate between colonies to the north (Norway and Iceland) and colonies to the south (Bass Rock, Grassholm, Rouzic). These data would suggest that a relatively small proportion of adult gannets from UK colonies overwinter in UK waters (and an even smaller proportion of immatures), whereas a relatively high proportion of adult gannets (but small proportion of immatures) from Norwegian and Icelandic colonies overwinter in UK waters. There are around 220,000 pairs in UK colonies, 36,000 pairs in Ireland, 5,950 pairs in the Channel Islands, 17,000 pairs in France, 28,500 pairs in Iceland, and 4,500 pairs in Norway (Wanless et al. 2005), 2,500 pairs in the Faroes (Hammer et al. 2013), about 632 pairs in Germany (Helgoland) (J. Dierschke in litt to JNCC July 2013) and a handful of pairs in Russia (Wanless et al. 2005). The fact that the UK population is by far the largest of these suggests that most gannets overwintering in southern UK waters are probably from UK colonies, whereas in the North Sea and off west Scotland, there may be a fairly high proportion of birds from Norwegian and Icelandic colonies. However, more data on movements of birds from those colonies would be needed to quantify these proportions accurately.

In the North Sea, gannets in summer show distributions that relate to the locations of breeding colonies (Langston et al. 2013), with birds travelling out from the colony to forage up to 540 km (and into Norwegian waters) from the colony in the case of the largest colonies such as the Bass Rock (Hamer et al. 2001), predominantly on pelagic fish such as sandeels, herring and mackerel. Foraging ranges from smaller colonies are much shorter. Foraging ranges of gannets breeding in Norwegian colonies are small, which relates at least in part to the small size of those colonies so less competition among foraging adults. Birds equipped with GPS trackers at two Norwegian colonies while breeding fed no more than 22 km from their colony in 2007, no more than 56 km in 2008 and no more than 49 km in 2009 (Pettex et al. 2010) so would not have entered UK waters during their breeding foraging trips. A similar situation probably applies for Faroese and Icelandic breeding gannets. Birds breeding at Irish colonies apparently avoid foraging during the breeding season close to areas used by gannets breeding in UK colonies, so that few gannets in UK waters in summer are likely to be from Irish colonies (Wakefield et al. 2013). However, gannets from the colonies in the Channel Islands apparently forage in UK waters of the western English Channel while breeding (Wakefield et al. 2013).

Many immature gannets, particularly of the 3 and 4 year old cohorts, attend colonies during the summer (mostly from May to August so for a shorter period than breeding adults are present), and those birds tend also to show ‘Central Place foraging’ with their feeding flights radiating out from the colony, but over larger areas of sea than used by breeding adults (Votier et al. 2011).

7.7 Numbers in UK waters

Tasker et al. (1985) found that about 60% of gannets in the southern North Sea in summer were immatures, whereas in the northern North Sea this was only 20%. In winter, there are few immature gannets in the North Sea (fewer than 7% of all records), and densities of adults are lower than in summer (Tasker et al. 1985). Tasker et al. (1985) reported an average across the North Sea of 0.4 gannets per km^2 in October but only 0.04 per km^2 in December to February. Gannet distribution in the North Sea show a stronger correlation in winter with the distribution of fishing vessels, as they scavenge extensively on trawl fishery discards in winter when pelagic fish are less available (Garthe et al. 1996). Off the west of Britain, gannets were found to be present in relatively much lower numbers in winter than in summer, with gannets in winter mostly associated with fishing vessels (Webb et al. 1990). Surprisingly few occurred within the Irish Sea at any time of year with peak abundance there (in September) still below 0.5 birds per km^2 (Webb et al. 1990). However, large numbers of adults and immatures feed at the shelf-edge in the SW Approaches, in the western English Channel and Celtic Sea in November to February (Stone et al. 1995; White and Reid 1998; Brown and Grice 2005). Forrester et al. (2007) consider that ‘a few thousand’ may be in Scottish waters during winter, but they define winter as December to February, while also noting that gannets may be back on nest sites from the start of January, whereas lowest numbers at sea in Scottish waters may occur in late November or early December.

7.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the entire species’ population, comprising 263,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 390,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 1,160,000 individuals. Birds in UK waters may originate from colonies in UK (255,500 pairs), Ireland (36,000 pairs), Iceland (28,500 pairs), Faroe (2,500 pairs), Norway (4,500 pairs) or Germany (632 pairs) (Mitchell et al. 2004, updated by Wanless et al. 2004, and Dierschke in litt). This gives a biogeographic population with connectivity to UK waters of 327,600 pairs, or 655,000 adults. Associated with this will be about 530,000 immatures, giving a total of around 1,180,000 individuals.

Figure 7.2. Breeding population origins of gannets in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

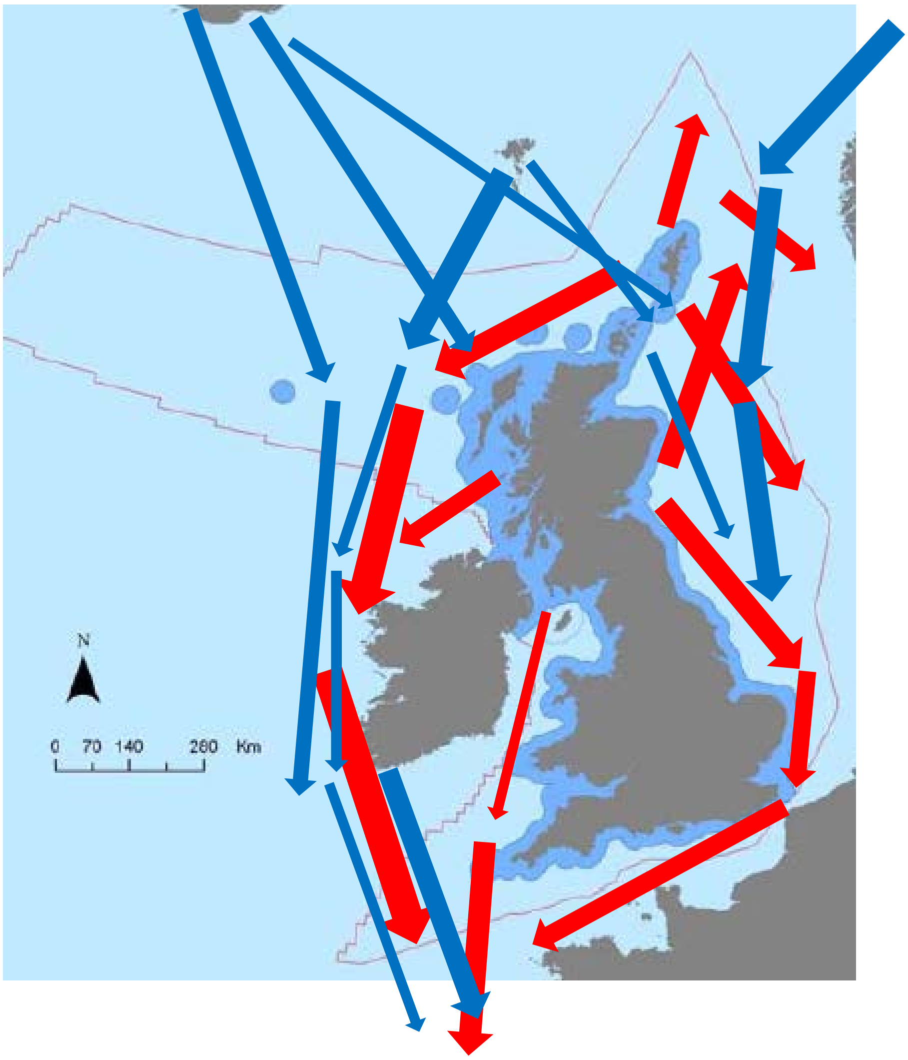

Figure 7.3. Main movements of gannets from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes.

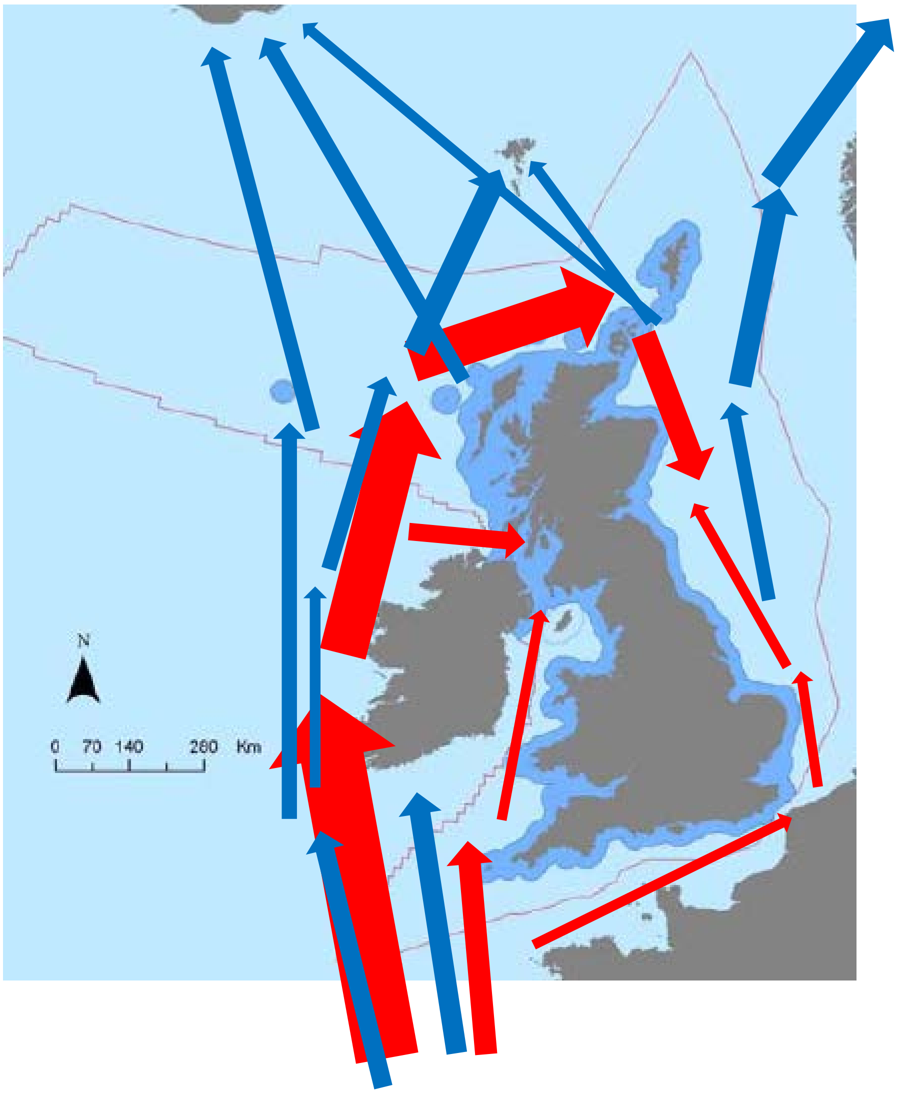

Figure 7.4. Main movements of gannets to UK breeding areas (red arrows) and by overseas populations (blue arrows) through UK waters during ‘spring’ migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. Note that spring migration routes differ from those in autumn as very few birds migrate through the southern North Sea in spring; most birds returning to colonies in the North Sea do so past the west of Scotland.

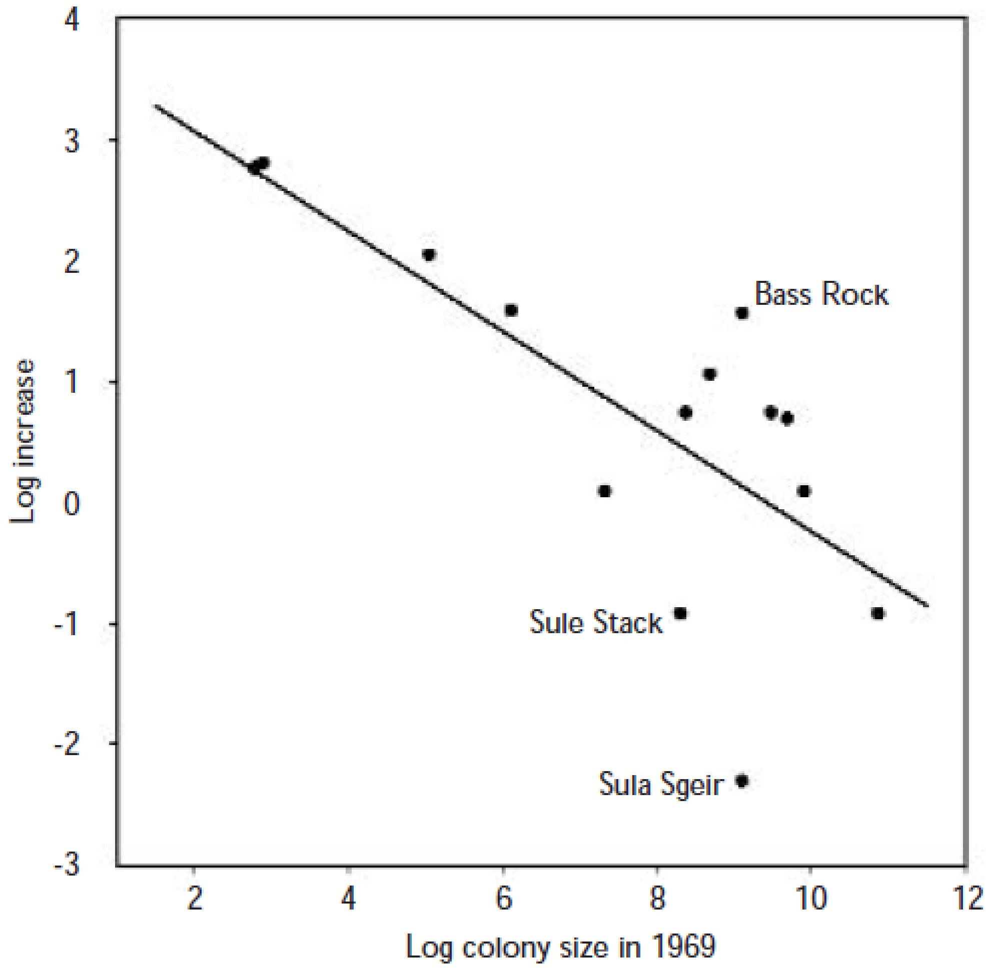

Figure 7.5. Rate of increase in breeding numbers of gannets at each colony in relation to original size of the colony in 1969. Larger colonies grow more slowly. From Wanless et al. (2004). The data are historical but are presented as an example of a pattern that appears to be typical; smaller colonies tend to grow faster than larger colonies, implying density-dependence, probably of recruitment as there is no evidence of reduced productivity in large colonies, and no evidence (though based on very limited data) of differences in adult survival rates between large and small colonies.

7.9 Proportion of UK population from UK breeding SPAs

The 10 SPAs with breeding gannets as a feature designated before 2000 together held 197,127 pairs at designation, estimated to represent ca. 98% of the British breeding population (Stroud et al. 2001). Almost all of these populations have increased in numbers since designation, and smaller colonies have tended to increase more rapidly than the largest colonies (Figure 7.5). Therefore, the proportion of the population in colonies that are not SPAs with gannet as a feature will have increased slightly since designation was completed. Several colonies that are SPAs for seabirds but held too few gannets for that species to qualify as a feature now hold large enough numbers to qualify (Table 7.1). For example, there were 2,787 pairs at Troup, Pennan and Lion's Heads SPA in 2010, 2,760 pairs on the Flannans SPA in 2004, both of which exceed the 1% of UK population threshold numbers based on the current population estimate of 220,000 pairs. However, even with the smaller colonies growing faster than SPA populations, the SPA suite still held 95.9% of the GB population around 2004 (Stroud et al. 2014), and this percentage is likely to remain around 95% in the near future.

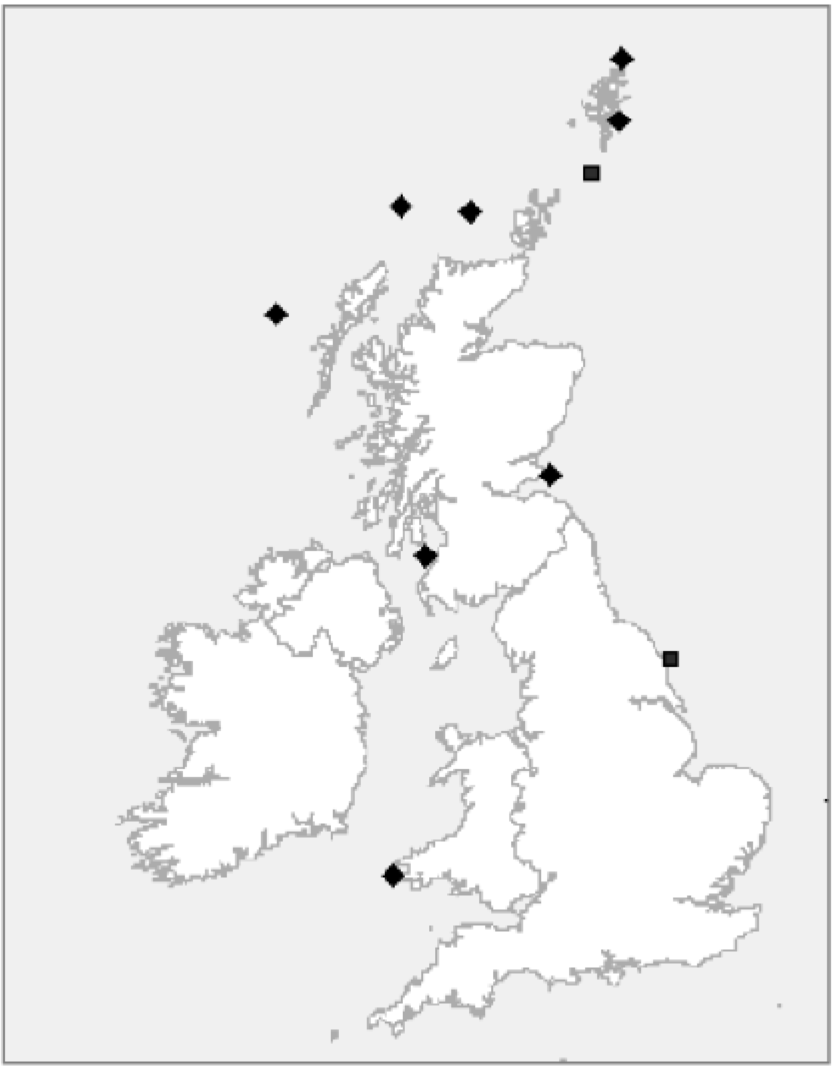

Figure 7.6. The UK SPA suite for gannet. These SPA populations are listed in Table 7.1.

Table 7.1. The UK SPA suite for breeding gannets and data for other major colonies.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea & Channel							
Hermaness, Saxavord & Valla	Shetland	12,000 (1994)	1994	Maintained 2008	15,633 24,353	2003 2008	Wanless et al. 2005 Lewis et al. 2012
Noss	Shetland	7,310 (1994)	1996	Maintained 2008	8,652 9,767	2003 2008	Wanless et al. 2005 Lewis et al. 2012
Foula	Shetland	Not yet listed as a qualifying feature			220 280 600 723 919 1,370	1990 1991 1994 2000 2004 2007	SCM database SCM database SCM database SCM database SCM database SCM database

Fair Isle	Shetland	1,166	1994	Maintained 2001	3,968 4,085 3,862 3,924	2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 SCM database SCM database
West Westray	Orkney	Not yet listed as a qualifying feature	1996		167 345 499 583 600 623	2007 2008 2009 2010 2011 2012	SCM database SCM database SCM database SCM database SCM database SCM database
Troup, Pennan and Lion's Heads	NE Scotland	Not yet listed as a qualifying feature	1997		545 1,085 1,228 1,547 1,810 2,787	1995 1998 2001 2004 2007 2010	SCM database SCM database SCM database SCM database SCM database SCM database
Forth Islands	E Scotland	21,600 (1985) Or 34,400 (Stroud et al. 2001)	1990	Maintained 2004	34,397 48,065 55,482	1995 2004 2009	Mitchell et al. 2004 Lewis et al. 2012 Lewis et al. 2012
Flamborough Head & Bempton (to be subsumed into Flamborough and Filey Coast SPA subject to consultation)	E England	2,501 (Stroud et al. 2001)	1993		3,940 3,480 6,487 7,859 11,061	2004 2005 2008 2009 2012	Wanless et al. 2005 SCM database SCM database SCM database SCM database
Flamborough and Filey Coast pSPA	E England	8,469 (2008-2012)	Not yet		As above		As above
UK Western waters							
Sule Skerry and Sule Stack	N Scotland	4,890 (1994)	1994	Maintained 2004	4,675	2004	Wanless et al. 2005
North Rona and Sula Sgeir	N Scotland	10,400 (1994) Or 9,000 (Stroud et al. 2001)	2001	Not reported	10,703 9,225	1999 2004	Lewis et al. 2012 Wanless et al. 2005
St Kilda	Western Isles	50,050 (1985) Or 60,400 (Stroud et al. 2001)	1992	Maintained 2000	60,428 59,622	1995 2004	Mitchell et al. 2004 Wanless et al. 2005
Flannan Isles	Western Isles	Not yet listed as a qualifying feature	1992		414 679 1,438 1,244 2,760	1988 1992 1994 1998 2004	SCM database SCM database SCM database SCM database SCM database

Ailsa Craig	W Scotland	23,000 (1987) or 32,460 (Stroud et al. 2001)	1990	Maintained 2004	32,456 27,130	1995 2004	Mitchell et al. 2004 Wanless et al. 2005
Grassholm	Wales	33,000 (1994)	1986		32,094 39,292	2004 2009	Wanless et al. 2005 SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

7.10 BDMPS

UK gannet numbers are much larger than numbers in Iceland, Norway, Faroe, so that UK birds, almost all of which are from SPA populations, generally predominate throughout UK waters. Gannets migrate southwards after initial autumn dispersal which can be northwards or southwards but birds tend to remain on or at the edge of the continental shelf rather than going into deep oceanic waters. Northern parts of UK waters see a large reduction in gannet numbers from 'autumn' (September-October) into 'winter' (November) and then increasing numbers with return migration in December to March. This could suggest three seasonal divisions: autumn, winter, and spring. However, in southern UK waters there seems to be little evidence of a distinct 'winter' period with low numbers and no migration activity, and numbers recorded monthly at offshore wind farm development sites show little or no winter minumim of numbers, and so it may be more appropriate to define two seasonal periods; 'autumn' (September-November) and 'spring' (December-March). These two migration seasons cannot be aggregated into a single non-breeding period because the migration routes used by gannets are distinctly different in autumn and spring; many birds migrate southwards through UK North Sea waters in autumn, but most migrate northwards in UK western waters in spring, even if returning towards UK North Sea breeding colonies. It makes sense to separate UK North Sea waters from UK western waters as separate BDMPS because the contributions of birds from particular SPA populations differ considerably between these two areas as a result of gannets rarely migrating overland.

The contributions of individual UK SPA populations, UK non-SPA populations, and overseas populations in the four BDMPS (UK North Sea and Channel autumn, UK North Sea and Channel spring, UK western waters autumn, UK western waters spring) are presented in detail in Appendix A Tables 14 to 17.

Based on evidence reviewed in sections 7.5, 7.6 and 7.7, it is estimated that 80% of adults and 80% of immatures from Shetland colonies are in the UK North Sea and Channel autumn BDMPS, as are 100% of adults and 90% of immatures from colonies in eastern Scotland and England, 10% of adults and 20% of immatures from colonies in the northern part of UK western waters (from north Scotland to St Kilda), 0% of adults and 10% of immatures from the southern part of UK western waters (from Ailsa Craig to Wales), 30% of adults and immatures from Iceland, Norway, Faroe, 0% of adults and 10% of immatures from Ireland, and 30% of adults and 40% of immatures from Germany. These sum to a total of 45,174 birds from overseas and 411,125 birds from UK populations, a total of 456,298 overall (Appendix A Table 14).

Based on evidence reviewed in sections 7.5, 7.6 and 7.7, it is estimated that 20% of adults and 10% of immatures from Shetland colonies are in the UK western waters autumn BDMPS, as are 0% of adults and 10% of immatures from colonies in eastern Scotland and England, 90% of adults and 70% of immatures from colonies in the northern part of UK western waters (from north Scotland to St Kilda), 100% of adults and 80% of immatures from the southern part of UK western waters (from Ailsa Craig to Wales), 20% of adults and 30% of immatures from Iceland, Norway, Faroe, and Ireland, and 0% of adults and 0% of immatures from Germany. These sum to a total of 63,359 birds from overseas and 482,605 birds from UK populations, a total of 545,954 overall (Appendix A Table 15).

Based on evidence reviewed in sections 7.5, 7.6 and 7.7, it is estimated that 70% of adults and 40% of immatures from Shetland colonies are in the UK North Sea and Channel spring BDMPS, as are 70% of adults and 40% of immatures from colonies in eastern Scotland and England, 0% of adults and 0% of immatures from colonies in UK western waters (from north Scotland to Wales), 10% of adults and immatures from Iceland, 20% of adults and immatures from Norway and Faroe, 0% of adults and 10% of immatures from Ireland, and 30% of adults and 30% of immatures from Germany. These sum to a total of 21,903 birds from overseas and 226,482 birds from UK populations, a total of 248,385 overall (Appendix A Table 16). This lower number in the UK North Sea and Channel BDMPS in spring than in autumn reflects the observation that many gannets migrating back towards colonies in the North Sea do so up the west coast of Scotland rather than through the North Sea, so are present in western waters during most of spring migration.

Based on evidence reviewed in sections 7.5, 7.6 and 7.7, it is estimated that 30% of adults and 30% of immatures from North Sea colonies are in the UK western waters spring BDMPS, as are 100% of adults and 80% of immatures from colonies in UK western waters (from north Scotland to Wales), 20% of adults and 20% of immatures from Iceland and Norway, 30% of adults and immatures from Faroe and Ireland, and 0% of adults and 0% of immatures from Germany. These sum to a total of 65,703 birds from overseas and 596,185 birds from UK populations, a total of 661,888 overall (Appendix A Table 17). The higher number in the UK western waters BDMPS in spring than in autumn reflects the observation that many gannets migrating back towards colonies in the North Sea do so up the west coast of Scotland rather than through the North Sea, so are present in western waters during most of spring migration.

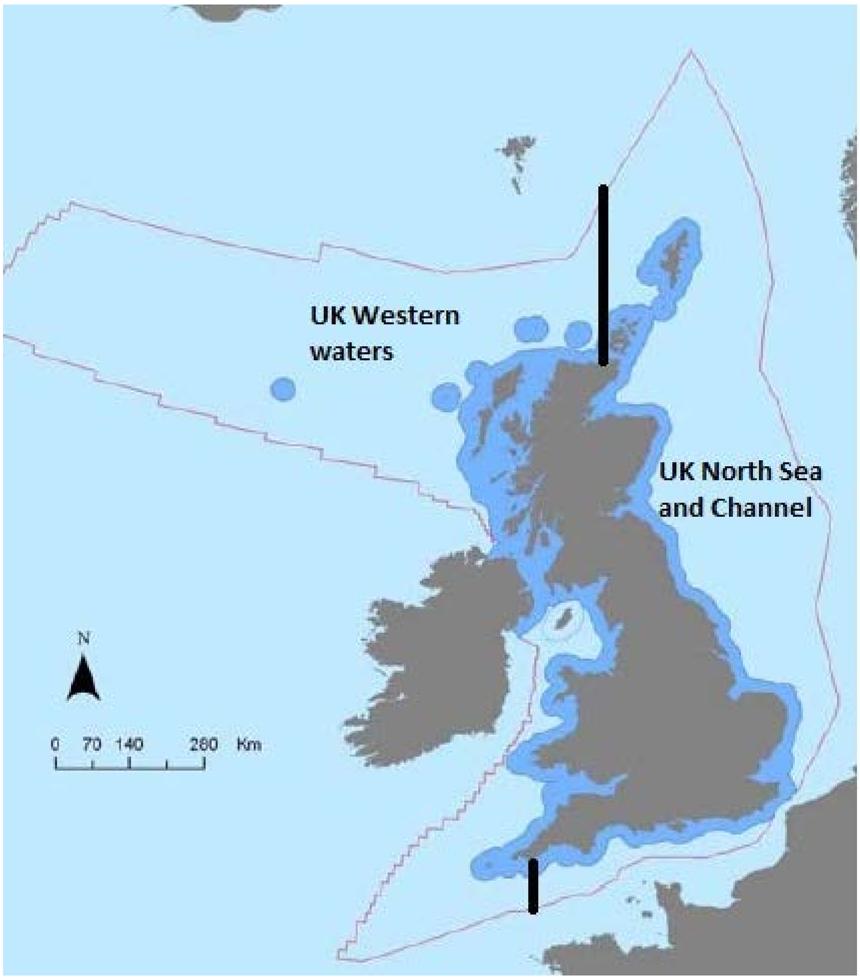

Figure 7.7. Two defined BDMPS spatial areas for gannet; ‘UK North Sea and Channel’ and ‘UK Western waters’.

7.11 Proportions of UK SPA birds in each BDMPS

Since over 95% of UK gannets are in SPA populations, the proportion of UK SPA birds in each BDMPS is virtually the same as the proportion that is from UK colonies. The proportions that are adult SPA birds in each BDMPS total can be computed from data in Appendix A Tables 14-17. For example, in the UK North Sea BDMPS in autumn, there are 208,661 adults from UK breeding gannet SPA populations out of a total of 456,298 birds, giving a proportion of 46% being adults from UK SPA populations.

7.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Since over 95% of UK gannets are in SPA populations, the geographical distribution of UK SPA birds is virtually identical to that of the UK population as a whole. During migrations gannets range widely, and are likely to be thoroughly mixed with birds from other populations across each BDMPS range.

8. GREAT CORMORANT *Phalacrocorax carbo*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (September to March) (adults and immatures)
Overseas	285,000	1,470
UK	39,000	31,653
Total	324,000	33,123

'Non-breeding season' BDMPS (September to March)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
NW North Sea	6,012	98	5,914
SW North Sea & Channel	10,460	1,107	9,353
West of Scotland	7,049	56	6,993
SW England & Wales	9,602	209	9,393

Colour coding is green for numbers from UK colonies in each BDMPS since the locations and sizes of cormorant colonies are well known from survey data and breeding numbers have shown only small changes in total numbers in the UK over recent years, apparently peaking around 2000 and declining slightly since then back to totals similar to those present in the mid-1980s. Colour coding for numbers of cormorants arriving into UK waters from overseas is red in recognition of the fact that the proportions of overseas populations visiting UK are not well known, although numbers of cormorants present in winter have been estimated and indicate that very few overseas birds are present in most of the UK apart from the southern North Sea. Even in the southern North Sea, continental cormorants represent only a small proportion of the total present, considerably outnumbered by UK birds, so that total numbers are mainly determined by the UK numbers, and so are coded green.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 18 to 21.

8.1 Breeding range and taxa

There are six subspecies of great cormorant which is a widely distributed species around the world. However, only two of these subspecies occur in the British Isles; nominate *carbo* breeds in Britain but also the Atlantic coast of Fennoscandia, Iceland and Greenland and breeds mainly at coastal colonies, and *sinensis* breeds mainly at freshwater colonies from northern France to the Baltic Sea and eastwards into China. Although most British and Irish cormorants are of the nominate race *carbo*, some cormorants breeding in Britain and Ireland at freshwater sites are of the continental race *sinensis* (Sellers et al. 1997). There might be potential to identify origins of individual cormorants from biometrics, but this does not seem to have been investigated. Although most cormorants found in UK waters are from the *carbo* subspecies, substantial numbers of birds of the *sinensis* subspecies visit UK waters on migration and overwinter, these *sinensis* birds being found predominantly in UK southern North Sea waters and being scarce in other parts of the UK marine area.

8.2 Non-breeding component of the population

Great cormorants start to breed when 3 years old (BTO Birdfacts). Adult survival rate is 0.88 (BTO Birdfacts), juvenile survival 0.58 (BTO Birdfacts) and mean productivity is 1.913 chicks per pair (JNCC database, n=62 measurements). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.6 for 1-year olds and 0.7 for 2-year olds. The model population comprised 46% adults, 30% juveniles and 24% older immatures. There are 1.17 immatures per adult.

8.3 Phenology

Breeding colonies are not completely deserted until September (Brown and Grice 2005), but modal departure occurs in late June and July (Pennington et al. 2004; Forrester et al. 2007). However, autumn migration starts in mid-June (Cramp et al. 1977-94), July/August (Wernham et al. 2002; Forrester et al. 2007), or mid-August (Pennington et al. 2004). Peak autumn migration occurs in August-October (Cramp et al. 1977-94), September (Forrester et al. 2007), mid-September (Pennington et al. 2004), September-November (Wernham et al. 2002). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late July and August (Figure 8.1). Autumn migration is completed by early November (Forrester et al. 2007), mid-November (Pennington et al. 2004) or November (Cramp et al. 1977-94; Wernham et al. 2002), excluding a few stragglers still moving in mid-late November.

Spring migration starts in January (Wernham et al. 2002), mid-January (Cramp et al. 1977-94), early March (Pennington et al. 2004) or March (Forrester et al. 2007). Peak spring migration occurs in February-March (Cramp et al. 1977-94; Wernham et al. 2002) or April (Pennington et al. 2004) or April-May (Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late January to late-March (Figure 8.1). Spring migration is completed by early April (Cramp et al. 1977-94), May (Wernham et al. 2002) or late May (Pennington et al. 2004; Forrester et al. 2007).

The first spring records of cormorant in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from 1 January and the last records were predominantly at 31 December, as cormorants overwinter, while peak autumn migration was reported in August to October in most years, and peak spring migration was reported in March to May in most years. Birds re-occupy breeding sites from February or March, but modal re-occupation occurs in March (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

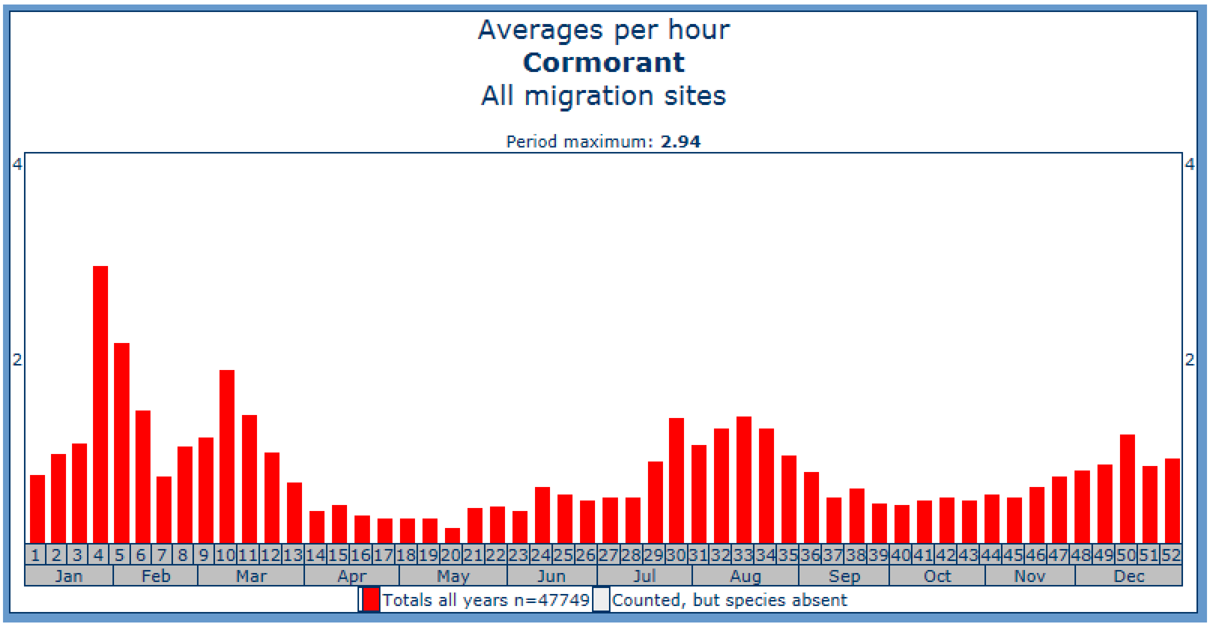

Figure 8.1. Average numbers of great cormorants counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as April-August, non-breeding season September-March.

8.4 Defined seasons:

- UK Breeding season — April-August
- Post-breeding migration in UK waters — August-October (with a few in July and November)
- non-breeding season — September-March (**non-breeding BDMPS**)
- Return migration through UK waters — February-April
- Migration-free breeding season — May-July
- Migration-free winter season — November-January

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for great cormorant:

Non-breeding season BDMPS (September-March).

8.5 Movements of birds from the UK population

Birds from British and Irish coastal colonies mostly overwinter near to their breeding site in coastal habitat (Wernham et al. 2002), but some move onto freshwater habitat in winter (Bearhop et al. 1999). In England, birds show a progressive movement from coastal areas to freshwater sites from September to December (Brown and Grice 2005). The proportion using freshwater habitat in winter has increased (Rehfisch et al. 1999), but is likely to vary according to winter weather, with birds moving back to marine habitats if freshwater sites freeze over. A small proportion of breeders move longer distances south to winter in France or northern Iberia. Long distance movements are more frequent among immatures, especially juveniles (Wernham et al. 2002). Ringing data suggest that birds hardly move south from breeding areas until October, and reach maximum distance south in November, slowly moving northwards from December to May (Wernham et al. 2002). However, it is evident from observation that birds depart from breeding colonies from July onwards (Wernham et al. 2002) so presumably initial dispersal is of a very limited scale. Almost all adult recoveries are in the breeding area from March onwards, while northward movements of immatures in spring occur later than those of adults (Wernham et al. 2002). There are regional differences around the British Isles in distances and directions moved by cormorants in autumn/winter (Coulson and Brazendale 1968; Wernham et al. 2002). Cormorants from Shetland and Orkney rarely move further south than southern Scotland or northern England. Cormorants from west England may cross the Irish Sea into Ireland, but the predominant direction of movement of those birds is southeastwards into SE England. Cormorants from Wales are the ones most likely to winter inland, predominantly moving to freshwater sites in England. Cormorants from SW England are the ones most likely to winter in Iberia or France. Cormorants tend to be faithful to their particular wintering site; colour ringed birds tend to be observed at their preferred wintering site both within and between winters (Wernham et al. 2002). Most immature cormorants tend to spend the summer close to colonies, although a few may summer in wintering areas.

8.6 Movements of birds from overseas into UK waters

Apart from Irish cormorants moving in small numbers into English freshwater habitat, most foreign-ringed cormorants recovered in the British Isles have been juvenile or immature birds recovered in SE England (where there used to be few breeding colonies). Most recoveries have been in winter, indicating some movement of immatures from continental populations of *sinensis*. These birds, predominantly from the Netherlands, Denmark, or France (Wernham et al. 2002) represent about 2.5% of the British wintering population of cormorants (but 20% of those wintering in freshwater habitat in England), but almost entirely located in SE England. A few of these birds have recruited to breed in SE England. Cormorants ringed as chicks at inland colonies show movement patterns different from UK *carbo* birds and more like those of continental *sinensis* birds (Wernham et al. 2002). Typically, *sinensis* birds migrate further southwards in winter. Many inland reared birds move south into France rather than overwintering in the UK, especially when young. Seabird 2000 reported 8,884 pairs in UK (but numbers have since declined slightly), 4,100 pairs in Ireland, 40,126 pairs in Denmark, 25,150 pairs in Norway, 19,205 pairs in the Netherlands, and 1,500 pairs in France (Mitchell et al. 2004), so populations in Norway, Denmark and the Netherlands are considerably larger than the population in the UK, but only a very small proportion of the birds from those continental populations visit the UK.

8.7 Numbers in UK waters

Highest numbers wintering in marine habitat in English waters occur in coastal areas in NW England (Brown and Grice 2005). However, ESAS data are not informative about cormorant numbers at sea because their distribution tends to be very coastal, in a band that is generally not covered by boat surveys at sea. Forrester et al. (2007) suggested that about 9,000-11,500 cormorants are in Scotland and Scottish waters in winter, and that numbers are not greatly higher during the migration periods. Musgrove et al. (2013) reported that there are 25,000 in Britain in winter, and 41,000 in the UK in winter.

8.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *carbo* population, comprising 41,200 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 52,500 pairs. Kober et al. (2010) presented an estimated biogeographic population of 117,900 individuals. In addition, the population of the subspecies *sinensis*, which occurs in small numbers in the UK, is some 300,000 to 330,000 pairs (Brown and Grice 2005). However, numbers of cormorants reaching UK waters from overseas are very small in relation to the large size of the European populations from which they are derived, and represent no more than about 2.5% of the British winter population of cormorants. Almost all of these continental birds occur in SE England, and mostly inland on freshwater habitat. The biogeographic population with connectivity to UK waters can therefore be defined as the populations of UK (now probably about 8800 pairs so a total of about 39,000 birds including adults and immatures) plus the populations of Denmark, Netherlands, Ireland and France. Those overseas populations sum to 285,000 birds including both adults and immatures. However, it may be more appropriate to consider the total numbers in UK waters in the non-breeding season since very few of those continental birds visit the UK. The total in UK waters in the non-breeding season sums to about 33,500 birds, of which 32,000 originate from UK colonies.

Figure 8.2. Breeding population origins of great cormorants in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

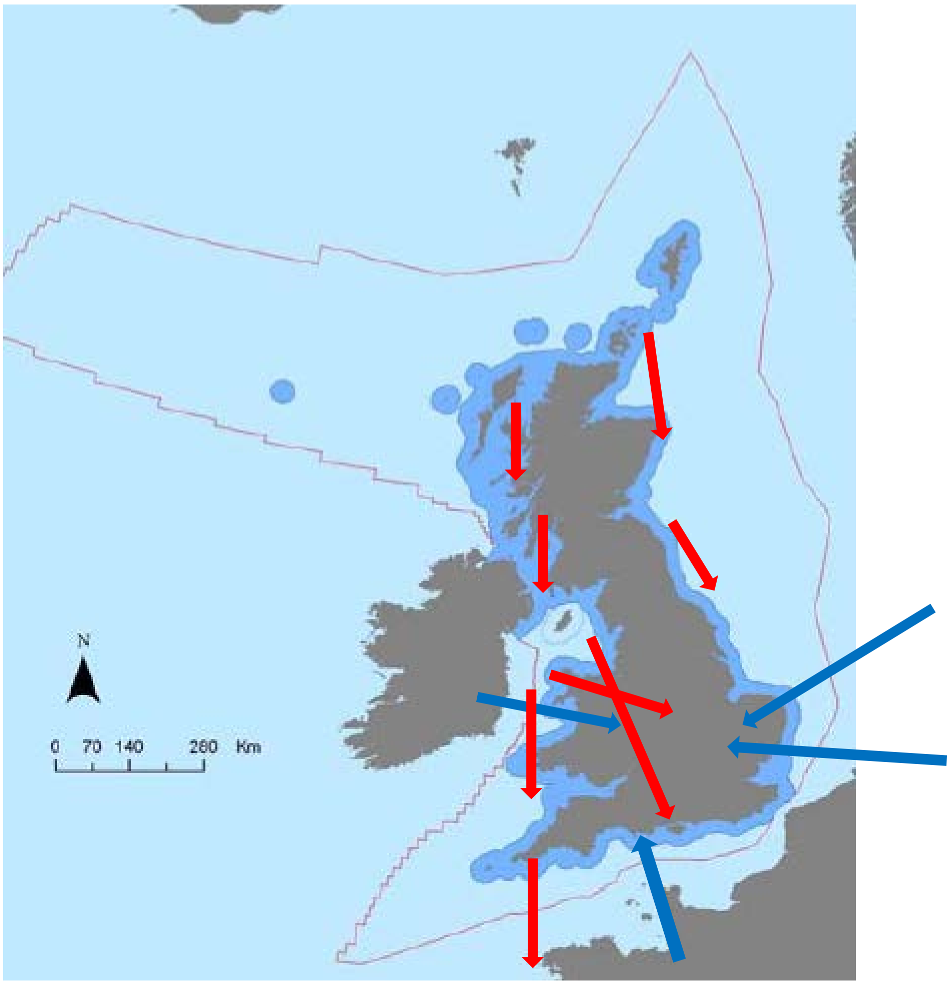

Figure 8.3. Main movements of great cormorants from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

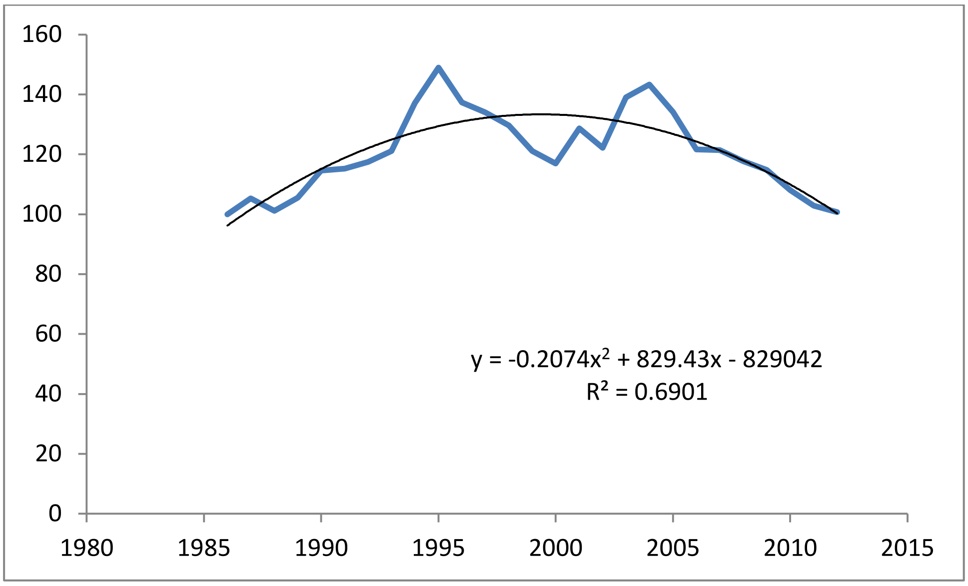

Figure 8.4. Trend in the great cormorant breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

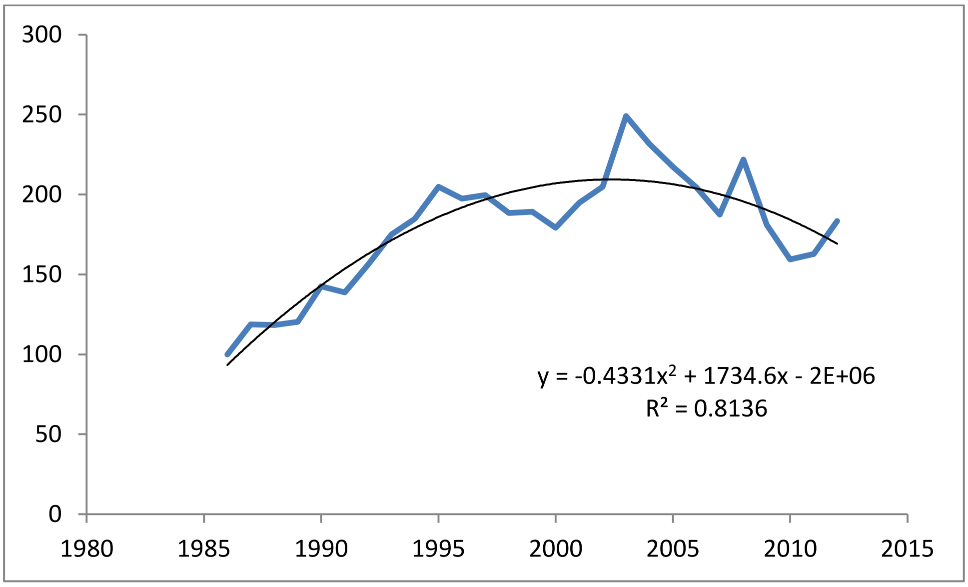

Figure 8.5. Trend in the great cormorant breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

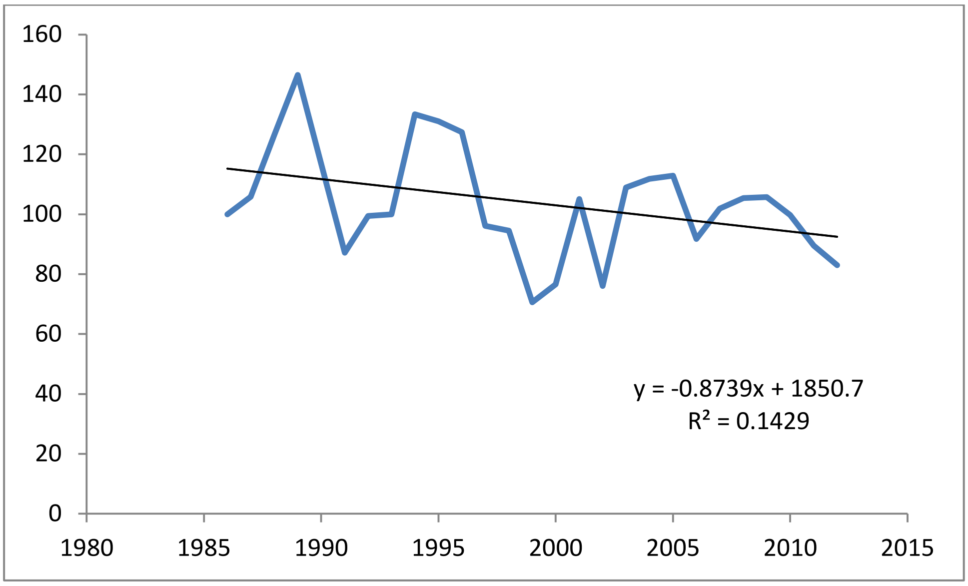

Figure 8.6. Trend in the great cormorant breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

8.9 Proportion of UK population from UK breeding SPAs

The 7 SPAs with breeding great cormorants as a feature together held 2,316 pairs at designation, estimated to represent ca. 30% of the British breeding population (Stroud et al. 2001). Numbers at several of these SPAs have decreased considerably since designation, while the overall population has declined only very slightly relative to numbers around the period of SPA designations. As a consequence the proportion of the GB population breeding within the SPA suite has fallen to an estimated 14.8% in the early 2000s (Stroud et al. 2014). There are also SPAs designated for non-breeding cormorants (Stroud et al. 2001), but those are not relevant in the context of establishing BDMPS.

Figure 8.7. The UK SPA suite for great cormorant. These SPA populations are listed in Table 8.1.

Table 8.1. The UK SPA suite for breeding great cormorants.

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent counts	Year	Reference
NW North Sea							
Calf of Eday	Orkney	223 (1995)	1998	Maintained 2006	195 204 181	2003 2006 2012	SCM database Lewis et al. 2012 SCM database
East Caithness Cliffs	N Scotland	230 Or 144 (Stroud et al. 2001)	1996	Declined 1999	53 81 67 85 52	2009 2010 2011 2012 2013	SCM database Lewis et al. 2012 SCM database SCM database SCM database
Forth Islands	E Scotland	200 (1985) Or 240 (Stroud et al. 2001)	1990	Declining 2010	102 91 132 57 80	2009 2010 2011 2012 2013	SCM database SCM database Lewis et al. 2012 SCM database SCM database

SW North Sea & Channel							
Farne Islands	NE England	194 (Stroud et al. 2001)	1985		158 145 141 139 121 135 87	2007 2008 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database SCM database
Abberton Reservoir	SE England	490 (1993-1997)	1999		370 352 332 322 216	2000 2001 2002 2004 2005	SCM database SCM database SCM database SCM database SCM database
West of Scotland							
Sheep Island	N Ireland	249 (1992-1996)	1992		182 141 100 117 112	2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database
SW England & Wales							
Puffin Island	Wales	556 (1996-2000) Or 776 (Stroud et al. 2001)	2002		383 730 491 606 760 464 484 410 448	2002 2005 2006 2007 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database SCM database SCM database SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

8.10 BDMPS

It seems appropriate to define four BDMPS for regions of UK waters (Figure 8.8) based on biological populations present. The ‘NW North Sea’ region holds about 6,000 cormorants in winter, almost exclusively birds from UK colonies within the NW North Sea region, making the composition of this BDMPS highly distinctive in having predominantly birds from NW North Sea colonies. The ‘West of Scotland’ region holds about 7,000 cormorants in winter, almost exclusively birds from UK colonies within the West of Scotland region, so again highly distinctive and separate from the other BDMPS populations. The ‘SW England and Wales’ region holds about 9,600 cormorants in winter, almost exclusively birds from UK colonies, but also including some immature birds from colonies in NW Scotland. The ‘SW North Sea and Channel’ region holds about 10,500 cormorants in winter, including large numbers of immature birds from colonies in Scotland and small numbers of continental birds. In the SW North Sea and Channel region, many birds move onto freshwater sites during winter, if weather permits. A few thousand birds from the UK population, mostly immatures, winter in France rather than in the UK. Migration of those birds to/from the Continent (mostly northern France) will marginally increase the BDMPS in southern Britain in the migration seasons compared to winter, but this difference is thought to be small enough that the BDMPS can be used for the entire non-breeding period.

Detailed composition of each of these four BDMPS populations is presented in Appendix A Tables 18 to 21.

Based on evidence reviewed in sections 8.5, 8.6 and 8.7, in the UK NW North Sea BDMPS numbers from UK breeding colonies are large enough to provide virtually all of the numbers of cormorants thought to be found in this area in the non-breeding season, so the proportions of overseas populations visiting this area appear to be extremely small. It is estimated that the percentages derived from overseas populations are 0% of birds from Ireland and France, 0.1% of immatures from Denmark, and 0.01% of immatures from The Netherlands, giving an estimate of only 98 birds from overseas populations in this BDMPS (Appendix A Table 18). It is estimated that 100% of adults and immatures from colonies in Orkney and Caithness remain in this BDMPS in the non-breeding season, together with 60% of adults and 50% of immatures from the Forth Islands and 80% of adults and immatures from UK NW North Sea non-SPA colonies, 10% of adults and 20% of immatures from the Farne Islands, 5% of adults and immatures from UK SW North Sea non-SPA colonies, but 0% of birds from Abberton Reservoir. In addition, ringing suggests that small numbers from western waters colonies move into the NW North Sea during the non-breeding season (Wernham et al. 2002) so the proportions are estimated at 0% of adults and 0.1% of immatures from western colonies (Appendix A Table 18). This gives an estimated total of 5,914 birds from UK populations in this BDMPS.

Based on evidence reviewed in sections 8.5, 8.6 and 8.7, in the UK SW North Sea and Channel BDMPS proportions of overseas populations visiting this area appear to be small, but much larger than in the other BDMPS populations. It is estimated that the percentages derived from overseas populations are 0.5% of immatures from Denmark, and 0.1% of adults and 0.1% of immatures from The Netherlands, giving an estimate of 1,107 birds from overseas populations in this BDMPS (Appendix A Table 19). It is estimated that negligible numbers (rounded to 0%) of adults and immatures from colonies in Orkney and Caithness join this BDMPS in the non-breeding season, but that there are 40% of the adults and 50% of immatures from the Forth Islands, and 20% of adults and immatures from UK NW North Sea non-SPA colonies, 90% of adults and 80% of immatures from the Farne Islands, 80% of adults and 70% of immatures from UK SW North Sea non-SPA colonies and from Abberton Reservoir. In addition, ringing suggests that small numbers from western waters colonies move into the SW North Sea during the non-breeding season (Wernham et al. 2002) so the proportions are estimated at 0% of adults and 0.1% of immatures from western colonies (Appendix A Table 19). This gives an estimated total of 9,353 birds from UK populations in this BDMPS.

Based on evidence reviewed in sections 8.5, 8.6 and 8.7, in the UK West of Scotland BDMPS proportions of overseas populations visiting this area appear to be extremely small. It is estimated that the percentages derived from overseas populations are 0.1% of immatures from Ireland and 0.05% of immatures from Denmark, giving an estimate of 56 birds from overseas populations in this BDMPS (Appendix A Table 20). Ring recovery data suggest that 0% of adults and immatures from colonies in the North Sea join this BDMPS in the non-breeding season. Ringing suggests that most birds from colonies in the West of Scotland area remain there during the non-breeding season (Wernham et al. 2002) so the proportions are estimated at 80% of adults and 60% of immatures from Sheep Island, 70% of adults and 50% of immatures from non-SPA colonies (which tend to be further south than Sheep Island so have higher connectivity with the BDMPS to the south of this. Probably a very small proportion of immatures from Welsh colonies may disperse northwards into this BDMPS (Wernham et al. 2002), so this proportion is estimated at 1% (Appendix A Table 20). This gives an estimated total of 6,993 birds from UK populations in this BDMPS.

Based on evidence reviewed in sections 8.5, 8.6 and 8.7, in the UK SW England and Wales BDMPS proportions of overseas populations visiting this area appear to be very small. It is estimated that the percentages derived from overseas populations are 2% of immatures from Ireland, 0.1% of immatures from France, and 0.01% of immatures from Denmark and The Netherlands, giving an estimate of 209 birds from overseas populations in this BDMPS

(Appendix A Table 21). Ring recovery data suggest that 0% of adults and immatures from colonies in the North Sea join this BDMPS in the non-breeding season. Ringing suggests that most birds from colonies in the West of Scotland area remain there during the non-breeding season (Wernham et al. 2002) but that some move south into the UK SW England and Wales BDMPS; the proportions are estimated at 20% of adults and 40% of immatures from Sheep Island, 30% of adults and 50% of immatures from non-SPA colonies (Appendix A Table 21). Although some move south into French waters, many birds from Puffin Island (Wales) and from non-SPA colonies in SW England and Wales remain within this area during the non-breeding season; the proportions are estimated at 60% of adults and 40% of immatures. This gives an estimated total of 9,393 birds from UK populations in this BDMPS.

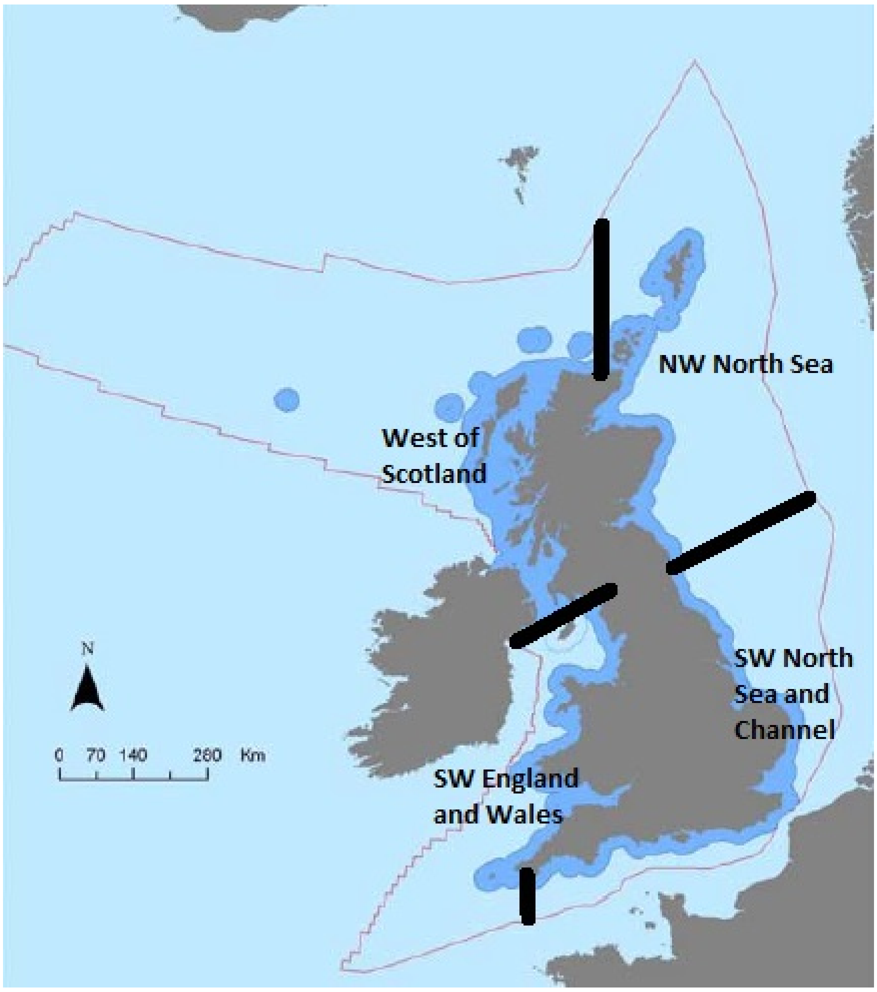

Figure 8.8. Four defined BDMPS spatial areas for great cormorant; NW North Sea, SW North Sea and Channel, West of Scotland, and SW England & Wales.

8.11 Proportions of birds from BDMPS in reference regions

Since almost all cormorants wintering in UK waters are from the UK population and only the SW North Sea and Channel BDMPS receives more than trivial numbers of continental birds, the proportion of birds in each BDMPS that originate from UK SPA breeding populations will be close to the UK average representation of 15%. The NW North Sea region holds the largest number of breeding cormorant SPAs (Table 8.1) but the largest SPA colonies are in the SW England and Wales area and SW North Sea and Channel area. The general population of cormorants breeding in the UK is widely spread across all of these regions, so the proportions of each BDMPS that are birds from UK breeding SPAs will be similar in the four areas. Proportions can be estimated directly from data in Appendix A Tables 18 to 21. For example, for the UK NW North Sea area (Appendix A Table 18), there are estimated to be 579 adults from UK SPA populations out of a total of 6,012 birds in the non-breeding season BDMPS, giving an estimate of 9.6% of this BDMPS population being adults from UK SPA populations.

8.12 Spatial distribution of UK breeding SPA birds across the BDMPS

The UK breeding cormorant SPA suite is widely distributed across the breeding range of the species in the UK. However, the suite holds only about 15% of the population. Given that many breeding adult cormorants may normally overwinter very close to their breeding site (Wernham et al. 2002 report a median distance between breeding site and wintering site based on ring recovery data of 179 km), it is likely that SPA birds tend to be aggregated in areas close to the seven SPAs, and relatively scarce in areas furthest from the SPAs. However, immature birds are likely to be more widely dispersed than the breeding adults.

9. EUROPEAN SHAG *Phalacrocorax aristotelis*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (September to January) (adults and immatures)
Overseas	9,000	209
UK	97,000	96,078
Total	106,000	96,287

'Non-breeding season' BDMPS (September to January)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
NW North Sea	41,503	0	41,503
SW North Sea & Channel	4,346	0	4,346
West of Scotland	37,363	52	37,311
SW England & Wales	13,075	157	12,918

Colour coding is green for overseas numbers since it is well established from ringing that extremely few shags from overseas populations have ever reached UK waters. Since locations of shag colonies are well known, and shags are known to remain mostly close to their breeding sites throughout the year, colour coding for numbers from UK and total numbers would be green apart from the fact that there is strong evidence for substantial recent declines in numbers at some, but not all, shag colonies. Because some other colonies have not been censused since 1999-2000, there is some uncertainty as to the sizes of those populations (as is evident from Table 9.1 which shows a 90% decline in breeding numbers at Foula SPA in 2000-2013, but much smaller declines at some other sites). This uncertainty seems not enough to code the data red since many of the SPA populations have been counted several times since 2000, and it is likely that declines at non-SPA colonies will be less pronounced since smaller colonies are likely to be less severely affected by density-dependent processes such as competition which is likely to be the cause of declines in numbers.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 22 to 25.

9.1 Breeding range and taxa

The European shag has three subspecies. Nominate *aristotelis* breed from Iceland and northern Scandinavia along the European coast to the Iberian peninsula. *P. a. desmarestii* breeds in the Mediterranean and Black Sea. *P. a. riggenbachi* breeds on the Atlantic coast of

Morocco. Neither of the latter two subspecies has been recorded in UK waters. Biometrics of nominate *aristotelis* do not seem to be useful to identify origins of individual birds.

9.2 Non-breeding component of the population

European shags start to breed when an average of 4 years old (BTO Birdfacts), though Daunt et al. (2003) point out that age of first breeding can vary from 3 to 17 years old in males and 3 to 15 years old in females, while Aebischer et al. (1986) report age of first breeding as 2 for males and 3 for females. Adult survival rate is 0.878 (BTO Birdfacts), juvenile survival 0.38 up to 2 years of age (BTO Birdfacts) and mean productivity is 1.289 chicks per pair (JNCC database, n=237 measurements) (but these can all be greatly affected by weather conditions, especially at exposed colonies on the east coast of Scotland, Frederiksen et al. 2008). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.62 for 1-year olds, 0.72 for 2-year olds, 0.85 for 3-year olds. The model population comprised 43% adults, 28% juveniles and 29% older immatures. There are 1.31 immatures per adult.

9.3 Phenology

Although breeding colonies are not completely deserted until October or November, modal departure occurs in August to October (Pennington et al. 2004; Forrester et al. 2007) and extremely few birds remain at colonies after September. In extreme cases, shags can sometimes still be breeding into October, and the last chicks may not fledge until after October in some years and colonies. However, autumn post-breeding dispersal/migration starts in July (Cramp et al. 1977-94), August (Wernham et al. 2002; Forrester et al. 2007), or mid-August (Pennington et al. 2004). Peak autumn migration occurs in August-October (Cramp et al. 1977-94), September (Pennington et al. 2004), or September-October (Wernham et al. 2002; Forrester et al. 2007). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late August and early September, but autumn passage was not pronounced (Figure 9.1). Autumn migration is completed by late October (Pennington et al. 2004), early November (Forrester et al. 2007) or November (Cramp et al. 1977-94; Wernham et al. 2002).

Spring migration starts in November (Pennington et al. 2004), late November (Forrester et al. 2007), December (Wernham et al. 2002) or mid-January (Cramp et al. 1977-94). Peak spring migration occurs in December (Pennington et al. 2004; Forrester et al. 2007), January (Wernham et al. 2002) or February (Cramp et al. 1977-94). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late November to February, with the most rapid decline in numbers (which may indicate birds returning to breeding areas) in January-March (Figure 9.1). Spring migration is completed by January (Pennington et al. 2004; Forrester et al. 2007), mid-March (Wernham et al. 2002) or mid-April (Cramp et al. 1977-94).

The first spring records of shag in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 1 January and the last records were at 31 December, as large numbers of shags overwinter, while peak autumn migration was reported in August to October in most years, and peak spring migration was not evident in most years. Birds start to re-occupy colonies from the start of January, but modal re-occupation occurs in February (Pennington et al. 2004; Forrester et al. 2007).

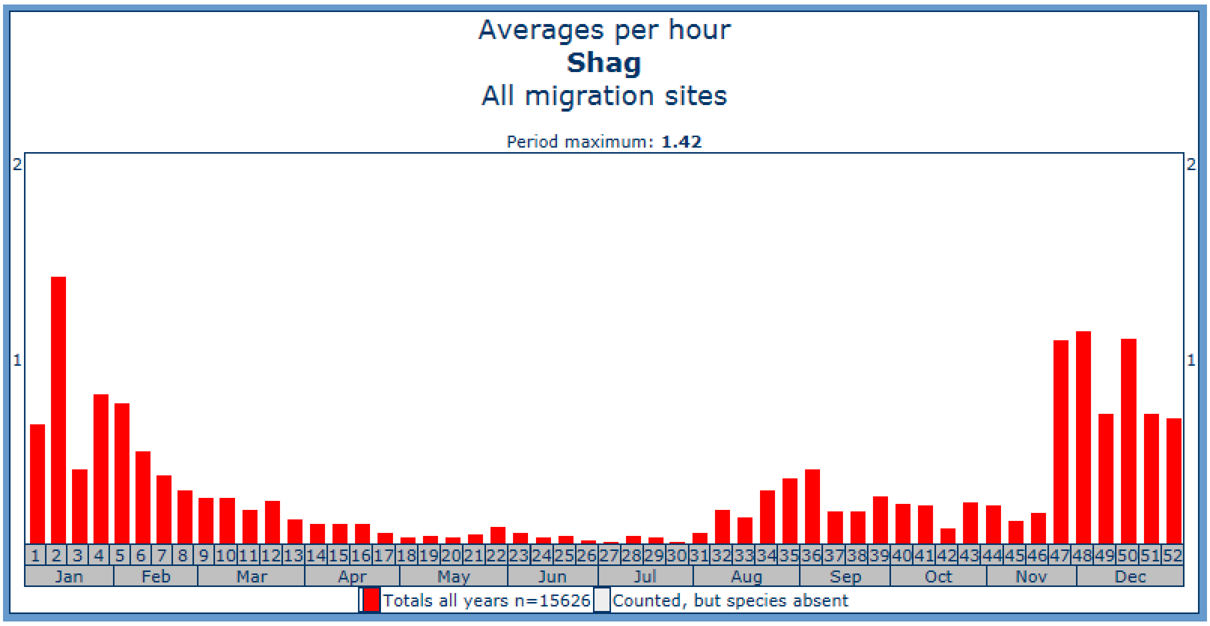

Figure 9.1. Average numbers of shags counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as March-September, non-breeding season October-February. However, from the data reviewed above, a more appropriate definition would be breeding season February-August, non-breeding season September-January.

9.4 Defined seasons:

- UK Breeding season — February-August (sometimes into October)
- Post-breeding migration in UK waters — August-October
- non-breeding season — September-January (**non-breeding BDMPS**)
- Return migration through UK waters — December-February
- Migration-free breeding season — March-July
- Migration-free winter season — November

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for European shag:

Non-breeding season BDMPS (September-January).

9.5 Movements of birds from the UK population

Shags at colonies in the British Isles are considered to disperse and not migrate, and relatively few birds move from their natal colony to breed at another colony (Barlow et al. 2013). However, the extent of dispersal varies between regions (Galbraith et al. 1986), probably to a large extent in response to the ease with which birds can find sheltered areas in the non-breeding season to avoid storms (Harris and Swann in Wernham et al. 2002). Thus birds from colonies in NE England and SE Scotland move the furthest, along a coastline where there is little protection from easterly storms. Indeed, ‘wrecks’ of shags from colonies in East Britain occur associated with easterly storms (Aebischer 1995), whereas wrecks are very unusual elsewhere in the UK (Frederiksen et al. 2008, Wernham et al. 2002). Birds at colonies in west Britain move very little. Many adults remain within 50 km of their breeding site throughout the year, even at northernmost colonies (Harris and Swann in Wernham et al. 2002). Immature birds disperse further, on average, than adults (Harris and Swann in Wernham et al. 2002). Very few shags from UK colonies have been recovered outside the UK; a few birds from the northern isles have been recovered in Norway, Denmark and as far as the southern North Sea, and a few from colonies in SW Britain and southern Ireland have been recovered in France (Wernham et al. 2002). Fledglings are fed by parents for some weeks after fledging, and after that period post-fledging dispersal occurs away from colonies. The timing of this dispersal varies greatly as timing of breeding in shags is much earlier in SW Britain than in NE Britain, and the breeding season is very protracted everywhere. So chicks may fledge from April to August.

9.6 Movements of birds from overseas into UK waters

No shags from Norway, Iceland or Faroe have been recovered in the UK (Wernham et al. 2002; Hammer et al. 2013). The only ‘foreign-ringed’ shags recovered in the British Isles originated from France and the Channel Islands, involving small numbers of birds crossing the English Channel (Wernham et al. 2002). However, some Irish-ringed birds have been recovered in SW England (Brown and Grice 2005) but these are not classified as ‘foreign’ because Ireland uses the same ringing scheme as the UK. Deployment of geolocators on breeding adult shags at colonies in UK (Isle of May), Iceland (Flatey), and north Norway (Røst and Hornøya) showed that birds from the UK and Icelandic colonies remained close to their colony through the winter. Some birds from Hornøya remained in the Barents Sea near to their colony through winter, but some moved south into the Norwegian Sea (Daunt et al. 2010). However, none of the Norwegian birds moved anywhere near to UK waters. Seabird 2000 reported 26,565 pairs in UK, so even if small numbers of shags from overseas populations occasionally visit UK waters, they are unlikely to represent more than a negligible fraction of the numbers in the UK during migration periods or winter.

9.7 Numbers in UK waters

Shags are not efficiently surveyed by ESAS surveys because they are extremely coastal, and often stand on the shore when not foraging. However, numbers in UK waters will be almost identical to the UK shag population size, since hardly any birds from overseas move into UK waters, and hardly any UK shags move out of UK waters. Numbers of shags in UK colonies have declined considerably since the Seabird 2000 survey, by about 20% from 2000 to 2012 (Figure 9.4), although there are divergent regional patterns with larger decreases in Scotland than in England, and an increase in Wales (Figures 9.5 to 9.7). There are relatively few in Wales though, so the increase there is far smaller than the decrease in Scotland. Overall, the UK breeding population is likely to be about 20,000 to 21,000 pairs now, or up to 42,000 adults. There will be about 55,000 immatures associated with these breeding numbers, so the total population is around 97,000 individuals.

9.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *aristotelis* population, comprising 125,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 66,000-73,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 201,800 individuals. Given that movement of birds into and out of UK waters is negligible except with regard to birds from Ireland, an appropriate biogeographic population with connectivity to UK waters would be the UK population of 20,000 to 21,000 pairs, or 97,000 birds including the immatures, plus the population in Ireland of around 2,000 pairs (equivalent to about 9,000 birds including immatures), so a grand total of 106,000 birds. From this population, numbers in the non-breeding season in all UK waters are estimated at 200 birds from overseas, plus 96,000 from UK colonies, giving a grand total in UK waters of 96,200 birds in the non-breeding season.

Figure 9.2. Breeding population origins of shags in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

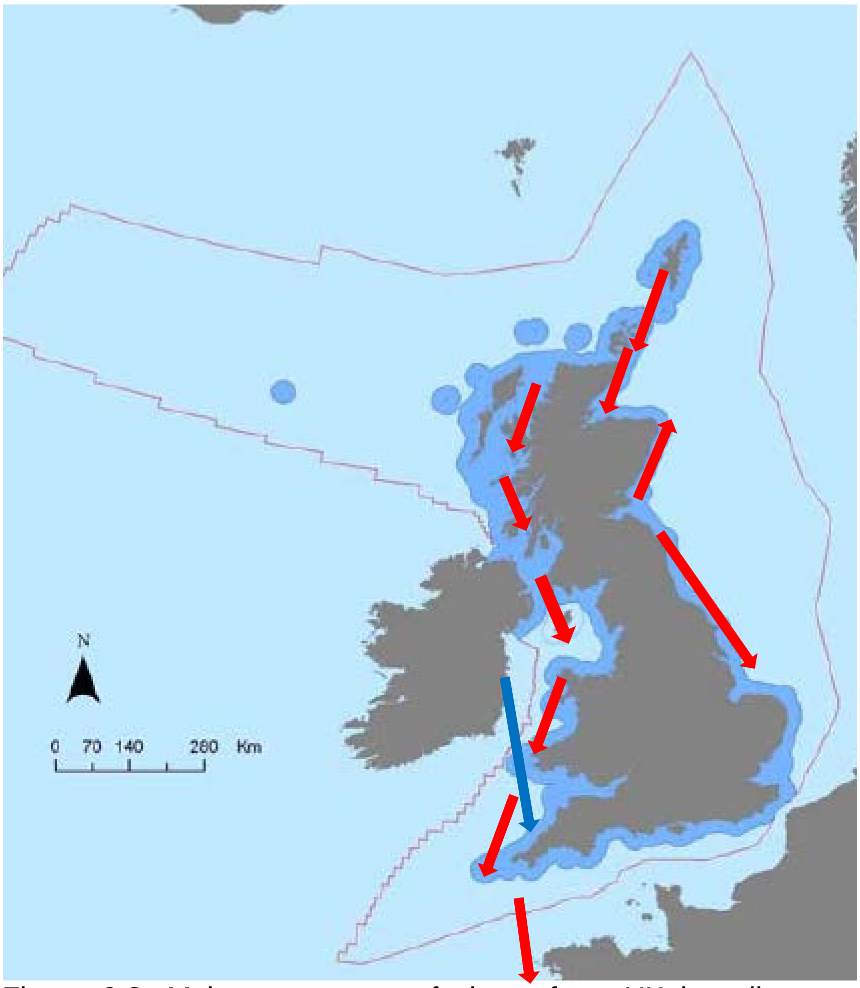

Figure 9.3. Main movements of shags from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration.

Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

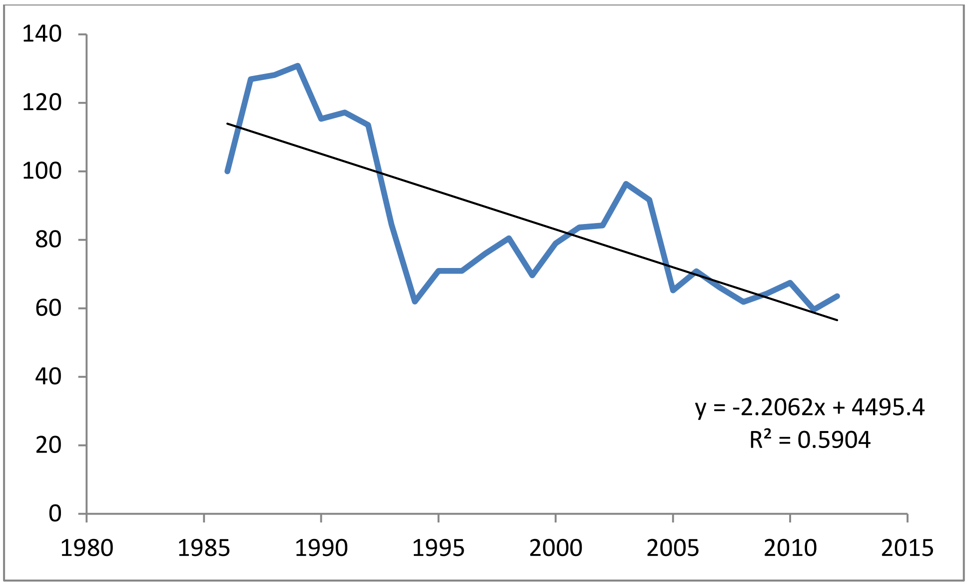

Figure 9.4. Trend in the shag breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

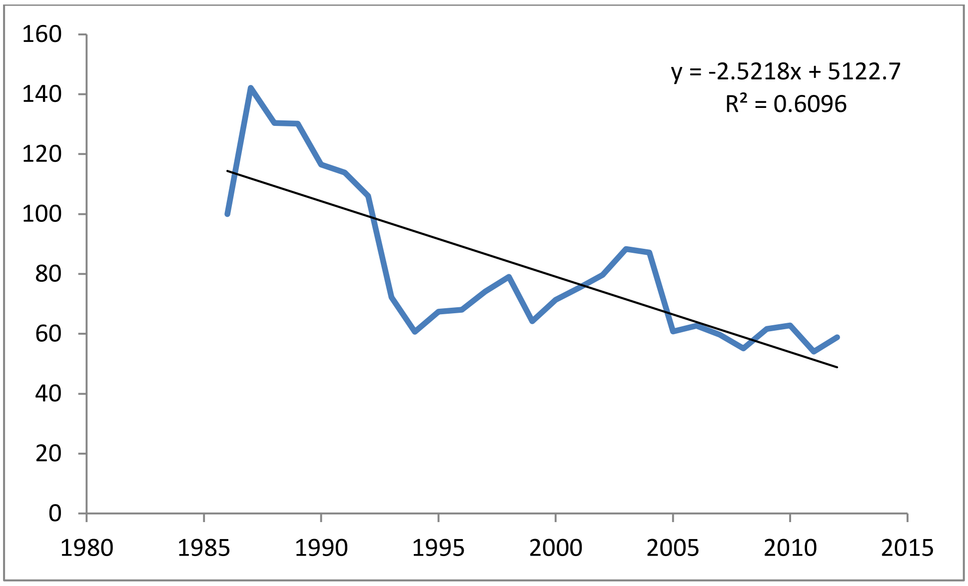

Figure 9.5. Trend in the shag breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

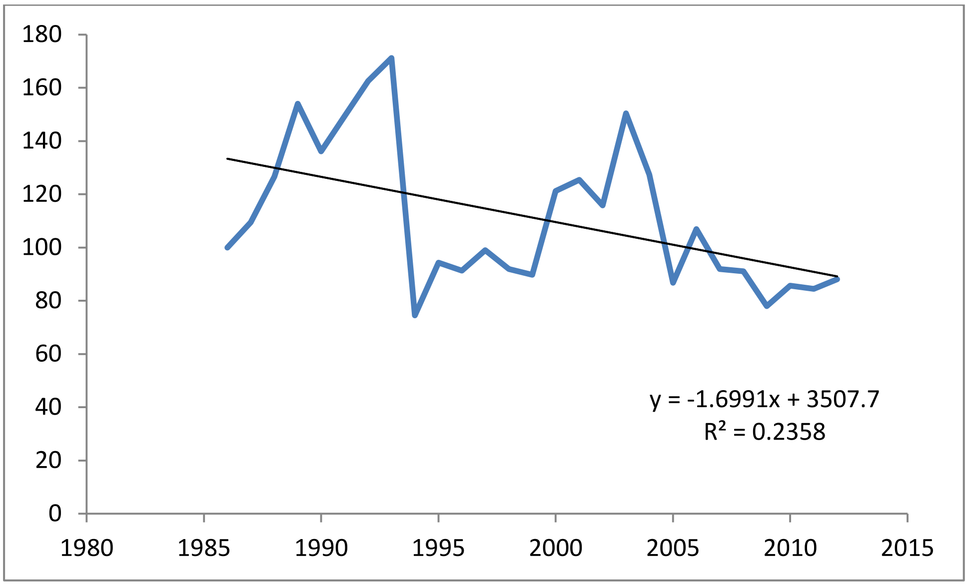

Figure 9.6. Trend in the shag breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

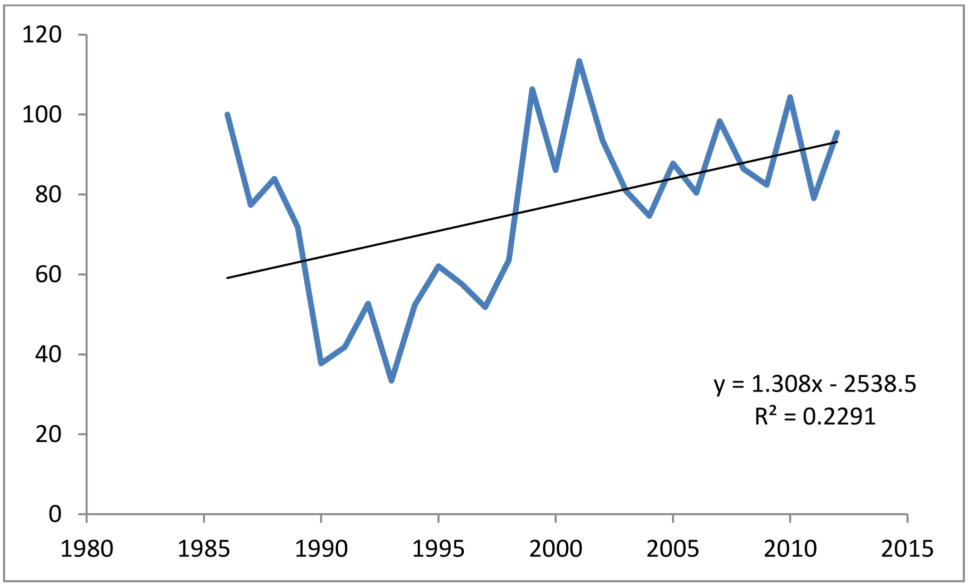

Figure 9.7. Trend in the shag breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

9.9 Proportion of UK population from UK breeding SPAs

The 13 SPAs with breeding shags as a feature together held 17,584 pairs at designation, estimated to represent ca. 47% of the British breeding population (Stroud et al. 2001). Numbers of shags have declined considerably in Scotland, but have declined only slightly in England and have increased slightly in Wales (but because most shags in the UK breed in Scotland, the better performance further south does not compensate for declines in Scottish colonies). Some colonies have declined very dramatically (for example the largest colony in Europe was at Foula, Shetland, and that fell from around 3,000 pairs in the 1970s to 2,277 pairs in 2000, and fewer than 200 pairs in 2013. Many of the largest declines appear to have occurred at the largest colonies, consistent with a density-dependent impact of reduced food supply. As a consequence, the proportion of the population within the SPA suite for shags fell to about 34% of the GB population in the 2000s (Stroud et al. 2014). The proportion within the SPA suite has almost certainly fallen further still since then (for example Stroud et al. 2014 used the 2000 estimate of 2,300 pairs for Foula whereas now that number is down to <200). The suite probably now holds around 25-30% of the UK shag population.

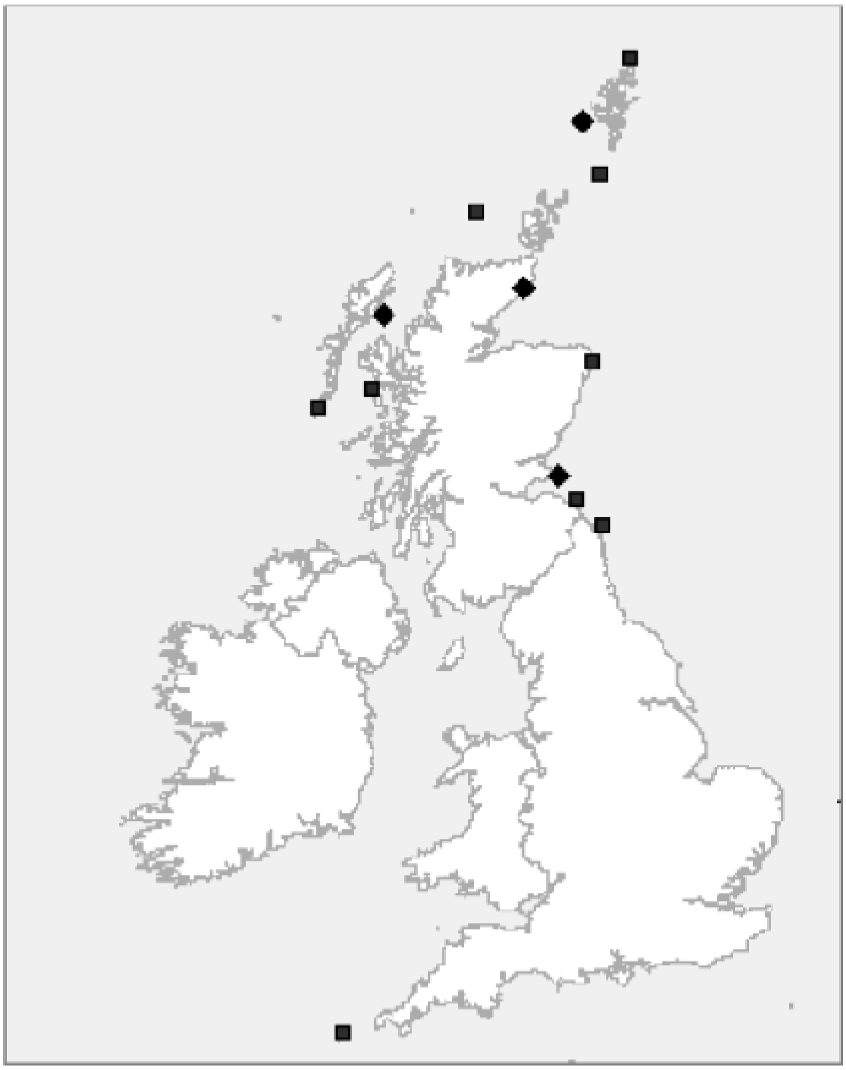

Figure 9.8. The SPA suite for shag. These SPA populations are listed in Table 9.1.

Table 9.1. The UK SPA suite for breeding shags.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent counts**	**Year**	**Reference**
NW North Sea							
Hermaness, Saxavord & Valla Field	Shetland	540	1994	Declined 2002	82 H'ness only: 94 33 41	1999 1994 1999 2002	Stroud et al. 2014 SMP database SMP database SMP database
Foula	Shetland	2,400 (1997)	1995	Declined 2007	2,300 258 <200	2000 2007 2013	Seabird2000 SMP database Gear 2013
Fair Isle	Shetland	1,099	1994	Declined 2008	567 663 732 235 204	1998 2001 2003 2008 2013	SMP database SMP database SMP database Lewis et al. 2012 SMP database

East Caithness Cliffs	N Scotland	2,345 (1986)	1996	Declined 1999	1,056	1999	Seabird2000
Buchan Ness to Collieston Coast	NE Scotland	1,045	1998	No change 2007	344 331	2007 2007	Lewis et al. 2012 Stroud et al. 2014
Forth Islands	E Scotland	2,400 (1985) Or 2,887 (Stroud et al. 2001)	1990	Recovering 2001	1,088 1,050 1,060 850	2010 2011 2012 2013	Lewis et al. 2012 SMP database SMP database SMP database
SW North Sea & Channel							
St Abb's Head to Fast Castle	E Scotland	651	1997	Declined 2008	329 269 160	2000 2000 2011	Stroud et al. 2014 Seabird2000 Lewis et al. 2012
Farne Islands	NE England	994 (Stroud et al. 2001)	1985		1,059 1,015 838 925 926 965 582	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
West of Scotland							
Sule Skerry and Sule Stack	N Scotland	874 (1986)	1994	Maintained 1998	701 724 15 200	1993 1998 2007 2011	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
Shiant Isles	Western Isles	1,780 (1986)	1992	Maintained 1999	506	1999	Seabird2000
Canna and Sanday	Inner Hebrides	1,140	1998	No change 2006	305 226 270 255	2010 2011 2012 2013	SMP database SMP database SMP database SMP database
Mingulay and Berneray	Western Isles	721 (1985)	1994	Declined 2009	281 330 115	1998 2003 2009	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
SW England & Wales							
Isles of Scilly	SW England	1,108	2001		1,296	2006	SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

9.10 BDMPS

Since adult shags show only very limited migration (most adults recovered in the non-breeding season being within 50 km of their breeding site; Wernham et al. 2002), UK waters can be split into several distinct non-breeding season BDMPS for shags. Birds from North Sea colonies tend to be more mobile than birds from western waters colonies, probably due to the greater exposure of east coast waters compared to relatively sheltered conditions in much of the west coast coastline. Based on evidence reviewed in sections 9.5, 9.6 and 9.7, the UK NW North Sea region holds about 41,500 birds in winter, with some birds, especially immatures, moving up or down much of the coastline. The West of Scotland region holds about 37,000 birds in winter, almost all derived from local colonies in that area. The SW England and Wales region holds about 13,000 birds in winter, many of which are immature birds from breeding sites further north, as breeding numbers in that region are relatively small but immatures from colonies further north move southwards into the area with relatively few locally breeding birds. The SW North Sea and Channel holds about 4,000 birds in winter, most of which are immature birds from breeding sites further north. Numbers during migration periods are essentially the same as these wintering numbers, so the BDMPS are appropriate for migration periods as well as wintering period.

The UK NW North Sea BDMPS has no birds from overseas populations. All adults from colonies in Shetland to Berwickshire are likely to remain within this BDMPS in the non-breeding season. All immatures from Shetland to Aberdeenshire are also likely to remain in the area, while it is estimated that 90% from Forth Islands and 80% of immatures from St Abbs Head area do so. It is estimated that 30% of adults and 40% of immatures from the Farne Islands spend the non-breeding period in the UK NW North Sea BDMPS. No birds from western colonies are thought to move into the area during the non-breeding season so that connectivity with populations to the west of the UK is negligible or zero. These figures result in an estimated BDMPS population of 41,503 birds in the UK NW North Sea BDMPS (Appendix A Table 22).

There have been a few recoveries of ringed shags from NW France in SE England (Wernham et al. 2002), but these appear to be negligible numbers from a small population in which many birds have been ringed, so connectivity between the French breeding population and UK waters is considered to be negligible. On this basis, the UK SW North Sea and Channel BDMPS has no significant numbers of birds from overseas populations. Although no birds from colonies in Shetland to Aberdeenshire are likely to move into the UK SW North Sea and Channel BDMPS, it is estimated that 10% of immatures from Forth Islands and 20% of immatures from St Abbs Head area do so. It is estimated that 70% of adults and 60% of immatures from the Farne Islands, and all birds from the non-SPA colonies in UK SW North Sea and Channel spend the non-breeding period in the UK SW North Sea and Channel BDMPS. No birds from western colonies are thought to move into the area during the non-breeding season so that connectivity with populations to the west of the UK is negligible or zero. These figures result in an estimated BDMPS population of 4,346 birds in the UK SW North Sea and Channel BDMPS (Appendix A Table 23).

Based on evidence reviewed in sections 9.5, 9.6 and 9.7, the UK West of Scotland waters BDMPS has small numbers of birds from Irish populations; it is estimated that perhaps 1% of immatures from Ireland spend the non-breeding season in this BDMPS (an estimated 52 birds). No birds from North Sea colonies are likely to be in this BDMPS in the non-breeding season. All birds from colonies in west Scotland are thought to remain within the area during the non-breeding season, but no birds from Wales and SW England are thought to move into the area. These figures result in an estimated BDMPS population of 37,311 birds in West of Scotland waters BDMPS (Appendix A Table 24).

Based on evidence reviewed in sections 9.5, 9.6 and 9.7, the UK Wales and SW England waters BDMPS has small numbers of birds from Irish populations; it is estimated that 3% of immatures from Ireland (157 birds) are in the BDMPS in the non-breeding season. No birds from North Sea or West of Scotland colonies are thought to move into the area during the non-breeding season. All birds from the Isles of Scilly and from non-SPA colonies in SW England and Wales are thought to remain within this BDMPS in the non-breeding season. These figures result in an estimated BDMPS population of 13,075 birds in the UK Wales and SW England waters BDMPS, with 12,918 coming from UK colonies (Appendix A Table 25).

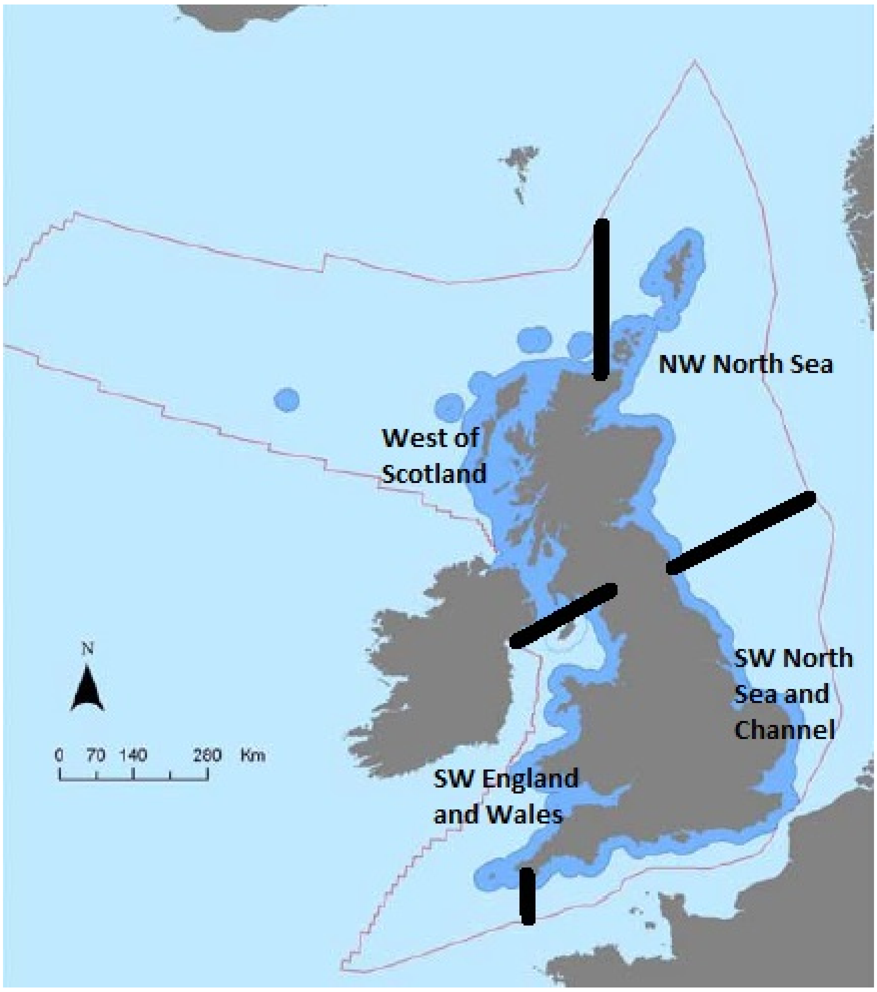

Figure 9.9. Four defined BDMPS spatial areas for shag; NW North Sea, SW North Sea and Channel, West of Scotland, and SW England & Wales.

9.11 Proportions of UK breeding SPA birds in each BDMPS

The distribution of breeding shag SPA populations is closely similar to the overall distribution of breeding shags in the UK. While almost all of the SPA sites are in the northern BDMPS (with the sole exception of the Isles of Scilly), most shags occurring in winter in the SW North Sea and Channel are immature birds dispersed from sites in the NW North Sea, so include immatures from SPAs. However, there are no breeding shag SPA populations in Wales or SW Scotland where there are breeding colonies, so the proportion of SPA birds in the SW England and Wales BDMPS will be lower than in the others. Proportions of adults from SPA colonies in each BDMPS can be computed from data in Appendix A Tables 22 to 25. For example, in the UK NW North Sea non-breeding season BDMPS, there are estimated to be 41,503 birds, of which 6,033 are adults from SPA populations, so those birds represent 14.5% of the total present in that BDMPS.

9.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Although only about 25-30% of shags in UK waters are from SPA populations, the 13 SPAs with breeding shags as a feature are well distributed across the breeding range of this species in the UK. Because adult shags may remain at colony sites through the winter, there is likely to be a tendency for SPA birds to be aggregated close to SPAs at all times of year (ring recoveries suggest that most adults remain within 50 km of their breeding area during the non-breeding season; Harris and Swann in Wernham et al. 2002). This aggregation may be most evident in the West of Scotland and SW England and Wales regions, where shags are most sedentary (Harris and Swann in Wernham et al. 2002). Birds from SPAs in the NW

North Sea region tend to disperse further. However, to counteract that effect, there are relatively more small non-SPA colonies of shags in the West of Scotland region between the SPA sites. Clearly if most adults move only a few tens of kilometres between breeding sites and wintering sites, the shags from colonies in on part of a BDMPS will not mix extensively with shags from areas on the other end of the BDMPS area. It might therefore be appropriate in assessments of impacts to define a reference area smaller than an entire BDMPS centered around a development site, and focus on the populations within that defined reference area. An appropriate reference area might be smaller in UK western waters than in the North Sea since shags are less mobine in western waters than in North Sea waters. Which populations should be included can be assessed from data presented in Tables 22 to 25. It would probably be appropriate to consider birds from all colonies within a radius of 300 km from a development site, but exclude consideration of birds from colonies at greater distances (since ring recoveries even of immature birds are predominantly from within 100 km of the location where the bird was originally ringed).

10. ARCTIC SKUA *Stercorarius parasiticus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in autumn (August to October) (adults and immatures)	Numbers in UK waters in spring (April-May) (adults and immatures)
Overseas	226,000	9,064	3,786
UK	3,000	2,650	2,552
Total	229,000	11,714	6,338

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Autumn migration BDMPS (August to October)			
UK North Sea and Channel	6,427	5,216	1,211
UK Western waters	5,287	3,848	1,439
Spring migration BDMPS (April-May)			
UK North Sea and Channel	1,227	582	645
UK Western waters	5,111	3,204	1,907

Although there are relatively few colonies of Arctic skuas in the UK, and the species is relatively easy to census, the numbers breeding in UK colonies have declined dramatically in recent years, with this species moving directly from being Green-listed to Red-listed as a consequence of the large decrease in breeding numbers. In addition, several colonies have not been censused since Seabird2000, so that current numbers are uncertain, especially in areas where the species is widely scattered at low density – areas where population trends may differ from those at large colonies with high nesting density. However, most SPA populations have been counted several times since 2000, and a complete survey was carried out in Orkney in 2010. So estimated numbers of UK birds migrating through UK waters are coded amber. Numbers of Arctic skuas that pass through UK waters have been estimated from sources such as seawatching data and ESAS data and reported in several publications (e.g. Forrester et al. 2007), but these numbers are relatively uncertain, and seem to vary from year to year, especially during spring migration when passage is predominantly west of the UK and may be more evident in years when weather conditions bring birds closer to land. Therefore, total numbers in BDMPS are coded red. Many of the birds passing through UK waters are from overseas populations rather than UK populations and although colour phase data can provide some indication of the origins of Arctic skuas, numbers that originate from overseas populations are rather uncertain, so are also coded red.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 26 to 29.

10.1 Breeding range and taxa

The monotypic Arctic skua is a trans-equatorial migrant and the UK is at the extreme southern limit of its breeding range which is circumpolar and largely Arctic (Furness 2010). Although there is no evidence that biometrics can be used to identify origins of individuals, Arctic skuas have two colour phases, with clinal variation in the proportions. Dark birds predominate at colonies at the southern edge of the range whereas all birds at high Arctic breeding sites are pale phase birds.

10.2 Non-breeding component of the population

Arctic skuas start to breed when 4 years old (BTO Birdfacts). Adult survival rate is 0.886 (BTO Birdfacts), juvenile survival 0.68 (BTO Birdfacts) and mean productivity is 0.522 chicks per pair (JNCC database, n=82 measurements). This estimate of productivity is low, but is certainly representative of breeding performance in the UK in recent decades. Productivity may be higher than this in regions where populations are performing better. However, for the population model, using a low value of productivity tends to be compensated for by increased estimates of juvenile and immature survival in order to achieve a stable population, so the exact value used in the model does not greatly alter the estimated proportion of immatures per adult. To obtain a stable population, survival of immatures was adjusted to 0.69 for juveniles, 0.8 for 1-year olds, and 0.886 for older age classes. The model population comprised 58% adults, 15% juveniles and 27% older immatures. There are 0.71 immatures per adult.

10.3 Phenology

Breeding colonies in the UK are deserted in August, with modal departure in early August (Pennington et al. 2004; Forrester et al. 2007). Autumn migration starts in early August (Wernham et al. 2002; Pennington et al. 2004) or August (Cramp et al. 1977-94; Forrester et al. 2007). Peak autumn migration occurs in August-September (Wernham et al. 2002; Pennington et al. 2004), early September (Forrester et al. 2007), September in English waters (Brown and Grice 2005), or September-October (Cramp et al. 1977-94) (but this last includes migration through southern hemisphere waters). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred very distinctly in late-August and early-September (Figure 10.1). Autumn migration is completed by late October (Pennington et al. 2004; Forrester et al. 2007) or late-November when also considering continued migration through southern hemisphere waters (Cramp et al. 1977-94).

Spring migration starts in late-March from southern hemisphere wintering areas (Cramp et al. 1977-94) but birds start to reach UK waters in early April (Wernham et al. 2002) or April (Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in April-May (Cramp et al. 1977-94; Wernham et al. 2002), early May (Pennington et al. 2004) or May (Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late April and early May (Figure 10.1). Spring migration is completed by late May (Cramp et al. 1977-94; Pennington et al. 2004), early June (Wernham et al. 2002) or June (Forrester et al. 2007).

The first spring records of Arctic skua in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were between 10 April and 7 May, but mostly in mid-April. The last records in autumn fell between 3 September and 8 November but mostly in October. Peak autumn migration was reported in July-September in most years, and peak spring migration was reported in May in most years. Birds re-occupy colonies from early April, with modal return in late April (Pennington et al. 2004; Forrester et al. 2007).

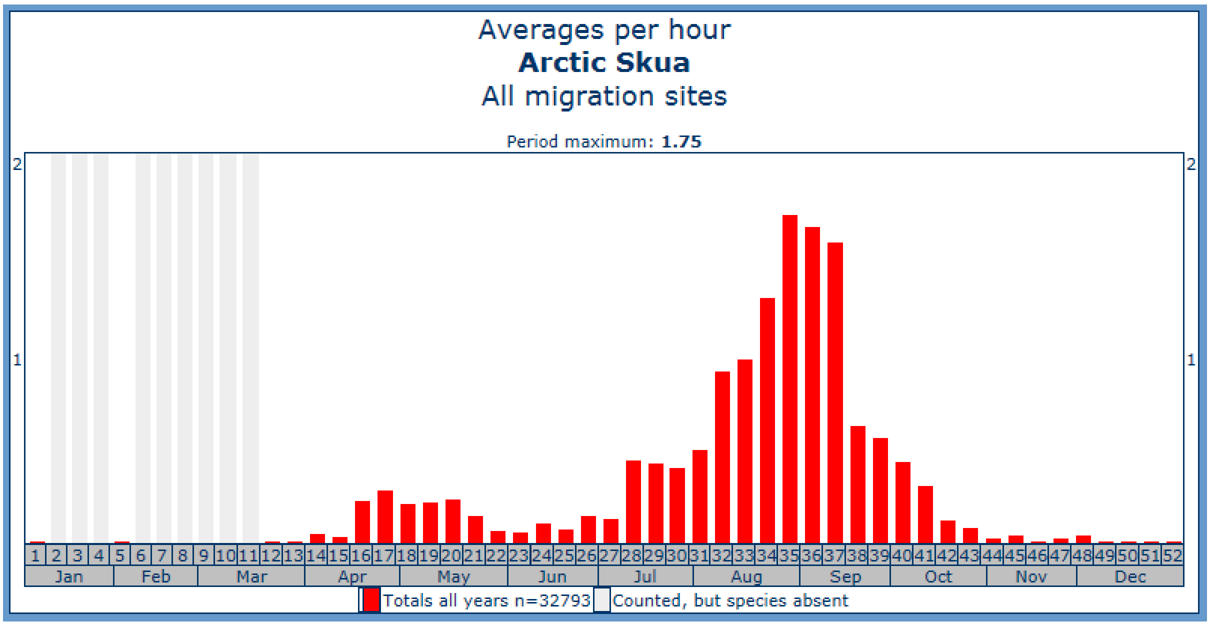

Figure 10.1. Average numbers of Arctic skuas counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season September-April. However, from the data reviewed above, a more appropriate definition would be breeding season May-July, non-breeding season August-April.

10.4 Defined seasons:

- UK Breeding season — May-July
- Post-breeding migration in UK waters — August-October (**autumn BDMPS**)
- non-breeding season — August-April
- Return migration through UK waters — April-May (**spring BDMPS**)
- Migration-free breeding season — June-July
- Migration-free winter season — November-March

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for Arctic skua:

'Autumn' (post-breeding) migration BDMPS (August-October); and

'Spring' (pre-breeding) migration BDMPS (April-May).

10.5 Movements of birds from the UK population

Some failed breeders and some immatures attending UK colonies as pre-breeders may set off on autumn migration as early as July, but most fledglings and adults at UK colonies depart in early August (Furness 2010; Wernham et al. 2002). Birds from North Sea colonies (Orkney and Shetland) disperse in autumn either through the North Sea or through western waters. Birds from colonies in western waters probably disperse through western waters mainly southwards or southwestwards rather than moving into the North Sea. However, spring migration seems to be more often through western waters, even for adults returning to colonies within the North Sea (Orkney, Shetland and Caithness).

10.6 Movements of birds from overseas into UK waters

Migrants from populations further north pass through British waters mainly in August-September. Autumn migration tends to occur close to the coast. At this time, individuals may hang around areas where there are flocks of terns. A few stragglers may still be present in October, but records from November are extremely scarce (and may involve identification errors as pomarine skuas may occasionally still be seen in November). No Arctic skuas overwinter in British waters. Return migration in spring tends to be more rapid, and with a high proportion of birds passing up the west side of Scotland rather than through the North Sea (Forrester et al. 2007). The proportion of light phase birds tends to increase through spring, as birds that breed at more southerly colonies (where dark phase birds predominate) tend to arrive first, with birds travelling on to the Arctic (where virtually all birds are pale phase) migrating later (Newnham 1984). Scottish adult Arctic skuas return to colonies in late April and May, but Arctic-breeding individuals may not occupy breeding grounds until June (Wernham et al. 2002). It is during May that the proportion of dark phase Arctic skuas is lowest in UK waters, consistent with these birds being predominantly from northern populations (Tasker et al. 1987). There are around 8,000 pairs in Fennoscandia, 7,500 pairs in Iceland, 750 pairs in the Faroes, and tens to hundreds of thousands of pairs on the Arctic tundra bordering the North Atlantic (Mitchell et al. 2004); figure of 50,000 pairs has been used in this report but that estimate is fairly uncertain. Small proportions of each of those populations are thought to migrate through UK waters, but there is very little evidence to indicate which of those populations predominate in the migration season.

10.7 Numbers in UK waters

Autumn migration of Arctic skuas in English waters is seen especially off the coast of E England, whereas spring migration is mainly seen off the S coast and rather few pass along the coast of E England (Brown and Grice 2005). In spring, numbers moving north along the east coast of Scotland tend to be small, but there can be large numbers off the west of Scotland, although these may often pass too far from the coast to be seen from land. As a result, numbers migrating through UK waters are not well defined, but Forrester et al. (2007) suggest that spring migration involves around 1,000 to 5,000 birds in Scottish waters, predominantly to the west of Scotland, while autumn migration involves 1,000 to 10,000 birds, with possibly slightly more than half of these off the west coast, but much better data on numbers available from observations at the east coast. These numbers are likely to be underestimates of the strength of migration of this species, particularly because the species is easily overlooked during boat-based surveys, and because migration can occur in pulses of birds passing beyond sight from shore-based observation points unless driven inshore by weather.

10.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the NE Atlantic population, comprising 30,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 15,000-35,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 75,000 individuals. It is likely that most of this widely distributed biogeographic population has connectivity with UK waters, but that the proportion of the population passing through UK waters is rather small. The UK population of Arctic skuas is small. Seabird 2000 recorded 2,136 AOTs (approximately equivalent to pairs) and numbers have declined considerably since 2000; data presented by Foster and Marrs (2012) suggest a 57% decline in numbers of AOTs at monitored colonies between 2000 and 2011, so the current UK population may be around 1,000 AOTs. However, the decline in numbers of AOTs does not necessarily mean a proportionate decline in population size, since adults from many of the abandoned AOTs may simply be non-breeding during times of low food supply, and might reoccupy AOTs if conditions were to improve. The biogeographic population with connectivity to UK waters is therefore estimated at 3,000 birds from the UK population and 226,000 birds from overseas populations, giving a total of 229,000 but with a very high uncertainty associated with this estimate. Total numbers in UK waters during autumn migration are estimated at 9,000 birds from overseas and 2,600 from UK populations, so about 12,000 birds overall. Total numbers in UK waters during spring migration are estimated at 4,000 birds from overseas and 2,500 from UK populations, so about 6,500 birds overall. These estimates also have a high uncertainty, especially regarding numbers from overseas populations which represent a major part of the totals.

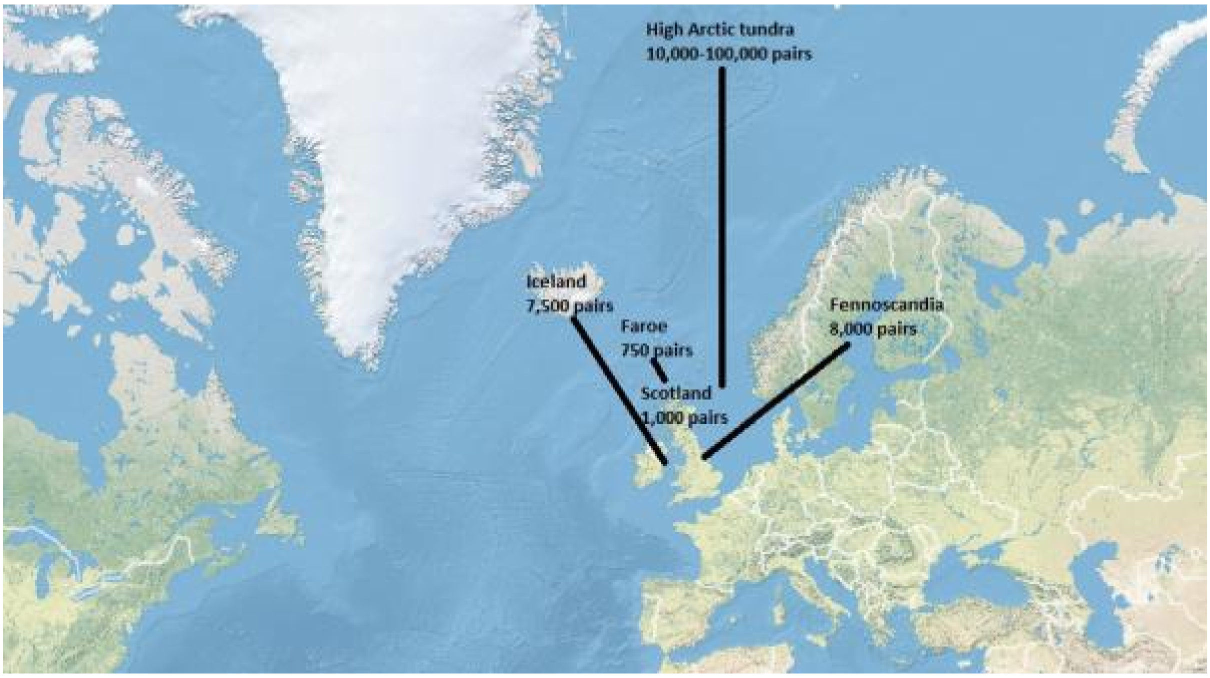

Figure 10.2. Breeding population origins of Arctic skuas in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

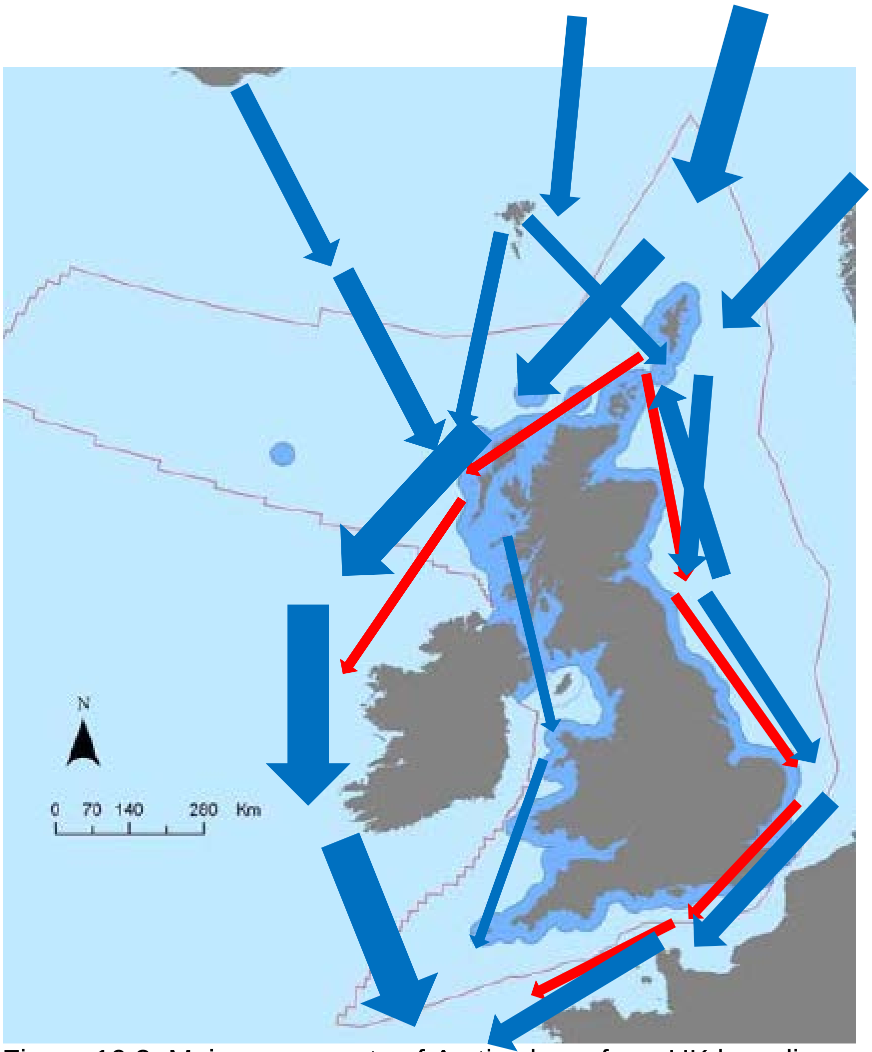

Figure 10.3. Main movements of Arctic skuas from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. See also Forrester et al. (2007) page 728.

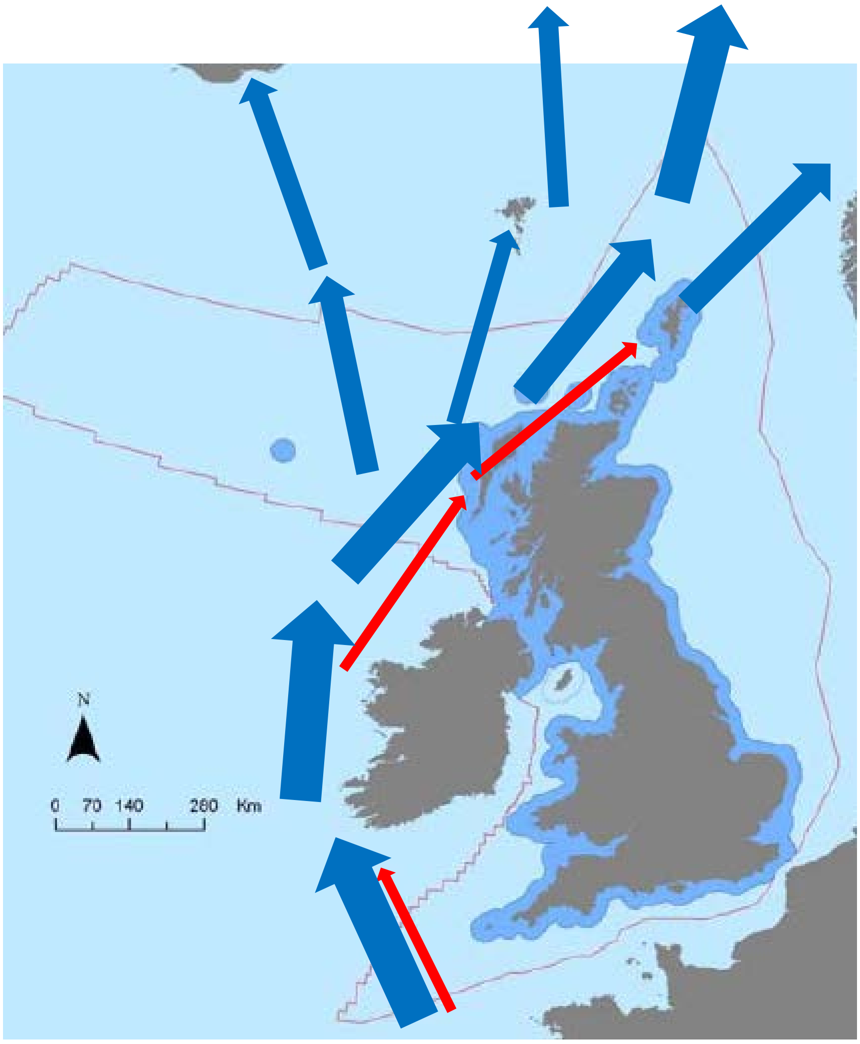

Figure 10.4. Main spring movements of Arctic skuas to UK breeding areas (red arrows) and towards overseas populations (blue arrows) through UK waters. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. See also Forrester et al. (2007) page 728.

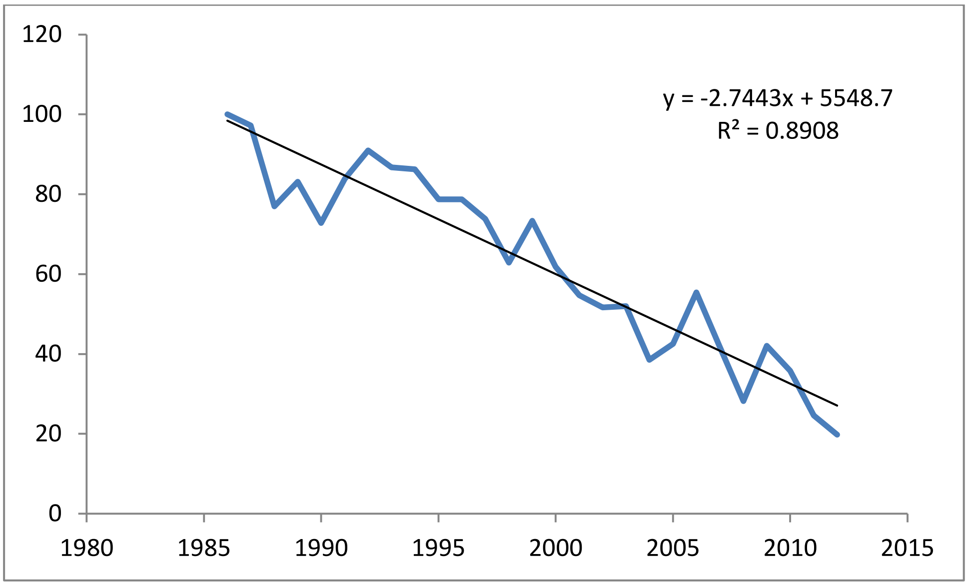

Figure 10.5. Trend in the Arctic skua breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

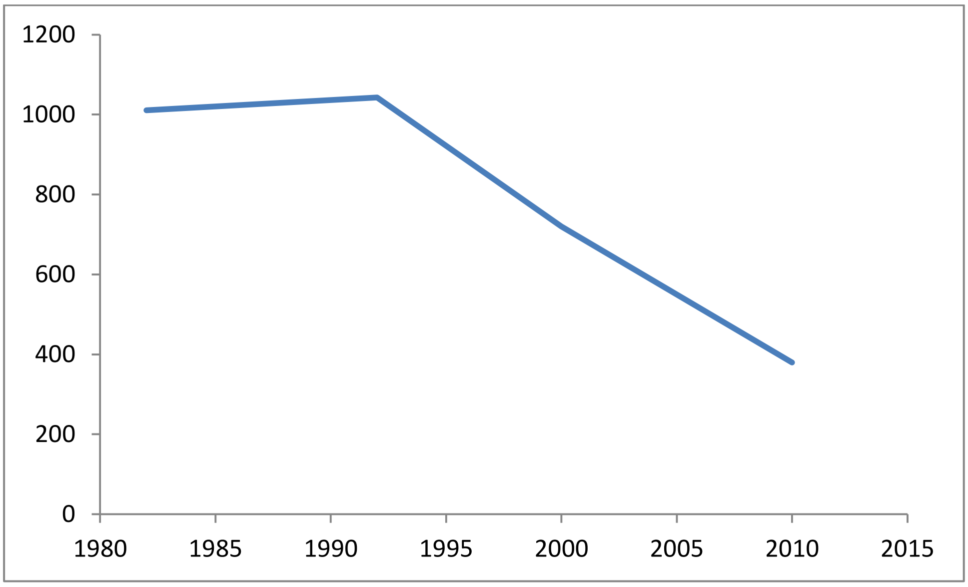

Figure 10.6. Trend in the Arctic skua breeding numbers in Orkney from 1982-2010. Data from Meek et al. (2011).

Data show a 31% decline in 8 years from 1992 to 2000, and a 47% decline in 10 years from 2000 to 2010 (Meek et al. 2011). Meek et al. (2011) concluded that declines in Arctic skua colonies in Orkney were related to colony size (a density-dependent relationship with larger colonies declining more than smaller ones) and to the numbers of great skuas in the area (an impact of predation, of mortality caused by fighting over territory ownership, and loss of nesting habitat to the larger species; see also Phillips et al. 1998).

10.9 Proportion of UK population from UK breeding SPAs

The 7 SPAs with breeding Arctic skuas as a feature together held 780 pairs at designation, estimated to represent ca. 24% of the British breeding population at that time (Stroud et al. 2001). Breeding numbers of Arctic skuas have declined very considerably since 2000 (Figures 10.5 and 10.6), with the decline being especially large at some of the largest colonies (which are the SPA populations). Therefore, the percent of the population breeding within the SPA suite for the species has decreased. Based on census data mostly from around 2010, Stroud et al. (2014) estimated that the breeding Arctic skua SPA suite held 16.3% of the GB (=UK) population at that time. The sum of the most recent counts at each SPA is only 235 pairs (Table 10.1) whereas Stroud et al. (2014) summed counts dated mostly around 2010 to 343 pairs. So it is clear that the decline in the numbers at SPAs has continued, and so the percent of the UK population in the SPA suite for breeding Arctic skuas is likely to be less than the 16.3% estimated by Stroud et al. (2014). The exact percentage is difficult to assess because the total breeding population in the UK has not been surveyed recently, and numbers in areas where the species breeds at low density outwith SPAs may possibly not have declined as much. The percent in the SPA suite is therefore likely to now be around 15%, but might possibly be even lower than that as the large colony on Fetlar SPA has not been counted since 2002 when there were still 83 pairs there, and it is highly likely that numbers there are now much lower than that, given that other SPA populations in Shetland that were previously similar in numbers to Fetlar have fallen to only 30 or 40 pairs (Table 10.1).

Figure 10.7. The SPA suite for Arctic skua. These SPA populations are listed in Table 10.1.

Table 10.1. The UK SPA suite for breeding Arctic skuas.

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent count	Year	Reference
UK North Sea & Channel							
Fetlar	Shetland	130	1994	Recovering 2006	96 83	2001 2002	SMP database Stroud et al. 2014
Foula	Shetland	125	1995	Declined 2007	71 41 63 50 41 37 35	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database Lewis et al. 2012 SMP database Gear 2012 Gear 2013
Fair Isle	Shetland	74	1994	Maintained 2009	37 65 70 29 20 19	2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database FIBO Report SMP database
West Westray	Orkney	77	1996	Declined 2007	55 38 <27	2000 2007 2010	Stroud et al. 2014 Lewis et al. 2012 Meek et al. 2011
Papa Westray	Orkney	135	1996	Declined 2000	25 22	2011 2012	Lewis et al. 2012 Orkney Bird Report
Hoy	Orkney	59	2000	Maintained 2000	16 12	2010 2010	Meek et al. 2011 SCR database
Rousay	Orkney	180	2000	Declined 2007	114 46 37	2000 2007 2010	Lewis et al. 2012 Lewis et al. 2012 Meek et al. 2011

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

10.10 BDMPS

UK waters can be split into two BDMPS for Arctic skuas during migration seasons. The UK North Sea and Channel region holds about 6,000 birds in autumn and 1,000 in spring. The UK Western waters region holds about 5,000 birds in autumn and 5,000 in spring. These two areas should be treated as spatially separate BDMPS because although all breeding Arctic skua SPAs are in the UK North Sea and Channel area, much of the migration of this species passes through UK western waters. Therefore UK SPA birds are strongly represented in one BDMPS but not in the other. Details of apportioning of birds from different populations are given in Appendix A Tables 26 to 29. Since individual birds cannot be members of more than one spatially defined BDMPS, a minority of birds from colonies in the North Sea are (perhaps counter-intuitively) allocated to the UK western waters BDMPS rather than to the UK North Sea and Channel BDMPS. These are birds, predominantly from colonies in Shetland and Orkney, which migrate quickly out of, or into, the North Sea, but linger in UK western waters for some prolonged period during migration. These birds are therefore allocated to the BDMPS spatial area in which they spend more time, rather than necessarily being allocated into the BDMPS spatial area within which their breeding site happens to be located.

Based on evidence reviewed in sections 10.5, 10.6 and 10.7, it is estimated that in autumn 60% of adults and 40% of immatures from breeding Arctic skua UK SPA populations migrate through the UK North Sea and Channel waters, whereas 40% of adults and 30% of immatures migrate through UK western waters, whereas 100% of adults and 70% of immatures from UK non-SPA western waters migrate through UK western waters. It is estimated that in autumn, 1% of adults and immatures from high Arctic populations migrate through UK North Sea and Channel waters and the same percentage through UK western waters, 2% of adults and immatures from Iceland migrate through UK North Sea and Channel waters and the same percentage through UK western waters, 10% of adults and immatures from Fennoscandia and Faroe migrate through UK North Sea and Channel waters, 5% of birds from Fennoscandia and 10% of birds from Faroe migrate through UK western waters (Appendix A Tables 26 and 27). This results in an estimate of 1,211 birds from UK and 5,216 from overseas in the autumn migration UK North Sea and Channel waters BDMPS and 1,439 birds from UK and 3,848 from overseas in the autumn migration UK western waters BDMPS.

Based on evidence reviewed in sections 10.5, 10.6 and 10.7, it is estimated that in spring, 40% of adults and 10% of immatures from breeding Arctic skua UK SPA populations migrate through the UK North Sea and Channel waters, whereas 60% of adults and 50% of immatures migrate through UK western waters, whereas 100% of adults and 70% of immatures from UK non-SPA western waters migrate through UK western waters. It is estimated that in spring, 0.2% of adults and 0.1% of immatures from high Arctic populations migrate through UK North Sea and Channel waters whereas 1% of birds from high Arctic populations migrate through UK western waters, 0.5% of adults and 0.1% of immatures from Iceland migrate through UK North Sea and Channel waters and 1% of Icelandic birds through UK western waters, 1% of adults and 0.5% of immatures from Fennoscandia migrate through UK North Sea and Channel waters, 5% of adults and 3% of immatures from Fennoscandia migrate through UK western waters, 0.5% of adults and 0.1% of immatures from Faroe migrate through UK North Sea and Channel waters and 5% of adults and 2% of immatures migrate through UK western waters (Appendix A Tables 28 and 29). This results in an estimate of 645 birds from UK and 582 from overseas in the spring migration UK North Sea and Channel waters BDMPS and 1,907 birds from UK and 3,204 from overseas in the spring migration UK western waters BDMPS.

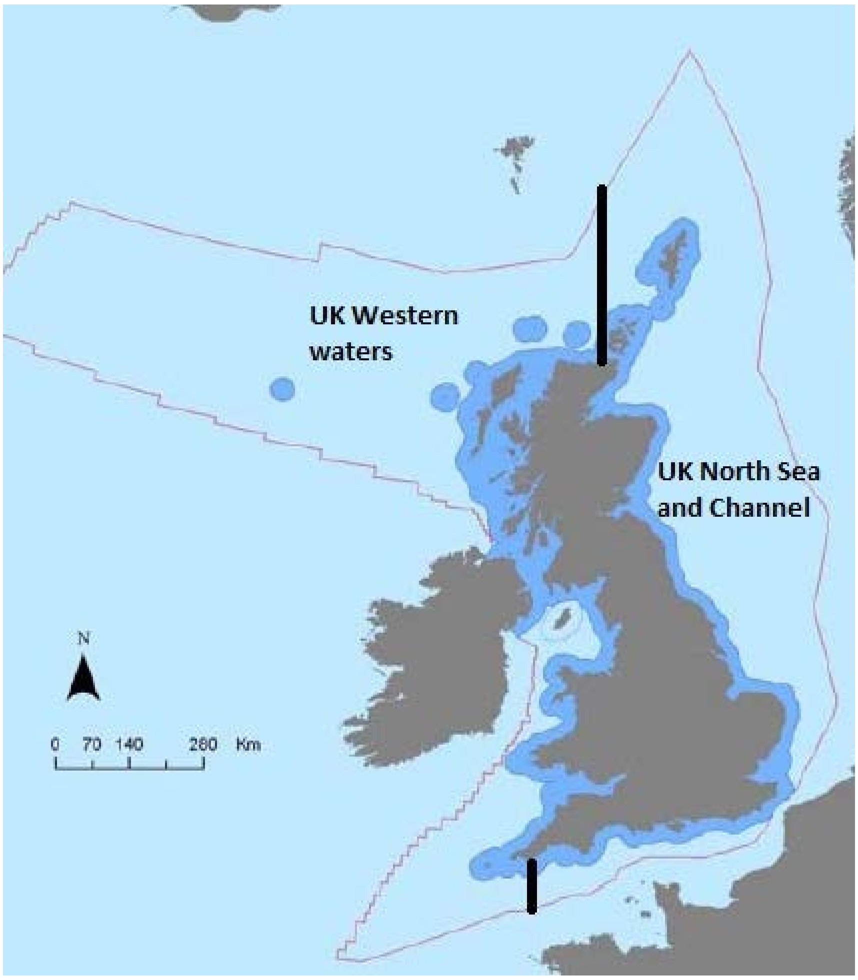

Figure 10.8. Two defined BDMPS spatial areas for Arctic skua: 'UK North Sea and Channel' and 'UK Western waters'.

10.11 Proportion of UK breeding SPA birds in BDMPS

During migration, the relatively small UK population (about 1,000 pairs, so 2,000 adults giving a total of about 3,000 birds of which many young immatures do not return from wintering areas to UK waters so a total of about 2,600 birds in UK waters) represents a minority of the birds present in UK waters. Probably UK birds represent about 20% of the birds present in UK waters on average during the migration months, but this percentage is very uncertain. The percentage is unlikely to be much higher than this, however, since most UK birds are dark phase, and the proportion of dark phase birds observed during migration watches at UK sites is generally small, indicating that a large majority of the birds originate from breeding areas further north where dark phase birds are at a frequency close to zero. Probably only about 15% of Arctic skuas from the UK colonies are from within the breeding Arctic skua SPA suite. However, since all the SPA populations and most of the species' breeding population in the UK, are in the NW North Sea area, and rather few Arctic skuas migrate northwards through that area, the proportion of SPA birds in that area in spring will be higher than in other BDMPSs. The proportion of the BDMPS represented by adults from UK SPA populations can be computed from data in Appendix A Tables 26 to 29. For example, in the UK North Sea and Channel BDMPS in autumn migration season there are 6,427 birds of which 281 are adults from UK SPA populations, so those represent 4.4% of the total present.

10.12 Spatial distribution of UK breeding SPA birds across the BDMPS

During autumn migration, birds dispersing from UK SPAs will all be in the North Sea and Channel BDMPS initially. However, these birds will move through this and some through the UK western waters BDMPS and often stop for some days in locations where there are opportunities to steal food from terns, so the distribution of SPA birds will quickly become fairly random across the BDMPSs. In spring, this process is likely to act in reverse, but with spring migration generally being somewhat faster and more direct towards colonies than in autumn.

11. GREAT SKUA *Stercorarius skua*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in autumn (August to October) (adults and immatures)	Numbers in UK waters in winter (November to February) (adults and immatures)	Numbers in UK waters in spring (March-April) (adults and immatures)
Overseas	30,000	5,562	1,363	5,655
UK	43,000	30,330	178	27,920
Total	73,000	35,892	1,541	33,575

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Autumn migration BDMPS (August to October)			
UK North Sea and Channel	19,556	2,141	17,415
UK Western waters	16,336	3,421	12,915
Winter BDMPS (November-February)			
UK North Sea and Channel	143	143	0
UK Western waters	1,398	1,220	178
Spring migration BDMPS (March-April)			
UK North Sea and Channel	8,485	982	7,503
UK Western waters	25,090	4,673	20,417

Colour coding for numbers of UK birds in the autumn migration BDMPS is amber. This reflects uncertainty about changes in breeding numbers at some UK colonies that have not been censused since Seabird2000. Breeding numbers have declined recently at some of the larger colonies but appear to still be increasing at some small colonies, and it is the latter that tend to lack recent census data. Colour coding for numbers of birds from overseas populations passing through UK waters in autumn is coded red because information on migrations of great skuas from Iceland, Faroe and Norway is based only on ring recovery data. Recoveries of pelagic or offshore seabirds tend to be highly biased because only a very small proportion of ringed birds are recovered, and many recoveries are associated with mortality related to human activities (such as fishery bycatch or birds being shot). There is only limited data from tracking birds equipped with geolocators (small numbers of breeding adults having been tracked from Iceland and Norway in only a single year). For these reasons, numbers in the winter BDMPS are coded red as are numbers in the spring migration BDMPS. The spring data are considered less reliable than the autumn data because spring passage results in very few ring recoveries, tends to occur over a shorter time period, and tends to occur in western waters which have lower survey coverage in the ESAS database than for North Sea waters and also have fewer and less consistently watched migration sites.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 30 to 35.

11.1 Breeding range and taxa

The species is monotypic (unless southern hemisphere taxa which do not visit European waters are included as conspecific which seems to be contrary to genetic evidence) and biometrics do not appear to help to identify origins of individuals. Great skuas breed in Scotland (9,634 pairs; Mitchell et al. 2004, but now decreased to probably about 8,900 pairs or less based on known declines at UK SPA colonies and assuming similar declines at other colonies), Faroe (500 pairs; Hammer et al. 2013), Iceland (5,400 pairs; Mitchell et al. 2004), Norway (360 pairs including Bear Island, Svalbard and Jan Mayen; Mitchell et al. 2004), and Russia (at least 10 pairs; Anker-Nilssen et al. 2000).

11.2 Non-breeding component of the population

Great skuas start to breed when 7 years old (BTO Birdfacts). Adult survival rate is 0.888 (BTO Birdfacts), juvenile survival 0.8 (BTO Birdfacts) and mean productivity is 0.664 chicks per pair (JNCC database, n=138 measurements). To obtain a stable population, survival of immatures was retained at 0.8 for juveniles, set at 0.82 for 1-year olds, 0.84 for 2-year olds, 0.86 for 3-year olds and 0.888 for older age classes. The model population comprised 41% adults, 14% juveniles and 45% older immatures. There are 1.42 immatures per adult.

11.3 Phenology

Breeding colonies in the UK are largely deserted by October, with modal departure in August (Pennington et al. 2004; Forrester et al. 2007). Autumn migration starts in August (Cramp et al. 1977-94; Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak autumn migration occurs in August-October in English waters (Brown and Grice 2005), early September (Pennington et al. 2004), September (Forrester et al. 2007), September-October (Cramp et al. 1977-94; Wernham et al. 2002), and July-October in Belgium (Vanermen et al. 2013). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in September and early October (Figure 11.1). Autumn migration is completed by late October (Forrester et al. 2007), early November (Pennington et al. 2004), November (Wernham et al. 2002) or early December (Cramp et al. 1977-94).

Spring migration starts in early March (Cramp et al. 1977-94; Pennington et al. 2004) or March (Wernham et al. 2002; Forrester et al. 2007). Peak spring migration occurs in January-April in Belgium (Vanermen et al. 2013) but the inclusion of January probably represents movement of very small numbers of birds, in March-April (Cramp et al. 1977-94), or in April in the UK (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late April (Figure 11.1). Spring migration is completed by May (Wernham et al. 2002), late May (Cramp et al. 1977-94; Pennington et al. 2004) or June (Forrester et al. 2007).

The first spring records of great skua in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were between 13 February and 24 April but mostly in late March, and the last records ranged from 11 October to 15 December but were predominantly in mid-November. Peak autumn migration was reported in August-September in most years, and peak spring migration was reported in April in most years. Birds re-occupy colonies from late March, with modal return in April (Pennington et al. 2004; Forrester et al. 2007).

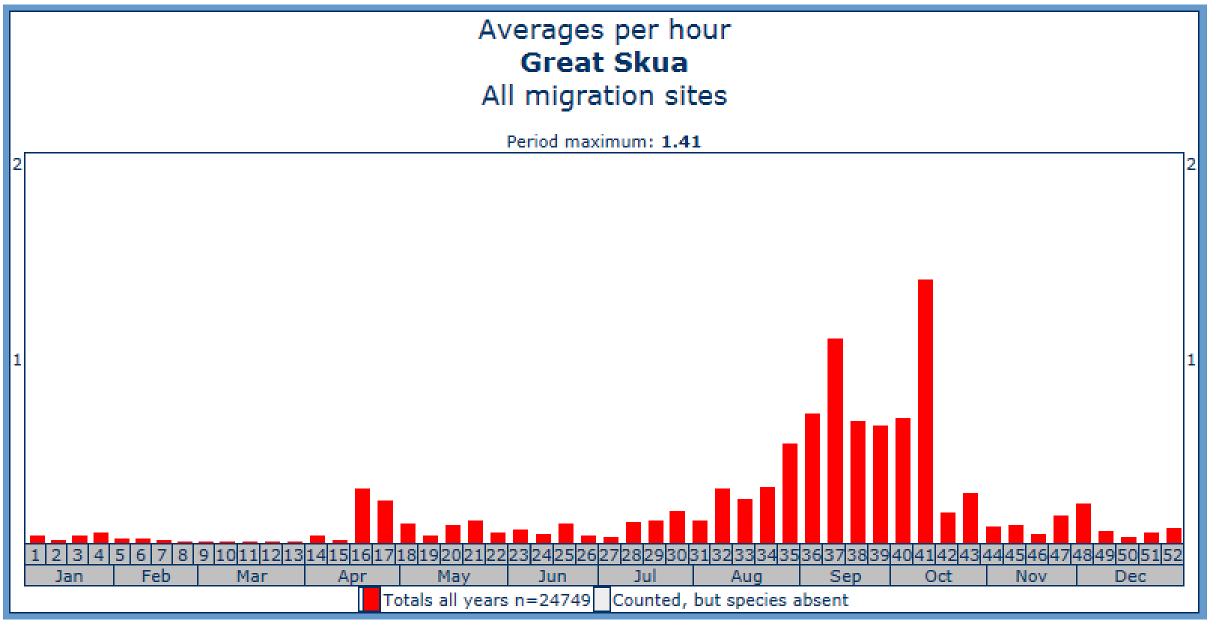

Figure 11.1. Average numbers of great skuas counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season September-April. From the data reviewed above, this would appear to be an appropriate definition.

11.4 Defined seasons:

• UK Breeding season	May-August
• Post-breeding migration in UK waters	August-October (**autumn BDMPS**)
• non-breeding season	September-April
• Return migration through UK waters	March-April (**spring BDMPS**)
• Migration-free breeding season	May-July
• Migration-free winter season	November-February (**winter BDMPS**)

Apart from the breeding season, three seasonal BDMPS periods are considered to be appropriate for great skua:

'Autumn' (post-breeding) migration BDMPS (August-October);

'Winter' BDMPS (November-February); and

'Spring' (pre-breeding) migration BDMPS (March-April).

11.5 Movements of birds from the UK population

Immatures (Klomp and Furness 1990) and failed breeders may leave colonies in July, followed in August-September by fledglings and successful breeders (Wernham et al. 2002; Furness 2010). Late breeders and young may not depart until October, and very small numbers remain in UK waters through to the end of the year and occasionally overwinter (Trektellen web site). Birds from UK colonies migrate over the Continental Shelf to the Bay of Biscay, Iberia or NW Africa. No adults from UK populations have been identified as wintering in North America. Only one or two ringed immatures from UK populations have been recovered on the coast of North America (Klomp and Furness 1992), so that region appears not to be visited by UK adults and not by significant numbers of UK immatures. Stable isotopes in feathers grown in the wintering area show location-specific signatures allowing individuals to be classified by major wintering areas: West Africa, southern Europe, or North America (Leat et al. 2013). Satellite tracking and deployment of geolocators on breeding great skuas suggests that numbers of adults wintering off west Africa may have increased, as numbers of ring recoveries from adult aged birds there were very small (Furness et al. 2006; Magnusdottir et al. 2012). Spring migration occurs in March-May, with rather rapid northwards movement mostly in April (Wernham et al. 2002; Trektellen web site). The high speed of spring migration may partly explain why there are far fewer ring recoveries in spring than in autumn (Wernham et al. 2002), but it also seems that most birds migrate northwards to the west of the British Isles with very few passing through the North Sea in spring, whereas during autumn migration much larger numbers are seen in the North Sea (Tasker et al. 1987; Forrester et al. 2007; Trektellen web site). As with most migrant seabirds, juveniles tend to winter further south, on average, than immatures which in turn tend to winter further south than breeding adults (Klomp and Furness 1992).

11.6 Movements of birds from overseas into UK waters

Migrants from all other breeding areas may pass through UK waters in autumn, at about the same time as UK birds are moving from colonies; there are autumn ring recoveries from birds ringed in Faroe and Iceland (Wernham et al. 2002). During autumn, peak numbers in the North Sea are seen in September (Tasker et al. 1987) and this pattern is also evident from seawatching data (Trektellen web site). While all breeders from UK colonies are thought to migrate through Europe to winter in southern Europe and off West Africa, about half of the breeders at colonies in Iceland and Bear Island migrate to winter off North America (Magnusdottir et al. 2012). A few of the birds wintering off North America also visit European waters during the same winter (Magnusdottir et al. 2012). Stable isotopes in feathers grown in the wintering area show location-specific signatures allowing individuals to be classified by major wintering areas: West Africa, southern Europe, or North America (Leat et al. 2013). Within the east Atlantic wintering range of the species, birds from Norway and Iceland tended to winter further north than those from UK (Magnusdottir et al. 2012). Great skuas from Faroe appear to show much the same migration and winter distribution as birds from UK colonies (Hammer et al. 2013). Thus, the very small numbers of great skuas present in UK waters in winter are more likely to be adults from Norway or Iceland than they are to be from UK colonies. Since the UK breeding numbers are twice those in Iceland, and numbers in Norway, Faroe and Russia are relatively small, birds from UK colonies predominate in the total population. In UK waters during migration, probably at least 80% of birds are from UK colonies, since half of the birds from Iceland and Norway apparently travel to North America directly and do not pass through UK waters. In winter, however, the very small numbers of great skuas in UK waters may be predominantly adults from Iceland and Norway because those birds winter further north than birds from the UK.

11.7 Numbers in UK waters

Very few great skuas are present in English waters in winter, but small numbers are in the SW Approaches from November to March (Brown and Grice 2005). Very few (Forrester et al. 2007 estimate fewer than ten birds) are present in Scottish waters in winter. However, large numbers (relative to population size) migrate south through UK waters, especially through the North Sea, in autumn, and similar numbers migrate north through UK waters in spring, but predominantly to the west of the British Isles. Forrester et al. (2007) suggest that there are about 2,000 to 10,000 birds in Scottish waters in autumn, and about 1,000 to 6,000 in spring. These birds passing south inevitably also pass through English waters, as they winter off southern Europe or west Africa. It is reasonable to assume that almost the entire UK great skua population passes south through UK waters in autumn and all but the youngest age classes pass north through UK waters in spring (the youngest birds may remain in wintering areas all year, while middle ages of immature birds may migrate to Greenland and Norway in summer rather than stopping at UK breeding areas). The UK population is probably about 9,000 pairs at present, so 18,000 adults. Associated with this population are about 25,600 immatures, of which perhaps half will return to UK waters in summer and half be either in the wintering area or visit high latitudes rather than the UK in summer. So about 30,300 birds from the UK population are estimated to pass through UK waters on autumn migration. In addition, a few thousand birds from colonies in Norway, Russia, Faroe and Iceland pass through UK waters in autumn and spring. The exact number is not known, but the total is likely to be around 4,000 to 6,000 birds, as a large part of the Norwegian and Icelandic populations migrate west across the North Atlantic to Canadian waters, and some appear to migrate south from Iceland over the mid-Atlantic rather than via UK waters. These numbers are rather larger than the numbers suggested by Forrester et al. (2007) which presumably at least in part reflects the turnover that occurs with birds migrating through over a period of time, so that total numbers involved are larger than the 'snapshot' estimates provided by survey data.

11.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the species' population, comprising 13,600 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 16,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 40,800 individuals. The biogeographic population with connectivity to UK waters is probably much the same as the total biogeographic population – so is estimated at 73,000 birds, 43,000 from the UK and 30,000 from overseas. This includes large numbers of immatures that do not necessarily return to UK waters but may range over areas from northern South America and west Africa to Greenland and the Barents Sea. Numbers in UK waters are estimated at 36,000 birds in autumn (August to October), 1,600 birds in winter (November to February), and 34,000 birds in spring (March and April).

Figure 11.2. Breeding population origins of great skuas in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

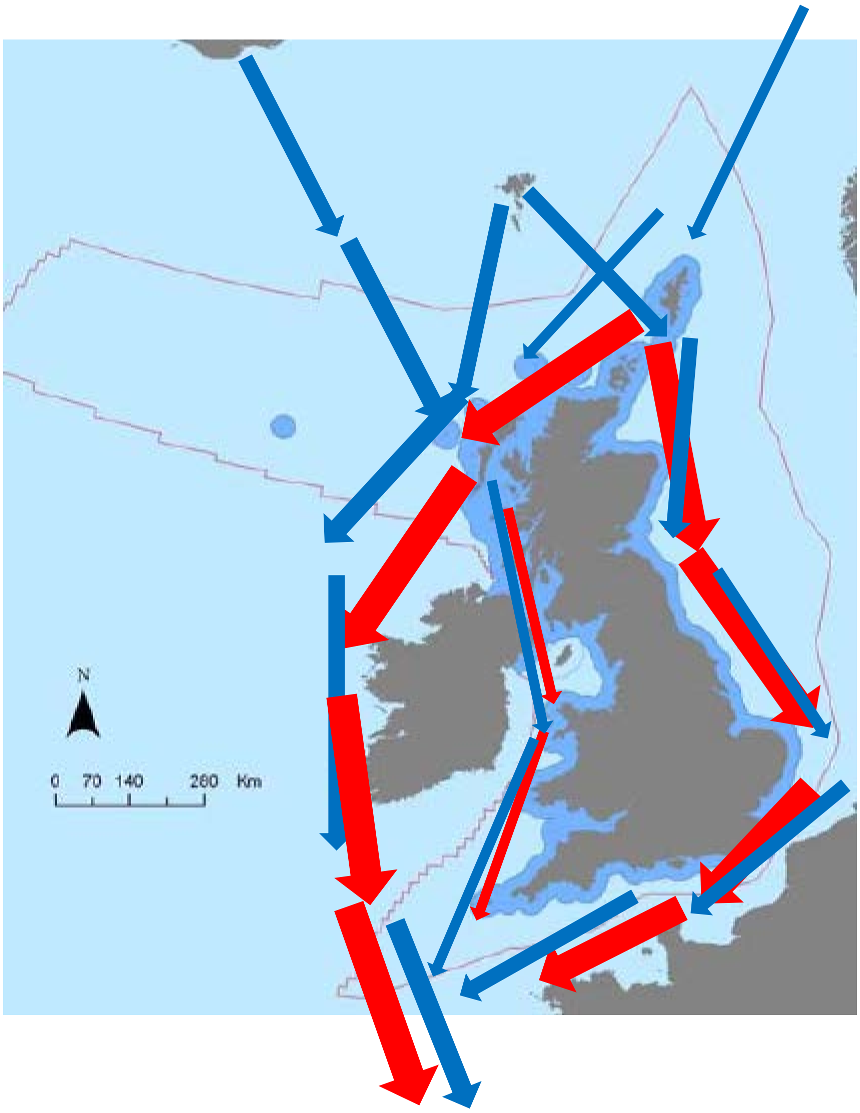

Figure 11.3. Main movements of great skuas from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes.

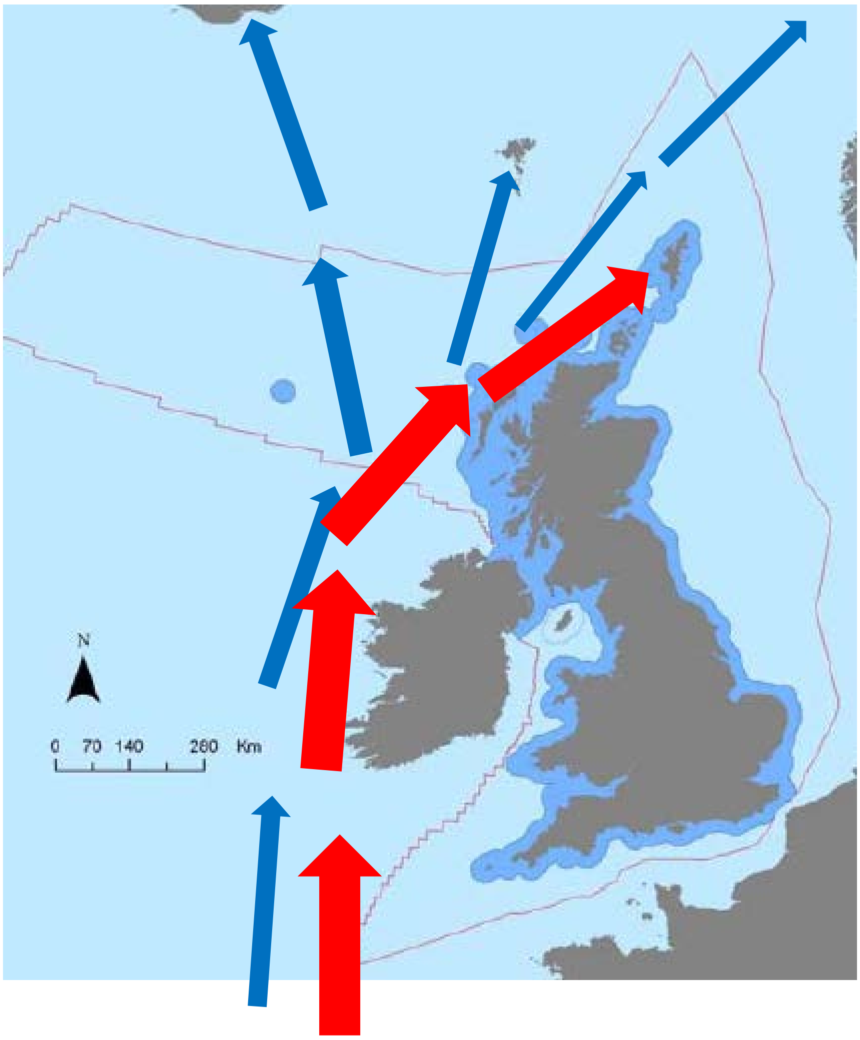

Figure 11.4. Main return movements of great skuas in spring to UK breeding areas (red arrows) and towards overseas populations (blue arrows) through UK waters. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes.

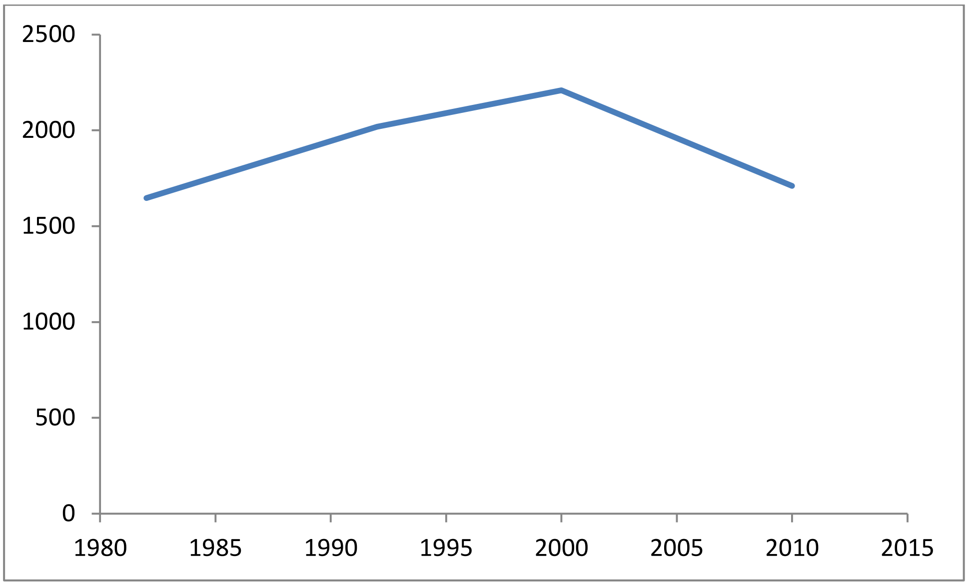

Figure 11.5. Trend in the great skua breeding numbers in Orkney from 1982-2010. Data from Meek et al. (2011).

Data show a 22.6% decline over the 10-year period between 2000 and 2010.

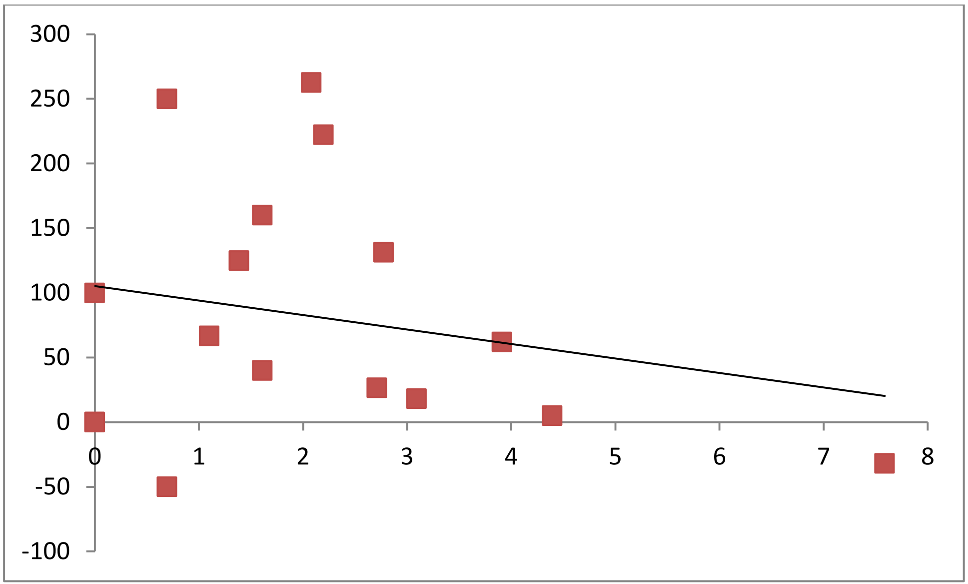

Figure 11.6. Rate of growth (% change in numbers) of breeding numbers of great skuas at colonies in Orkney between 2000 and 2010 in relation to size of the colony in 2000 (Natural Log). While the largest colony (Hoy) decreased considerably in numbers, many of the small colonies grew. Data from Meek et al. (2011).

11.9 Proportion of UK population from UK breeding SPAs

The 9 SPAs with breeding great skuas as a feature together held 6,262 pairs at designation, estimated to represent ca. 74% of the British breeding population (Stroud et al. 2001). Numbers have decreased since 2000 in Orkney, and at large SPA colonies in Shetland such as Foula, but have continued to increase at some smaller colonies. So the exact population size now is uncertain but is likely to be around 9,000 pairs. Because several of the largest colonies have decreased particularly markedly in size, and those are all SPA populations, the proportion of the UK population in the SPA suite for breeding great skuas will probably be less than it was previously. Based on data from years between 2000 and 2011, Stroud et al. (2014) estimated that 73.6% of the population was on SPAs. However, the figure may now be closer to 70% due to continued large declines at Foula and Hoy in particular (the two largest colonies) and possibly some increases in areas that are not SPA populations where small numbers breed although those increases are very unlikely to be large enough to have much effect in reducing the overall decline in total breeding numbers that seems to be occurring (see Figure 11.8).

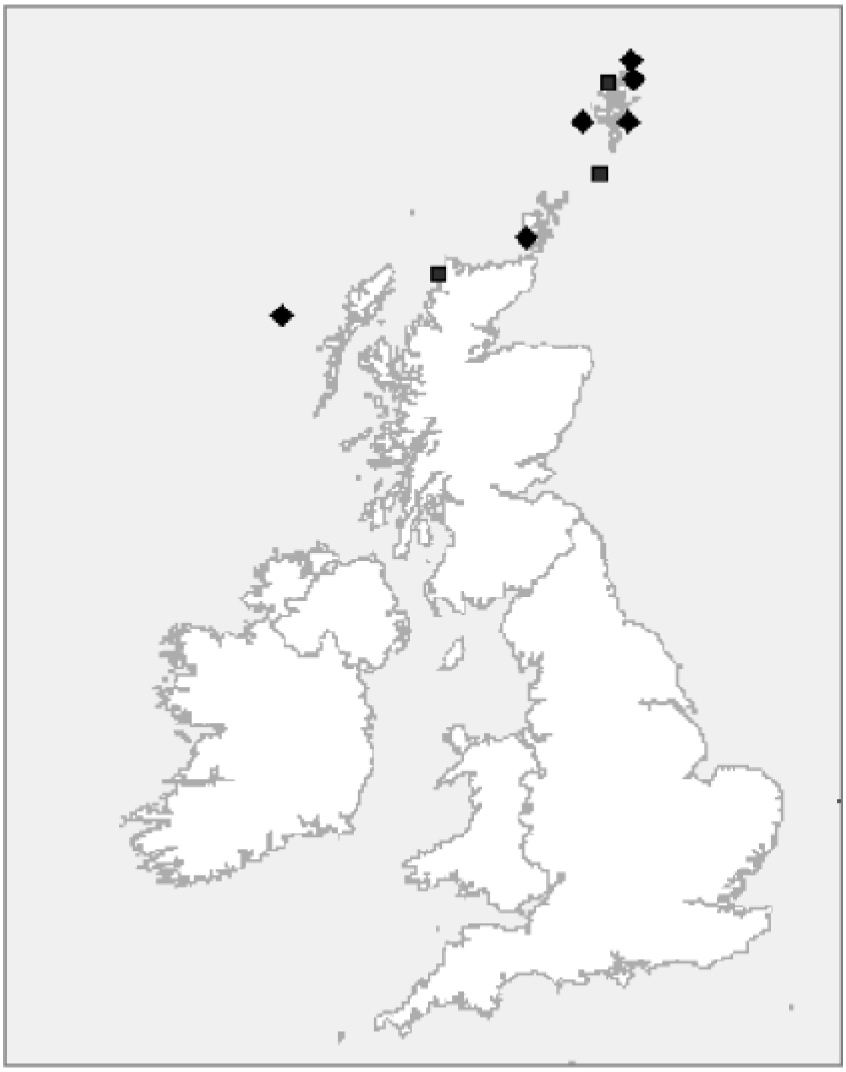

Figure 11.7. The SPA suite for great skua. These SPA populations are listed in Table 11.1.

Table 11.1. The UK SPA suite for breeding great skuas.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea & Channel							
Hermaness, Saxavord & Valla	Shetland	630	1994	Maintained 2013	726 751 979	2001 2007 2013	SMP database SMP database SMP database
Ronas Hill – North Roe & Tingon	Shetland	130	1997	Maintained 2002	189	2002	Stroud et al. 2014
Fetlar	Shetland	512	1994	Maintained 2006	593 585	2001 2002	SMP database Stroud et al. 2014
Foula	Shetland	2,170 (1992)	1995	Declined 2007	2,293 1,657	2000 2007	Seabird2000 SMP database

Noss	Shetland	410	1996	Maintained 2007	432 365 465	2001 2007 2013	Lewis et al. 2012 Lewis et al. 2012 SMP database
Fair Isle	Shetland	130	1994	Maintained 2009	280 227 300 266	2010 2011 2012 2013	SMP database SMP database FIBO Report SMP database
Hoy	Orkney	1,900 (1992)	2000	Maintained 2000	1,973 1,346	2000 2010	Seabird2000 Meek et al. 2011
UK Western waters							
Handa	NW Scotland	110	1990	Maintained 2000	212 202 190 272 266 241 135	2005 2006 2007 2008 2009 2010 2013	SMP database SMP database SMP database Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database
St Kilda	Western Isles	270 (1997)	1992	Maintained 2000	240 Hirta only: 210 189 139 174 151	2000 2000 2007 2008 2009 2012	Seabird2000 SMP database SMP database SMP database SMP database SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

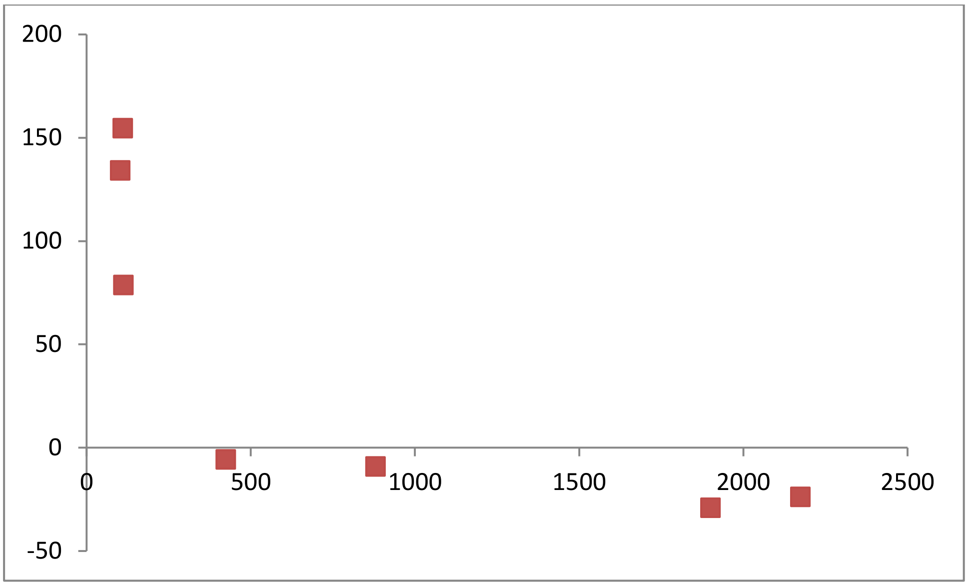

Figure 11.8. Percent change in numbers of pairs of great skuas from 1992 to 2010 at the largest colonies where count data are available (Foula, Hoy, Hermaness, Noss, St Kilda, Fair Isle, Handa). The data indicate that colonies of more than 400 pairs would decline in size while those with considerably fewer than 400 would grow. Data from Seabird Monitoring Programme database.

11.10 BDMPs

We need to consider three separate seasonal BDMPSs as the numbers in UK waters in winter are very much smaller than in autumn or spring, while in spring the migration route most used by great skuas is different from that used in autumn. We need to consider two spatial units for BDMPS; UK North Sea and Channel waters, and UK western waters. Most great skua colonies are in UK North Sea and Channel waters, but large numbers of migrants pass through UK western waters, especially in spring. Details of apportioning of birds into BDMPS are presented in Appendix A Tables 30 to 35.

Based on evidence reviewed in sections 11.5, 11.6 and 11.7, in autumn in the UK North Sea and Channel BDMPS, it is estimated that 60% of adults and 30% of immatures from colonies in the Northern Isles and Caithness will be members of the UK North Sea and Channel BDMPS, while 40% of adults and 20% of immatures will be members of the UK western waters BDMPS. This recognises that fact that a substantial number of birds from colonies in the northern isles move quickly during autumn migration into UK western waters but then spend some time there before moving further south to wintering areas, so those birds are allocated pro rata to the UK western waters BDMPS rather than to the UK North Sea and Channel BDMPS from which they departed from their breeding colonies at the end of the breeding season. No birds from colonies in the west of Scotland will be in the North Sea and Channel BDMPS whereas 100% of adults and 40% of immatures will be in the UK western waters BDMPS (Appendix A Tables 30 and 31). In addition, during autumn migration it is estimated that 10% of adults and 5% of immatures from Iceland, Norway and Faroe will be in the UK North Sea and Channel BDMPS, and 20% of adults and 5% of immatures from Iceland, 10% of adults and 5% of immatures from Norway, and 30% of adults and 5% of immatures from Faroe will be in the UK western waters BDMPS. These values result in an estimated BDMPS of 19,556 birds in the UK North Sea and Channel in autumn (17,415 originating from the UK), and 16,336 birds in the UK western waters BDMPS (12,915 originating from the UK).

Geolocator data loggers, satellite tracking data, and stable isotope analysis indicate that virtually all great skuas from the UK winter further south than UK waters with only a few adults wintering in the UK SW Approaches, whereas tracking data from adults nesting in Iceland and Norway show that birds from those populations tend to winter further north than birds from the UK. This implies that most, and apparently almost all, great skuas wintering in UK waters are birds from overseas populations. In the winter UK North Sea and Channel BDMPS there are thought to be no birds from UK colonies, and only very small numbers from overseas. Based on evidence reviewed in sections 11.5, 11.6 and 11.7, it is estimated that 1% of adults and 0.1% of immatures from Iceland, Norway and Faroe winter in UK North Sea and Channel waters (a total of 143 birds; Appendix A Table 32), while it is estimated that 1% of adults from UK colonies, 5% of adults and 0.1% of immatures from Faroe, 10% of adults and 0.1% of immatures from Iceland and Norway winter in UK western waters. This results in a BDMPS for UK western waters in winter of 1,398 birds. These totals appear to be reasonably consistent with evidence from the ESAS database and other at sea survey data which suggest a small winter hotspot for great skuas in the far SW of UK waters (Kober et al. 2010).

Based on evidence reviewed in sections 11.5, 11.6 and 11.7, spring migration of great skuas sees rather few birds moving north through the southern North Sea, but more pronounced migration through UK western waters, with many adults returning to colonies in the northern isles by way of western waters rather than through the North Sea. It is estimated that 30% of adults and 10% of immatures from UK North Sea colonies are in the UK North Sea and Channel spring BDMPS, whereas 70% of adults and 30% of immatures are in the UK western waters spring BDMPS (Appendix A Tables 34 and 35). 100% of adults and 40% of immatures from western colonies are in the UK western waters spring BDMPS. For birds from overseas populations in spring, 5% of adults and 2% of immatures from Iceland, Norway and Faroe are estimated to be in the UK North Sea and Channel spring BDMPS, whereas 30% of adults and 5% of immatures from Iceland, 20% of adults and 5% of immatures from Norway, and 40% of adults and 5% of immatures from Faroe are in the UK western waters spring BDMPS (Appendix A Tables 34 and 35). This gives estimated BDMPSs for spring of 8,485 birds in the UK North Sea and Channel, and 25,090 birds in the UK western waters.

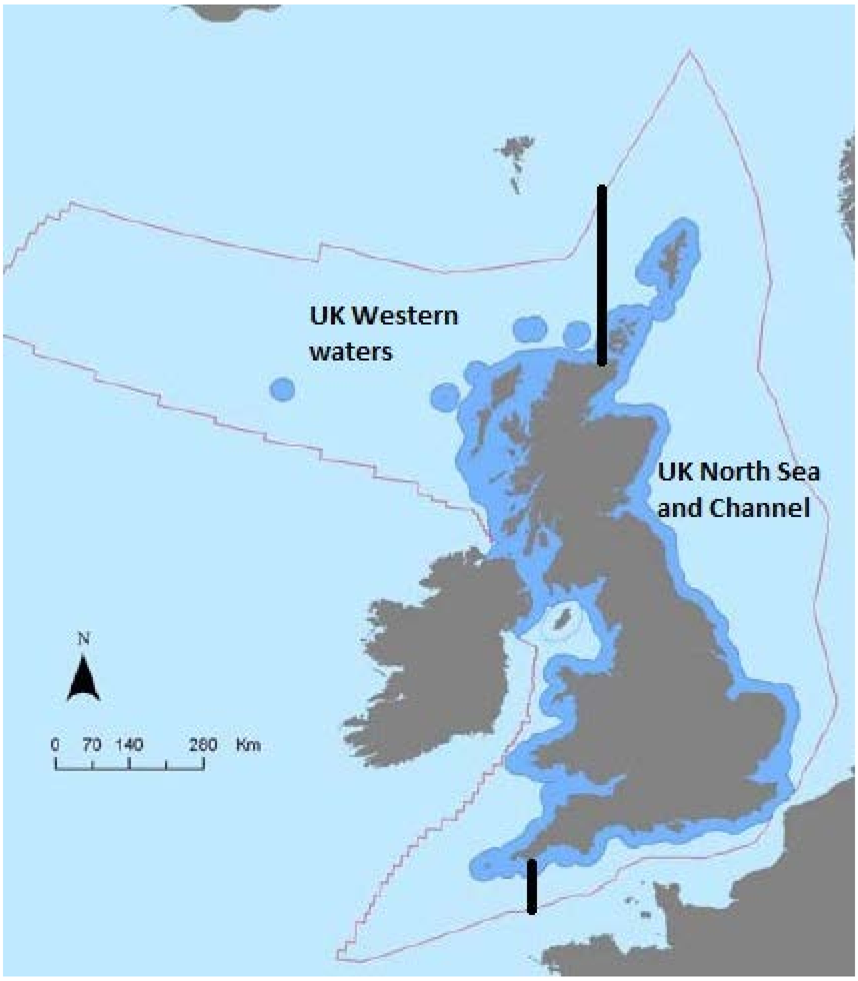

Figure 11.9. Two defined BDMPS spatial areas for great skua: ‘UK North Sea and Channel’ and ‘UK Western waters’.

11.11 Proportions of UK SPA birds in each BDMPS

The UK suite for breeding great skuas is very strongly concentrated in the NW North Sea, with only small numbers in the West of Scotland region (Handa 135 pairs, St Kilda 151 pairs). The birds from SPA populations in the NW North Sea do not all migrate south through the North Sea; a proportion migrate southwards via the west of the British Isles. So the proportions of UK SPA birds in the different BDMPS in autumn and spring are not dramatically different despite the concentration of SPA birds being in Orkney and Shetland. Proportions can be computed from data in Appendix A Tables 30, 31, 34 and 35. For example, 6,584 adults from great skua breeding UK SPAs are in the UK North Sea and Channel autumn BDMPS which totals 19,556 birds, so adults from SPA colonies represent 34% of the total present. In UK western waters in autumn, adults from SPA colonies total 5,022 birds out of a population of 16,336, or 31%. Wintering birds in each BDMPS are likely to be predominantly from colonies in Norway and possibly Iceland, as those birds winter further north, on average, than birds from the UK. Data in Appendix A Tables 32 and 33 can be used to estimate the proportion of each winter BDMPS comprising adults from breeding great skua UK SPAs. In the winter UK North Sea and Channel BDMPS this proportion is 0% adults from UK SPA colonies. In the winter UK western waters BDMPS there are estimated to be 116 adults from breeding great skua UK SPAs, from a BDMPS of 1,398 birds, so about 8% are adults from UK SPAs.

11.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Great skuas disperse from colonies in all directions at the end of the breeding season, and so the SPA birds will be mixed with non-SPA birds across the BDMPS. Aggregations of SPA birds are unlikely except to the extent that in Shetland some adults may attend colonies late into autumn, so there is likely to be some tendency for proportions of SPA birds to be locally higher close to the main SPA sites into the autumn, and birds returning early in spring may similarly aggregate in waters close to colonies before returning to their breeding territories onshore. However, aggregations are not likely to be pronounced, and there will be considerable mixing of birds from different populations.

12. LESSER BLACK-BACKED GULL *Larus fuscus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in autumn (August to October) (adults and immatures)	Numbers in UK waters in winter (November to February) (adults and immatures)	Numbers in UK waters in spring (March-April) (adults and immatures)
Overseas	572,000	105,969	15,350	94,445
UK	292,000	266,342	65,123	266,342
Total	864,000	372,311	80,473	360,787

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Autumn migration BDMPS (August-October)			
UK North Sea and Channel	209,007	62,870	146,137
UK Western waters	163,304	43,099	120,205
Winter BDMPS (November-February)			
UK North Sea and Channel	39,314	7,724	31,590
UK Western waters	41,159	7,626	33,533
Spring migration BDMPS (March-April)			
UK North Sea and Channel	197,483	51,346	146,137
UK Western waters	163,304	43,099	120,205

Numbers of lesser black-backed gulls in colonies in the UK are moderately well documented, with most SPA populations counted in at least one year since completion of Seabird2000. Moderate but fairly consistent declines in breeding numbers since 2000 are indicated both by the JNCC seabird monitoring data and by examination of SPA colony counts. Thus data on numbers of UK lesser black-backed gulls migrasting through UK waters are coded amber. However, numbers of overseas lesser black-backed gulls passing through UK waters on migration are less well known. Information is mainly from ring recovery data (but including very extensive and detailed colour ringing studies from the Netherlands). Populations of lesser black-backed gulls overseas are large, and although only small or very small proportions of these birds migrate through UK waters, this increases the uncertainty about numbers passing through UK waters so estimated numbers of overseas birds are coded red. Numbers of lesser black-backed gulls wintering in UK waters seem to vary from year to year, presumably in relation to weather or food abundance. These numbers have increased over recent decades, but there is further uncertainty regarding the extent to which these birds spend time at sea or in terrestrial habitats. Wintering numbers in BDMPS are coded red both for numbers from overseas and from UK.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 36 to 41.

12.1 Breeding range and taxa

Three subspecies of lesser black-backed gull breed in Europe, but biometrics of individuals do not seem to have been used to identify origins of individuals. The subspecies *fuscus* breeds in Finland, northern Norway and northern and eastern Sweden, and has a distinct migration pattern, moving to winter in east Africa (Bustnes et al. 2013). Birds from that subspecies (which are relatively easy to identify in the field from plumage features) only occur in UK waters as vagrants. The subspecies *graellsii* breeds in Iceland, Faroe, the British Isles, and western Europe south to Portugal, and winters predominantly in Iberia or on the coast of northwest Africa. The subspecies *intermedius* breeds in Denmark, southern Norway and southern Sweden while populations somewhat intermediate between *intermedius* and *graellsii* breed in Germany and the Netherlands (Wernham et al. 2002). Birds from populations of *intermedius* show much the same migration patterns as birds from *graellsii* (Wernham et al. 2002).

12.2 Non-breeding component of the population

Lesser black-backed gulls start to breed when 4 years old (BTO Birdfacts). Adult survival rate is given as 0.913 in BTO Birdfacts (but more recent work on this species indicates a decline in survival with time for the population at Skomer http://jncc.defra.gov.uk/page-2886 so a lower value could be used but would have only a small influence on the ratio estimate because of corresponding adjustment of immature survival rates in the opposite direction to achieve a stable population trend), juvenile survival unknown (BTO Birdfacts) and mean productivity is 0.517 chicks per pair (JNCC database, n=66 measurements). To obtain a stable population, survival of immatures was adjusted to 0.7 for juveniles, 0.74 for 1-year olds, 0.79 for 2-year olds, 0.84 for 3-year olds. The model population comprised 60% adults, 15% juveniles and 25% older immatures. There are 0.68 immatures per adult.

12.3 Phenology

Breeding colonies in the UK are deserted by September, with modal departure in late July or early August (Pennington et al. 2004; Forrester et al. 2007). Autumn migration starts in late June (Pennington et al. 2004), July (Cramp et al. 1977-94; Forrester et al. 2007) or mid-July (Wernham et al. 2002). Peak autumn migration occurs in August (Pennington et al. 2004), August-September (Wernham et al. 2002), September (Forrester et al. 2007), and June-October in Belgium (Vanermen et al. 2013) and August-November throughout Europe and North Africa (Cramp et al. 1977-94). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred rather consistently through August-November (Figure 12.1) suggesting a very protracted autumn migration through UK waters. Autumn migration is completed by early October in Shetland (Pennington et al. 2004) but not until October-November (Wernham et al. 2002) or November (Forrester et al. 2007) or early December (Cramp et al. 1977-94) in the UK as a whole.

Spring migration starts in February in the winter quarters (Cramp et al. 1977-94), mid-February (Wernham et al. 2002) or late February (Forrester et al. 2007) in the UK as a whole, or early March (Pennington et al. 2004) in Shetland. Peak spring migration occurs in February-April in Belgium (Vanermen et al. 2013), in March (Wernham et al. 2002; Forrester et al. 2007), March-April (Cramp et al. 1977-94), or in April in Shetland (Pennington et al. 2004). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in early March, although there were suggestions of a further peak in mid-April (Figure 12.1). Spring migration is completed by April (Wernham et al. 2002) or May (Cramp et al. 1977-94; Forrester et al. 2007) or early June in Shetland (Pennington et al. 2004).

The first spring records of lesser black-backed gull in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 2 January to 1 April, but mostly in February, and the last records were from 25 August to 29 December, but mostly in late October. Peak autumn dispersal/migration was reported in July-August in most years, and peak spring migration was reported in March in most years. Birds re-occupy colonies from late February or early March with modal return in late March (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

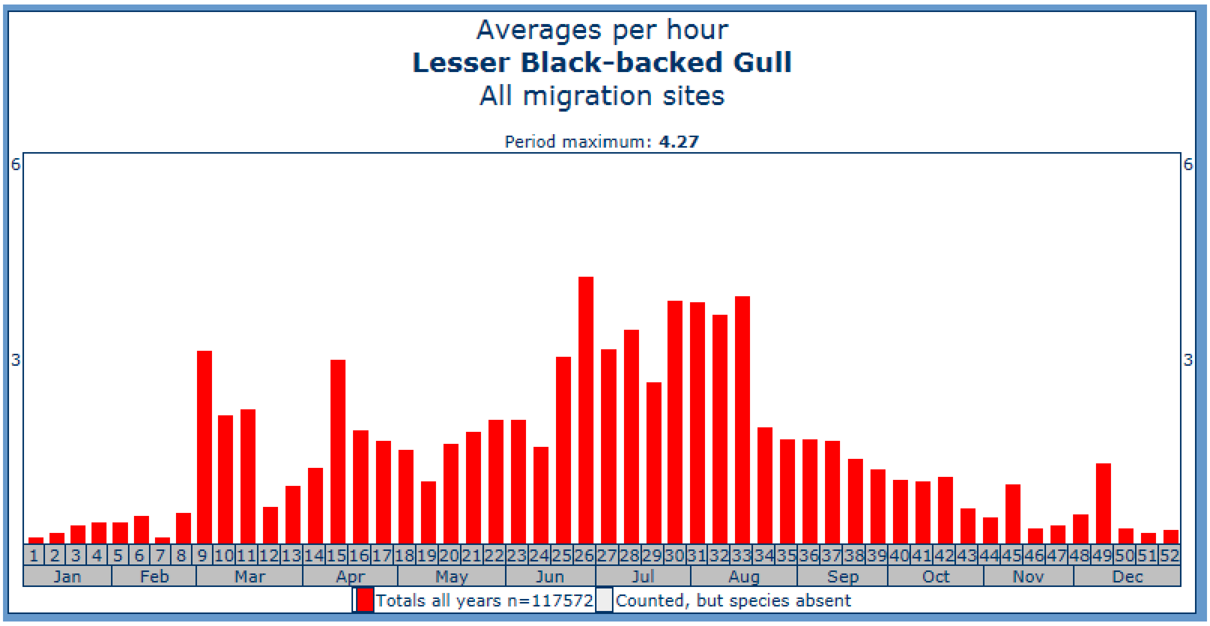

Figure 12.1. Average numbers of lesser black-backed gulls counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season September-April. However, from the data reviewed above, a more appropriate definition would be breeding season April-August, non-breeding season September-March.

12.4 Defined seasons:

- UK Breeding season — April-August
- Post-breeding migration in UK waters — August-October (**autumn BDMPS**)
- non-breeding season — September-March
- Return migration through UK waters — March-April (**spring BDMPS**)
- Migration-free breeding season — May-July
- Migration-free winter season — November-February (**winter BDMPS**)

Apart from the breeding season, three seasonal BDMPS periods are considered to be appropriate for lesser black-backed gull:

'Autumn' (post-breeding) migration BDMPS (August-October);

'Winter' BDMPS (November-February); and

'Spring' (pre-breeding) migration BDMPS (March-April).

12.5 Movements of birds from the UK population

In the UK, autumn movements start in the second half of July. Migration southwards is fairly rapid from northern colonies, with most birds away by August (Orkney Bird Reports; Shetland Bird Reports), but is protracted in southern Britain where some birds remain near colonies until early October (Wernham et al. 2002). Timing of dispersal from colonies is the same in The Netherlands; occurring in July-August (Camphuysen 2013). Many fledglings are accompanied by their parents during initial autumn dispersal, but it is unclear if families remain together during autumn migration. Camphuysen (2013) found that successful breeders abandoned the colony when their young were about 50 days old, and that southward autumn movement started first in immatures, then in adults, and last in juveniles, suggesting that post-fledging care of juveniles was mostly minimal. Camphuysen (2013) reported that movement away from colonies in The Netherlands occurred earlier in autumn in years since 2000 than it had previously, suggesting deteriorating conditions in the breeding areas. Young birds tend to move further south than adults (Wernham et al. 2002). Some adults apparently tend to return each year to the same wintering site, although some may change wintering areas between years. Adults return to colonies in the UK in February to April (Wernham et al. 2002), with some evidence for birds that winter furthest north arriving back at colonies first. Until the 1950s the lesser black-backed gull in the UK was considered to be a migrant, with all birds wintering in southern Europe or north Africa. However, in the 1960s and 1970s increasing numbers, mostly of adults, remained in the UK overwinter (Wernham et al. 2002). This change may relate as much to availability of land-fill feeding sites as to warming of the climate (Banks et al. 2007). There were estimated to be about 70,000 lesser black-backed gulls wintering in Britain and Ireland in censuses held in 1985 and 1993 (Wernham et al. 2002), and 125,113 in 2003-06 (Burton et al. 2013) suggesting that numbers have continued to increase. Not only did winter distribution change, but migration routes also changed, with increasing numbers migrating overland. Recent tracking studies by the British Trust for Ornithology of breeding adults from a colony in East Anglia found that although autumn migration was predominantly coastal, the more rapid spring migration from north Africa to England occurred overland through central France.

12.6 Movements of birds from overseas into UK waters

Foreign-ringed lesser black-backed gulls recovered in Britain and Ireland have come from Iceland, Faroe, Norway, Sweden, Finland, Denmark, the Netherlands, Belgium, the Channel Islands and Spain; almost 60% of these are likely to be from the subspecies *intermedius* mostly from breeding sites in Norway, Sweden and Denmark, while the remaining 40% are predominantly *graellsii* from Iceland and Faroe (Wernham et al. 2002). The single recovery of a bird of the subspecies *fuscus* from Finland can be discounted as exceptional, as that subspecies can be identified in the field from plumage features, and is only very rarely seen in the UK (Wernham et al. 2002). Most foreign-ringed lesser black-backed gulls from Norway, Sweden, Denmark, the Netherlands and Belgium have been found in SE England (Wernham et al. 2002), suggesting that these continental birds cross the southern North Sea. Birds from Iceland and Faroe have been more broadly distributed through the British Isles. However, lesser black-backed gulls from colonies in The Netherlands mostly winter in France, Portugal and Spain, and relatively few birds marked in The Netherlands have been seen in the UK (Camphuysen 2013), although there are a few records. Seabird 2000 reported 87,413 pairs in UK, 3,800 pairs in Ireland, 25,000 pairs in Iceland, 9,000 pairs in Faroe, 25,000-36,000 pairs in Norway, 15,000-20,000 pairs in Sweden (however BirdLife International (2004) cite 2000-5000 pairs in Sweden but without listing the data source), 4,400 pairs in Denmark, 32,000-57,000 pairs in the Netherlands. In the Netherlands, breeding numbers peaked around 2005 (Camphuysen 2013) at around 90,000 pairs and are probably now around 80,000 pairs (Camphuysen 2013).

12.7 Numbers in UK waters

Musgrove et al. (2013) report that there are 120,000 in Britain in winter, 130,000 in UK in winter, but it is unclear if these include birds at sea as well as onshore and at coastal roosts. From surveys in 2007 and 2008, Fauchald and Tveraa (2009) reported mean densities at sea of 0.7-10 birds per km^2 in the Norwegian Sea in spring/summer, and 0 birds per km^2 in the Barents Sea in autumn. Lesser black-backed gulls are distributed throughout the North Sea in summer but with much higher densities in the southeastern North Sea and low densities in the northwestern North Sea (Skov et al. 1995; Camphuysen 2013). About 130,000 birds were estimated to be in the North Sea in March-August (Skov et al. 1995) (although this estimate was based on data that are now rather out of date), with about 95% of these in the eastern half of the North Sea (Camphuysen 2013). Areas of greatest importance for this species in the North Sea are between Vlieland and Ijmuiden (off Texel) from May to October, in the Skagerrak in March-April and Helgoland Bight in May-June (Camphuysen 2013). Lesser black-backed gulls show a strong association with the distribution of fishing vessels in the southern North Sea in summer, congregating in areas where fisheries discards are available (Camphuysen et al. 1995), so their distribution reflects the locations of large colonies and also the behaviour of fisheries in the area. In winter, the North Sea is largely abandoned, but about 15,000 birds spend the winter in the English Channel (Camphuysen 2013). According to Brown and Grice (2005) highest numbers in English waters in winter are found in the Celtic and Irish Seas and SW Approaches. Wintering numbers inland in England have increased from 165 in 1953 to 6,960 in 1963, 15,823 in 1973, 36,154 in 1983, and 27,230 in 1993 (Brown and Grice 2005). It is estimated that there were 70,000 lesser black-backed gulls wintering in England (inland plus English waters) in the 1980s, and that numbers have increased since then (Brown and Grice 2005). Forrester et al. (2007) suggest that only about 200-600 birds winter in Scotland but that there are 30,000-50,000 in spring passage and 50,000-80,000 in autumn passage. Bradbury et al. (in press) used ESAS and offshore wind farm survey data to compare the relative importance of different marine areas at different times of year.

12.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *graellsii* population, comprising 124,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 179,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 550,000 individuals. The biogeographic population with connectivity to UK waters totals about 292,000 birds (adults plus immatures) from the UK plus 572,000 birds (adults plus immatures) from overseas populations (Iceland, Norway, Sweden, Denmark, Faroe, Ireland, and The Netherlands). However, only small proportions of the birds from overseas populations visit UK waters, so the estimated total numbers in UK waters are much smaller than this total. In autumn (August to October) there are estimated to be 372,000 birds in UK waters, 266,000 from UK and 106,000 from overseas. In winter (November to February) there are estimated to be 80,000 birds in UK waters, 65,000 from the UK and 15,000 from overseas. In spring (March and April) there are estimated to be 360,000 birds in UK waters, 266,000 from UK and 94,000 from overseas.

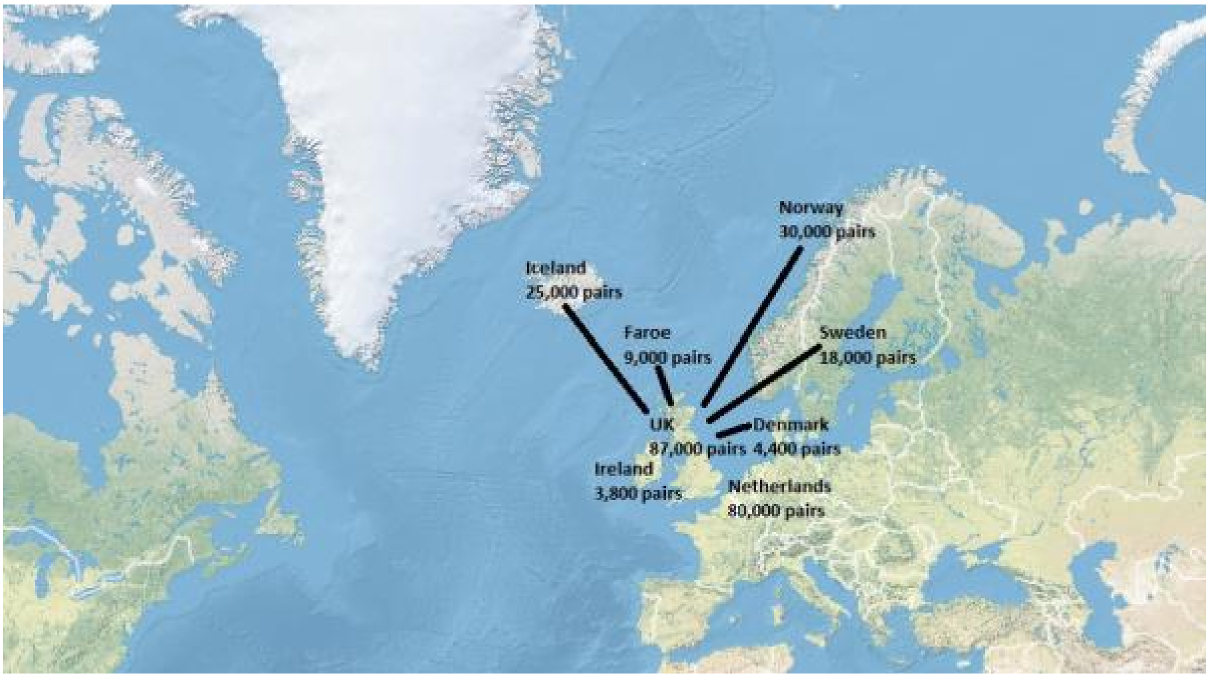

Figure 12.2. Breeding population origins of lesser black-backed gulls in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

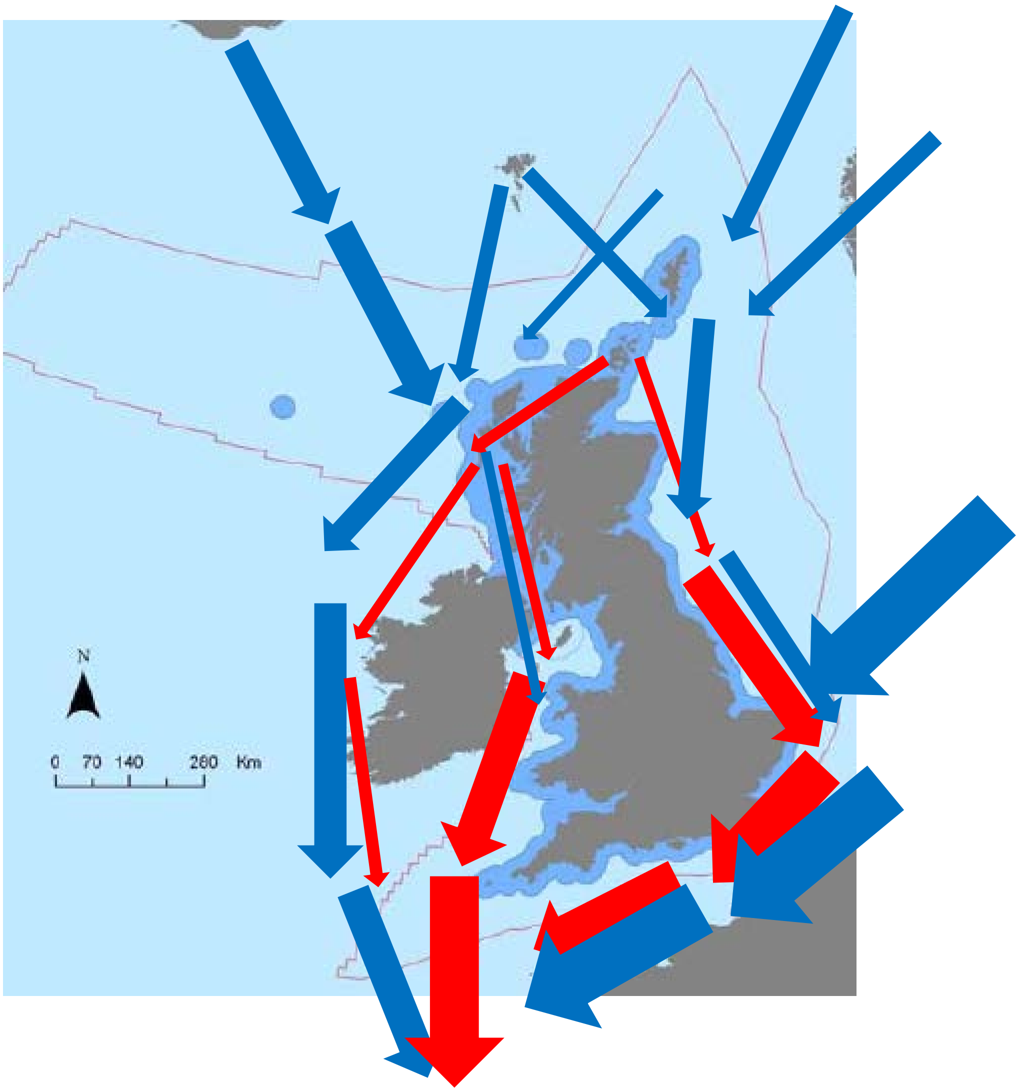

Figure 12.3. Main movements of lesser black-backed gulls from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes.

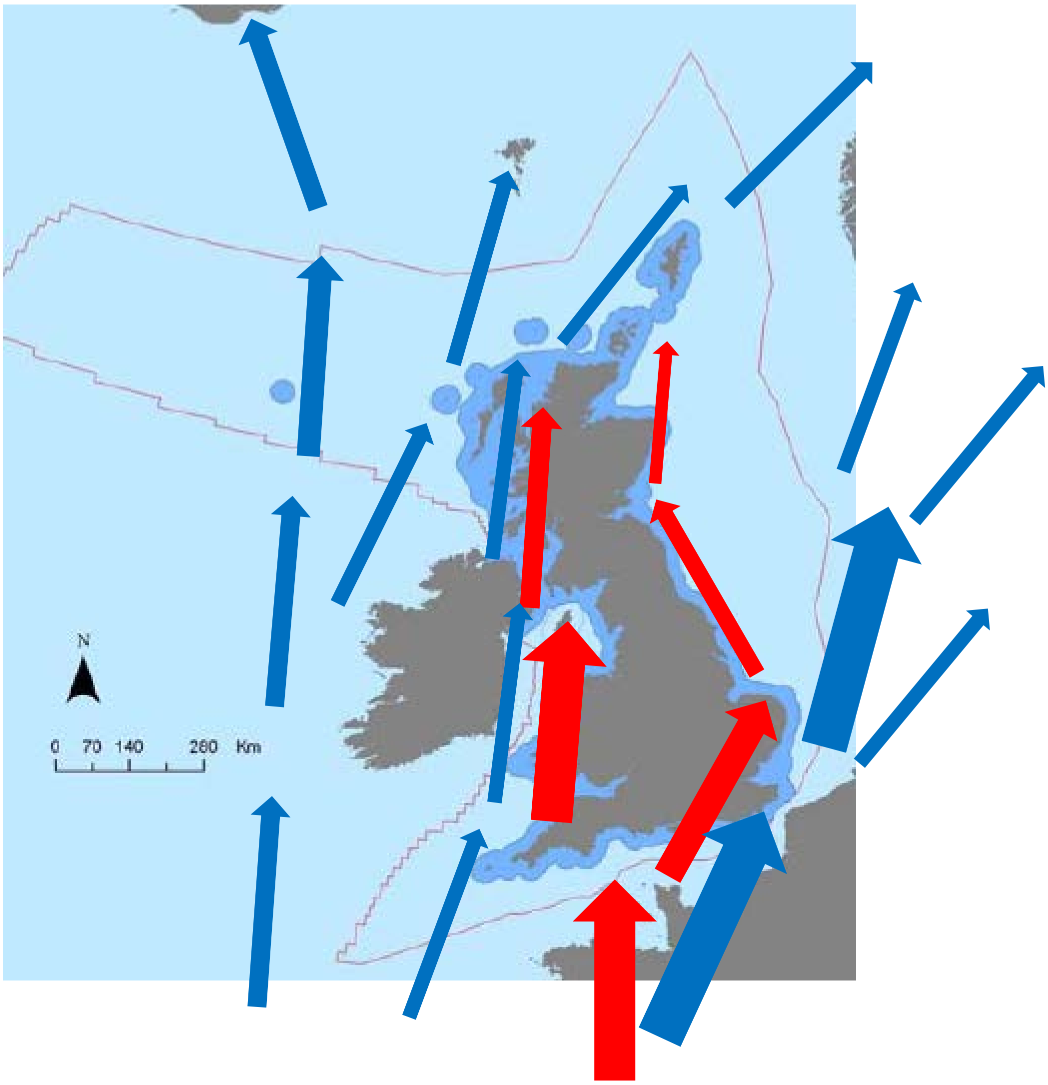

Figure 12.4. Main return movements of lesser black-backed gulls in spring to UK breeding areas (red arrows) and towards overseas populations (blue arrows) through UK waters. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes.

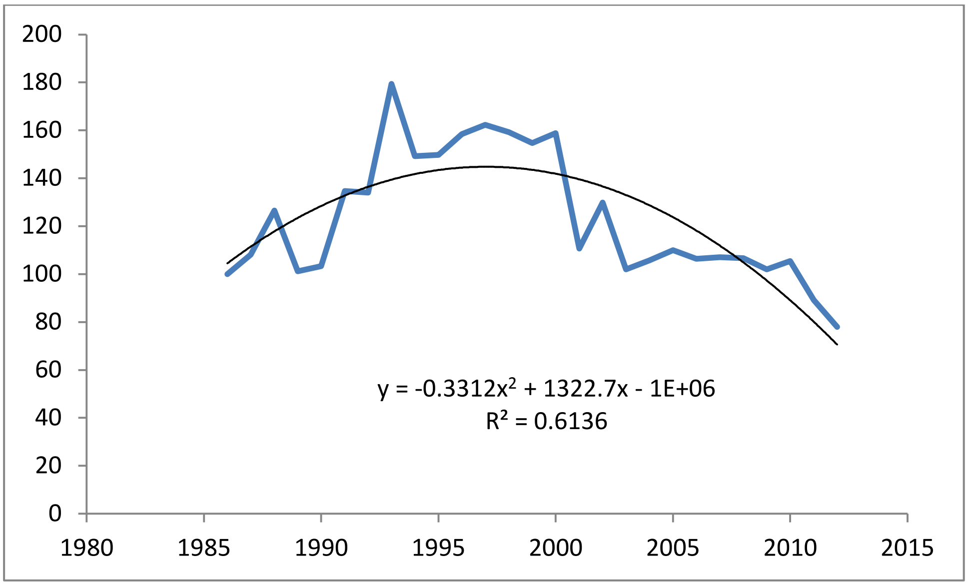

Figure 12.5. Trend in the lesser black-backed gull breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

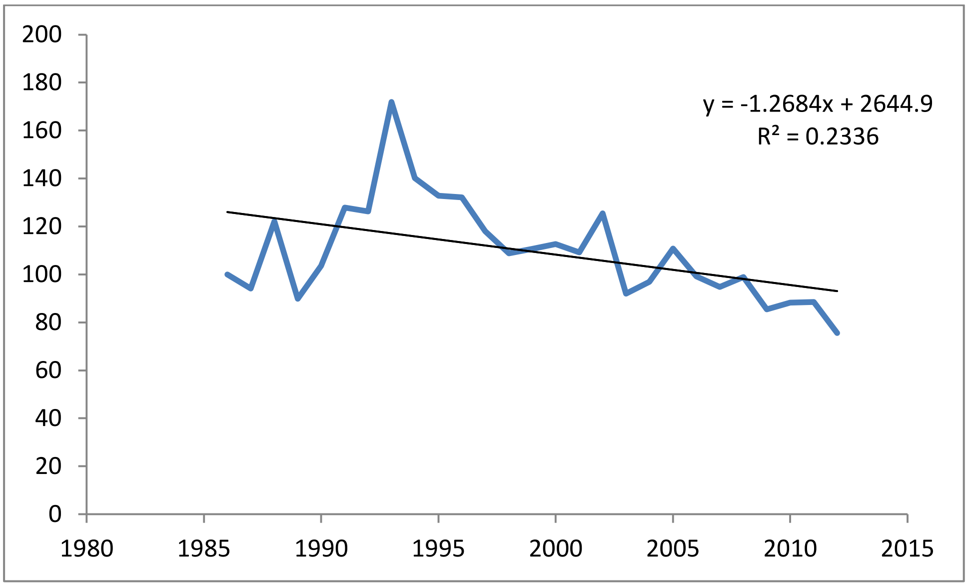

Figure 12.6. Trend in the lesser black-backed gull breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

12.9 Proportion of UK population from UK breeding SPAs

The 10 SPAs with breeding lesser black-backed gulls as a feature together held 88,633 pairs at designation, estimated to represent ca. 100% of the British breeding population (Stroud et al. 2001). However, this clearly overestimates the proportion on SPAs as there have been non-SPA colonies with substantial numbers for many decades. The 2014 UK SPA review (Stroud et al. 2014) reported that the UK breeding SPA populations represented 38.5% of the GB population in 2003-11, this large decrease being due to very large declines in breeding numbers at some of the largest colonies (all of which are SPAs).

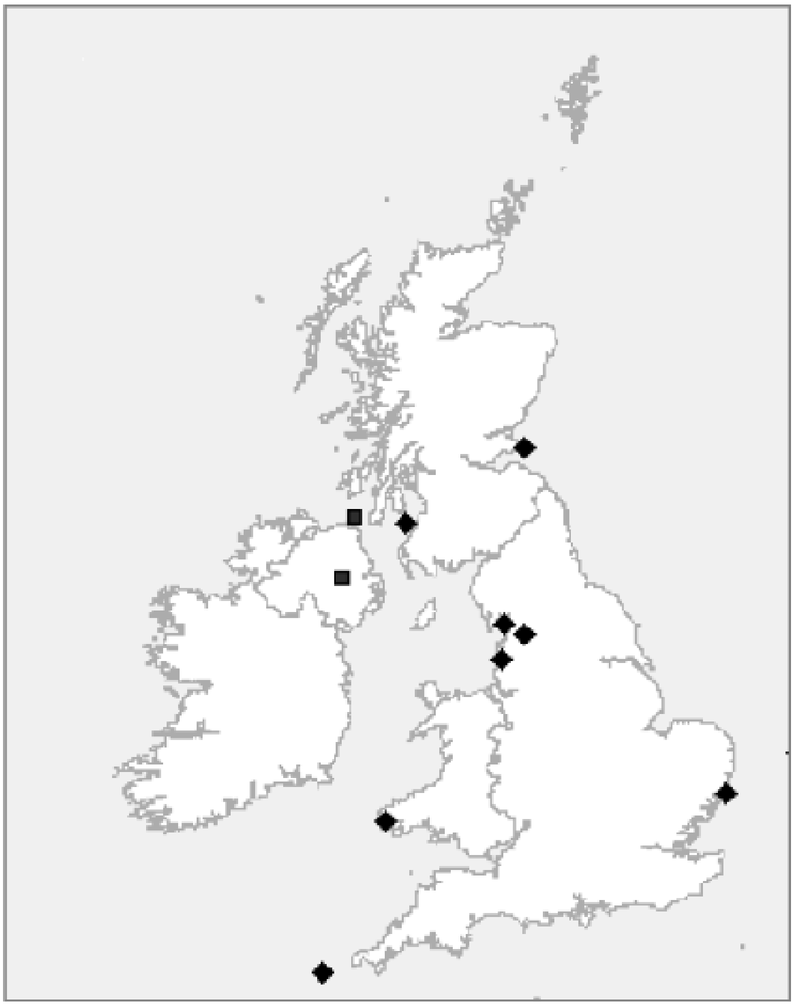

Figure 12.7. The SPA suite for lesser black-backed gull. These SPA populations are listed in Table 12.1.

Table 12.1. The UK SPA suite for breeding lesser black-backed gulls.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea & Channel							
Forth Islands	E Scotland	1,500 (1985) Or 2,920 (Stroud et al. 2001)	1990	Maintained 2008	2,013 >2,100 1,608	2002 2008 2005-2009	Lewis et al. 2012 Lewis et al. 2012 Stroud et al. 2014
Alde-Ore Estuary	SE England	14,070 (1994-1998) Or 21,700 (Stroud et al. 2001)	1996	Counts may relate to just Orfordness and may exclude Havergate Marshes; there were 1747 AON there in 2013	6,000 5,000 1,678 1,584 900 550 550 640	2003 2006 2007 2008 2009 2010 2011 2012	Stroud et al. 2014 SMP database SMP database SMP database SMP database SMP database SMP database SMP database

UK Western waters							
Ailsa Craig	W Scotland	1,800 (1987)	1990	Declined 2010	183	2010	Lewis et al. 2012
Rathlin Island	N Ireland	155 (1985)	1999		127 36 107	1999 2007 2011	SMP database SMP database Stroud et al. 2014
Lough Neagh & Lough Beg	N Ireland	450 (Stroud et al. 2001)	1996		385 493	2000 2000	SMP database Stroud et al. 2014
Bowland Fells	NW England	11,470 Or 13,900 (1998) (Stroud et al. 2001)	1993		18,518 4,575	2001 2008-2012	SMP database Stroud et al. 2014
Morecambe Bay	NW England	22,000 (Stroud et al. 2001)	1996		12,100 11,988 10,354 10,670 9,829 8,130 4,987	2006 2007 2008 2009 2010 2011 2012	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Ribble and Alt Estuaries		1,800 (1993)	1995	The 2012 count used a new method and may not be a real increase from 2008	4,150 3,348 4,117 8,267	1998 2003 2008 2012	SMP database SMP database SMP database SMP database
Skomer and Skokholm	Wales	20,300 (1993-1997)	1982		12,660 12,780 12,690 10,890 9,640	2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database
Isles of Scilly	SW England	3,608 (1999)	2001		3,400 3,333	2006 2006	SMP database Stroud et al. 2014

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

12.10 BDMPS

UK waters can be split into two spatial BDMPS for lesser black-backed gulls, the UK North Sea and Channel, and the UK western waters (Figure 12.8). This split is based on the fact that while some lesser black-backed gulls from colonies in western Britain move into the North Sea during autumn migration, many tend to move southwards in autumn through UK western waters whereas birds from North Sea colonies tend primarily to move southwards through the North Sea. In addition, birds from overseas are likely to show a tendency to occur more in one side of the UK than the other, with birds from continental Europe more frequent in the North Sea than in western waters. There is a need to define three distinct seasonal BDMPS in each of these spatial units – autumn migration (August to October), winter (November to February), and spring migration (March and April). Numbers are much smaller in winter than during the migration periods.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 36 to 41.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in autumn in the UK North Sea and Channel, the BDMPS is estimated to include 100% of adults and 70% of immatures from colonies on the UK North Sea coast, 50% of adults and 40% of immatures from UK colonies in western Scotland, Northern Ireland and NW England, 30% of birds from colonies in Wales and 10% of adults and 5% of immatures from the Isles of Scilly (Appendix A Table 36). The BDMPS is also estimated to include birds from several overseas populations; 20% of adults and 10% of immatures from Iceland, 30% of adults and 10% of immatures from Norway, 40% of adults and 20% of immatures from Faroe, 10% of adults and 5% of immatures from Sweden, Denmark and Ireland, 5% of adults and 2.5% of immatures from The Netherlands. These proportions result in an estimated BDMPS of 209,007 birds in the UK North Sea and Channel in autumn, 146,137 from the UK and 62,870 from overseas.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in autumn in UK western waters, the BDMPS is estimated to include no adults from UK North Sea colonies but 10% of immatures from those sites, 50% of adults and 40% of immatures from colonies from west Scotland, Northern Ireland and NW England, 70% of adults and 40% of immatures from colonies in Wales, 90% of adults and 60% of immatures from colonies in SW England (Appendix A Table 37). The BDMPS is also estimated to include birds from several overseas populations; 20% of adults and 10% of immatures from Iceland, 10% of adults and 5% of immatures from Norway, 40% of adults and 20% of immatures from Faroe, 5% of adults and 2% of immatures from Sweden and Denmark, 40% of adults and 20% of immatures from Ireland, 2.5% of adults and 1% of immatures from The Netherlands. These proportions result in an estimated BDMPS of 163,304 birds in the UK North Sea in autumn, 120,205 from the UK and 43,099 from overseas.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in winter in the UK North Sea and Channel, the BDMPS is estimated to include 50% of adults and 5% of immatures from colonies on the UK North Sea coast, 10% of adults and 1% of immatures from UK colonies in western Scotland, Northern Ireland, Wales and W England (Appendix A Table 38). The BDMPS is also estimated to include birds from several overseas populations; 5% of adults but no immatures from Iceland, Norway, and Faroe, 1% of adults but no immatures from Sweden, Denmark and Ireland, 0.5% of adults but no immatures from The Netherlands. These proportions result in an estimated BDMPS of 39,314 birds in the UK North Sea and Channel in winter, 31,590 from the UK and 7,724 from overseas.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in winter in UK western waters, the BDMPS is estimated to include no birds from UK North Sea colonies, 20% of adults and 5% of immatures from colonies from west Scotland, Northern Ireland, Wales and W England (Appendix A Table 39). The BDMPS is also estimated to include birds from several overseas populations; 5% of adults but no immatures from Iceland, 2% of adults but no immatures from Norway, 5% of adults but no immatures from Faroe, 1% of adults but no immatures from Sweden and Denmark, 20% of adults and 5% of immatures from Ireland, 0.5% of adults but no immatures from The Netherlands. These proportions result in an estimated BDMPS of 41,159 birds in the UK North Sea in winter, 33,533 from the UK and 7,626 from overseas.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in spring in the UK North Sea and Channel, the BDMPS is estimated to include 100% of adults and 70% of immatures from colonies on the UK North Sea coast, 50% of adults and 40% of immatures from UK colonies in western Scotland, Northern Ireland and NW England, 30% of birds from colonies in Wales and 10% of adults and 5% of immatures from the Isles of Scilly (Appendix A Table 40). The BDMPS is also estimated to include birds from several overseas populations; 10% of adults and 5% of immatures from Iceland, 30% of adults and 10% of immatures from

Norway, 20% of adults and 10% of immatures from Faroe, 10% of adults and 5% of immatures from Sweden, Denmark and Ireland, 5% of adults and 2.5% of immatures from The Netherlands. These proportions result in an estimated BDMPS of 197,483 birds in the UK North Sea and Channel in spring, 146,137 from the UK and 51,346 from overseas.

Based on evidence reviewed in sections 12.5, 12.6 and 12.7, in spring in UK western waters, the BDMPS is estimated to include no adults from UK North Sea colonies but 10% of immatures from those sites, 50% of adults and 40% of immatures from colonies from west Scotland, Northern Ireland and NW England, 70% of adults and 40% of immatures from colonies in Wales, 90% of adults and 60% of immatures from colonies in SW England (Appendix A Table 41). The BDMPS is also estimated to include birds from several overseas populations; 20% of adults and 10% of immatures from Iceland, 10% of adults and 5% of immatures from Norway, 40% of adults and 20% of immatures from Faroe, 5% of adults and 2% of immatures from Sweden and Denmark, 40% of adults and 20% of immatures from Ireland, 2.5% of adults and 1% of immatures from The Netherlands. These proportions result in an estimated BDMPS of 163,304 birds in the UK North Sea in spring, 120,205 from the UK and 43,099 from overseas.

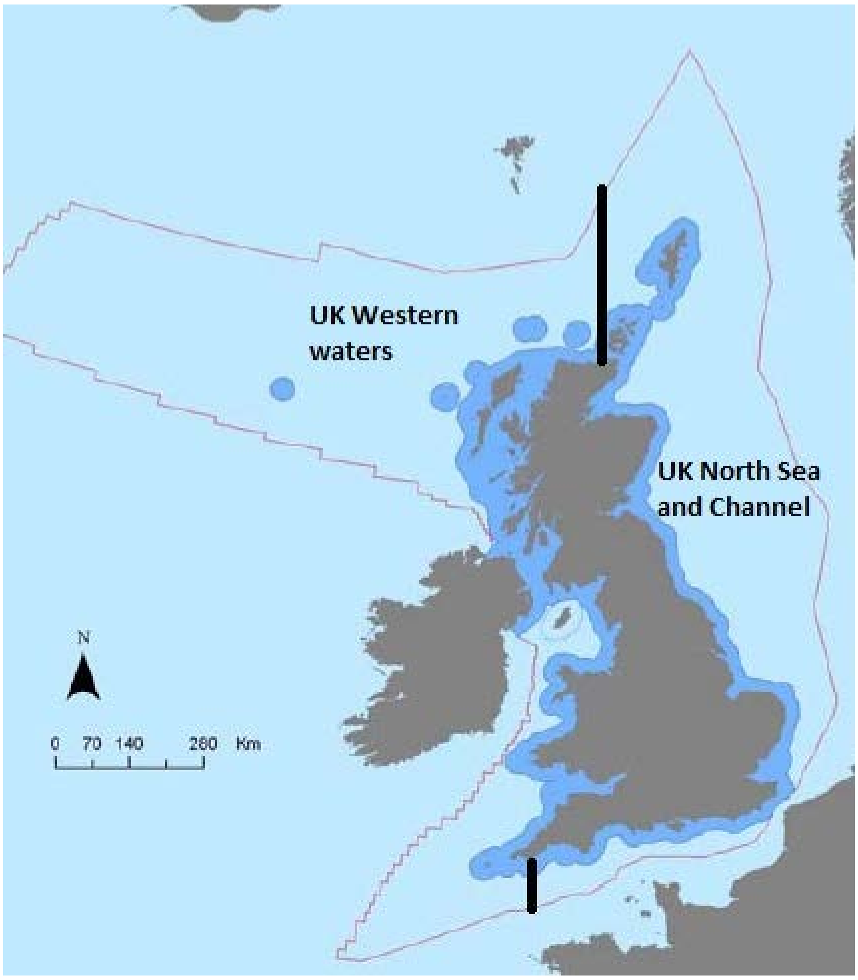

Figure 12.8. Two defined BDMPS spatial areas for lesser black-backed gull: ‘UK North Sea and Channel’ and ‘UK Western waters’.

12.11 Proportions of UK SPA birds in each BDMPS

These proportions can be estimated directly from data in Appendix A Tables 36 to 41. For example, in the UK North Sea and Channel autumn migration BDMPS (Appendix A Table 36), there are 209,007 birds in the BDMPS, of which 29,572 are adults from UK SPA populations, giving a percent of 14%. In contrast, in the UK western waters autumn migration BDMPS (Appendix A Table 37), there are 163,304 birds in the BDMPS, of which 38,228 are from UK SPA populations, giving a percent of 23%.

12.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Most SPA populations of lesser black-backed gulls are in southern Britain, and the northernmost SPA populations (Forth Islands in the east, Ailsa Craig and Rathlin Island in the west) hold only 1,608 pairs, 183 pairs and 107 pairs respectively (Table 12.1), so the proportions of UK SPA birds in the northern parts of the North Sea and the West of Scotland will be lower than in the southern parts. During the migration seasons and during winter, birds are likely to be well mixed with a large number of UK SPA, UK non-SPA, and overseas populations represented. As a result, proportions of birds within each BDMPS that are adults from UK SPA populations will be likely to be fairly consistent across much of each BDMPS spatial area, apart from a likely tendency for the proportion of UK SPA birds to be lower in the northern parts of each BDMPS range.

13. HERRING GULL *Larus argentatus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (September to February)
Overseas	555,000	145,696
UK	543,000	494,114
Total	1,098,000	639,810

Non-breeding season BDMPS (September to February)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
UK North Sea and Channel	466,511	135,130	331,381
UK Western waters	173,299	10,566	162,733

Most UK herring gull SPA populations have been censused since Seabird2000. The JNCC seabird monitoring programme indicates a decline in breeding numbers since 2000, as do counts from several SPA colonies. Because a high proportion of breeding herring gulls in the UK are not in SPA colonies, up to date breeding numbers away from major SPA populations are less well known. Movements of breeding adults and of immatures in the UK have been studied in detail by individual colour ringing of birds in wintering areas and on migration, and have provided a fairly comprehensive picture of local movement patterns as well as connectivity with overseas populations. The key overseas population in the Barents Sea is thought to be approximately stable in numbers. Ringing studies abroad have also shown migrations of herring gulls from Faroe and Norway. Thus although there have not been geolocator tracking studies of herring gulls, the colour ringing work in the late 20th century does provide a good understanding of herring gull movements. BDMPS contributions from UK and overseas populations are coded amber.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 42 and 43.

13.1 Breeding range and taxa

The herring gull breeds across the Western Palearctic, with two subspecies. Birds breeding in Britain and Ireland are the endemic subspecies *argenteus*. Seabird 2000 reported 132,000 pairs in the UK and 5,500 pairs in Ireland (Mitchell et al. 2004). Elsewhere in northern Europe, birds are of the nominate subspecies *argentatus*. Herring gulls show clinal variation in size, with birds from northern Europe noticeably larger than those from the British Isles. They also show variation in the grey shade of the mantle and upperwing, and variation in wing tip pattern. These variations can be used to infer origins of individual birds at least in terms of broad geographical regions; in particular, adult birds from northern colonies can be identified in the field when alongside British herring gulls, from differences in size and colour, though differences are not quite so obvious in juveniles and immatures.

13.2 Non-breeding component of the population

Herring gulls start to breed when 4 years old (BTO Birdfacts). Adult survival rate is 0.88 (BTO Birdfacts; Pons and Migot 1995), juvenile survival 0.63 up to age 4 years (BTO Birdfacts) and mean productivity is 0.936 chicks per pair (JNCC database, n=136 measurements). To obtain a stable population, survival of immatures was adjusted to 0.6 for juveniles, 0.7 for 1-year olds, 0.75 for 2-year olds, 0.83 for 3-year olds. The model population comprised 48% adults, 22% juveniles and 30% older immatures. There are 1.09 immatures per adult. The use of an alternative adult survival rate (for example derived from studies at Skomer http://jncc.defra.gov.uk/page-2886) would only alter this ratio very slightly.

13.3 Phenology

Although most adults remain close to their breeding sites throughout the year, few adults remain at colonies after August, with modal departure in August (Pennington et al. 2004; Forrester et al. 2007). However, as a partial migrant species in the UK, some adults remain close to their colony throughout the year. Autumn dispersal/migration starts in August (Wernham et al. 2002; Forrester et al. 2007) or mid-August (Cramp et al. 1977-94). Peak autumn migration occurs in July-December (Brown and Grice 2005), September-October (Forrester et al. 2007; Pennington et al. 2004), or October (Cramp et al. 1977-94; Wernham et al. 2002). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late October to late December (Figure 13.1). Trektellen sites (predominantly in east and south-east England) may observe mostly herring gulls arriving from north Norway rather than dispersing birds from UK colonies, but timing of autumn movements appears not to differ much between UK and north Norwegian populations (Stanley et al. 1981; Horton et al. 1983; Brown and Grice 2005). Autumn migration is completed by November (Forrester et al. 2007), early December (Cramp et al. 1977-94), or December (Wernham et al. 2002).

Spring migration starts in January (Wernham et al. 2002; Forrester et al. 2007) or mid-February (Cramp et al. 1977-94). Peak spring migration occurs in January (Pennington et al. 2004), January-April (Forrester et al. 2007), or March-April (Cramp et al. 1977-94; Wernham et al. 2002; Brown and Grice 2005). Peak rate of change in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in February-April (Figure 13.1). Spring migration is completed by early May (Cramp et al. 1977-94) or May (Wernham et al. 2002; Forrester et al. 2007).

The first spring records of herring gull in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 1 January and the last records were predominantly at 31 December, as large numbers of herring gulls overwinter, but peak autumn migration was reported in October in most years, and peak spring migration was reported in January-March if detected at all which it was not in most years. Birds re-occupy colonies from early January, with modal return in early March (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

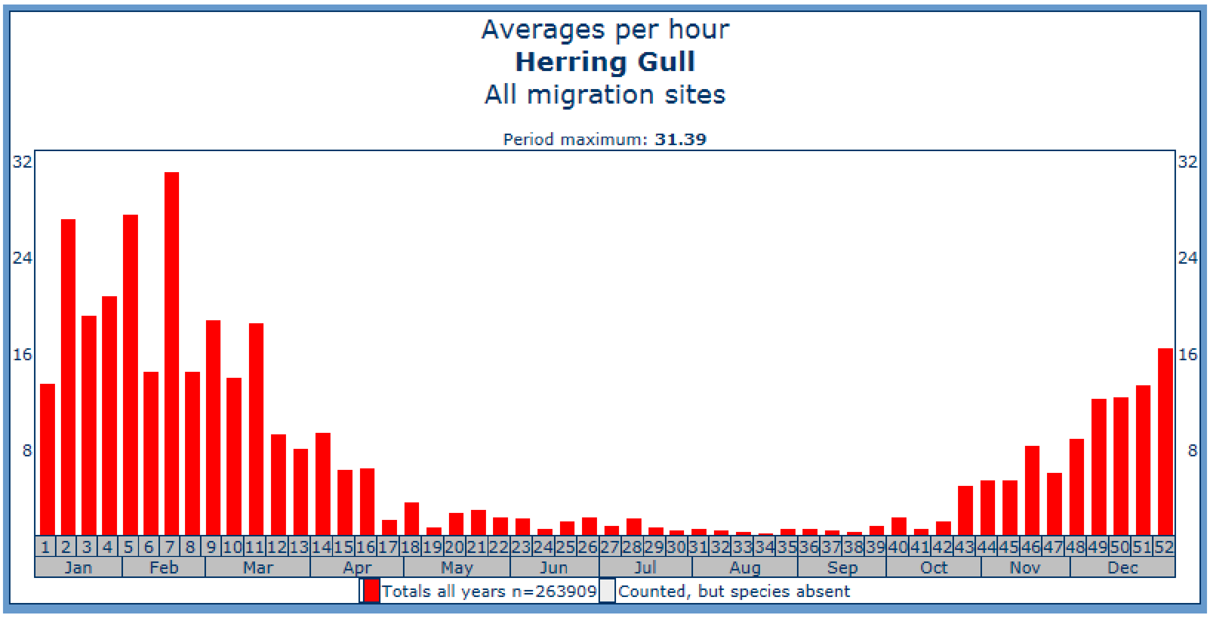

Figure 13.1. Average numbers of herring gulls counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as April-August, non-breeding season September-March. However, from the data reviewed above, a more appropriate definition would be breeding season March-August, non-breeding season September-February.

13.4 Defined seasons:

- UK Breeding season March-August
- Post-breeding migration in UK waters August-November
- non-breeding season September-February (**non-breeding BDMPS**)
- Return migration through UK waters January-April
- Migration-free breeding season May-July
- Migration-free winter season December

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for herring gull:

Non-breeding season BDMPS (September-February).

13.5 Movements of birds from the UK population

Herring gulls in Britain and Ireland do not migrate, and show only limited dispersal. Most adults remain close to their breeding sites throughout the year. Young birds move further than adults, but the median distance between ringing site and recovery site for all UK ringed herring gulls (so predominantly ringed as chicks in colonies) was only around 15 km (Wernham et al. 2002). Camphuysen (2013) found that successful breeders abandoned the colonies in The Netherlands in July-August, when their young were about 50 days old, and that southward autumn movement started first in immatures, then in adults, and last in juveniles, suggesting that post-fledging care of juveniles was mostly minimal. At UK colonies, dispersal after breeding can be evident from August onwards and while birds can move in all directions the autumn movements tend to be predominantly southwards, but lead to little increase in distance between ringing and recovery site until October. A measureable but small average distance is evident in ring recoveries until March, but by April virtually all recoveries of adults are at or very close to the colony, although immature birds may be somewhat more widely distributed (Wernham et al. 2002). Studies on refuse tips in north-east England found that colour ringed herring gulls originated from the whole east coast of Scotland as well as local birds from NE England. Adults started to arrive from late July (presumably these were failed breeders) with peak passage in September-October and some individuals not arriving until December, with a tendency for individuals to show the same seasonal pattern in successive years (Wernham et al. 2002). Herring gulls generally tend to remain close to coasts, occurring at rather low density in pelagic waters. Although herring gulls may move along coasts or sometimes across water, movements between east and west coasts of the UK are surprisingly limited (Wernham et al. 2002). Populations to the west of the UK are therefore unlikely to mix much with populations to the east of the UK.

13.6 Movements of birds from overseas into UK waters

Many nominate *argentatus* birds, especially those from furthest north, can be identified in the field from their considerably larger body size and plumage features (darker mantle, white tip to outermost primary). In winter, those birds tend to be seen in largest numbers in eastern Britain (Coulson et al. 1984). Birds from the nominate subspecies mostly occur in the UK from September to February (Wernham et al. 2002). Ringing suggests that very few of those birds come from Iceland (Wernham et al. 2002). Ringing in Faroe has resulted in two recoveries of birds ringed as chicks and subsequently recovered in their first winter in the UK (Hammer et al. 2013), indicating that at least some young birds from Faroe winter in the UK. However, these come from a relatively small population (1,500 pairs; Hammer et al. 2013). Much larger numbers arrive from the Barents Sea coast of north Norway and north Russia (Wernham et al. 2002), where there are around 126,000 pairs (Anker-Nilssen et al. 2000). Those birds obviously carry out a long-distance migration with extensive travel across the sea from Norway to Scotland, but perhaps surprisingly they very rarely occur in west Britain, tending to remain on the east coast of the UK from Shetland to SE England (Wernham et al. 2002). The Barents Sea population of herring gulls is considered to be partially migratory, with some adults remaining in the Barents Sea throughout the year, but some adults and a higher proportion of immatures migrate during October to winter in the North Sea. Birds from northern Norway winter further south than birds from southern Norway (Haftorn 1971), so Norwegian birds in UK waters are almost all of northern Norwegian origin. Large numbers of herring gulls (many thousands) overwinter along the coast of southern Norway (Petersen et al. 2011), but those birds are probably mostly local breeders that remain in the same area throughout the year, possibly with some birds from north Norway too. While birds from the Norwegian sector of the Barents Sea predominantly migrate along the Norwegian coast, birds from the Russian sector of the Barents Sea (including the White Sea) mostly migrate through the Baltic Sea. Some of these reach the North Sea, while others winter further east (Anker-Nilssen et al. 2000). Herring gulls breeding in The Netherlands are largely sedentary, with many adults remaining within a few km of their colony through winter (Camphuysen 2013). The limited dispersal of herring gulls from colonies in The Netherlands apparently does not normally involve movements to the UK since only 3 sightings out of over 86,000 movements of colour ringed herring gulls from colonies in The Netherlands were made in the UK (Camphuysen et al. 2011).

13.7 Numbers in UK waters

Musgrove et al. (2013) report that there are 730,000 in Britain in winter, 740,000 in UK in winter, but it appears that these totals do not include birds at sea except where they were visible from land. From surveys in 2007 and 2008, Fauchald and Tveraa (2009) reported mean densities at sea of 9.7 to 13.6 birds per km^2 in the Norwegian Sea in spring/summer, and 1.8 to 6.4 birds per km^2 in the Barents Sea in autumn. Nearly 1,000,000 herring gulls are in the entire North Sea in winter (November to February) dispersed throughout the North Sea but many of these birds are not in UK waters (Skov et al. 1995) (although these data are now rather out of date). About 175,000 more winter in the Wadden Sea (Camphuysen 2013). Lack (1986) estimated that about 500,000 herring gulls winter inland or on coasts in Britain and Ireland, with about 122,000 of these in England (Brown and Grice 2005). There were estimated to be 63,780 birds at inland roosts in England in January 1993 and 192,846 at coastal roosts (Burton et al. 2003; Brown and Grice 2005; Burton et al. 2013). Forrester et al. (2007) suggest that there are well over 91,000 herring gulls from the UK population in Scotland, in mid-winter, in terrestrial habitats, but numbers that may be at sea at that time in addition to this total were not estimated, and that count did not include herring gulls in Shetland, Orkney, Western Isles or several parts of northern Scotland, so this number is clearly a large underestimate. In addition, Forrester et al. (2007) estimated that between 5,000 and 20,000 Scandinavian herring gulls are in Scotland in winter, but again this estimate seems to be based mainly on data from terrestrial sites rather than from marine habitats, and is likely to be an underestimate of the total.

In March-April most central areas of the North Sea are vacated by herring gulls, with concentrations found in the Southern Bight and German Bight, the Skagerrak/Kattegat, and in Shetland to NE Scotland (Camphuysen 2013). In summer and early autumn, herring gull numbers in the North Sea are low, showing a coastal distribution related to breeding colony locations (Camphuysen 2013). In winter, herring gulls show a strong association with the distribution of fishing vessels, congregating in areas where fisheries discards are available (Camphuysen et al. 1995). Thus the numbers and distribution of herring gulls in UK waters in winter are likely to vary in response to changes in fisheries activity.

13.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the NW Europe population, comprising 940,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 705,000-799,000 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. Populations with connectivity to UK waters sum to 262,500 pairs, with the UK population almost exactly half of this. Thus the biogeographic population including immatures as well as adults may number about 1,098,000 birds, with 543,000 from UK and 555,000 from overseas. However, only part of the large Barents Sea population comes into UK waters in winter, so UK birds will tend to outnumber birds from overseas populations during migration periods and midwinter. The total numbers in UK waters in the non-breeding season (September to February) sum to a total of about 640,000 birds, 494,000 from UK and 146,000 from overseas.

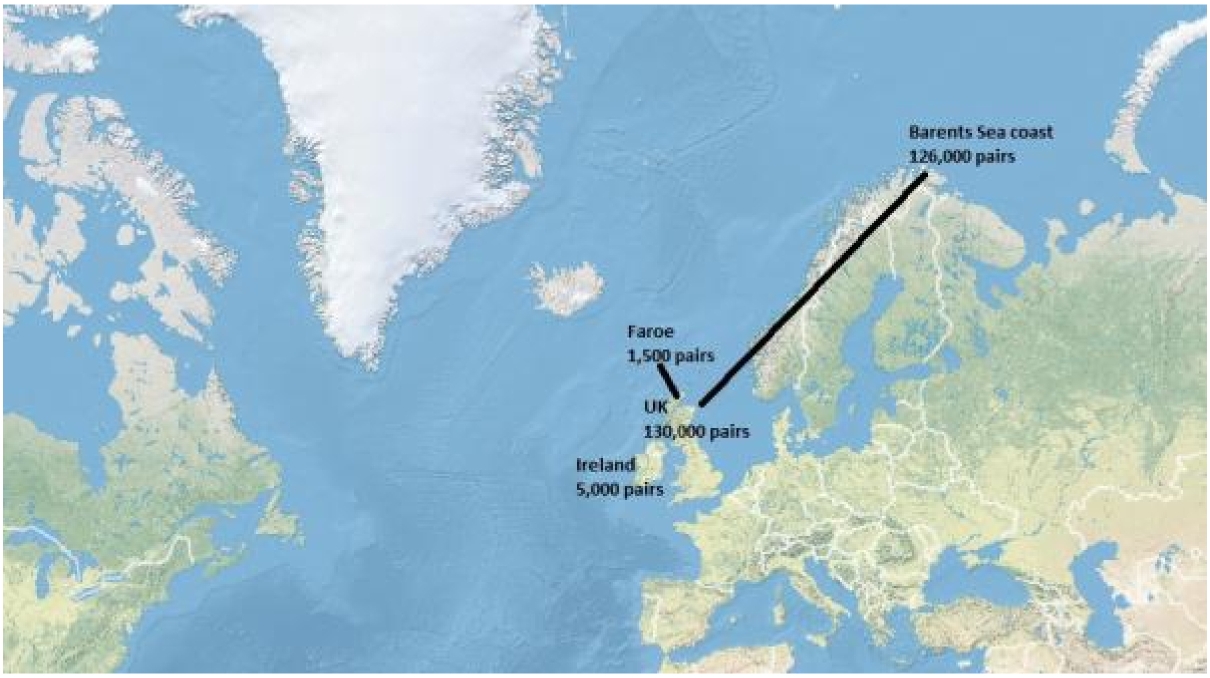

Figure 13.2. Breeding population origins of herring gulls in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

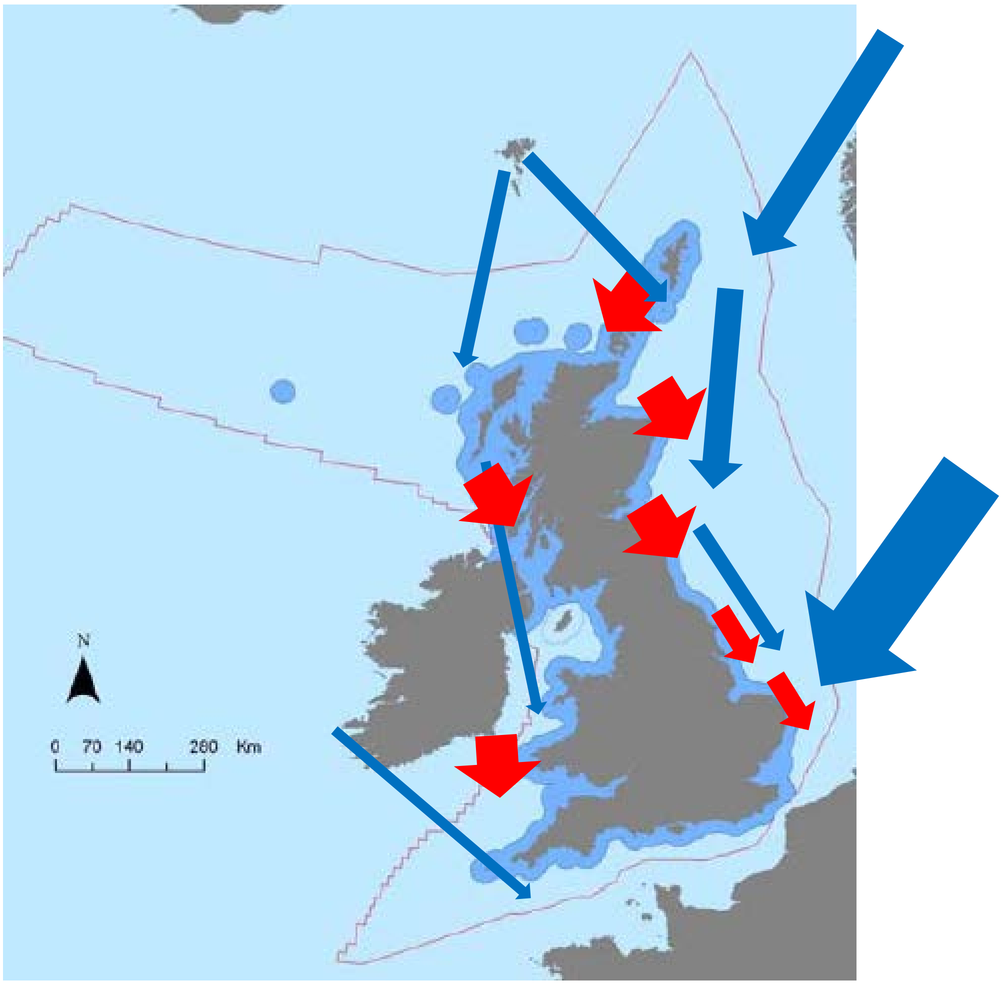

Figure 13.3. Main movements of herring gulls from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

13.9 Proportion of BDMPS from UK breeding SPAs

The 12 SPAs with breeding herring gulls as a feature together held 54,650 pairs at designation, estimated to represent ca. 32% of the British breeding population (Stroud et al. 2001) (although this misses some of the inland breeding colonies so probably rather overestimates the proportion breeding on SPAs; G Mudge in litt.). Herring gull numbers have declined considerably since these SPAs were designated, and as with other declining seabird populations, the decreases have been especially large in the largest populations, which are the SPAs. Stroud et al. (2014) estimated that the UK SPA suite for breeding herring gulls held 12.5% of the GB population in 1999-2011, and since numbers have declined further at some of the SPAs where they used data from 1999-2003, this percentage has almost certainly decreased further and may now be around 11% based on more up to date data in Table 13.1.

Figure 13.4. The SPA suite for herring gull. These SPA populations are listed in Table 13.1.

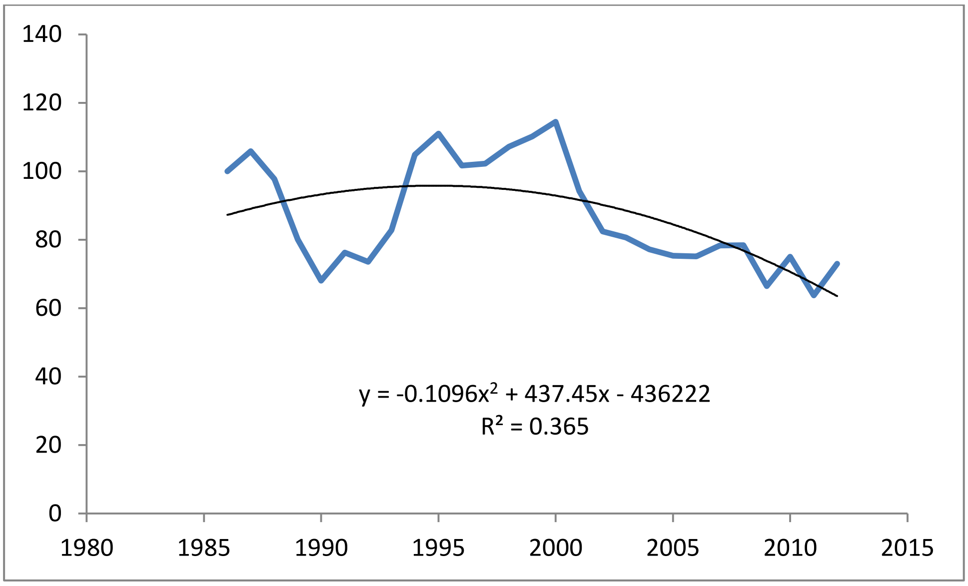

Figure 13.5. Trend in the herring gull breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

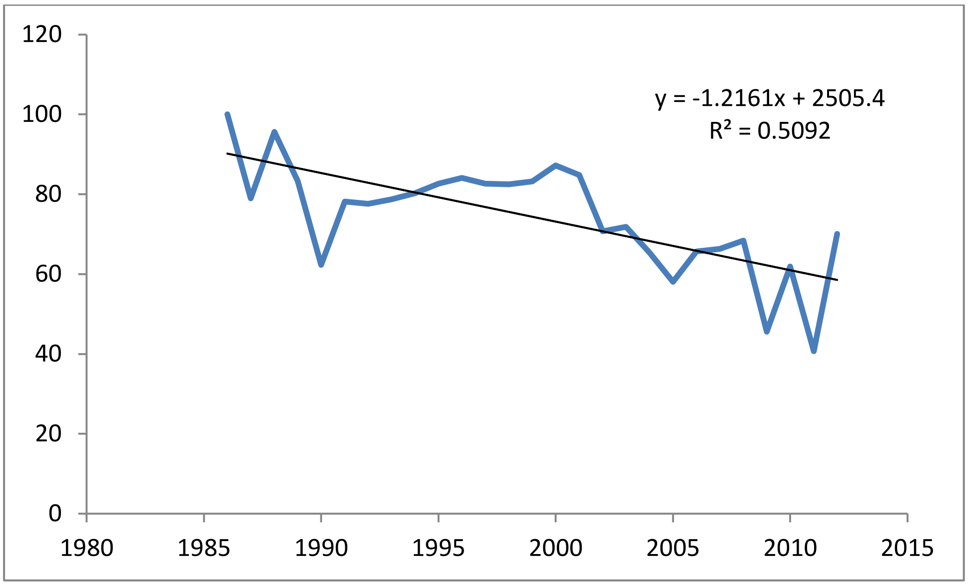

Figure 13.6. Trend in the herring gull breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

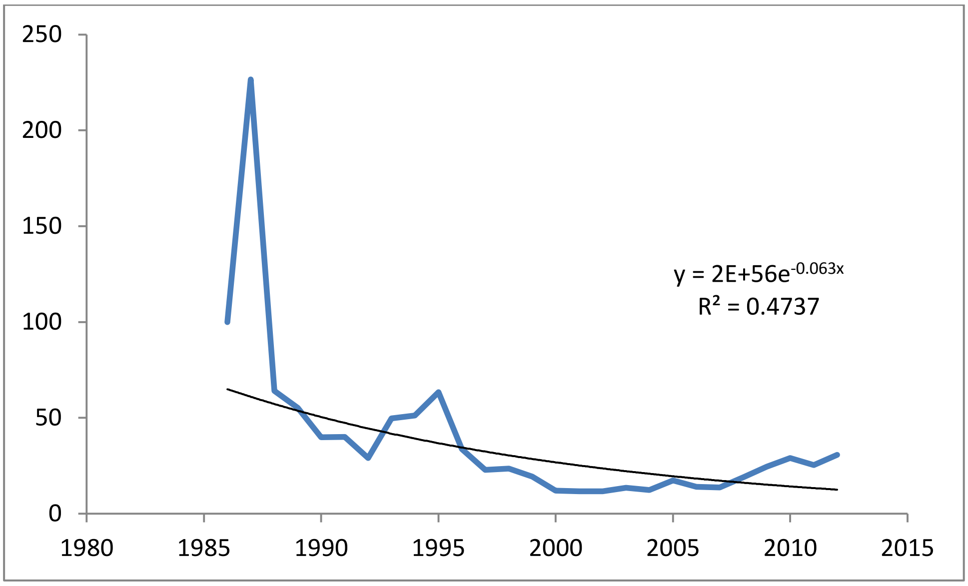

Figure 13.7. Trend in the herring gull breeding population index in Northern Ireland from 1986-2012. Data from JNCC seabird population monitoring database.

Table 13.1. The UK SPA suite for breeding herring gulls.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea & Channel							
East Caithness Cliffs	N Scotland	9,370 (1986)	1996	Declined 1999	3,393	1999	Seabird2000
Troup, Pennan and Lion's Heads	NE Scotland	4,200 (1995)	1997	No change 2007	1,951 1,687 1,597	2001 2007 2007	Lewis et al. 2012 Lewis et al. 2012 SCM database
Buchan Ness to Collieston Coast	NE Scotland	4,292	1998	No change 2007	3,079 3,114	2007 2010	SCM database Lewis et al. 2012

Fowlsheugh	NE Scotland	3,190	1992	Declined 1999	122 214 259	2008 2009 2012	Lewis et al. 2012 Lewis et al. 2012 SCM database
Forth Islands	E Scotland	6,600 (1985)	1990	Maintained 2001	5,026 5,100 2,827	2002 2004 -12 2005 -09	Lewis et al. 2012 SCM database Stroud et al. 2014
St Abb's Head to Fast Castle	SE Scotland	1,160	1997	Declined 2002	541 647 220 266 239	2000 2000 2011 2012 2013	Seabird2000 Stroud et al. 2014 SCM database SCM database SCM database
Flamborough Head & Bempton Cliffs	E England	1,110 (1987)	1993		721 533 495	2000 2008 2010	SCM database SCM database SCM database
Alde-Ore Estuary	SE England	6,050 (Stroud et al. 2001)	1996	These counts are for Orfordness only and exclude Havergate	6,750 2,575 2,000 1,000 1,000 800	2000 2002 2003 2004 2005 2006	SCM database SCM database SCM database SCM database SCM database SCM database
UK Western waters							
Canna and Sanday	Inner Hebrides	1,391	1998	Declined 2001	70 63	2010 2011	Lewis et al. 2012 Lewis et al. 2012
Ailsa Craig	W Scotland	2,250 (1987)	1990	Declined 2010	131 82 129	2010 2012 2013	Lewis et al. 2012 SCM database SCM database
Rathlin Island	N Ireland	4,037	1999		14 5 28 23	1999 2007 2011 2011	SCM database SCM database SCM database Stroud et al. 2014
Morecambe Bay	NW England	11,000	1996		3,225 3,040 2,246 2,094 1,734	2008 2009 2010 2011 2012	SCM database SCM database SCM database SCM database SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

13.10 BDMPS

UK waters can be split into two spatial BDMPS for herring gulls; UK North Sea and Channel waters, and UK western waters. Although some birds move between these two areas, there is a distinct tendency for birds to remain in one or other of these two areas with little interchange. Also, birds from the Barents Sea tend to migrate into the North Sea in large numbers, but very few of those birds enter UK western waters. Population sizes in these two spatial BDMPS are essentially the same for the migration periods (once birds from overseas have reached UK waters and until they depart in spring) and winter, so there is no requirement to split these into separate temporal units.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 42 and 43.

Based on evidence reviewed in sections 13.5, 13.6 and 13.7, in the non-breeding season (September to February) in the UK North Sea and Channel, the BDMPS is estimated to include 99% of adults and 95% of immatures from colonies on the UK North Sea coast, 5% of adults and 10% of immatures from UK colonies in western Scotland, Northern Ireland, Wales and W England (Appendix A Table 42). The BDMPS is also estimated to include birds from three overseas populations; 20% of adults and 30% of immatures from the Barents Sea, 20% of adults and 30% of immatures from Faroe, 2% of adults and 5% of immatures from Ireland. These proportions result in an estimated BDMPS of 466,511 birds in the UK North Sea and Channel in the non-breeding season, 331,381 from the UK and 135,130 from overseas.

Based on evidence reviewed in sections 13.5, 13.6 and 13.7, in the non-breeding season (September to February) in the UK western waters, the BDMPS is estimated to include 0.1% of adults and 0.1% of immatures from colonies on the UK North Sea coast, 80% of adults and 70% of immatures from UK colonies in western Scotland, Northern Ireland, Wales and W England (Appendix A Table 43). The BDMPS is also estimated to include birds from three overseas populations; 0.1% of adults and 0.5% of immatures from the Barents Sea, 20% of adults and 30% of immatures from Faroe, 30% of adults and 40% of immatures from Ireland. These proportions result in an estimated BDMPS of 173,299 birds in UK western waters in the non-breeding season, 162,733 from the UK and 10,566 from overseas.

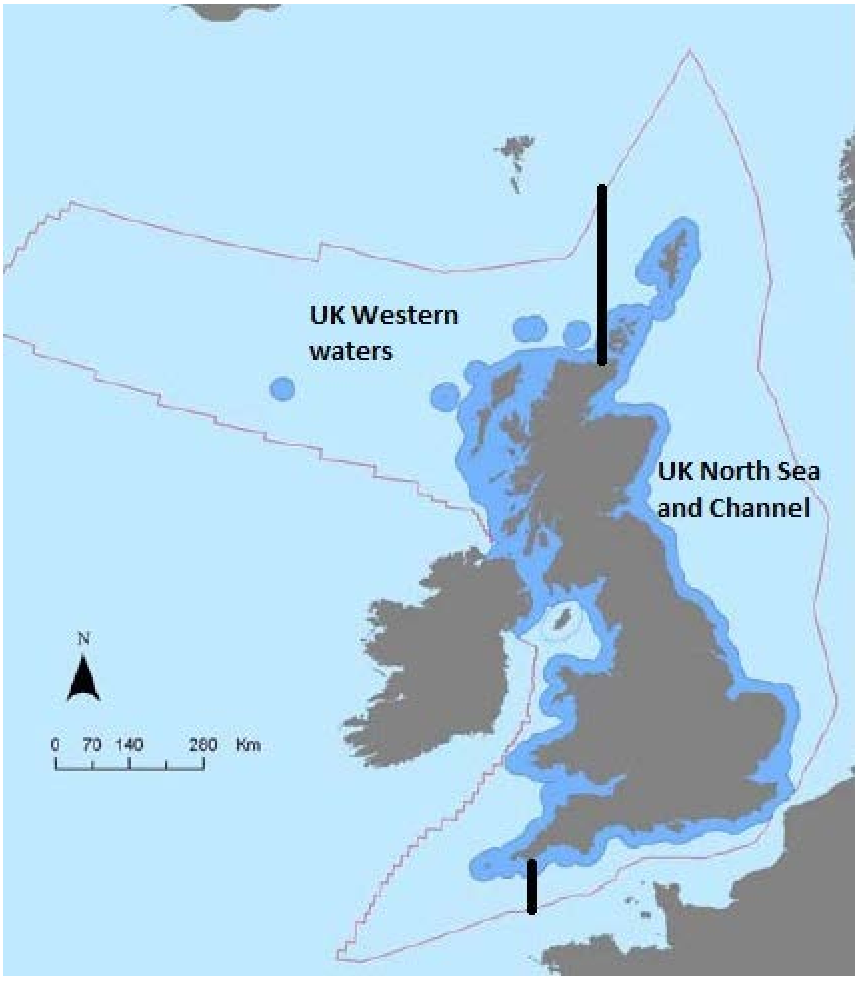

Figure 13.8. Two defined BDMPS spatial areas for herring gull: ‘UK North Sea and Channel’ and ‘UK Western waters’.

13.11 Proportions of UK SPA birds in each BDMPS

About 11% of the UK adult herring gull population breeds in the UK SPA suite for breeding herring gull. Given that the SPAs for herring gull are distributed in a way that reflects fairly closely the breeding distribution of the species in the UK (Figure 13.4), this will probably apply in all areas. However the proportion will be diluted by the presence of immature birds and by the presence of birds from overseas populations. The proportion of birds in each BDMPS that are adults from UK SPA populations can be estimated directly from Appendix A Tables 42 and 43. For example, the UK North Sea and Channel non-breeding season BDMPS comprises 466,511 birds in total, of which 25,389 are adults from UK SPA populations, giving an estimate of 5.4% being adults from UK SPAs.

13.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Because adult herring gulls from UK colonies tend to remain close to their colony throughout the year, there is likely to be a tendency for SPA birds to be aggregated near the SPA sites, although immature birds will disperse more widely and be more mixed. There is some evidence to suggest that herring gulls from the Barents Sea population tend to be more marine than UK herring gulls during migration periods and winter, so that birds at sea may include a higher proportion of ‘foreign’ herring gulls while birds in terrestrial sites may include a higher proportion of UK herring gulls, and so also a higher proportion of birds from UK SPA populations than found at sea. However, this difference in local distribution of birds has not been quantified so cannot be assessed in any detail.

14. GREAT BLACK-BACKED GULL *Larus marinus*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (September to March)
Overseas	163,000	76,492
UK	72,000	67,029
Total	235,000	143,521

Non-breeding season BDMPS (September to March)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
UK North Sea	91,399	62,736	28,663
UK West of Scotland	34,380	9,677	24,703
UK South-west & Channel	17,742	4,079	13,663

Slightly more than half of the UK great black-backed gull SPA populations have been censused since Seabird2000, so breeding numbers in these large colonies are known in some cases but rather uncertain in others. The JNCC seabird monitoring programme indicates a decline in breeding numbers since 2000, as do counts from several SPA colonies. Because a high proportion of breeding great black-backed gulls in the UK are not in SPA colonies, up to date breeding numbers away from major SPA populations are less well known. Movements of breeding adults and of immatures in the UK have been studied in detail by individual colour ringing of birds in wintering areas and on migration, and have provided a fairly comprehensive picture of local movement patterns as well as connectivity with overseas populations. The key overseas population in the Barents Sea is thought to be approximately stable in numbers. Ringing studies abroad have also shown migrations of great black-backed gulls from Faroe and Norway. Although there have not been geolocator tracking studies of great black-backed gulls, the colour ringing work in the late 20th century does provide a good understanding of great black-backed gull movements, and these appear to be consistent from year to year. BDMPS contributions from UK and overseas populations are therefore coded amber overall.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 44 to 46.

14.1 Breeding range and taxa

This Holarctic breeding species is monotypic, and there is no evidence to suggest that biometrics are useful in assessing origins of individuals.

14.2 Non-breeding component of the population

Great black-backed gulls start to breed when 4 years old (BTO Birdfacts). Adult survival rate is unknown (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is 1.139 chicks per pair (JNCC database, n=132 measurements). To obtain a stable population, adult survival was set at 0.88 (the same as herring gull), survival of immatures was adjusted to 0.56 for juveniles, 0.67 for 1-year olds, 0.74 for 2-year olds, and 0.78 for 3-year olds. The model population comprised 44% adults, 25% juveniles and 31% older immatures. There are 1.26 immatures per adult.

14.3 Phenology

Breeding colonies in the UK are deserted by early September, with modal departure in late July or early August (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in July (Wernham et al. 2002), August (Forrester et al. 2007) or mid-August (Cramp et al. 1977-94). Peak autumn migration occurs in July-October (Brown and Grice 2005), September (Wernham et al. 2002), October (Pennington et al. 2004), September-October (Forrester et al. 2007), or September-November in Belgium (Vanermen et al. 2013) or throughout Europe (Cramp et al. 1977-94). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in November-December (Figure 14.1), suggesting that those sites recorded later arriving birds from north Norway rather than birds dispersing from UK colonies. Autumn migration is completed by November (Forrester et al. 2007), early December (Cramp et al. 1977-94) or December (Wernham et al. 2002).

Spring migration starts in January (Forrester et al. 2007), February (Wernham et al. 2002) or mid-February (Cramp et al. 1977-94). Peak spring migration occurs in January-February in Belgium (Vanermen et al. 2013), January in Shetland (Pennington et al. 2004) January-April (Forrester et al. 2007), late February in England (Brown and Grice 2005), February-March (Wernham et al. 2002), or March (Cramp et al. 1977-94). Peak rate of change in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in January-March (Figure 14.1). Spring migration is completed by April (Wernham et al. 2002) early May (Cramp et al. 1977-94), or May (Forrester et al. 2007).

The first spring records of great black-backed gull in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 1 January and the last records were at 31 December, as large numbers of great black-backed gulls overwinter, while peak autumn migration was reported in October or November in most years, and peak spring migration was reported as not evident in most years. Birds re-occupy colonies from early February, with modal return in March (Forrester et al. 2007).

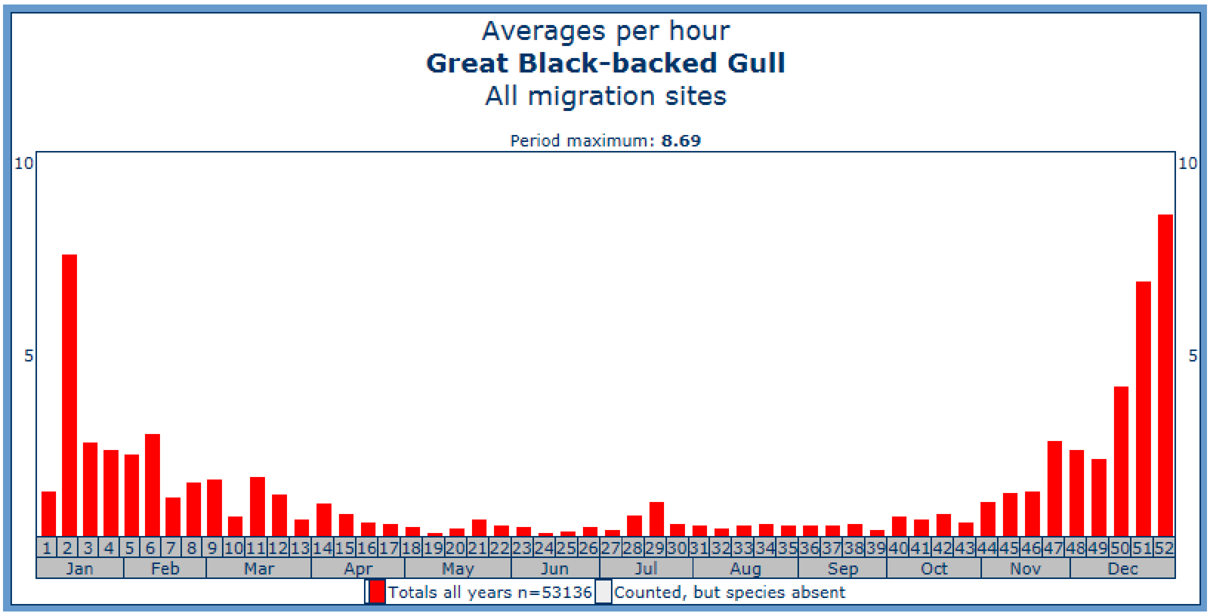

Figure 14.1. Average numbers of great black-backed gulls counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as April-August, non-breeding season September-March. From the data reviewed above, this appears to be an appropriate definition.

14.4 Defined seasons:

- UK Breeding season — late March-August
- Post-breeding migration in UK waters — August-November
- non-breeding season — September-March (**non-breeding BDMPS**)
- Return migration through UK waters — January-April
- Migration-free breeding season — May-July
- Migration-free winter season — December

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for great black-backed gull:

Non-breeding season BDMPS (September-March).

14.5 Movements of birds from the UK population

Adult great black-backed gulls in the UK are partial migrants, with adults being mainly sedentary or travelling only short distances from their breeding area. Some adults disperse short distances from colonies to winter mainly south or east of their colony, tending to return to the same wintering site each year (Coulson et al. 1984). Juveniles and older immatures disperse slightly further than adults; the median distance between colony and wintering area was 54 km for adults but 115 km for immatures ringed in Britain and Ireland (Wernham et al. 2002). Adults return to breeding areas in late winter. Birds ringed at colonies in the northern isles and north Scotland were mainly recovered close to the breeding areas where they were ringed, or down the east coast, a very few birds reaching the south coast of England or coast of the Netherlands or Belgium (Wernham et al. 2002). Very few of these birds crossed to the West coast of Britain or to Ireland. Birds ringed at colonies in the west of Scotland, northwest of England or northern half of Ireland were mainly recovered close to the breeding areas where they were ringed, with a very few reaching the south coast of Ireland, Wales and SW of England. Extremely few birds from the west coast crossed Britain to reach the North Sea. Birds ringed at colonies in SW England, Wales, and the southern part of Ireland were mainly recovered close to the breeding areas where they were ringed, with a very few reaching France.

14.6 Movements of birds from overseas into UK waters

In contrast to the mainly sedentary nature of adult great black-backed gulls in Britain and Ireland, some birds from northern populations migrate long distances, especially to overwinter in the North Sea. Although large numbers breed in Iceland (15,000 to 20,000 pairs; Mitchell et al. 2004), and moderate numbers in Faroe (1,200 pairs; Hammer et al. 2013), these birds are predominantly sedentary (Wernham et al. 2002). Hammer et al. (2013) reported one recovery in the UK and three in Ireland of great black-backed gulls ringed in Faroe, all of which were recovered when less than a year old. Similarly, great black-backed gulls in southern Norway are considered to be mainly sedentary, most remaining in Norwegian waters throughout the year (Anker-Nilssen et al. 2000; Wernham et al. 2002). Foreign-ringed great black-backed gulls recovered in Britain and Ireland mainly originate from the north coasts of Norway and Russia. These birds begin arriving in July, mainly on the east coast of England (Wernham et al. 2002). Numbers peak in September (Wernham et al. 2002), then remain high through early winter until the return migration in February (Wernham et al. 2002). The Barents Sea population of great black-backed gulls, most of which breed along the north coast of Norway, is estimated at around 33,000 pairs (Anker-Nilssen et al. 2000). The Barents Sea great black-backed gull is a partial migrant. Some birds remain close to colonies all year round, while others migrate to winter in the North Sea. It is not clear what proportion of this population winters in the North Sea rather than in the Barents Sea or Norwegian Sea, or in the Caspian or Black Sea, but it is thought that the North Sea is their main wintering area (Anker-Nilssen et al. 2000). Most migrate along the Norwegian coast. Some migrate through the White Sea then along rivers to the Volga delta to winter in the Caspian or Black Sea. Some migrate overland between the White and Baltic Seas, then may continue to the North Sea (Anker-Nilssen et al. 2000). Southward movement is more extensive among immatures than among adults. Birds leave the breeding colonies in north Norway in August, but migration south mainly occurs in September-October (Anker-Nilssen et al. 2000). Adults arrive back at colonies in the Barents Sea in March-April (Anker-Nilssen et al. 2000). With a population in the UK of around 16,800 pairs, with many of these in colonies on the west of the British Isles rather than in the North Sea, the resident great black-backed gulls in the North Sea are likely to be outnumbered in winter by great black-backed gulls from northern Norway. There may be very small numbers of great black-backed gulls from southern Norway, Denmark, SW Sweden and France that visit UK waters, but these numbers appear to be so small relative to the large numbers from the Barents Sea and from the UK that they can be ignored as trivial.

14.7 Numbers in UK waters

Musgrove et al. (2013) report that there are 76,000 in Britain in winter, 77,000 in UK in winter, but these estimates only include birds at sea that could be counted from land, as well as birds onshore and at coastal roosts. From surveys in 2007 and 2008, Fauchald and Tveraa (2009) reported mean densities at sea of 4.8-11.3 birds per km^2 in the Norwegian Sea in spring/summer, and 0.5-1.4 birds per km^2 in the Barents Sea in autumn. Most migrants in English waters occur off east England, whereas most breeders in England are in Cornwall and the Scillies (Brown and Grice 2005). Some northern immatures remain in the southern North Sea all year round (Brown and Grice 2005). There were estimated to be 21,077 birds at inland roosts in England in January 1993 and 17,838 at coastal roosts (Burton et al. 2003; Brown and Grice 2005). Forrester et al. (2007) suggest that there are around 2,000 to 10,000 birds in Scotland during the migration seasons, and 7,500 to 10,000 in winter. However, these estimates appear to be based on counts of birds onshore rather than at sea. Skov et al. (1995) estimated that there are around 300,000 great black-backed gulls in the North Sea in winter (although these data are now rather out of date), with peak numbers in November to February (Stone et al. 1995). However, this number may be an overestimate because great black-backed gulls are attracted to boats (Kober et al. 2010). Since almost all UK great black-backed gulls winter in UK waters, there will be the 16,000 pairs from UK colonies (32,000 adults) plus associated immatures (about 40,000 of those) so about 72,000 birds. However, it is likely that about half of these are in waters west of the UK and half in the North Sea, as very few great black-backed gulls breed along the east coasts of England and Scotland except in the far north (Shetland, Orkney and Caithness). In contrast, the species breeds along most of the west coast of Scotland and in smaller numbers in Wales and west England. However, most of the SPA populations (the largest colonies) are in Orkney and north Scotland. In addition to birds from the UK, birds from Barents Sea colonies arrive in autumn, especially into the North Sea. It is uncertain how many of these winter in UK waters as some may winter in the Norwegian Sea (Anker-Nilssen et al. 2000), but there is evidence from colour ringing studies that relatively few from the Barents Sea winter in the west of Scotland. Count data suggest that the majority of birds in the North Sea in winter are likely to be from the Barents Sea. The Barents Sea population is 33,000 pairs and is apparently approximately stable (Anker-Nilssen et al. 2000, R.T. Barrett pers. comm.), so 66,000 adults plus about 83,000 immatures, so 149,000 birds. Given the estimate that up to 300,000 birds winter in the North Sea, it would seem likely that most birds from the Barents Sea population are in the North Sea in winter, as it would otherwise be impossible to reach such a large total.

14.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the European population, comprising 95,546 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 100,000-110,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 440,000 individuals. The biogeographic population with connectivity to UK waters comprises birds from the UK, Ireland, Faroe and Barents Sea (Figure 14.2). This sums to 235,000 birds (adults plus immatures), of which 72,000 are from UK and 163,000 from overseas populations. Substantial proportions of these populations occur in UK waters in the non-breeding period (September to March); the totals for UK waters are estimated at 143,000 birds, with 67,000 frrom UK and 76,000 from overseas populations.

Figure 14.2. Breeding population origins of great black-backed gulls in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

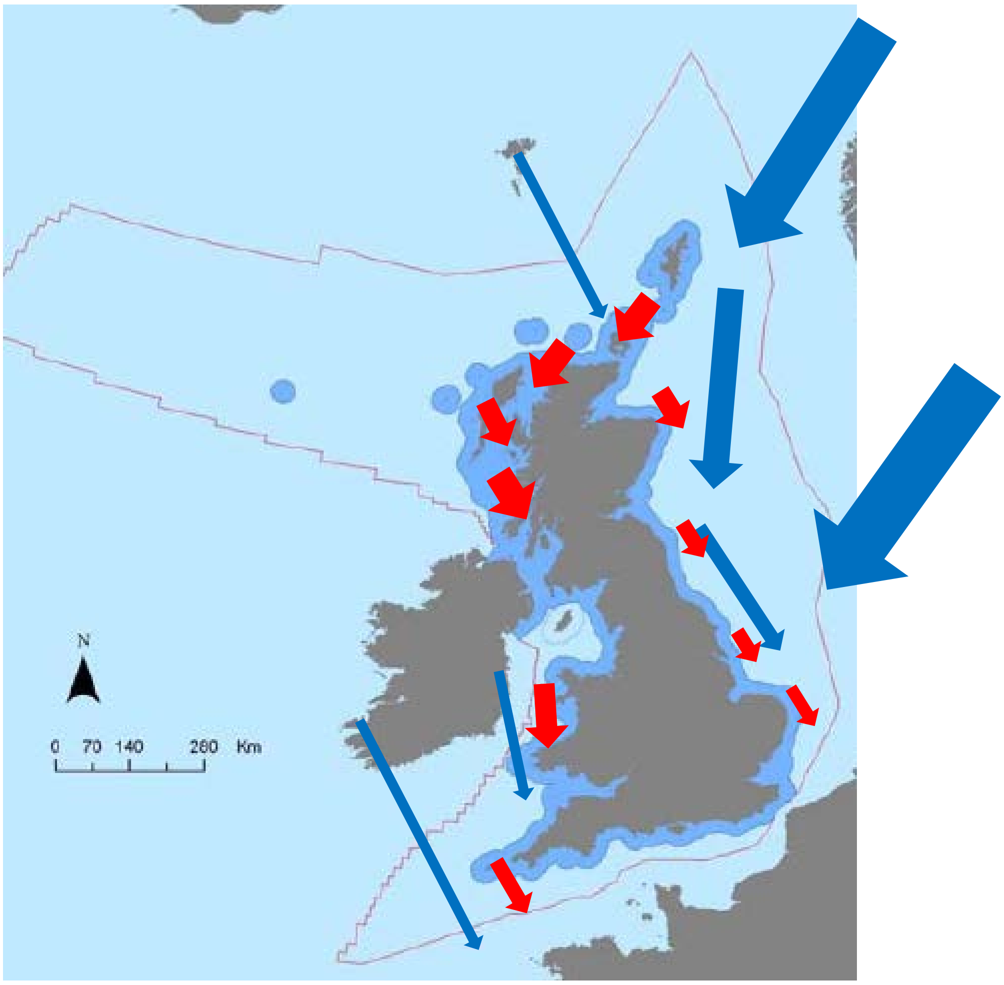

Figure 14.3. Main movements of great black-backed gulls from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

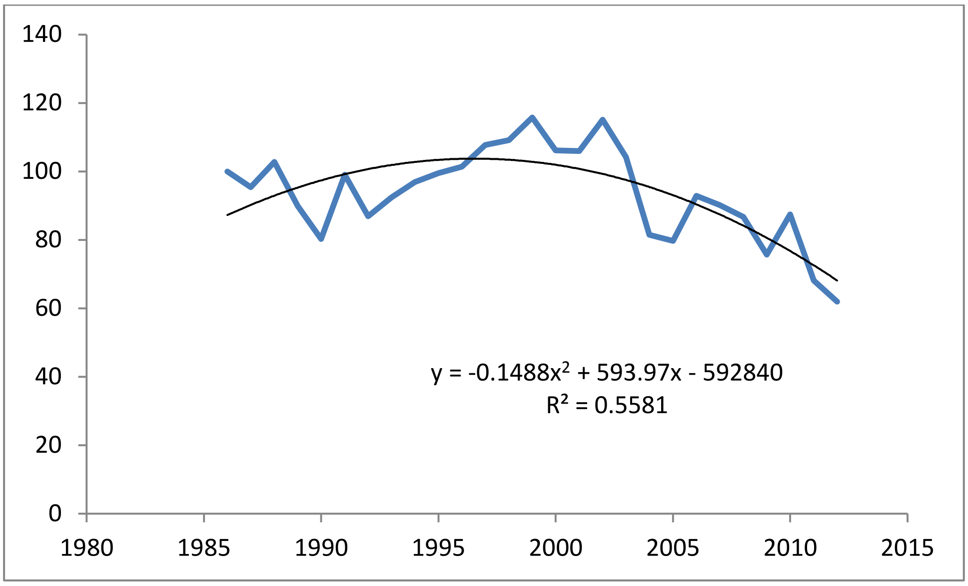

Figure 14.4. Trend in the great black-backed gull breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

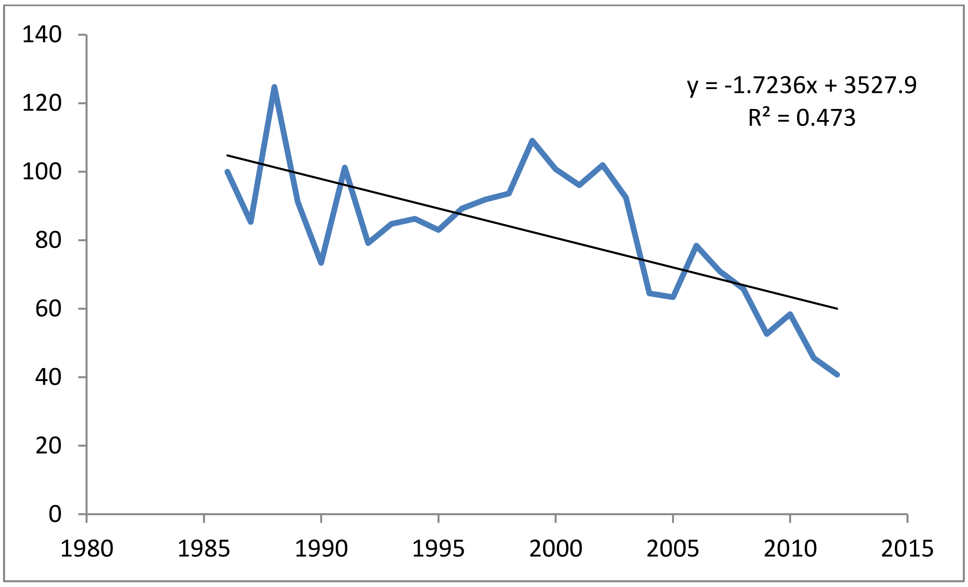

Figure 14.5. Trend in the great black-backed gull breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

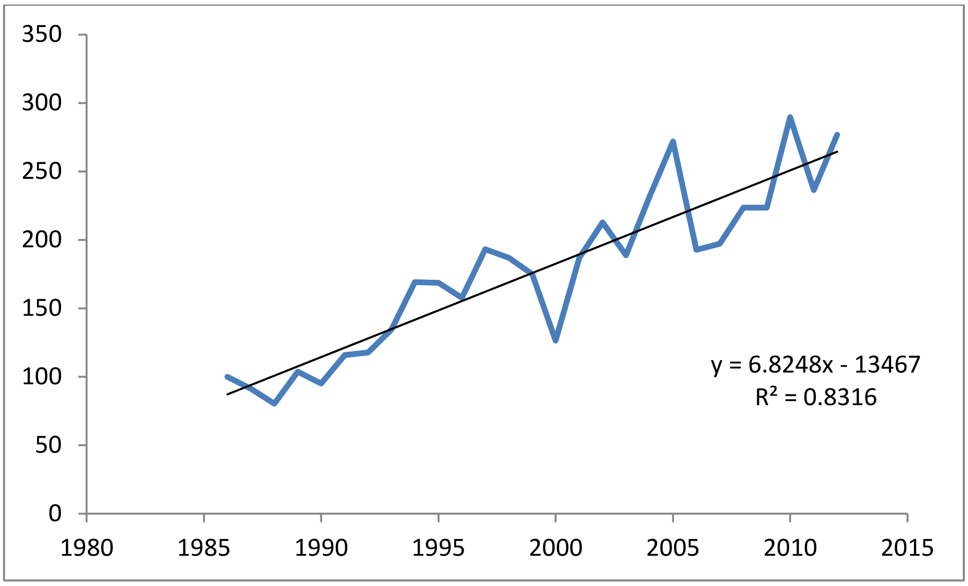

Figure 14.6. Trend in the great black-backed gull breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

14.9 Proportion of UK population from UK breeding SPAs

The six SPAs with breeding great black-backed gulls as a feature together held 4,457 pairs at designation, estimated to represent ca. 23.5% of the British breeding population (Stroud et al. 2001). Stroud et al. (2014) estimated that the six SPAs held about 2,863 pairs in counts made around 1999-2009, but data used for several of these colonies came from 1999-2000 so are rather out of date. Their estimate was that the SPA suite then held about 16.8% of the GB population. However, the most recent counts for these sites (Table 14.1) sum to only 1,826 pairs, with half of these being at Isles of Scilly SPA, so if the UK population is around 16,800 pairs the data suggest that the SPA suite now holds close to 11% of the population, with the single SPA in SW England being by far the largest contribution, due to very large declines in the colonies in north Scotland.

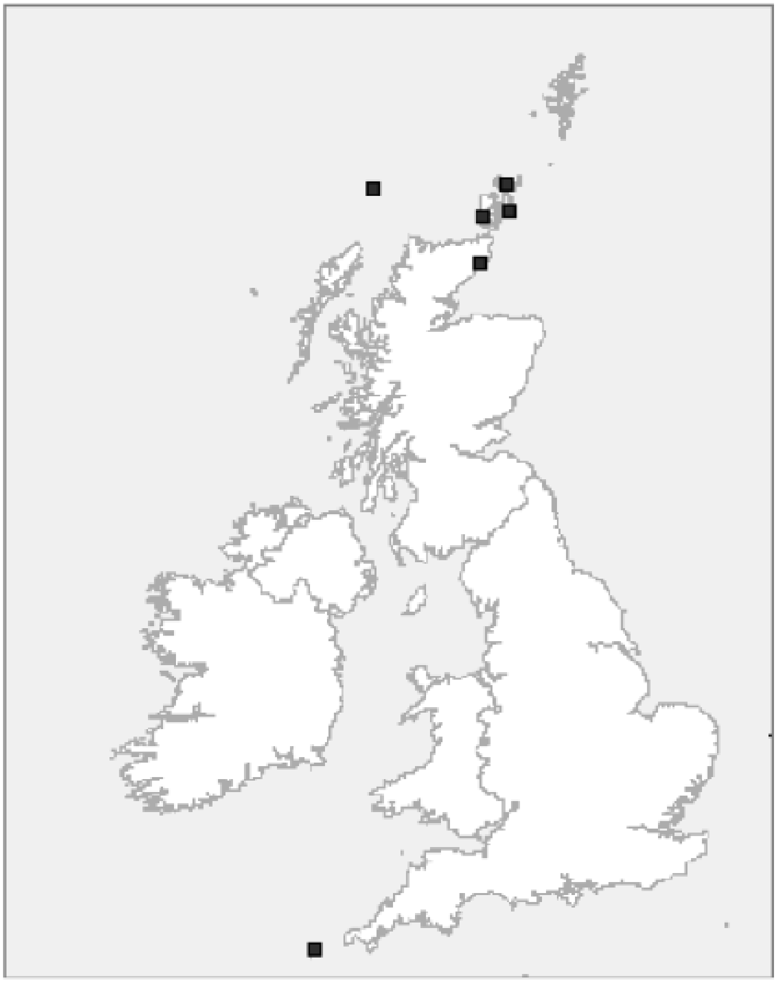

Figure 14.7. The SPA suite for breeding great black-backed gulls. These SPA populations are listed in Table 14.1.

Table 14.1. The UK SPA suite for breeding great black-backed gulls.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea							
Calf of Eday	Orkney	938 (1996)	1998	Declined 2006	675 100 281	2000 2004 2006	Stroud et al. 2014 Lewis et al. 2012 Lewis et al. 2012
Copinsay	Orkney	600	1994	Declined 2008	324 218	2008 2010	Lewis et al. 2012 SCM database
East Caithness Cliffs	N Scotland	850	1996	Declined 1999	175	1999	Seabird2000
Hoy	Orkney	570	2000	Maintained 2000	438 ca.60	2000 2011	Stroud et al. 2014 SMP database
West of Scotland							
North Rona & Sula Sgeir	N Scotland	733 (1986)	2001	Declined 2012	350 191	2009 2012	SMP database SMP database
SW and Channel							
Isles of Scilly	SW England	766	2001		901	2006	SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

14.10 BDMPS

UK waters can be divided into three BDMPS for great black-backed gull. It would be difficult to divide the North Sea region into separate northern and southern BDMPS populations because great black-backed gulls in the North Sea appear to be fairly mobile in the non-breeding period, changing distribution with movement of trawl fishery fishing effort, and because there have been no studies of great black-backed gulls using tracking methods, the details of movements of birds from particular sites are not known. In the UK North Sea BDMPS the population appears to be dominated by birds arriving from Barents Sea colonies in late summer and remaining until spring. There are probably about 910,000 birds in the area in the non-breeding season, with about 29,000 coming from the UK population and 63,000 from the Barents Sea. The area west of Scotland is quite distinct from the North Sea BDMPS because very few birds from the Barents Sea population enter the west of Scotland area, and few birds from North Sea colonies cross into west of Scotland. Similarly, few birds from west of Scotland colonies cross to the North Sea. In the West of Scotland BDMPS there are probably about 34,000 birds in the area in the non-breeding season, with about 25,000 from the UK population and 10,000 from the Barents Sea, Irish and Faroe populations. The southwest of Britain and Channel represents another distinct BDMPS for this species because birds in that area originate from local colonies in that area, together with rather small numbers of immatures from colonies further north in west of Scotland area, and very small numbers of birds from overseas (mostly Ireland). In the South-west and Channel BDMPS there are probably about 18,000 birds in the non-breeding season, with about 14,000 from the UK population and 4,000 from the Barents Sea, Irish and Faroe Populations (most of those coming from Irish colonies).

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 44 to 46.

Based on evidence reviewed in sections 14.5, 14.6 and 14.7, in the non-breeding season (September to March) in the UK North Sea, the BDMPS is estimated to include 100% of adults and 100% of immatures from colonies on the UK North Sea coast, 1% of adults and 10% of immatures from UK colonies in western Scotland, Northern Ireland, Wales and W England (Appendix A Table 44). The BDMPS is also estimated to include birds from two overseas populations; 30% of adults and 50% of immatures from the Barents Sea, 30% of adults and 30% of immatures from Faroe, but no birds from Ireland. These proportions result in an estimated BDMPS of 91,399 birds in the UK North Sea in the non-breeding season, 28,663 from the UK and 62,736 from overseas.

Based on evidence reviewed in sections 14.5, 14.6 and 14.7, in the non-breeding season (September to March) in the UK West of Scotland, the BDMPS is estimated to include no adults or immatures from colonies on the UK North Sea coast, 99% of adults and 80% of immatures from UK colonies in western Scotland, but none from Northern Ireland, Wales and W England (Appendix A Table 45). The BDMPS is also estimated to include birds from three overseas populations; 1% of adults and 8% of immatures from the Barents Sea, 10% of adults and 30% of immatures from Faroe, and 10% of adults and 20% of immatures from Ireland. These proportions result in an estimated BDMPS of 34,380 birds in UK West of Scotland in the non-breeding season, 24,703 from the UK and 9,677 from overseas.

Based on evidence reviewed in sections 14.5, 14.6 and 14.7, in the non-breeding season (September to March) in the UK South-west waters and Channel, the BDMPS is estimated to include no adults or immatures from colonies on the UK North Sea coast, no adults but 10% of immatures from UK colonies in western Scotland and Northern Ireland, 90% of adults and 70% of immatures from colonies in SW England (Appendix A Table 46). The BDMPS is also estimated to include birds from three overseas populations; no adults but 2% of immatures from the Barents Sea, no adults but 20% of immatures from Faroe, 10% of adults and 30% of immature from Ireland. These proportions result in an estimated BDMPS of 17,742 birds in the UK SW waters and Channel in the non-breeding season, 13,663 from the UK and 4,079 from overseas.

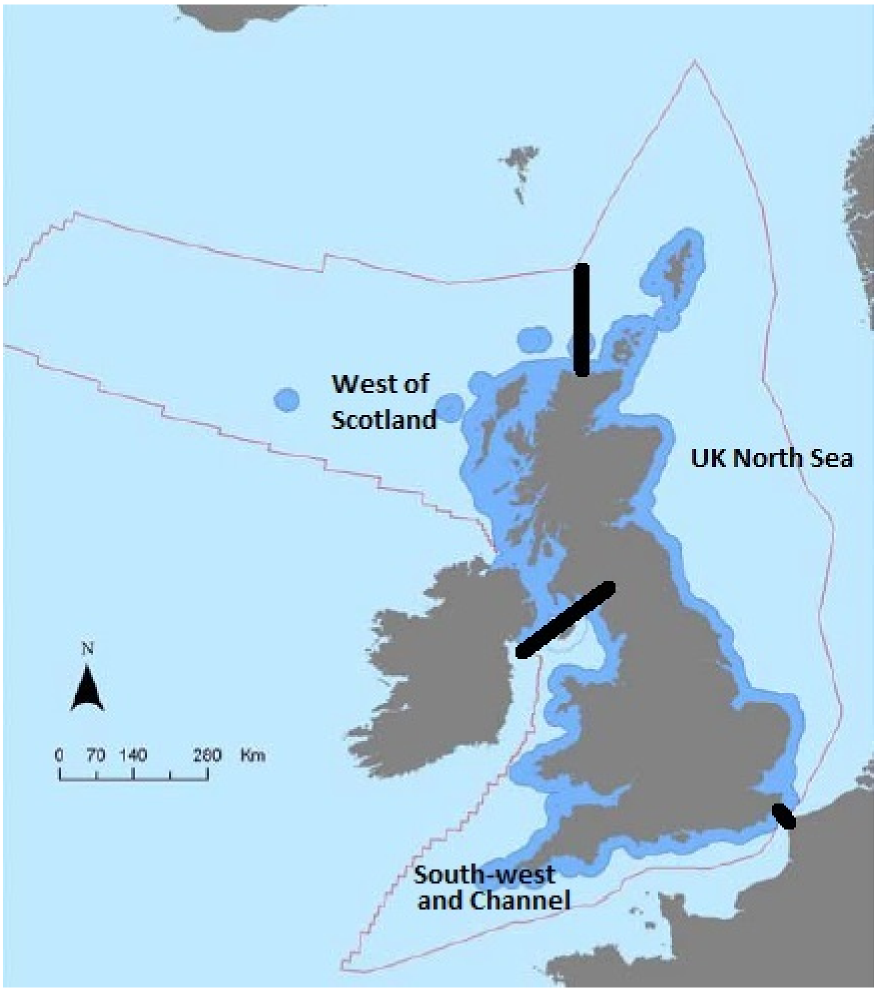

Figure 14.8. Three defined BDMPS spatial areas for great black-backed gull: ‘UK North Sea’, ‘West of Scotland’ and ‘South-west and Channel’.

14.11 Proportions of UK SPA birds in each BDMPS

The UK North Sea BDMPS holds four of the six UK SPAs for breeding great black-backed gulls, but breeding numbers in these colonies have decreased dramatically. There are now probably no more than 700 pairs in total at these four sites combined, and possibly fewer than 600 given that no count data are available since 1999 for East Caithness Cliffs SPA or since 2006 for Calf of Eday SPA. The BDMPS of 91,399 birds in the UK North Sea is likely to contain only about 1,490 adults from UK SPA populations (Appendix A Table 44). So UK SPA breeding adults represent only about 2% of the BDMPS population in that area. The West of Scotland BDMPS holds only one SPA population, on North Rona and Sula Sgeir SPA. This contributes 378 adults to the non-breeding BDMPS, represent about 1% of the BDMPS total of birds (Appendix A Table 45). Ringing data suggest that very few birds from North Sea colonies (including Orkney and Shetland) move out of the North Sea into the West of Scotland region, so these populations appear to be fairly discrete, though it is less certain that birds from North Rona remain entirely in the West of Scotland rather than moving into the North Sea, as few birds have been ringed at North Rona. The UK South-west waters and Channel BDMPS contains one SPA population, Isles of Scilly SPA. There were 901 pairs there in 2006 and that population, in contrast to those in Scotland, appears to be increasing or at least stable (Table 14.1). The UK SPA breeding adults contributing to that non-breeding season BDMPS (1,622 adults) represent about 9% of the BDMPS in UK South-west waters and Channel (Appendix A Table 46).

14.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Adult great black-backed gulls from UK colonies may remain very close to the colony throughout the year, while immatures tend to move south but not over very large distances. So the distribution of UK SPA birds within the BDMPS is likely to be aggregated in waters close to SPA colony sites. This may be especially the case in the West of Scotland BDMPS, with adult birds from North Rona mainly being close to North Rona, and in UK South-west waters and Channel with adult birds being around the Scillies all through the year. However, no detailed tracking studies have been carried out with great black-backed gulls, so the interpretation is based on ring recovery data and it would be useful to support that with work deploying geolocators on this species at major SPA colonies.

15. BLACK-LEGGED KITTIWAKE *Rissa tridactyla*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in autumn (August to December) (adults and immatures)	Numbers in UK waters in spring (January to April) (adults and immatures)
Overseas	4,020,000	1,017,320	567,136
UK	1,080,000	724,203	752,206
Total	5,100,000	1,741,523	1,319,342

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Autumn migration BDMPS (August to December)			
UK North Sea	829,937	397,808	432,129
UK Western waters plus Channel	911,586	619,512	292,074
Spring migration BDMPS (January to April)			
UK North Sea	627,816	238,424	389,392
UK Western waters plus Channel	691,526	328,712	362,814

Breeding adult kittiwakes have been equipped with geolocators in many different countries to investigate migrations and wintering areas, and that work has been summarised in a detailed paper by Frederiksen et al. (2012). However, it must be recognised that the geolocator study provides data for only a single winter, so that annual variation is not assessed, and provides data only for breeding adults, so that comparison with movements of immature birds cannot be made. There is other evidence indicating that individual breeding kittiwakes may differ in their migration behaviour from year to year depending on their breeding success, and that numbers of kittiwakes passing through UK waters vary strongly from year to year apparently in relation to weather conditions. Ring recovery data for kittiwakes are quite limited, and with a pelagic seabird tend to provide a biased indication of distribution. Geolocator data show rather different pattern from ring recovery data. In addition to this uncertainty about movement patterns, and evidence that these show high variability, there is also considerable uncertainty about very recent changes in kittiwake population sizes; several populations appear to be in decline, but the extent and scale of decline are uncertain for most overseas populations. While breeding numbers at some UK SPA colonies have been counted since Seabird2000, some particularly large populations have not been counted since 2000 (e.g. East Caithness Cliffs where over 40,000 pairs nested in 1999). Many non-SPA colonies in the UK have not been counted recently. Changes in breeding numbers differ between Shetland (extreme decline), Orkney (decline in some colonies but perhaps not in others), southern Scotland (more stable numbers), and Wales (increases in some colonies but declines in others). Therefore, overall, numbers from UK in BDMPS are coded amber, and numbers from overseas are coded red, as are total numbers in BDMPS.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 47 to 50.

15.1 Breeding range and taxa

This Holarctic breeding species is usually split into two subspecies; *R. t. pollicaris* breeds in the North Pacific and does not normally reach the Atlantic. *R. t. tridactyla* breeds in the North Atlantic from Spain to the Arctic Ocean. Because *R. t. pollicaris* does not normally reach the Atlantic Ocean, this report focuses only on the nominate subspecies *R. t. tridactyla.* There is clinal variation in size, with birds from further north being larger (Barrett et al. 1985), but there does not seem to be much use of this variation to assess origins of individual birds.

15.2 Non-breeding component of the population

Kittiwakes start to breed when 4 years old (BTO Birdfacts). Coulson (2011) gives mean ages at first breeding of 3.97 years for males and 4.7 years for females at North Shields. Adult survival rate is 0.882 (BTO Birdfacts), juvenile survival 0.79 (BTO Birdfacts) and mean productivity is 0.672 chicks per pair (JNCC database, n=189 measurements), though this is strongly influenced by sandeel abundance near to the colony (Frederiksen et al. 2005). Coulson (2011) presents a table listing estimated adult survival rates for studies of kittiwakes breeding at North Shields, Marsden, Skomer, Brittany, Foula, Isle of May, Fair Isle, and colonies in north Norway and Alaska. Adult survival rate varied with period and colony, ranging from 0.8 to 0.93, indicating that this parameter is certainly not a constant for the species. To obtain a stable population, survival of immatures was adjusted to 0.68 for juveniles, and set at 0.76 for 1-year olds, 0.8 for 2-year olds, and 0.86 for 3-year olds. The model population comprised 53% adults, 18% juveniles and 29% older immatures. There are 0.88 immatures per adult.

15.3 Phenology

Breeding colonies in the UK are deserted in August, with modal departure in early August (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in July (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007) or August (Cramp et al. 1977-94). Peak autumn migration occurs in August-September in Shetland (Pennington et al. 2004), August-November in Scottish waters (Forrester et al. 2007), September-November throughout Europe (Cramp et al. 1977-94), but as late as October-November in Belgium (Vanermen et al. 2013). Variation in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) was erratic and not clearly indicative of autumn migration (Figure 15.1). Autumn migration is completed by December (Cramp et al. 1977-94; Pennington et al. 2004; Forrester et al. 2007).

Spring migration starts in January (Pennington et al. 2004) or January-February (Cramp et al. 1977-94; Forrester et al. 2007). Peak spring migration occurs in January-April in Belgium (Vanermen et al. 2013), in March-April generally in Europe (Cramp et al. 1977-94; Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in March (Figure 15.1). Spring migration is completed by May (Cramp et al. 1977-94; Forrester et al. 2007).

The first spring records of kittiwake in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from January and the last records were predominantly in December. Peak autumn migration was reported in August-October in most years, and peak spring migration was reported in April in most years. Birds re-occupy colonies from February, with modal return in March (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007). Recent studies of kittiwakes have shown that corticosterone levels influence migratory and breeding behaviour. Experimentally increased levels of corticosterone caused female kittiwakes to migrate away from the breeding colony earlier and to spend longer on the wintering grounds (Schultner et al. 2014), while in years with poor food availability, corticosterone levels increased in kittiwakes, birds bred later and made longer foraging trips travelling further from the colony in the pre-breeding period (Goutte et al. 2014). Although demonstrated in kittiwakes, these patterns seem likely to apply in all seabirds.

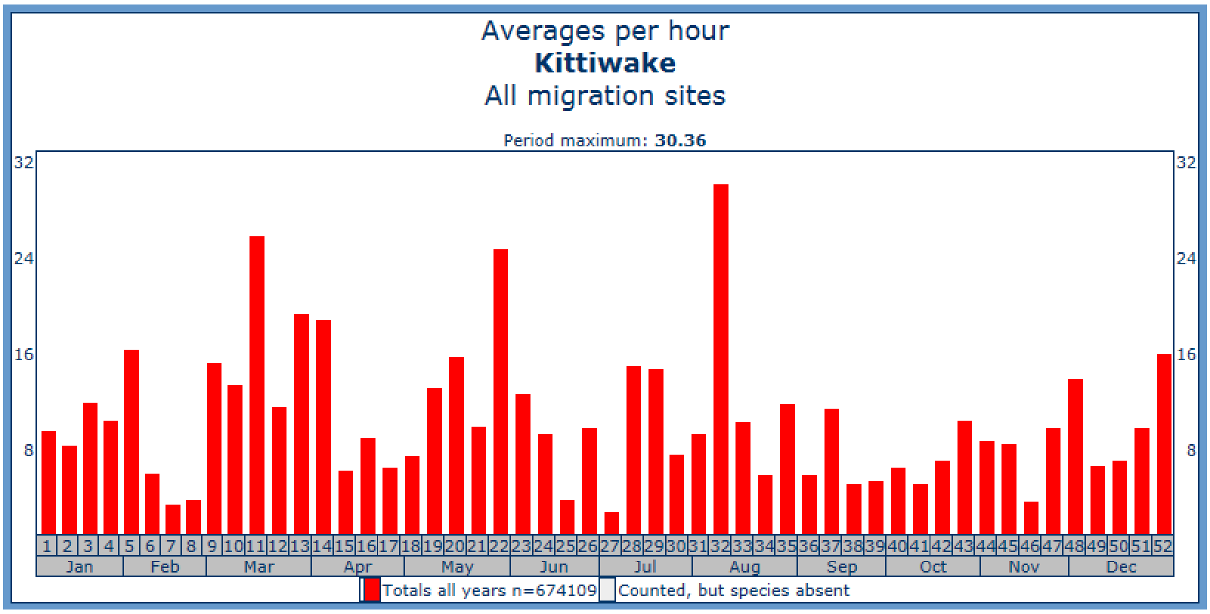

Figure 15.1. Average numbers of kittiwakes counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-September, non-breeding season October-April. However, from the data reviewed above, a more appropriate definition would be breeding season March-August, non-breeding season September-February.

15.4 Defined seasons:

- UK Breeding season — March-August
    - Migration-free breeding season — May-July
- Non-breeding season — September-February
    - Post-breeding migration in UK waters — August-December (**autumn BDMPS**)
    - Return migration through UK waters — January-April (**spring BDMPS**)

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for black-legged kittiwake:

'Autumn' (post-breeding) migration BDMPS (August-December); and

'Spring' (pre-breeding) migration BDMPS (January-April).

15.5 Movements of birds from the UK population

In the UK, kittiwake chicks disperse rapidly from colonies, leaving the area about 10 days on average after their first flight (Coulson 2011). Rapid dispersal is consistent with the fact that chicks are not fed by their parents after departing, so can depart without constraint (Coulson 2011). After initial dispersal which can be in any direction with birds congregating where food is available, subsequent autumn migration takes some young birds west across the Atlantic and others south towards Iberia (Wernham et al. 2002). Kittiwakes in winter may be distributed all across the North Atlantic and North Sea, regularly as far south as about 40^{o}N, but with a few birds even crossing into the southern hemisphere (Coulson 2011). The main spread southwards occurs in early October, birds reaching their southernmost distribution in December-January (Coulson 2011). Ring recovery data show that in spring, young birds may move north, with birds on the west side of the Atlantic visiting seas around Greenland, and birds on the east side possibly moving north but not as far as their breeding colony (Coulson 2011). However, in their first summer and in subsequent summers, kittiwakes vacate the open ocean areas they occupy in winter, and move into shallow continental shelf waters, and may rest on shores though generally away from colonies (Coulson 2011). Immature birds follow a similar pattern to juveniles (although a few two year olds do return to the colony in summer if only briefly), and then tend to return towards breeding colonies in their third summer, though even at that age some may remain in the west Atlantic (Wernham et al. 2002; Coulson 2011). Adults depart from colonies in the northern part of the UK rather rapidly in late July or early August, apparently at least in part in response to sandeels becoming unavailable towards the end of the summer. Further south, adults may linger near colonies for longer. Some adults cross the Atlantic to winter off Newfoundland, but there are far more recoveries of adult kittiwakes in the east Atlantic (Wernham et al. 2002). Ring recoveries indicate that British kittiwakes tend to winter further south than those from colonies in the far north of Europe, so populations only show partial overlap outside of the breeding season (Wernham et al. 2002; Coulson 2011).

15.6 Movements of birds from overseas into UK waters

Over 100 foreign-ringed kittiwakes have been recovered in the British Isles, mostly in autumn and winter. Those birds originated mainly from Norway, Russia, France, and the Channel Islands. Only small numbers of recoveries originated from Iceland, Faroe, Denmark, Sweden, Germany and Greenland. Deployment of geolocators on breeding kittiwakes at many colonies in Svalbard, Barents Sea, Norwegian Sea, North Sea, Celtic-Biscay Shelf, Faroe, Iceland, Greenland and Canada (Frederiksen et al. 2012) has provided more detailed information on the migrations and wintering areas of 236 adult breeding status kittiwakes from different North Atlantic populations. Those data are largely consistent with the ring recovery data, but tend to more strongly emphasise the tendency for birds to cross to the west side of the Atlantic, strongly suggesting that ring recovery data under-represent trans-Atlantic movements. Geolocation data must be considered with some caution, as they are not available from all kittiwake populations in the North Atlantic, they represent only birds of breeding adult status, and data were collected in only two years (2008-09 and 2009-10), so may not be typical of kittiwake migration behaviour in other years. Nevertheless, the geolocation data provide detailed information on the movements of a large sample of birds from many different regions and colonies. Details of this study can be accessed at http://www.hav.fo/PDF/Ritgerdir/2011/Kittiwake_paper_Bergur.pdf. Most tracked birds moved to the west Atlantic to winter between Newfoundland and the mid-Atlantic ridge.

Some wintered in the North Sea and west of the British Isles, and those birds mostly came from colonies in the British Isles or from colonies in the Barents Sea. No birds from colonies in west Atlantic wintered in Europe. There was considerable overlap in winter distributions of birds from different colonies, although colonies closer together showed greatest overlap in distribution, so there was some spatial structuring. Overall, about 80% of the 4.5 million breeding adult kittiwakes in the Atlantic were estimated to winter west of the mid-Atlantic ridge, with only birds from British Isles and France remaining predominantly on the European side. Many equipped birds remained near to their breeding site throughout August, but some moved to post-breeding aggregations in the Barents Sea, the Denmark Strait, and the Labrador Sea. In November most birds had reached wintering areas mostly south of 62^{o}N, but some birds remained in the Norwegian Sea. In December, most birds were in the west Atlantic, but with substantial numbers in the North Sea and west of the British Isles. By January, some birds were returning towards breeding sites. Most birds were back at breeding sites by April, but some high-Arctic breeders remained offshore in the Barents Sea or Davis Strait or off Newfoundland. Frederiksen et al. (2012) present electronic supplementary material to their paper indicating estimates that 255,261 adult kittiwakes were present in the entire North Sea (not just the UK portion) in December 2009, with 102,671 of these from Barents Sea colonies, 114,195 from North Sea colonies, 24,071 from Norwegian Sea colonies, and 14,324 from Celtic Shelf colonies. In the Celtic-Biscay Shelf area they estimate that there were 345,288 adult kittiwakes in December 2009, with 189,934 from Celtic-Biscay shelf colonies, 116,027 from Barents Sea colonies, 39,180 from North Sea colonies, and 147 from Norwegian Sea colonies. While these detailed data are extremely valuable, it must be remembered that these only apply to adult kittiwakes and not immatures, and only apply to a single winter, so it is uncertain whether these are typical or not. Kittiwakes may return to breeding colonies from mid-February in the UK, though not until April in the Arctic (Coulson 2011). To complicate this picture further, Bogdanova et al. (2011) found that unsuccessful breeding kittiwakes from the Isle of May colony were more likely than successful breeders to migrate to the west Atlantic area. Males and females may also differ in migratory behaviour although this is less certain (Bogdanova et al. 2011). The difference in migration behaviour of successful and failed breeders could indicate a time constraint to the migration to the west Atlantic, as birds that fail in their breeding attempt tend to leave the colony earlier in the summer than successful breeders. Since breeding success was very poor at many kittiwake colonies in the eastern Atlantic in the two years when geolocators were deployed, it is possible that the proportion of adults migrating to the west Atlantic was higher than in other years.

15.7 Numbers in UK waters

Although clearly an abundant seabird, kittiwake numbers in UK waters during migration and winter are not well known, and apparently vary considerably, perhaps in relation to food supply and weather conditions. ESAS data suggest a total of around 1,500,000 birds in the North Sea in autumn migration period, with the majority of these birds in the NW North Sea (up to 700,000 birds) and off the English north-east coast (up to 200,000 birds) (Camphuysen et al. 1995), with at sea densities of around 4 birds per km^2. From surveys in 2007 and 2008, Fauchald and Tveraa (2009) reported mean densities at sea of 24-60 birds per km^2 in the Norwegian Sea in spring/summer, and 15-54 birds per km^2 in the Barents Sea in autumn, so densities in the North Sea are not high when compared with some other regions. Breeding numbers in Iceland declined by 17% from 630,000 pairs in 1983-86 to 523,000 pairs in 2005-08 (Gardarsson 2006), but apparently Icelandic kittiwakes do not visit UK waters. However, breeding numbers of kittiwakes have apparently been declining throughout most of the North Atlantic over recent years, so numbers are almost certainly lower in most countries than they were in the period that informed total population estimates in Stroud et al. (2001) and Mitchell et al. (2004). Forrester et al. (2007) suggest that there may be about 10,000 birds in Scottish inshore waters in winter, but give no estimate for numbers in offshore waters. Frederiksen et al. (2012) present electronic supplementary material to their paper estimating that 255,261 adult kittiwakes were present in the entire North Sea (not just the UK portion) in December 2009. This would suggest that taking immatures into account (and the fact that a higher proportion of immatures move across to the west Atlantic) there would probably be about 200,000 kittiwakes in UK North Sea waters in winter. Camphuysen et al. (1995) estimated that there were about 300,000 to 1,100,000 kittiwakes in the (entire) North Sea in February based on surveys in 1993 and 1994 and ESAS data, with the largest proportion of these in UK sectors of the North Sea. Densities of kittiwakes in inshore waters west of the UK in winter are very low indeed; close to zero. Offshore, densities in winter are low, but highly variable as occasional large numbers pass through UK waters in winter, apparently in response to weather more than to food. During autumn, large numbers disperse from UK colonies out of UK waters, returning in spring. Birds from populations further north pass through western UK waters in autumn, and to a lesser extent in spring, but the absolute numbers involved are very uncertain, despite the detailed tracking reported by Frederiksen et al. (2012).

15.8 Biogeographic population and relevant smaller units (BDMPS)

Stroud et al. (2001) defined the biogeographic breeding population as that of the North Atlantic population, comprising 3,170,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 2,500,000-3,000,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 8,400,000 individuals. Counts in the UK suggest a breeding population of around 288,500 pairs (Appendix Table 47). Summing populations with connectivity to UK waters gives an estimated total of about 1,270,000 pairs (Figure 15.2); the huge size of populations in the Barents Sea is a major part of this total. Numbers in the Barents Sea have apparently not declined as much as numbers in the UK and probably in Faroe, but there is low confidence in the exact numbers at Barents Sea colonies and how much these have changed (Frederiksen 2010, Frederiksen et al. 2012). Numbers in Norway have declined too, but there is some uncertainty about how much and how this pattern varies regionally (Barrett et al. 2006). The biogeographic population with connectivity to UK waters is therefore a total of about 5.1 million birds, 1.08 million from UK and 4.02 million from overseas. However, only very small proportions of these overseas populations are found in UK waters during migration seasons (autumn; August to December, and spring; January to April). The estimated total numbers in UK waters in autumn are 1,740,000 birds (720,000 from UK, 1,020,000 from overseas) and 1,320,000 birds in spring (750,000 from UK, 570,000 from overseas).

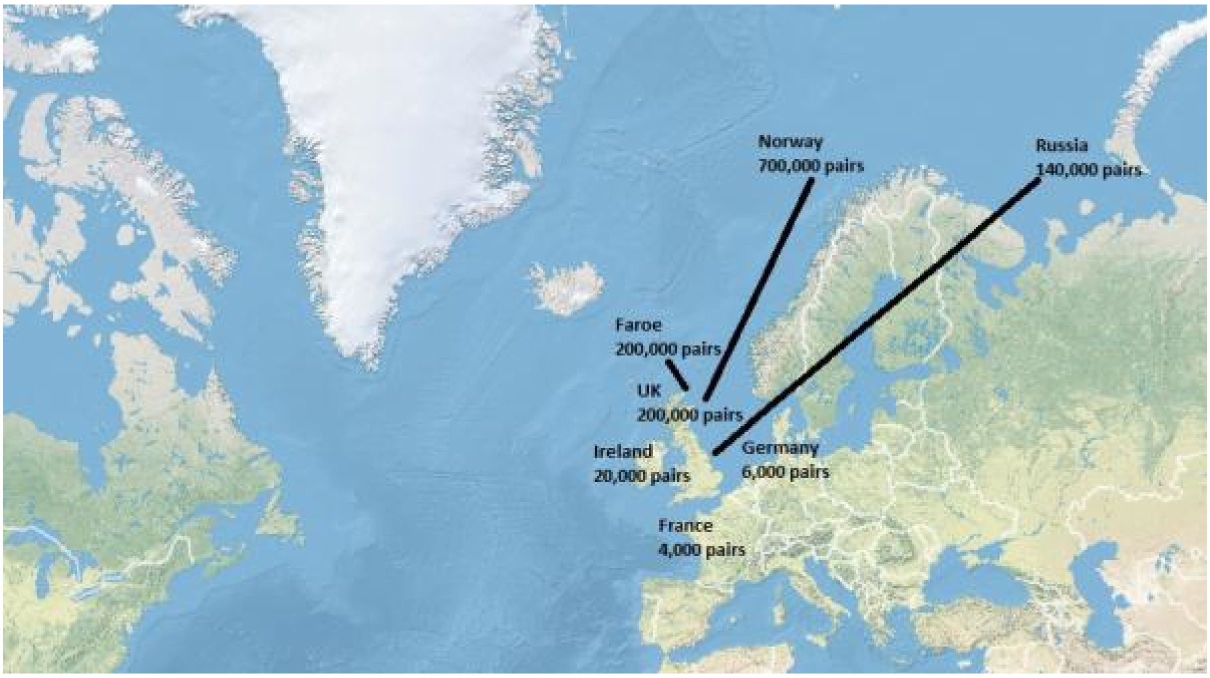

Figure 15.2. Breeding population origins of kittiwakes in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

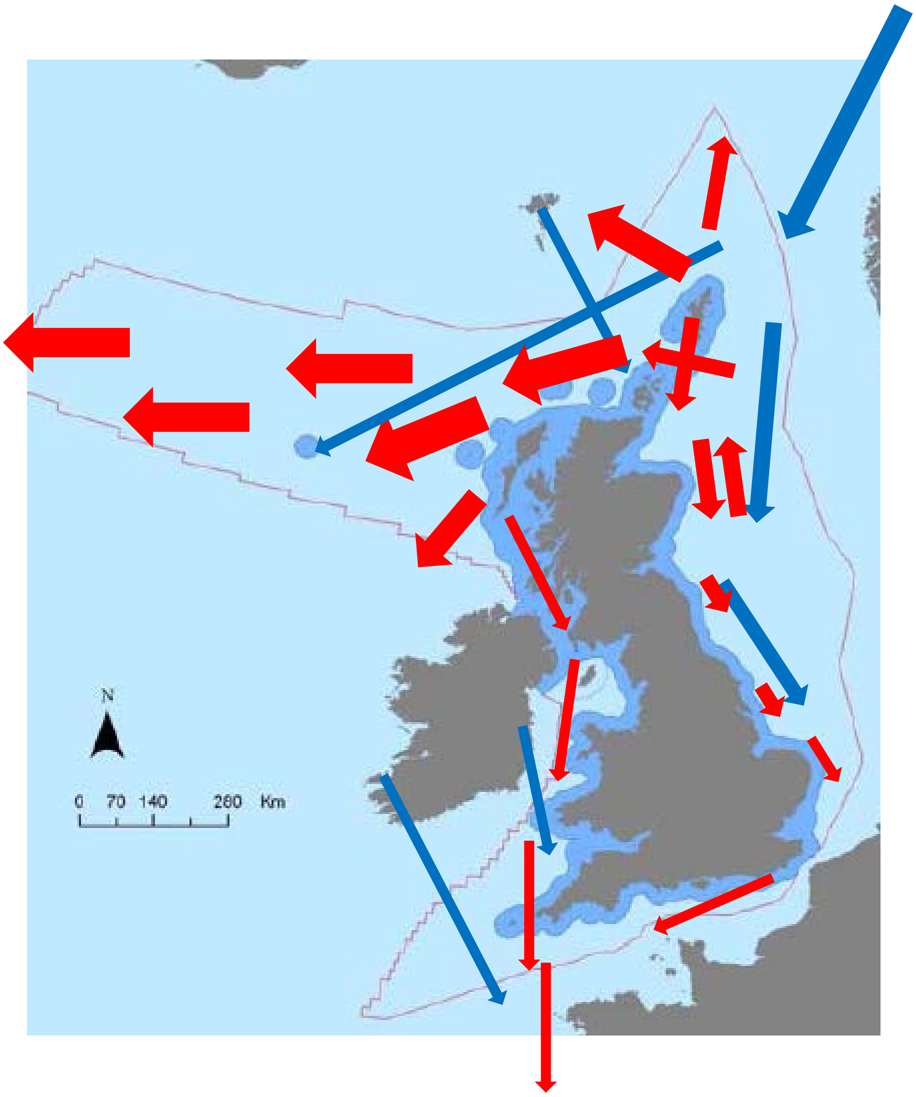

Figure 15.3. Main movements of kittiwakes from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

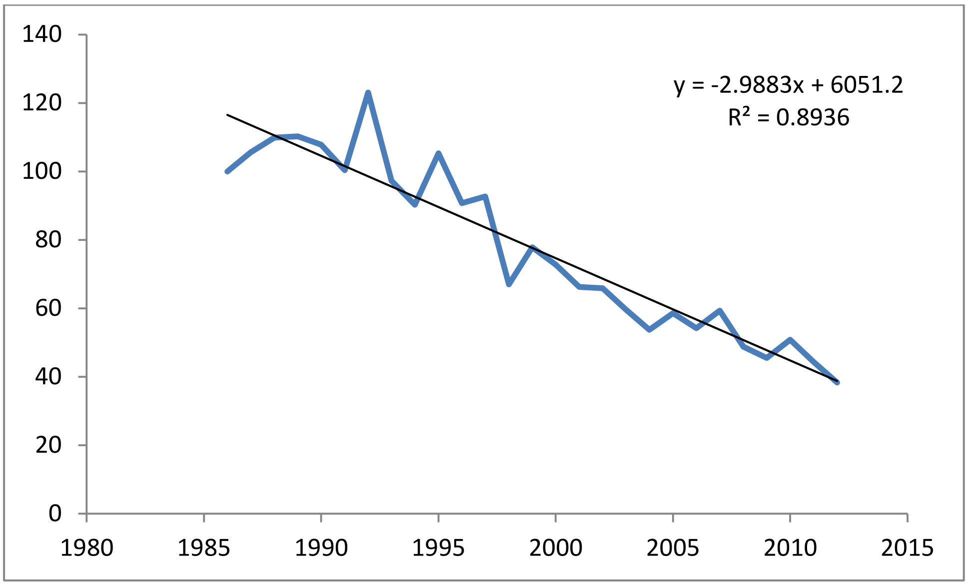

Figure 15.4. Trend in the kittiwake breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

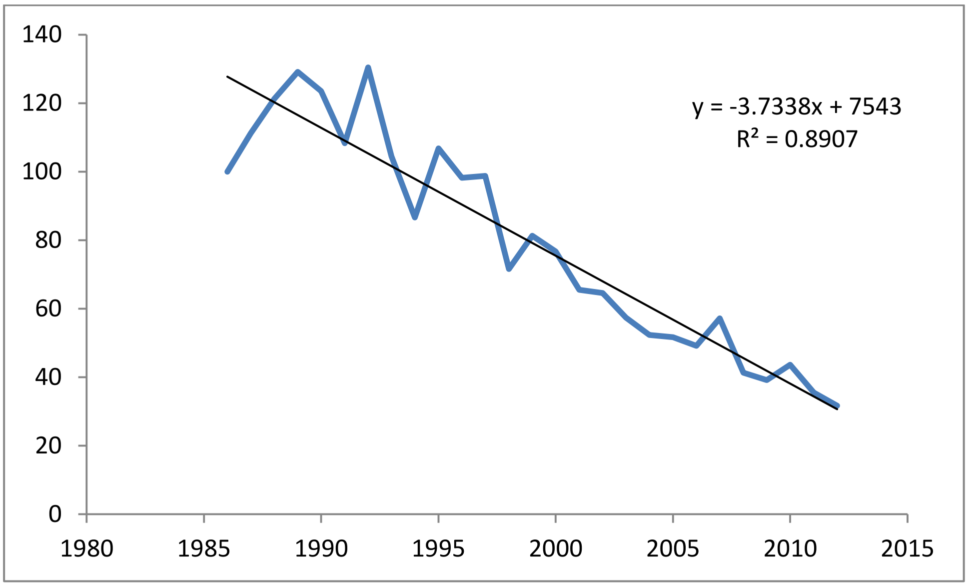

Figure 15.5. Trend in the kittiwake breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

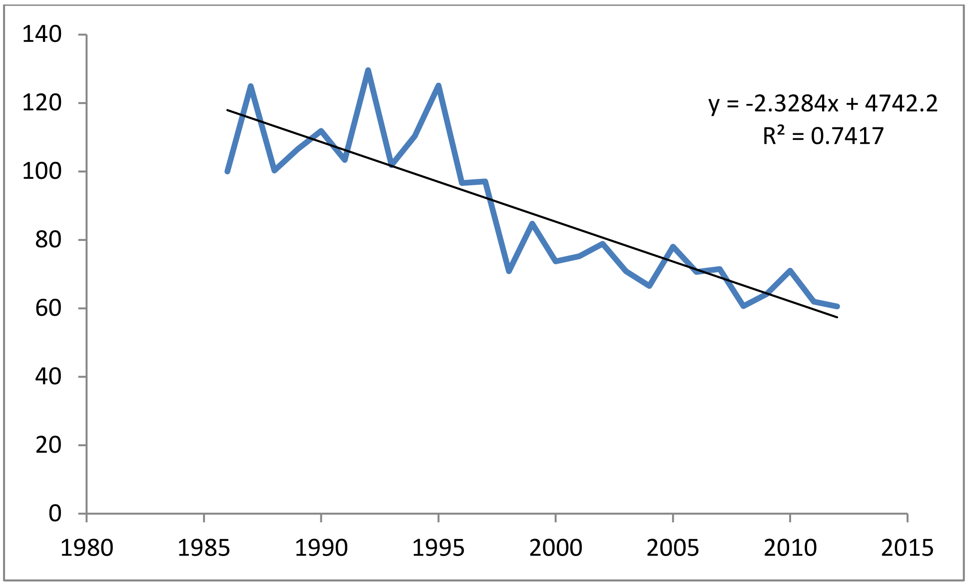

Figure 15.6. Trend in the kittiwake breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

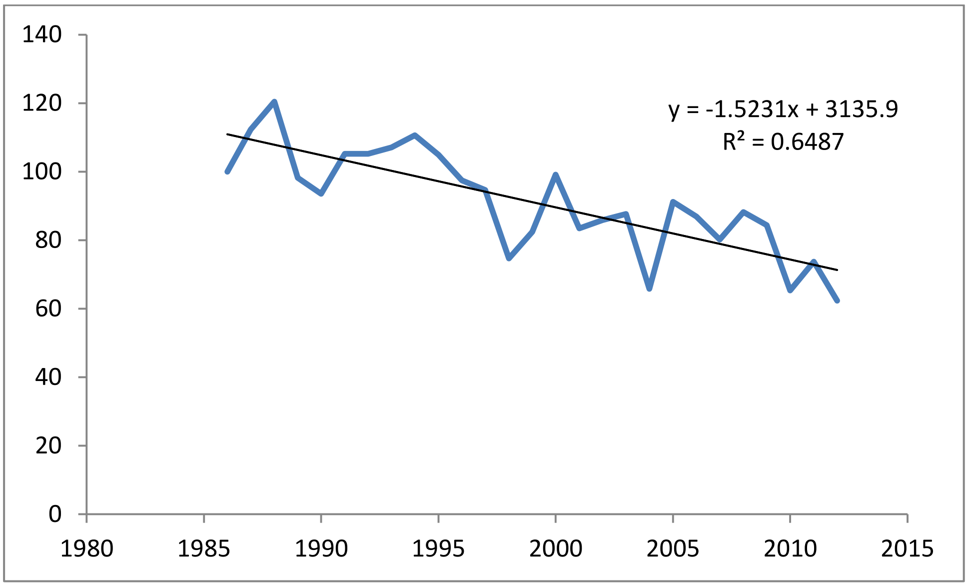

Figure 15.7. Trend in the kittiwake breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

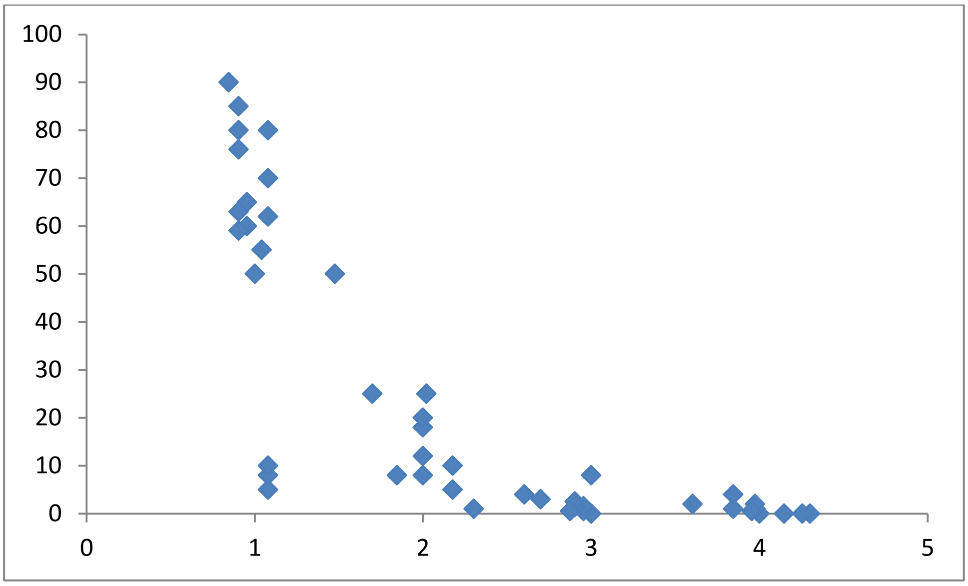

Figure 15.8. Percentage increase in kittiwake colony size (number of nests) at 46 colonies in the UK between surveys in 1959 and 1969 (from Coulson 2011), showing the density-dependent relationship between colony size and growth rate during this period of rapid population growth. Colony size is on a log scale. The same sort of density-dependent relationship between growth rate and colony size has been shown for other time periods so this graph is simply one example of this general phenomenon.

15.9 Proportion of UK population in UK breeding SPAs

The 33 SPAs with breeding kittiwakes as a feature together held 390,597 pairs at designation, estimated to represent ca. 78% of the British breeding population (Stroud et al. 2001). However, based on census data for 1999-2011, Stroud et al. (2014) estimated that this suite held 56.5% of the GB population, as many of the largest colonies have declined even more than the population as a whole. Since a number of the colony size estimates used by Stroud et al. (2014) were from 1999 or 2000, so are very likely to be considerable overestimates of numbers in those colonies now, the true percentage of the population in the SPA suite for breeding kittiwakes is likely to be slightly lower than the estimate in Stroud et al. (2014), perhaps around 55% now.

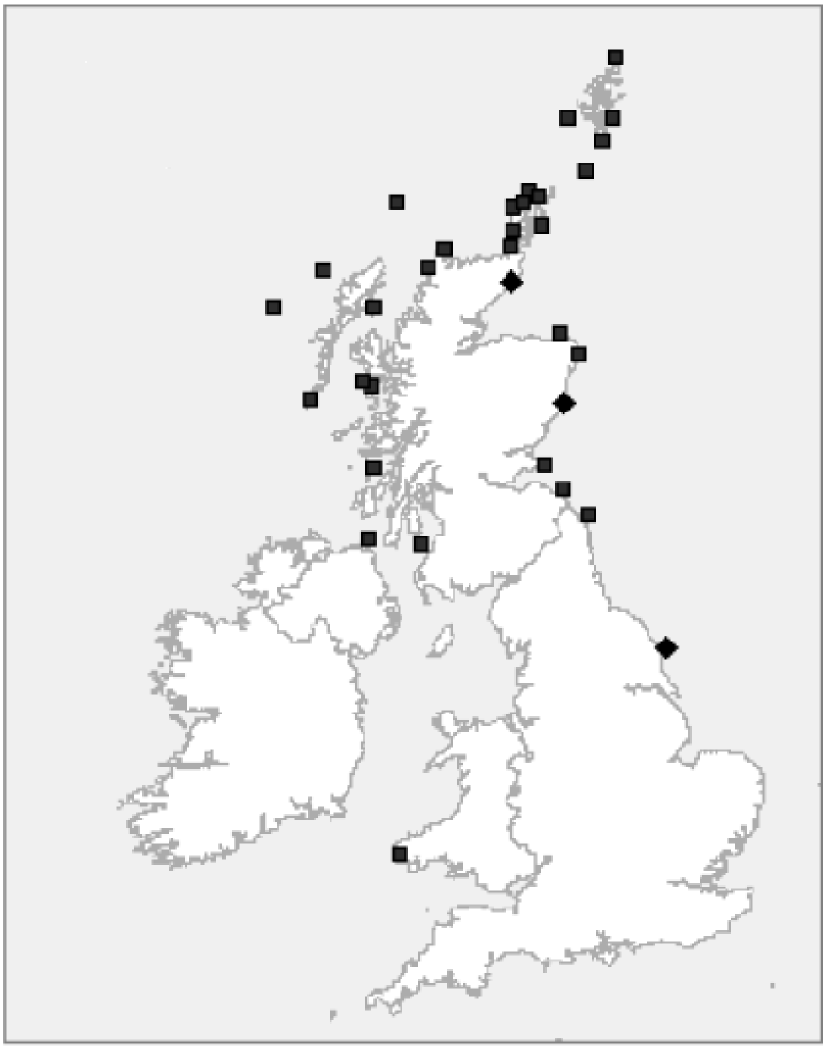

Figure 15.9. UK SPA suite for breeding kittiwakes. These SPA populations are listed in Table 15.1.

Table 15.1. The UK SPA suite for breeding kittiwakes.

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent counts	Year	Reference
UK North Sea							
Hermaness, Saxavord & Valla	Shetland	1,710	1994	Declined 2009	710 624 490 391	1999 2002 2005 2009	SCM database SCM database SCM database SCM database
Foula	Shetland	3,840	1995	Declined 2007	997 509 582 480 378 327	2007 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SCM database Gear 2012 Gear 2013
Noss	Shetland	4,270	1996	Declined 2005	2,395 1,427 507	2000 2005 2010	Seabird2000 Lewis et al. 2012 Lewis et al. 2012
Sumburgh Head	Shetland	1,366 (1994)	1996	Declined 2007	506 500 549 210	2007 2009 2010 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SCM database

Fair Isle	Shetland	9,660	1994	Declined 2008	2,688 1,438 1,225 771	2008 2011 2012 2013	SCM database SCM database FIBO Report SCM database
West Westray	Orkney	24,000	1996	Declined 2007	33,281 12,055	1999 2007	Seabird2000 Lewis et al. 2012
Calf of Eday	Orkney	1,717	1998	No change 2006	765 747	2002 2006	Lewis et al. 2012 Lewis et al. 2012
Marwick Head	Orkney	7,110	1994	Declined 2006	3,860 2,185 2,018 1,134 526	2003 2006 2009 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SCM database SCM database
Rousay	Orkney	4,900	2000	Declined 2009	2,713 1,764	1999 2009	Seabird2000 Lewis et al. 2012
Copinsay	Orkney	3,610	1994	Declined 2008	3,552 666	2008 2012	Lewis et al. 2012 SCM database
Hoy	Orkney	3,000	2000	Declined 2007	781 397	1999 2007	Seabird2000 Lewis et al 2012
North Caithness Cliffs	N Scotland	15,650	1996	Declined 2000	10,150	2000	Seabird2000
East Caithness Cliffs	N Scotland	31,930 (1986)	1996	Maintained 1999	40,410	1999	Seabird2000
Troup, Pennan and Lion’s Heads	NE Scotland	31,660 (1995)	1997	No change 2007	18,482 15,570 17,171 14,896	2001 2004 2007 2007	Seabird2000 Lewis et al. 2012 Lewis et al. 2012 SCM database
Buchan Ness to Collieston Coast	NE Scotland	30,452	1998	No change 2007	13,330 14,133 12,542	2004 2007 2007	SCM database Lewis et al. 2012 SCM database
Fowlsheugh	NE Scotland	34,870	1992	Maintained 1999	11,140 9,454 9,337	2006 2009 2012	Lewis et al. 2012 Lewis et al. 2012 SCM database
Forth Islands	E Scotland	8,400 (1985) Or 9,380 (Stroud et al. 2001)	1990	Declined 2007	5,164 3,884 3,766 3,100	2007 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 SCM database SCM database
St Abb’s Head to Fast Castle	E Scotland	19,600	1997	Declined 2008	15,430 c.5,000 4,314 3,403	2000 2011 2012 2013	Seabird2000 Lewis et al. 2012 SCM database SCM database
Farne Islands	NE England	6,236	1985		4,275 3,699 4,768 3,976 4,241 3,443	2008 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database
Flamborough Head & Bempton (to be subsumed into Flamborough and Filey Coast SPA)	E England	83,370 (1987)	1993		42,692 37,617	2000 2008	SCM database SCM database

Flamborough and Filey Coast	E England	44,520 (2008-2011)	Not yet		42,692 37,617	2000 2008	SCM database SCM database
UK Western waters & Channel							
Cape Wrath	NW Scotland	9,660	1996	Maintained 2000	10,344	2000	Seabird2000
North Rona and Sula Sgeir	N Scotland	5,040 (1986)	2001	Declined 2012	4,119 1,253	1998 2012	Lewis et al. 2012 SCM database
Handa	NW Scotland	7,420	1990	Declined 1999	7,013 5,985 4,466 1,872	1999 2005 2009 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SCM database
St Kilda	Western Isles	7,800 (1987)	1992	Maintained 2000	4,268 1,516 957	1999 2006 2008	Seabird2000 Lewis et al. 2012 Lewis et al. 2012
Flannan Isles	Western Isles	2,800 (1988)	1992	Declined 2013	1,392	1998	Seabird2000
Shiant Isles	Western Isles	1,850	1992	Maintained 1999	2,006 549	1999 2008	Seabird2000 Lewis et al. 2012
Canna and Sanday	Inner Hebs	1,193	1998	Maintained 2001	960 1,002 1,083 820	2010 2011 2012 2013	SCM database SCM database SCM database SCM database
Rum	Inner Hebs	1,500	1982	No change 2006	788	2000	Seabird2000
Mingulay and Berneray	Western Isles	8,610 (1985)	1994	Declined 2009	5,511 4,974 2,228	1998 2003 2009	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
North Colonsay & Western Cliffs	W Scotland	4,512	1997	Maintained 2008	5,563	2000	Seabird2000
Ailsa Craig	W Scotland	3,100 (1987)	1990	Declined 2003	1,675 200 428 489	2001 2008 2009 2013	SCM database SCM database Lewis et al. 2012 SCM database
Rathlin Island	N Ireland	6,822 (1985)	1999		9,917 9,896 7,922	1999 2007 2011	SCM database SCM database SCM database
Skomer and Skokholm	Wales	1,959 Stroud et al. 2001)	1982		2,282 2,046 1,922 1,837 1,594 1,045	2008 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

15.10 BDMPS

The UK waters can be divided into two spatially distinct BDMPS. Most birds from UK North Sea colonies are members of the UK North Sea BDMPS, whereas few birds from western colonies enter the North Sea. Conversely, although some birds from UK North Sea colonies enter UK western waters plus Channel, these are a minority from those populations whereas most birds from colonies in western waters contribute to the UK western waters plus Channel BDMPS. UK North Sea holds about 830,000 birds during autumn migration (August to December), and 630,000 in spring migration (January to April). It seems that slightly more than half of these birds are from the UK population. UK western waters plus Channel BDMPS holds about 910,000 birds during autumn migration, and 690,000 in spring migration. It should be recognised, however, that although kittiwake numbers are undoubtedly large in both these populations, numbers are not known with confidence, and appear to be highly variable depending on weather patterns, and possibly also on food supply.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 47 to 50.

Based on evidence reviewed in sections 15.5, 15.6 and 15.7, the UK North Sea autumn migration BDMPS is estimated to contain 60% of adults and 40% of immatures from colonies in the UK North Sea, 1% of adults and 5% of immatures from colonies in UK western waters, 10% of adults and immatures from Russia, Norway, Faroe and Germany, 5% of adults and immatures from France and Ireland. This results in an estimated BDMPS population of 829,937 birds in autumn, 432,129 from UK and 397,808 from overseas (Appendix A Table 47).

Based on evidence reviewed in sections 15.5, 15.6 and 15.7, the UK western waters plus Channel autumn migration BDMPS is estimated to contain 20% of adults and 20% of immatures from colonies in the UK North Sea, 60% of adults and 40% of immatures from colonies in UK western waters, 10% of adults and immatures from Russia, 15% of adults and immatures from Norway, 20% of adults and immatures from Faroe and 5% of adults and immatures from Germany, 10% of adults and immatures from France, and 30% of adults and 20% of immatures from Ireland. This results in an estimated BDMPS population of 911,586 birds in autumn, 292,074 from UK and 619,512 from overseas (Appendix A Table 48).

Based on evidence reviewed in sections 15.5, 15.6 and 15.7, the UK North Sea spring migration BDMPS is estimated to contain 60% of adults and 30% of immatures from colonies in the UK North Sea, 1% of adults and 2% of immatures from colonies in UK western waters, 5% of adults and 7% of immatures from Russia, Norway, and Faroe, 15% of adults and 25% of immatures from Germany, 5% of adults and 10% of immatures from France, and 1% of adults and immatures from Ireland. This results in an estimated BDMPS population of 627,816 birds in spring, 389,392 from UK and 238,424 from overseas (Appendix A Table 49).

Based on evidence reviewed in sections 15.5, 15.6 and 15.7, the UK western waters plus Channel spring migration BDMPS is estimated to contain 30% of adults and 20% of immatures from colonies in the UK North Sea, 80% of adults and 40% of immatures from colonies in UK western waters, 5% of adults and 10% of immatures from Russia and Norway, 10% of adults and immatures from Faroe, 5% of adults and immatures from Germany, 10% of adults and immatures from France, 30% of adults and 20% of immatures from Ireland. This results in an estimated BDMPS population of 691,526 birds in spring, 362,814 from UK and 328,712 from overseas (Appendix A Table 50).

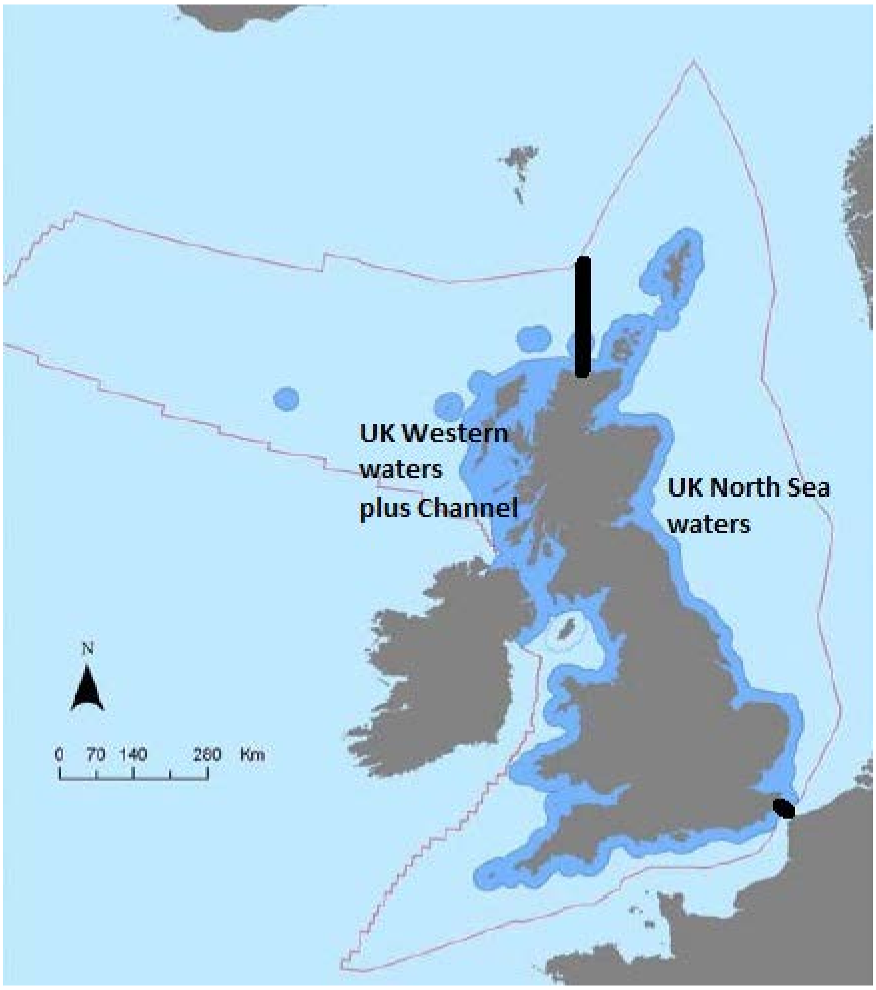

Figure 15.10. Two defined BDMPS spatial areas for kittiwake: ‘UK North Sea waters’ and ‘UK Western waters plus Channel’.

15.11 Proportions of UK breeding SPA birds in BDMPS

The proportion of birds in each BDMPS that are adults from UK SPA populations can be estimated directly from Appendix A Tables 47 to 50. For example, the UK North Sea autumn migration season BDMPS comprises 829,937 birds in total, of which 184,615 are adults from UK SPA populations, giving an estimate of 22% being adults from UK SPAs.

15.12 Spatial distribution of UK breeding SPA birds across the BDMPS

The SPAs for breeding kittiwakes in UK North Sea BDMPS and UK Western waters plus Channel BDMPS are well distributed through the broad breeding range of the species in those areas. In the South-west and Channel area there is only one SPA population, in south Wales, so the distribution of SPA birds could be patchy, but since kittiwakes disperse very widely it is likely that in all areas they are very thoroughly mixed through the broader UK population and with birds from overseas.

16. SANDWICH TERN *Thalasseus sandvicensis*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (July-September and March-May)
Overseas	107,000	13,560
UK	41,000	35,252
Total	148,000	48,812

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (July-September and March-May)			
UK North Sea and Channel	38,051	10,090	27,961
UK Western waters	10,761	3,470	7,291

Sandwich tern numbers in UK SPA colonies are almost all monitored frequently. However, numbers in UK colonies that are not SPA populations are less well monitored, and do represent a substantial proportion of the UK total. Sandwich tern migrations have not been studied by geolocator deployment, and ringing recoveries from the migration period in UK waters are very limited. So understanding of details of Sandwich tern movements are relatively poor, especially to the extent that birds from overseas populations are concerned. While ring recoveries show that some birds from overseas pass through UK waters, the proportions of those populations doing so are very uncertain since ring recovery data are subject to considerable potential bias. Therefore, numbers of overseas birds and total numbers in the BDMPS are classed as red, whereas numbers from the UK population are classed amber.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 51 and 52.

16.1 Breeding range and taxa

Sandwich tern has a Holarctic breeding distribution in warm temperate latitudes. There are three subspecies, but only nominate *T. s. sandvicensis* occurs within British waters. There is no evidence that biometrics would allow origins of individuals to be identified. Most populations breed south of the UK. There are moderate numbers in Denmark and Germany, but few in Norway or Sweden.

16.2 Non-breeding component of the population

Sandwich terns start to breed when 3 years old (BTO Birdfacts). Adult survival rate is 0.898 (BTO Birdfacts), juvenile survival 0.358 (BTO Birdfacts) and mean productivity is 0.656 chicks per pair (JNCC database, n=174 measurements). To obtain a stable population, survival of immatures was adjusted to 0.55 for juveniles, 0.7 for 1-year olds, and 0.8 for 2-year olds. The model population comprised 61% adults, 20% juveniles and 19% older immatures. There are 0.63 immatures per adult.

16.3 Phenology

Breeding colonies in the UK are deserted by late September (Brown and Grice 2005), with modal departure in August (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in July (Cramp et al. 1977-94; Pennington et al. 2004; Forrester et al. 2007) or August (Wernham et al. 2002). Peak autumn migration occurs in August in Shetland (Pennington et al. 2004), and Scotland (Forrester et al. 2007), July-September in Belgium (Vanermen et al. 2013) or September throughout Europe (Cramp et al. 1977-94; Wernham et al. 2002). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred from July to September (Figure 16.1). Autumn migration is completed in UK waters by October (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007) or early November throughout the geographical range (Cramp et al. 1977-94).

Spring migration starts in late February in the winter quarters (Cramp et al. 1977-94) and in March in UK waters (Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in March-April in Belgium (Vanermen et al. 2013) and in English waters (Brown and Grice 2005), in April (Cramp et al. 1977-94; Wernham et al. 2002) in April-May in Scottish waters (Forrester et al. 2007) and in June in Shetland (Pennington et al. 2004). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in April (Figure 16.1). Spring migration is completed in May (Cramp et al. 1977-94; Wernham et al. 2002), June (Forrester et al. 2007) or July in Shetland (Pennington et al. 2004).

The first spring records of Sandwich tern in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 2 March to 26 April but predominantly in late March, and the last records were from 28 June to 31 December but mostly in October. Peak autumn migration was reported in August-September in most years, and peak spring migration was reported in April or May in most years. Birds re-occupy colonies from March, with modal return in April (Pennington et al. 2004; Forrester et al. 2007).

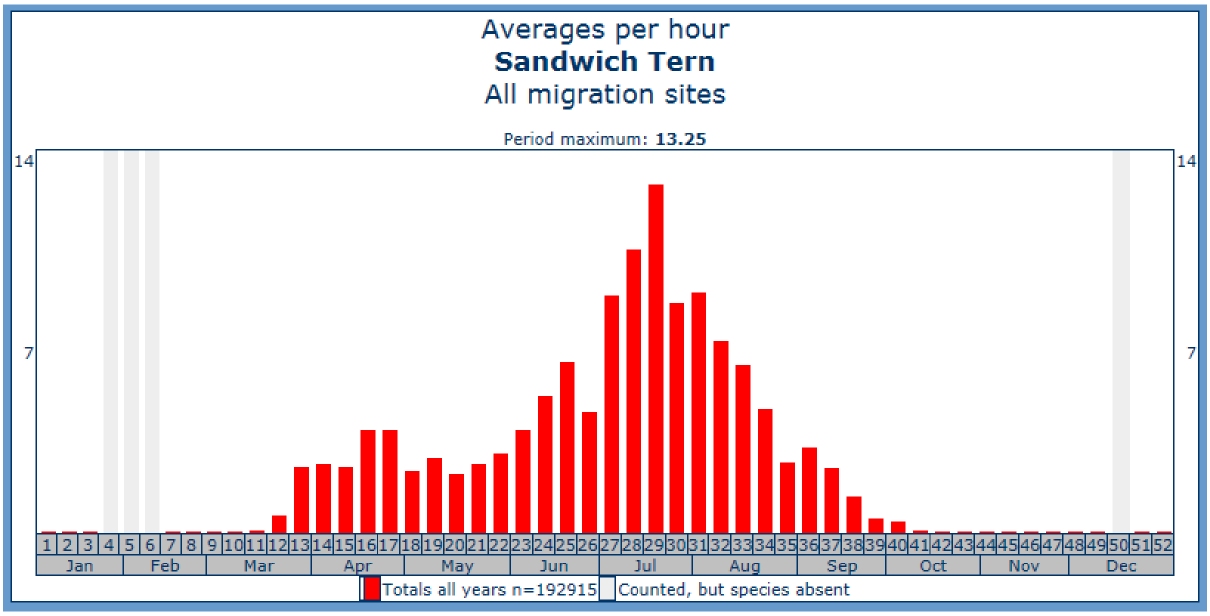

Figure 16.1. Average numbers of Sandwich terns counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season birds predominantly absent from UK waters. However, from the data reviewed above, a more appropriate definition would be breeding season April-August, non-breeding season September-March.

16.4 Defined seasons:

• UK Breeding season	April-August
• Post-breeding migration in UK waters	July-September (**migration BDMPS**)
• non-breeding season	September-March
• Return migration through UK waters	March-May (**migration BDMPS**)
• Migration-free breeding season	June
• Migration-free winter season	October-February

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for Sandwich tern:

Migration periods BDMPS (July-September, and March-May).

16.5 Movements of birds from the UK population

Sandwich terns breeding in the UK are mainly concentrated in a small number of colonies, with high concentrations in Norfolk, and Northumberland. Breeding adults may abandon colonies where habitat change, predation or flooding impact on productivity, and may move considerable distances to recruit into another colony, so European populations represent a large meta-population (Møller 1981). Birds begin to disperse from colonies in late June and many fledglings may cross the North Sea between continental and UK colonies in July-August (Wernham et al. 2002). Sandwich tern fledglings remain dependent on their parents for food for some weeks after fledging, so move as family parties rather than as independent individuals (Meissner and Krupa 2007). Birds move quite rapidly southwards to wintering areas from west Africa to southern Africa, so that very few remain in UK waters after September (Wernham et al. 2002), although there are small numbers seen as late as November on English coasts (Balmer et al. 2013).

16.6 Movements of birds from overseas into UK waters

Ring recoveries show movements of Sandwich terns from populations in Ireland, Denmark, Germany, The Netherlands and Belgium moving through UK waters. For example, birds caught at Teesmouth in late summer included individuals ringed in Belgium (2), Netherlands, Denmark (2) and Northern Ireland (3) as well as 75 ringed in the UK (Ward 2000). All but one of these ringed birds from the continent were juveniles, suggesting that young birds are most likely to cross the North Sea during autumn dispersal. There is also one recovery of a juvenile reared at a colony in North America (so of a different subspecies from the birds in Europe) recovered dead in SW England in November (Wernham et al. 2002). The North American subspecies normally winters in South America, so this ring recovery is highly atypical. Many juveniles remain dependent on their parents for some of their food during migration and during winter (Fernandez-Cordeiro and Costas 1991; Wernham et al. 2002). Most first year birds remain in the winter quarters through their first summer and second years mainly move only part way towards their natal area, summering off west Africa or southern Europe. Most three year olds and older birds migrate rapidly back to their breeding area in March-April, but some three year olds, and some older birds spend the summer in west Africa or southern Europe rather than breeding (Wernham et al. 2002). Birds may recruit into colonies hundreds of kilometres from where they were reared, so there is considerable interchange between colonies in UK, Ireland and countries on the east side of the North Sea (Wernham et al. 2002). Seabird 2000 estimated that about 12,490 pairs bred in the UK, 1,800 pairs in Ireland, 4,500 in Denmark, 9,700 in Germany, 14,500 in The Netherlands, and 1,550 in Belgium (Mitchell et al. 2004). With extensive dispersal between these populations and the large numbers on each side of the North Sea, it is likely that many of the Sandwich terns in UK waters in July-October originate from mainland European colonies (and some also from Ireland though numbers there are relatively small). Few breed in Norway or Sweden (in total about 300 to 400 pairs) and there are none in Faroe or Iceland, so numbers migrating through UK waters from further north will be very small. Meissner and Krupa (2007) reported that Sandwich terns caught in the southern Baltic during migration had longer wing lengths than birds caught in NE England on migration, indicating that different populations were involved in these two regions. It is likely that the numbers of birds crossing the North Sea during post-breeding dispersal will vary considerably from year to year, as terns will congregate, post-breeding, in areas where there are aggregations of prey fish; small pelagic fish such as sandeels, sprats and young herring (Stienen and Brenninkmeijer 1998, 2002). Productivity of these short-lived fish varies considerably from year to year, and so there may be some years when many UK birds move to Danish waters to feed on sprats, some years when many Dutch birds move to UK waters to feed on sandeels, and so on. As a result, the proportions of birds from different countries and the absolute numbers of birds in UK waters post-breeding and during migration may vary considerably from year to year. Although large numbers of Sandwich terns breed in France (about 7,000 pairs) and many birds are ringed in those colonies, they are not recovered in the UK and so appear not to pass through UK waters. The distribution of Sandwich tern colonies in France is predominantly in the Bay of Biscay, with few nesting in northern France (Hagemeijer and Blair 1997), so the lack of connectivity with the UK is understandable.

16.7 Numbers in UK waters

Forrester et al. (2007) suggest that about 500 to 1,500 birds are in Scottish waters during autumn migration, and about 100 to 1,000 birds during spring migration, and that there may be up to 5 birds in Scottish waters in winter. Numbers in English waters are uncertain, but likely involve all of the UK population (of about 12,500 pairs so 25,000 adults). Associated with that UK adult population will be about 15,700 immatures, but the youngest age class will predominantly remain in the winter quarters rather than return to UK waters, so perhaps about 8,000 to 9,000 of the immatures are likely to be in UK waters during the migration periods. In addition, even more uncertain numbers from overseas populations pass through

UK waters on passage. These are likely to include about 1,000 to 4,000 birds from Ireland passing mainly through SW English waters, and perhaps 1,000 to 20,000 birds from Norway to Belgium passing mainly through southern North Sea UK waters (as many of those birds will pass through southern North Sea continental rather than UK waters). Summing these suggests that about 44,000 birds may pass through UK waters during autumn migration, and perhaps similar or slightly smaller numbers in spring.

16.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the European population, comprising 132,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 69,000-79,000 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. The biogeographic population with connectivity to UK waters would be the sum of the populations listed in Figure 16.2, or a total of about 45,000 pairs. Populations in France (which are predominantly in the Bay of Biscay and western Mediterranean; Hagemeijer and Blair 1997) and Spain appear to have no connectivity with UK waters. The biogeographic population with connectivity to UK waters comprises 148,000 birds (adults and immatures) with 41,000 from UK and 107,000 from overseas. However, only a small proportion of the birds from the connected overseas populations occur within UK waters, so that the estimated total number of birds in UK waters during migration is 49,000 birds, with 35,300 from UK and 13,600 from overseas.

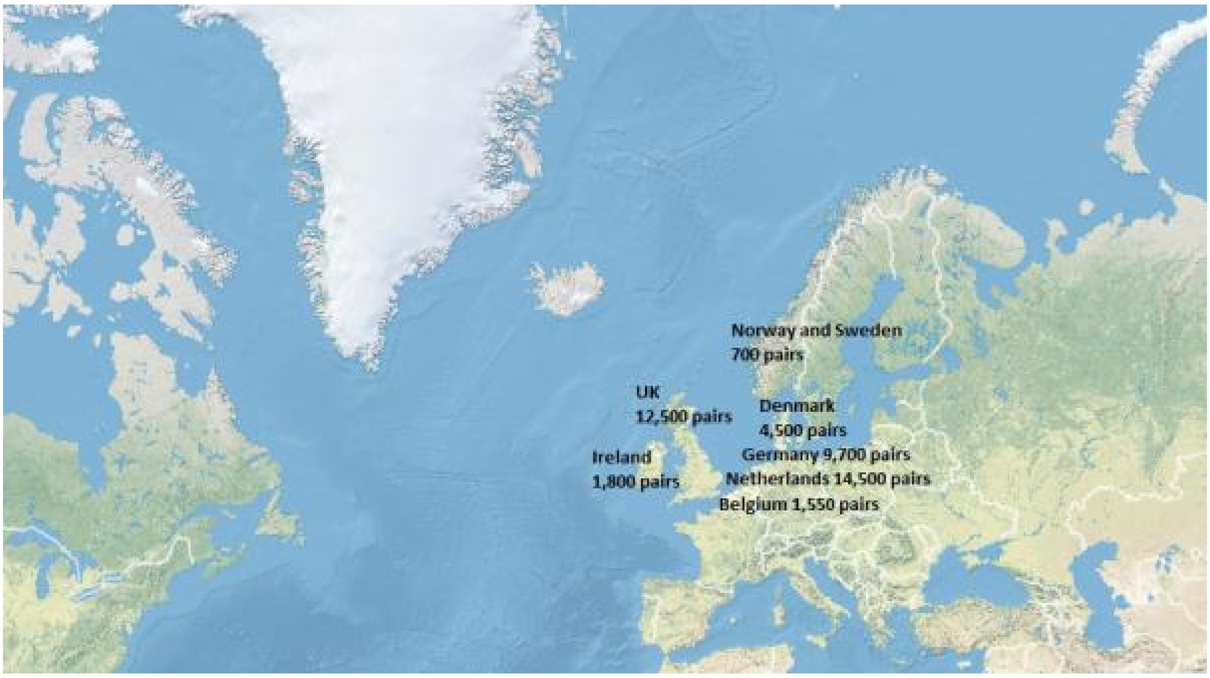

Figure 16.2. Breeding population origins of Sandwich terns in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

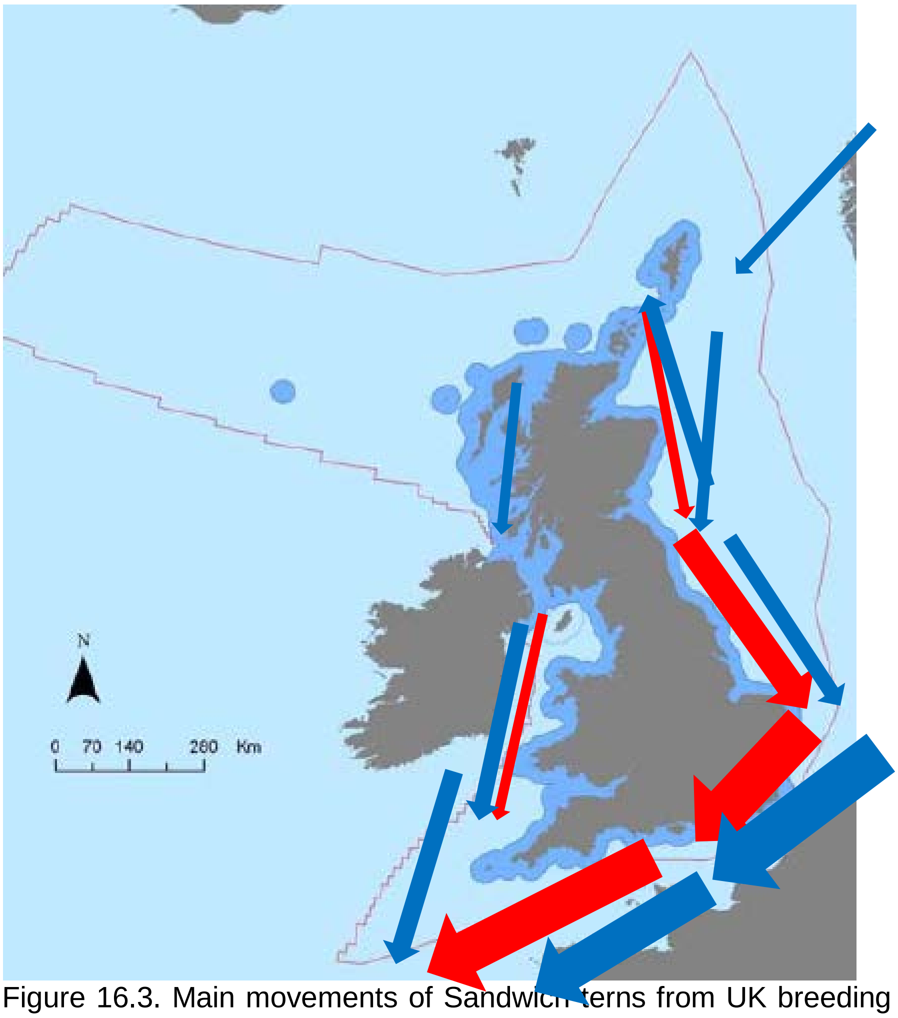

Figure 16.3. Main movements of Sandwich terns from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

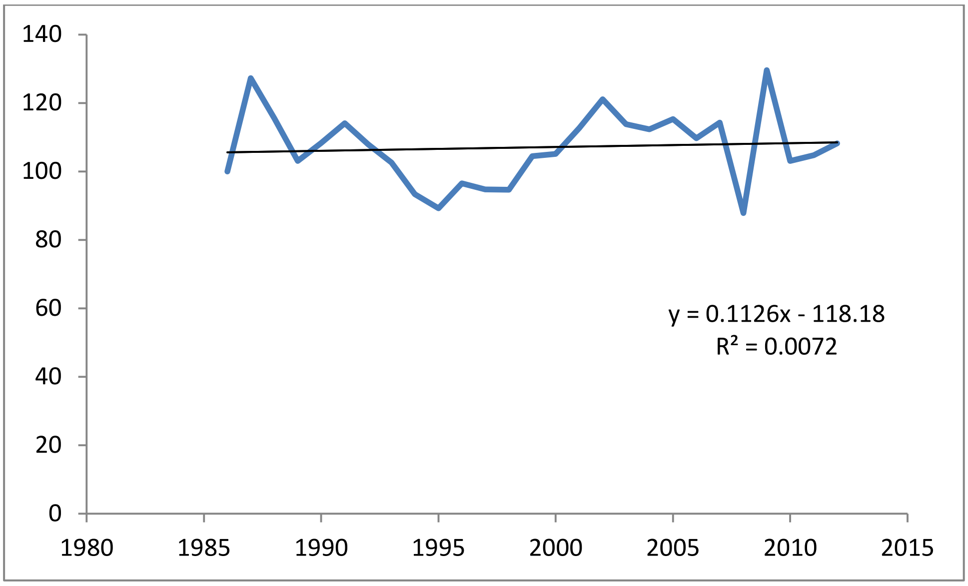

Figure 16.4. Trend in the Sandwich tern breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

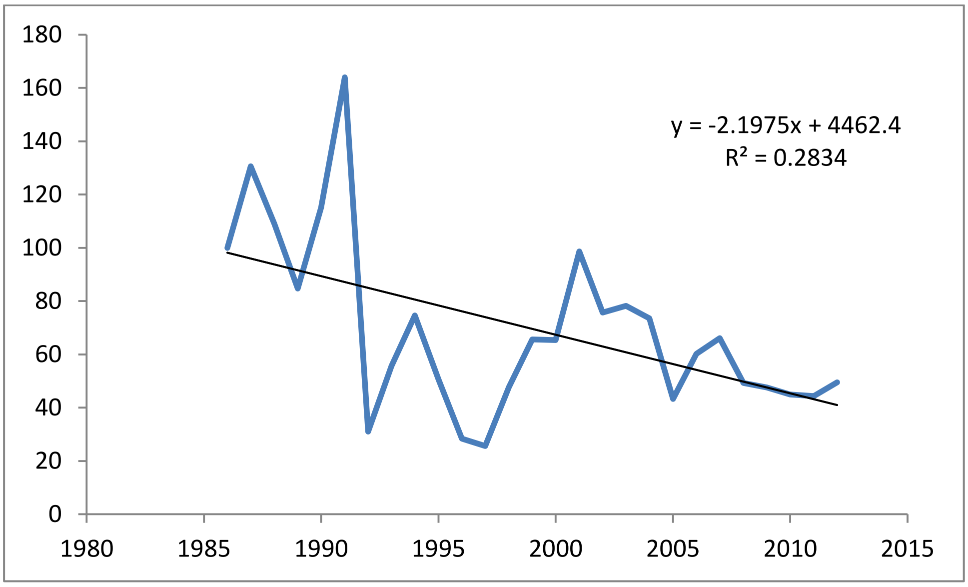

Figure 16.5. Trend in the Sandwich tern breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

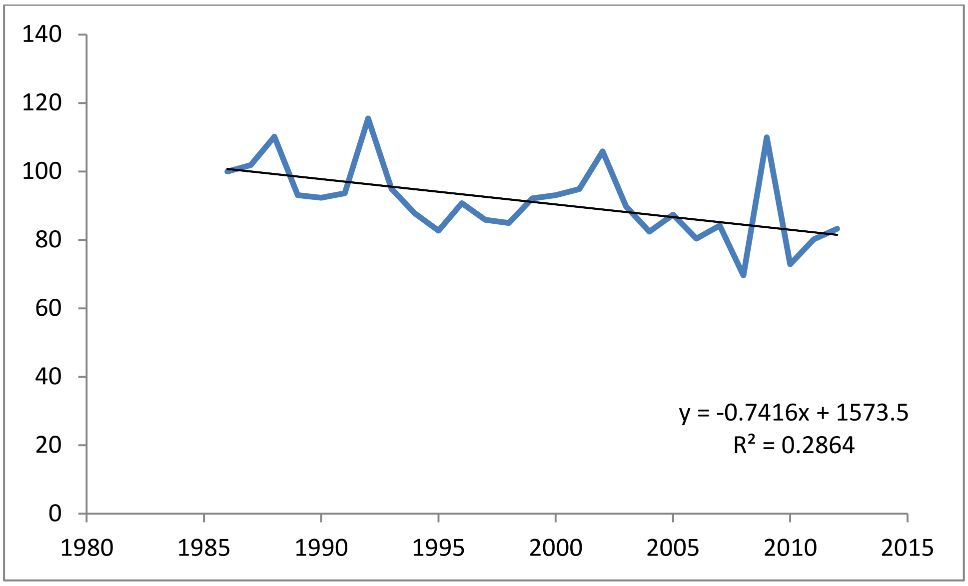

Figure 16.6. Trend in the Sandwich tern breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

16.9 Proportion of BDMPS from UK breeding SPAs

The 16 SPAs with breeding Sandwich terns as a feature together held 11,440 pairs at designation, estimated to represent ca. 72% of the British breeding population (Stroud et al. 2001). Based on census data from 2006-2011, Stroud et al. (2014) estimated that the population on GB SPAs for breeding Sandwich terns comprised 72%, suggesting no change overall in this statistic since SPA designations. This is despite the fact that several SPA populations have declined to zero (Table 16.1).

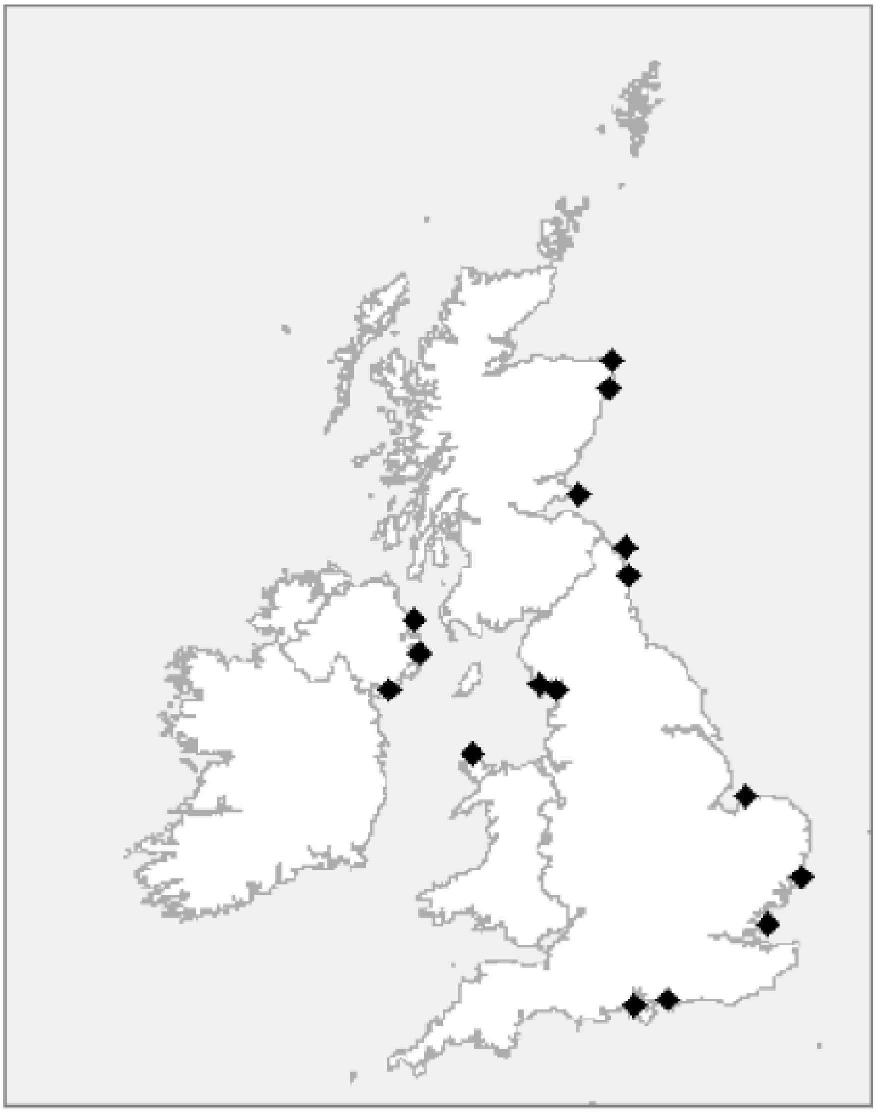

Figure 16.7. The UK SPA suite for breeding Sandwich terns. These SPA populations are listed in Table 16.1.

Table 16.1. The UK SPA suite for breeding Sandwich terns.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
UK North Sea & Channel							
Loch of Strathbeg	NE Scotland	530	1995	Declined 2004	0 0 0 0 0 0 0	2007 2008 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database SMP database SMP database
Ythan Estuary, Sands of Forvie	NE Scotland	600 (early 1990s)	1998	Maintained 2012	900 670 645 674 590 657 565	2007 2008 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database SMP database

Forth Islands	E Scotland	440 (1985) Or 22 (Stroud et al. 2001)	1990	Declined 2003	0 1 0 0 0 0	2007 2008 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database SMP database
Farne Islands	NE England	2,070 (1993- 1997)	1985		1,413 1,358 1,415 1,019 544 966 824	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Coquet Island	NE England	1,590 (1993- 1997)	1985		759 1,223 804 873 1,069 1,717 1,289 670	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
North Norfolk Coast	E England	3,700 (1992- 1996) Or 3,457 (Stroud et al. 2001)	1989		3,550 3,450 3,600 2,680 3,100 2,980 3,562 4,135	2005 2006 2007 2008 2009 2010 2011 2012	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Alde-Ore Estuary	E England	170 (1992- 1996) Or 169 (Stroud et al. 2001)	1996		2 3 0 0 0 2	2004 2005 2006 2007 2008 2009	SMP database SMP database SMP database SMP database SMP database SMP database
Foulness		320 (1992- 1996)	1996		0 0 0 0	2003 2004 2005 2006	SMP database SMP database SMP database SMP database
Chichester & Langstone Harb	S England	31 (1993- 1997) Or 158 (Stroud et al. 2001)	198 7		271 204 78 130 183 205 175 46 6	2005 2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Solent & Southampton Water	S England	231 (1993- 1997)	1998		275 268 210 226 0 140 0 0 0 215 0	1999 2000 2001 2002 2003 2004 2005 2006 2007 2007 2008	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database Stroud et al. 2014 SMP database

UK Western waters							
Carlingford Lough	N Ireland	575 (1993-1997)	1998		1,125 826 363 170 0 78 0	2005 2006 2007 2008 2009 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Larne Lough	N Ireland	165 Stroud et al. 2001)	1997		788 465 695 545 373 449 324 433 257	2005 2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Strangford Lough	N Ireland	593 (1993-1997)	1998		1,092 1,385 1,594 1,398 1,994 1,203 978 771	2005 2006 2007 2008 2009 2010 2011 2012	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Morecambe Bay	NW England	422 (1992-1996) Or 290 (Stroud et al. 2001)	1996		0 0 0 0 0 1	2002 2003 2004 2005 2006 2011	SMP database SMP database SMP database SMP database SMP database SMP database
Duddon Estuary	Cumbria	210 (1988-1992)	1998		300 300 280 400 400 10 0 1	2005 2006 2007 2008 2009 2010 2011 2012	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Ynys Feurig, Cemlyn Bay	Wales	460 (1993-1997)	1992		0 0 1 0 0 0	2004 2005 2006 2007 2008 2009	SMP database SMP database SMP database SMP database SMP database SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

16.10 BDMPS

The UK waters can be divided into two distinct spatial BDMPS for Sandwich tern, the UK North Sea and Channel, and the UK western waters. These areas are appropriate for passage periods, including both autumn and spring. The UK North Sea and Channel BDMPS holds the bulk of the overseas migrants passing through UK waters and the bulk of the UK breeding population. About 38,000 birds may occur in this BDMPS in autumn and spring, with about 28,000 of those being from the UK population. The UK western waters

BDMPS holds smaller numbers of birds, with about 11,000 in total and 7,300 of these from the UK and 3,500 from overseas.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 51 and 52.

Based on evidence reviewed in sections 16.5, 16.6 and 16.7, the UK North Sea and Channel migration seasons BDMPS holds 100% of adults and 70% of immatures from UK North Sea colonies, none from UK western waters colonies, and 10% of adults and immatures from Norway, Sweden, Denmark, Germany, The Netherlands, and Belgium, but none from Ireland. This gives a BDMPS total of 38,051 birds, 27,961 from UK and 10,090 from overseas.

Based on evidence reviewed in sections 16.5, 16.6 and 16.7, the UK western waters migration seasons BDMPS holds 0% of adults and immatures from UK North Sea colonies, 100% of adults and 70% of immatures from UK western waters colonies, 5% of adults and immatures from Norway and Sweden, 3% of adults and immatures from Denmark, 2% of adults and immatures from Germany, 1% of adults and immatures from The Netherlands and Belgium, 30% of adults and immatures from Ireland. This gives a BDMPS total of 10,761 birds, 7,291 from UK and 3,470 from overseas.

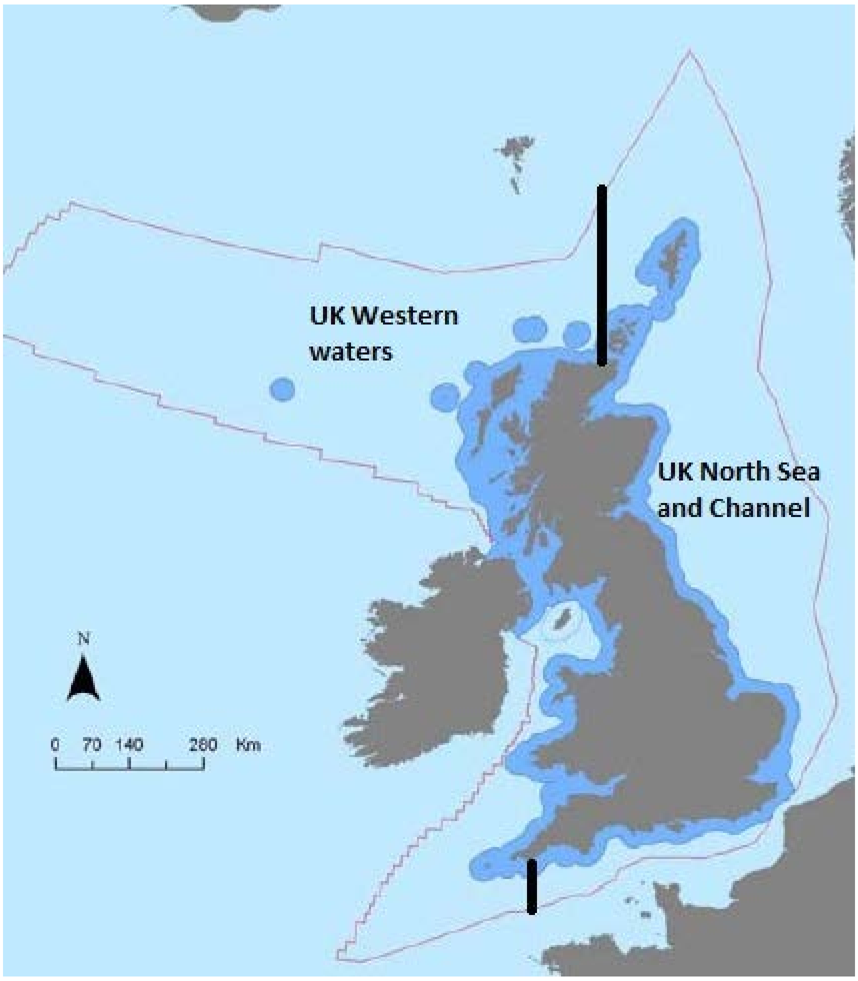

Figure 16.8. Two defined BDMPS spatial areas for Sandwich tern: 'UK North Sea waters and Channel' and 'UK Western waters'.

16.11 Proportions of UK SPA birds in BDMPS

The proportion of birds in each BDMPS that are adults from UK SPA populations can be estimated directly from Appendix A Tables 51 and 52. For example, the UK North Sea and Channel migration season BDMPS comprises 38,051 birds in total, of which 12,404 are adults from UK SPA populations, giving an estimate of 33% being adults from UK SPAs.

16.12 Spatial distribution of UK breeding SPA birds across the BDMPS

During migration periods, UK SPA birds will be fairly well mixed throughout the BDMPS area. In UK western waters the very high concentration of most SPA birds in a single SPA may result in some local aggregation of SPA birds around North Wales. However, dispersal of birds in autumn can be quite rapid so that aggregations of UK SPA birds are likely to disappear as migration proceeds.

17. ROSEATE TERN *Sterna dougallii*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (August-September and late April-May) (adults and immatures)
Overseas	2,600	2,111
UK	300	244
Total	2,900	2,355

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (August-September and late April-May)			
East coast and Channel	251	7	244
North and west Scotland	4	4	0
West England & Wales	2,100	2,100	0

Although scarce, roseate tern is intensively monitored in the UK and Ireland. Colony locations are regularly checked, and breeding numbers are counted annually at most colonies. Migrations of roseate terns through UK waters have not been studied in detail, but it is certain that birds from UK colonies pass through UK waters on migration (apart from very young immatures that remain in the winter quarters throughout their first summer). It is almost certain that Irish roseate terns migrate through western UK waters, since they would have difficulty getting from Ireland to west Africa without passing through the SW Approaches. There is unlikely to be significant interchange between birds from western waters and the North Sea, as roseate terns are not seen migrating overland in the way that common terns often do. The main uncertainty is what proportion of immature roseate terns from the Irish population migrate through UK waters, and for that reason the numbers of overseas roseate terns in the West England & Wales BDMPS are coded amber, while other component numbers are coded green.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 53 to 55.

17.1 Breeding range and taxa

Roseate tern is a cosmopolitan species, breeding in tropical, sub-tropical and temperate regions around the world. There are five subspecies, but only nominate *dougallii* occurs in

British waters. The species is so scarce in the UK that useful biometrics are unlikely to be available.

17.2 Non-breeding component of the population

Roseate terns start to breed when 2 years old (BTO Birdfacts). Adult survival rate is 0.855 (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is 1.293 chicks per pair (JNCC database, n=88 measurements). To obtain a stable population, productivity was adjusted to 1 chick per pair as the reported productivity seems out of line with other data on productivity of terns and may be biased by coming predominantly from highly protected colonies, survival of immatures was adjusted to 0.5 for juveniles, and 0.6 for 1-year olds. The model population comprised 57% adults, 29% juveniles and 14% older immatures. There are 0.75 immatures per adult.

17.3 Phenology

Breeding colonies in the UK are deserted by late August, with modal departure in August (Pennington et al. 2004; Forrester et al. 2007). Autumn migration starts in July (Wernham et al. 2002; Forrester et al. 2007) or late-August (Cramp et al. 1977-94). Peak autumn migration occurs in August (Forrester et al. 2007), August-September (Wernham et al. 2002), or September (Cramp et al. 1977-94). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in August, with very few after early September (Figure 17.1). Autumn migration is completed by early October (Forrester et al. 2007) mid-October (Cramp et al. 1977-94) or October (Wernham et al. 2002).

Spring migration starts in late March from southern hemisphere wintering areas (Cramp et al. 1977-94), late April (Forrester et al. 2007) or early May (Wernham et al. 2002) in UK waters. Peak spring migration occurs in May (Cramp et al. 1977-94; Wernham et al. 2002; Brown and Grice 2005; Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in mid- to late-May (Figure 17.1). Spring migration is completed by early June (Cramp et al. 1977-94; Wernham et al. 2002) or June (Forrester et al. 2007). Birds re-occupy colonies from early May, with modal return in mid- to late-May (Forrester et al. 2007). It is interesting to note that numbers seen on spring migration are very much smaller than numbers seen on autumn migration (Figure 17.1). This pattern is typical of most seabird species but is very pronounced for roseate tern. The reasons for this are not understood. The fact that spring migration occurs more rapidly than autumn migration may be a major factor. Possibly the fact that autumn migration includes juvenile birds may also be a factor (since the inexperienced juveniles may be particularly evident passing coastal migration watch points in autumn as they might perhaps migrate closer to shore than most adults do).

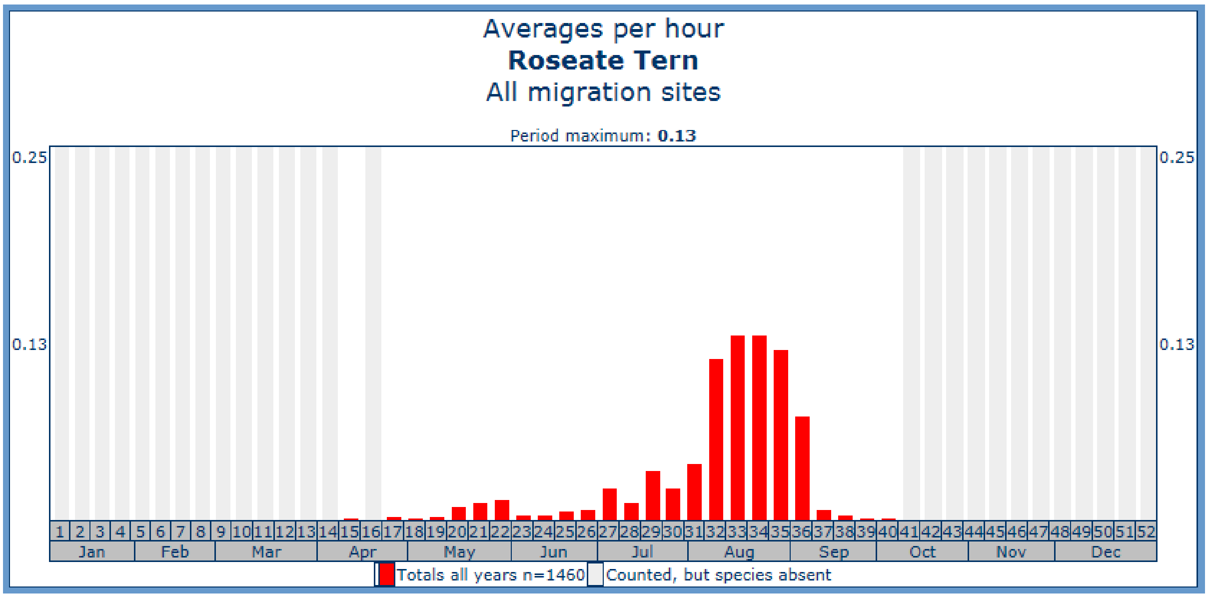

Figure 17.1. Average numbers of roseate terns counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season birds predominantly absent from UK waters. From the data reviewed above, an appropriate definition would be breeding season May-August, non-breeding season September-April.

17.4 Defined seasons:

• UK Breeding season	May-August
• Post-breeding migration in UK waters	August-September (**migration BDMPS**)
• non-breeding season	September-April
• Return migration through UK waters late	April-May (**migration BDMPS**)
• Migration-free breeding season	June-July
• Migration-free winter season	October-March

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for roseate tern:

Migration periods BDMPS (August-September, and late April-May).

17.5 Movements of birds from the UK population

Roseate terns at UK colonies fledge chicks in July, and pre-migratory dispersal occurs in August (Wernham et al. 2002). At this time, birds tend to congregate where there is suitable food, and chicks remain dependent on their parents for feeding (Wernham et al. 2002). Autumn migration to wintering areas off west Africa occurs mainly during August-October, although some birds (presumably failed breeders or nonbreeders) arrive on the wintering grounds by July (Wernham et al. 2002). Almost all juveniles remain on the wintering grounds through their first summer, although very small numbers return to visit breeding colonies briefly in July. Many, but not all, 2nd year birds return to breeding areas in late June and July to prospect for nest sites. Older birds leave west Africa in March-April and return to colonies in May (Wernham et al. 2002).

17.6 Movements of birds from overseas into UK waters

No roseate terns ringed at colonies outside the British Isles have been recovered within UK waters (Wernham et al. 2002). However, although there is a preference for returning to the natal colony, chicks are likely to recruit into any colony in NW Europe, so this population clearly represents a meta-population with extensive gene flow. In contrast, chicks from NW Europe have hardly ever been seen in colonies in the Azores (where there are between 1,000 and 1,500 pairs) or North America (where there are around 4,000 pairs), suggesting that those populations are somewhat distinct. Seabird 2000 recorded about 56 pairs breeding in the UK, 734 in Ireland, 80 in France, and 1-3 pairs in Germany, Netherlands and Belgium (Mitchell et al. 2004). Based on the much larger numbers breeding in Ireland than in the UK, it seems likely that a very high proportion of the roseate terns seen in UK waters to the west of the UK in spring or autumn will be Irish birds (Brown and Grice 2005). Most UK roseate terns breed on the coast of Northumberland (colonies in the Firth of Forth which used to be a stronghold have declined to just one or two pairs since 2000). A high proportion of roseate terns in North Sea UK waters are likely to be from UK colonies as there is no evidence to suggest that Irish (or French) roseate terns pass through the North Sea.

17.7 Numbers in UK waters

Numbers in UK waters are very low, and so are very difficult to assess with any confidence. Forrester et al. (2007) suggest that between 5 and 20 birds migrate through Scottish waters. The relatively large population breeding in Ireland (750 pairs plus some of the associated immatures) almost certainly passes though SW English waters during autumn and spring migrations.

17.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the European population, comprising 1,770 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 1,900-2,400 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. The biogeographic population with possible connectivity to UK waters comprises 84 pairs in the UK, 750 pairs in Ireland, and 3 pairs in Germany to Belgium (Figure 17.2). This equates to 2,900 birds in total, with 300 from UK and 2,600 from overseas. A high proportion of this biogeographic population with connectivity does pass through UK waters on migration. Estimated numbers in UK waters during migration are 2,340 birds in total, with 240 from UK and 2,100 from overseas (the total from UK in UK waters is less than the biogeographic total in the UK population because some first year birds remain in winter quarters so do not enter UK waters at that stage of their life).

Figure 17.2. Breeding population origins of roseate terns in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

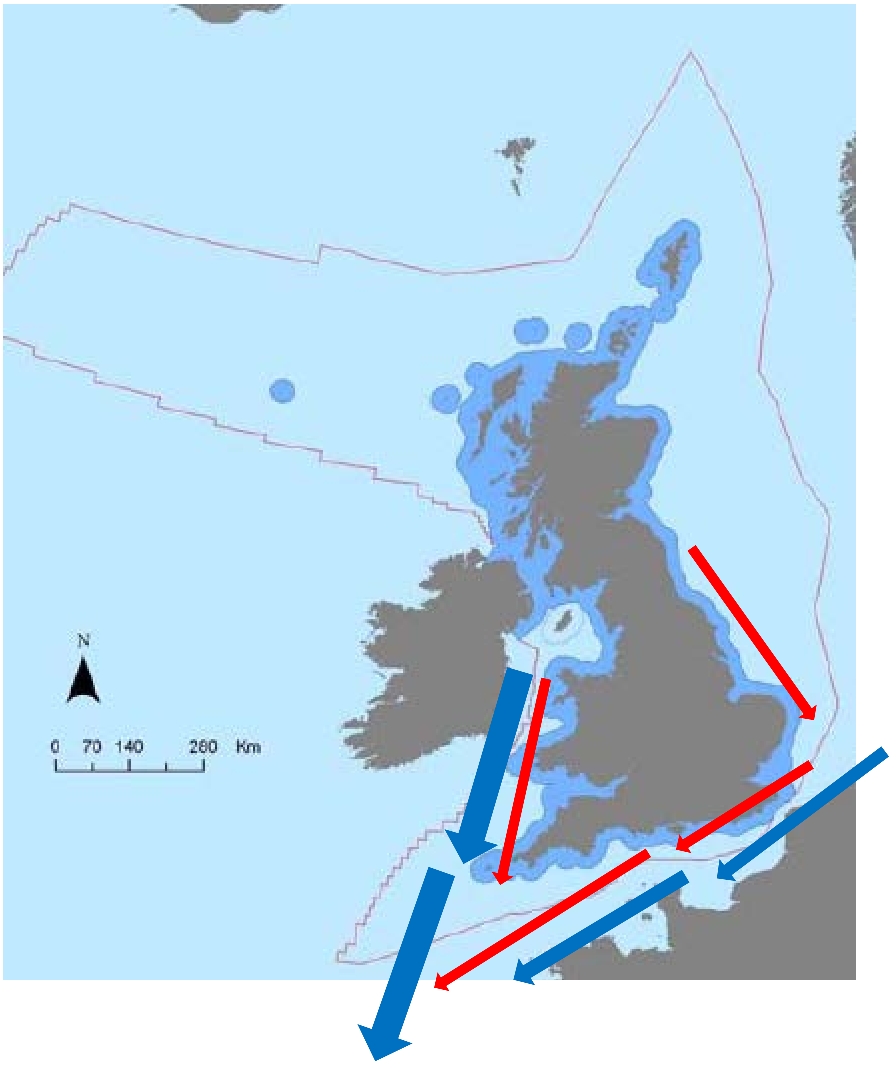

Figure 17.3. Main movements of roseate terns from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

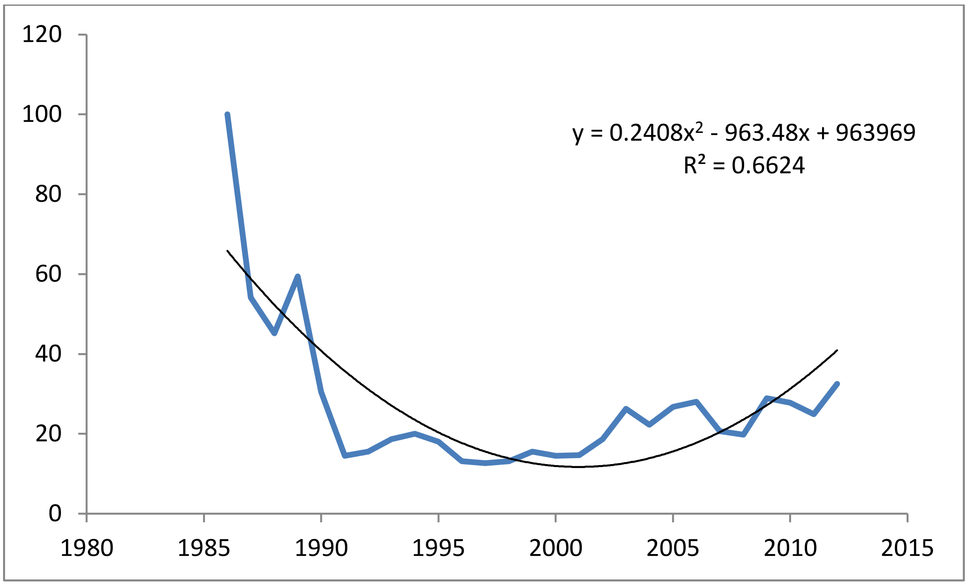

Figure 17.4. Trend in the roseate tern breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

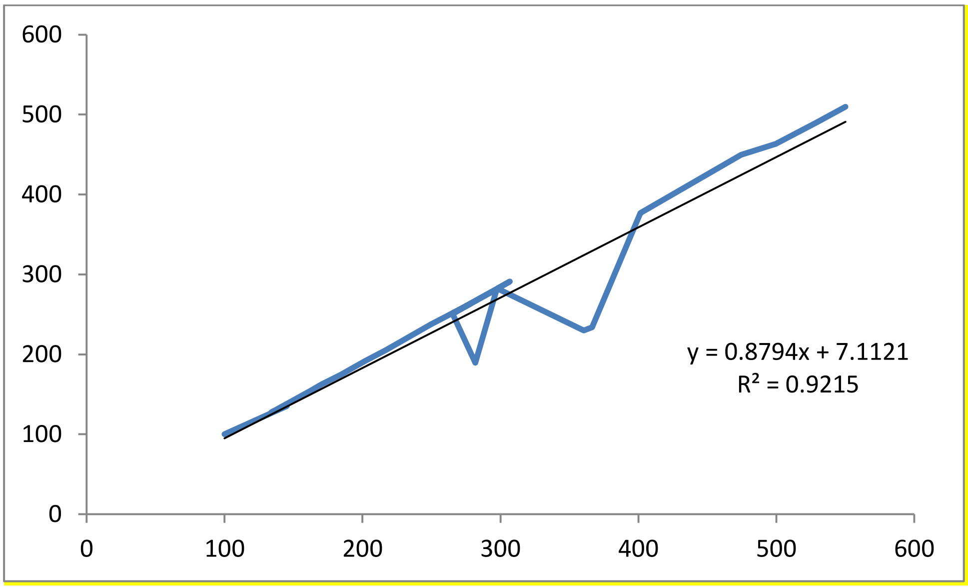

Figure 17.5. Trend in the roseate tern breeding population index in all-Ireland from 1986-2012. Data from JNCC seabird population monitoring database.

17.9 Proportion of UK population from UK breeding SPAs

The 7 SPAs with breeding roseate terns as a feature together held 56 pairs at designation, estimated to represent ca. 88% of the British breeding population and 1.4% of the all-Ireland breeding population (Stroud et al. 2001). Stroud et al. (2014) estimate that the UK SPA populations counted in 2005-2011 represented 94% of the GB population.

Figure 17.6. SPA suite for roseate tern. These SPA populations are listed in Table 17.1.

Table 17.1. The UK SPA suite for breeding roseate terns.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count**	**Year**	**Reference**
East coast and Channel							
Forth Islands	E Scotland	8 (1997-2001) Or 9 (Stroud et al. 2001)	1990 (and 2004)	Declined 2009	3	2005-2009	Stroud et al. 2014
Farne Islands	NE England	3 (Stroud et al. 2001)	1985		0	2011	Stroud et al. 2014
Coquet Island	NE England	31 (1993-1997)	1985		78	2011	Stroud et al. 2014
North Norfolk Coast	E England	2 (Stroud et al. 2001)	1989		0	2010	Stroud et al. 2014

Solent & Southampton Water	S England	2 (1993-1997)	1998		0	2009	Stroud et al. 2014
West England & Wales							
Larne Lough	N Ireland	6 (1993-1997)	1997		0	2011	Stroud et al. 2014
Ynys Feurig, Cemlyn Bay	Wales	3 (1992-1996)	1992		0	2011	SCM database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

17.10 BDMPS

UK waters can be divided into three BDMPS based on strong differences in origins and numbers of birds present in the three areas during migration seasons. 'North and West Scotland' holds no breeding birds and has a BDMPS of about 4 birds, which are most likely to be immatures from the Irish population. 'East Coast and Channel' holds a breeding population of about 82-84 pairs, of which 81 are in SPAs. The BDMPS comprises these 82-84 pairs plus associated immatures, plus about 7 birds from the population in Germany to Belgium that may pass through UK waters. In total this BDMPS probably includes 251 birds. The 'West England and Wales' BDMPS holds no UK breeding birds, but will see migration of many birds from the population in Ireland. Possibly some 2,100 roseate terns migrate to and from the east coast of Ireland through the West of England and Wales marine area. So the BDMPS for this area is 2,100 birds, all from outwith the UK population.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 53 to 55.

Based on evidence reviewed in sections 17.5, 17.6 and 17.7, the East coast and Channel migration seasons BDMPS holds 100% of adults and 60% of immatures from UK North Sea colonies but no birds from other parts of the UK, 5% of adults and 10% of immatures from Germany, The Netherlands and Belgium, and 0.2% of adults and 0.3% of immatures from Ireland (Appendix A Table 53). These proportions result in a BDMPS population total of 251 birds, 244 from UK and 7 from overseas.

Based on evidence reviewed in sections 17.5, 17.6 and 17.7, the North and West Scottish waters migration seasons BDMPS holds no birds from UK colonies, but 0.1% of immatures from Germany, The Netherlands and Belgium, and 0.05% of adults and 0.3% of immatures from Ireland (Appendix A Table 54). This gives an estimated BDMPS of 4 birds, all from overseas populations.

Based on evidence reviewed in sections 17.5, 17.6 and 17.7, the West England and Wales migration seasons BDMPS holds no birds from UK North Sea colonies, 100% of adults and 60% of immatures from UK west coast colonies, 0.01% of immatures from Germany, The Netherlands and Belgium, 95% of adults and 60% of immatures from Ireland (Appendix A Table 55). This gives an estimated BDMPS of 2,100 birds, none from UK colonies but 2,100 from overseas colonies.

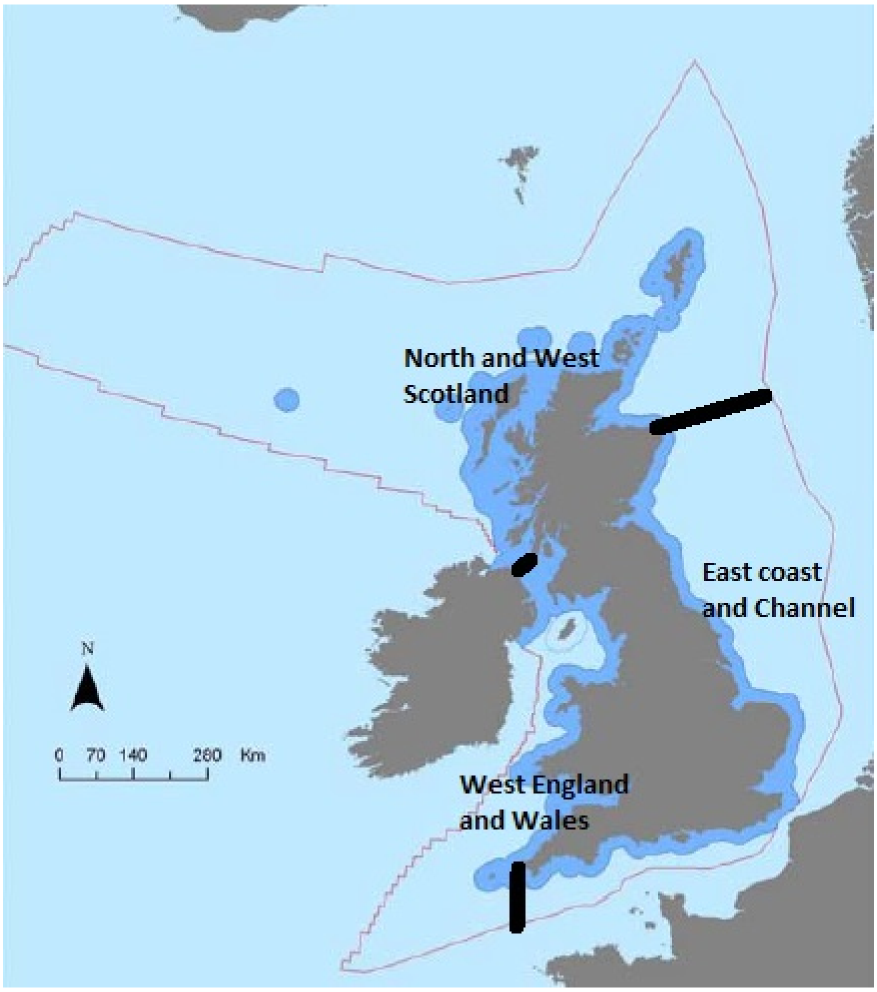

Figure 17.7. Three defined BDMPS spatial areas for roseate tern: ‘East coast and Channel’, ‘North and West Scotland’ and ‘West England and Wales’.

17.11 Proportions of UK SPA birds in BDMPS

In North and West Scotland BDMPS there are probably no UK SPA birds. In East Coast and Channel BDMPS UK birds are likely to form 97% of the population, with 94% of those 97% being UK SPA birds, so that UK SPA birds represent 91% of the population. In West England and Wales BDMPS UK birds are likely to form 0% of the population. The proportion of birds in each BDMPS that are adults from UK SPA populations can be estimated directly from Appendix A Tables 53 to 55. For example, the East coast and Channel migration season BDMPS comprises 251 birds in total, of which 168 are adults from UK SPA populations, giving an estimate of 67% being adults from UK SPAs.

17.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Since the UK SPA birds either form 0% or a high percentage of the BDMPS, the spatial distribution within regions is likely to be consistent; high in East coast and Channel BDMPS and zero in North and West Scotland BDMPS and in West England and Wales BDMPS.

18. COMMON TERN *Sterna hirundo*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (late July to early September, and April-May) (adults and immatures)
Overseas	440,000	174,416
UK	40,000	35,154
Total	480,000	209,570

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (late July to early September and April-May)			
UK North Sea and Channel	144,911	125,969	18,942
UK Western waters	64,659	48,447	16,212

Common tern numbers in most UK SPA colonies are monitored frequently. However, numbers in UK colonies that are not SPA populations are less well monitored, and do represent a substantial proportion of the UK total. Common tern migrations have not been studied by geolocator deployment, and ringing recoveries from the migration period in UK waters are very limited. So understanding of details of common tern movements is relatively poor, especially to the extent that birds from overseas populations are concerned. While ring recoveries show that many birds from overseas pass through UK waters, the proportions of those populations doing so are very uncertain since ring recovery data are subject to considerable potential bias. Furthermore, these overseas populations are large, and certainly represent a high proportion of the total of common terns in UK waters during the migration season. There is yet another complication, which is that common terns rather frequently will migrate overland, and there is known to be considerable movement from North Sea estuaries over to western waters in autumn, and overland from southern England in spring. Therefore, estimated numbers of birds in the BDMPS are classed as red for the total population and numbers from overseas, whereas numbers from the UK population are classed amber.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 56 and 57.

18.1 Breeding range and taxa

Common tern has a Holarctic breeding range, predominantly in temperate latitudes. There are four subspecies, but only nominate *hirundo* occurs in British waters. Subspecies *hirundo* breeds in North America, northern South America, the Atlantic Islands, most of Europe, north and west Africa, and through the Middle East to central Russia. Despite this large range, there appears to have been no assessment of whether biometrics would allow origins of individuals to be identified (Ward 2000). However, timing of primary moult varies between populations and can help to infer origins of birds caught on autumn migration (Ward 2000).

18.2 Non-breeding component of the population

Common terns start to breed when 3 years old (BTO Birdfacts). Adult survival rate is 0.9 (BTO Birdfacts), juvenile survival 0.47 up to 2 years old (BTO Birdfacts) and mean productivity is 0.721 chicks per pair (JNCC database, n=246 measurements). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.7 for 1-year olds, and 0.8 for 2-year olds. The model population comprised 60% adults, 22% juveniles and 18% older immatures. There are 0.67 immatures per adult.

18.3 Phenology

Breeding colonies in the UK are deserted by late August, with modal departure in early August (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in early July (Pennington et al. 2004), mid-July (Cramp et al. 1977-94) or July (Wernham et al. 2002; Forrester et al. 2007). Peak autumn migration occurs in early August in Shetland (Pennington et al. 2004), in August (Forrester et al. 2007), August-September in UK waters in general (Wernham et al. 2002) and in Belgium (Vanermen et al. 2013). Peak migration through southern Europe and past west Africa continues through October (Cramp et al. 1977-94). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in August, with numbers declining rapidly in early September (Figure 18.1). Autumn migration is completed in Shetland by early September (Pennington et al. 2004), in UK waters by early October (Brown and Grice 2005; Forrester et al. 2007) or October (Wernham et al. 2002).

Spring migration starts in mid-March in the wintering areas of the southern hemisphere (Cramp et al. 1977-94), but starts in UK waters in early April (Wernham et al. 2002) or mid- to late-April in Shetland and Scotland (Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in early to mid-April in English waters (Brown and Grice 2005), April (Cramp et al. 1977-94), in April-May in Belgium (Vanermen et al. 2013), in April-May in UK waters (Wernham et al. 2002) and in early May in Shetland (Pennington et al. 2004). Forrester et al. (2007) suggests peak spring migration occurs in June, which seems rather late. Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late April and early May (Figure 18.1). Spring migration is completed by late May (Pennington et al. 2004), early June (Cramp et al. 1977-94), June (Wernham et al. 2002) or late June (Forrester et al. 2007). It is interesting to note that numbers seen on spring migration are very much smaller than numbers seen on autumn migration (Figure 18.1). This pattern is typical of most seabird species but is very pronounced for common tern. The reasons for this are not understood but seem to be due to behaviour of birds rather than to differences in numbers present. The fact that spring migration occurs more rapidly than autumn migration may be a major factor; if birds spend ten times longer on autumn migration through UK waters than on spring migration through UK waters it would be reasonable to expect counts at Trektellen sites to be ten times higher in autumn than in spring even if numbers of birds involved were the same. Possibly the fact that autumn migration includes juvenile birds may also be a factor (since the inexperienced juveniles may be particularly evident passing coastal migration watch points in autumn as they might perhaps migrate closer to shore than most adults do).

The first spring records of common tern in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 10 April to 20 May, but mostly in late April, and the last records were from 24 August to 30 October, but mostly in late September. Peak autumn migration was reported in July-August in most years, and peak spring migration was reported in May (and usually in early May) in most years. Birds re-occupy colonies from late April, with modal return in mid- to late-May (Pennington et al. 2004; Forrester et al. 2007).

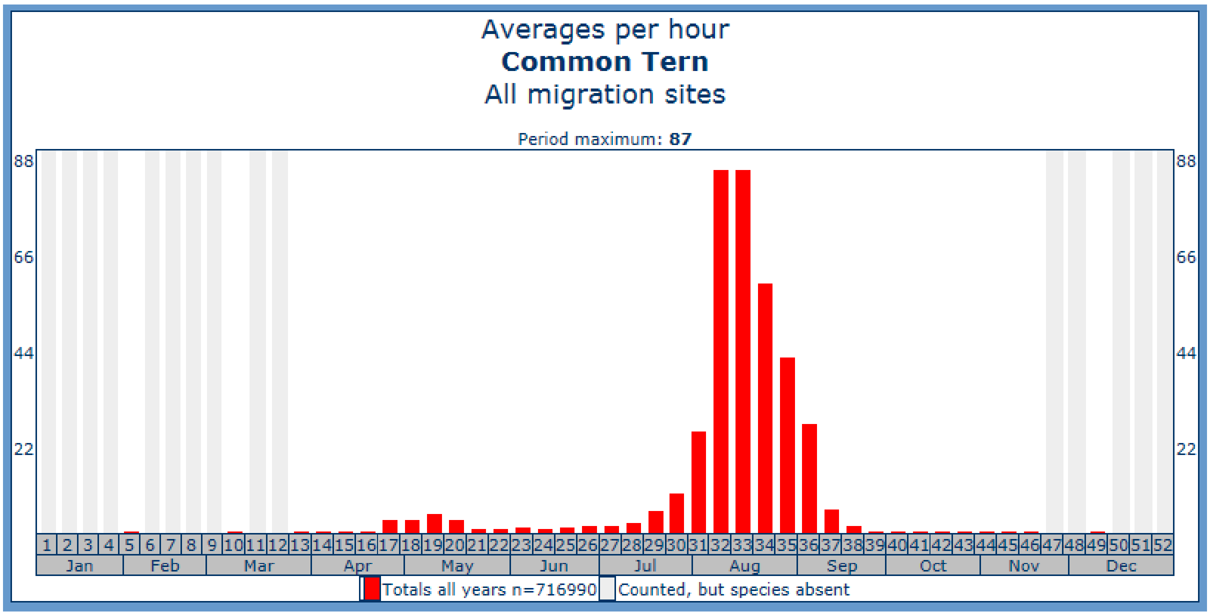

Figure 18.1. Average numbers of common terns counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-September, non-breeding season birds predominantly absent from UK waters. However, from the data reviewed above, a more appropriate definition would be breeding season May-August, non-breeding season September-April.

18.4 Defined seasons:

- UK Breeding season — May-August
- Post-breeding migration in UK waters — late July-early September (**migration BDMPS**)
- non-breeding season — September-April
- Return migration through UK waters — April-May (**migration BDMPS**)
- Migration-free breeding season — June-mid-July
- Migration-free winter season — October-March

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for common tern:

Migration periods BDMPS (late July-early September, and April-May).

18.5 Movements of birds from the UK population

Post-fledging dispersal from UK (and continental) colonies begins in July, but continues as late as October (Wernham et al. 2002). Post-fledging dispersal may be northwards rather than southwards, and may involve birds crossing the North Sea. For example, a fledgling ringed in Belgium was recovered in Durham together with fledglings from colonies in Norfolk in late August/early September (Wernham et al. 2002). As with many other tern species, fledglings tend to congregate in areas where feeding is easy (especially in estuaries and large bays where there are presumably aggregations of sprats or sandeels), and may remain dependent on their parents for food for some time after fledging (Johnasson and Jakobsson 1997; Newton 2010), although they become independent of parents more quickly than Sandwich tern fledglings (Meissner and Krupa 2007). Some birds travel quickly to Africa, arriving in west Africa by August, while others remain in UK waters into September. During September and October, a strong southward migration occurs out of UK waters and along the coast of SW Europe to west Africa, with juveniles often still being fed by their parents. Migration follows the coastline (Wernham 2002). British birds appear to move south somewhat earlier than those from Norway, with those from Baltic colonies later still (Ward 2000).

18.6 Movements of birds from overseas into UK waters

Birds from many northern European countries pass through UK waters during post-fledging dispersal and autumn migration. Some birds move overland rather than following coasts, recognised routes being between the Firth of Forth and Clyde (Forrester et al. 2007) and between Teesmouth and Merseyside (Ward 2000). Ward (2000) reported peak numbers of common terns at Teesmouth in mid-August, with ringed fledglings from Lithuania (2), Finland (6), Sweden (2), Norway (9), and Netherlands (2) as well as 32 ringed as chicks at UK colonies. Based on moult scores, Ward (2000) inferred that a substantial minority of the adult common terns at Teesmouth in August were from the Baltic population, but the analysis was unable to estimate an accurate proportion because differences in timing of moult of UK and Baltic breeders are not well enough known. Wernham et al. (2002) report 101 ring recoveries to or from countries to the north and east, with 23 involving Belgium and the Netherlands, 14 involving Germany, Poland and the Baltic States, and 64 involving Fennoscandia. In contrast, there is no evidence from ringing of any movement of common terns from southern or eastern populations through UK waters. Common terns from North America are extremely rare visitors to Europe, and there are no records of American common terns reaching UK (Wernham et al. 2002).

Many adults return to breeding areas in the UK by April, and it is thought that spring migration is rapid and often occurs overland rather than tracking coasts (Wernham et al. 2002) At Dungeness and Portland Bill, spring passage of common terns peaks in late April and early May, and since movement is primarily eastwards at those sites and occurs at a time when many UK birds are already back at their colonies, probably involves birds returning to colonies in Fennoscandia or the Baltic States rather than to UK colonies (Wernham et al. 2002). However, migration timing may alter with climate change and oceanographic system oscillations (Favero et al. 2006). Although most first year birds remain in the wintering areas during the summer, most two year olds return to colonies, though they arrive from late May to late June. Three year olds often recruit into their natal colony, but substantial numbers may recruit elsewhere, with occasional movements to colonies in another country. In contrast, breeding adults are highly philopatric, usually returning to the same nest site in successive years, although there are a few cases of breeding dispersal to colonies across the North Sea (Wernham et al. 2002).

Based on data for Seabird 2000 (Mitchell et al. 2004), the UK breeding population (11,838 pairs) is small compared to some of the populations that may at least in part migrate through UK waters which total about 140,000 pairs (Finland 50,000, Sweden 22,000, Netherlands 19,000, Norway 15,000, Baltic States 12,750, Germany 9,000, Poland 6,000, Ireland 2,700, Belgium 2,250, Denmark 1,000). So it is likely that in August-October and in April-May, a substantial proportion of common terns in UK waters originate from these foreign populations. Meissner and Krupa (2007) reported that common terns caught in the southern Baltic during migration had longer wing lengths than birds from British breeding sites or birds caught in NE England on migration, indicating that different populations were involved in these two regions.

18.7 Numbers in UK waters

Numbers of migrating terns are difficult to assess. Forrester et al. (2007) suggest that between 2,000 and 20,000 are in Scottish waters during migration periods. However, migration through English waters will almost certainly include all of the UK breeding population (24,000 adults) plus some of the associated immatures (perhaps 8,000). It is also certain that large numbers of birds from continental Europe pass through UK waters, involving many tens of thousands of birds.

18.8 Biogeographic population and relevant smaller units (BDMPS)

Stroud et al. (2001) defined the biogeographic breeding population as that of the European population, comprising 195,105 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 220,000-340,000 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. The biogeographic population with possible connectivity to UK waters (Figure 18) includes the 12,000 breeding pairs in the UK plus associated immatures (of the immature population of about 16,000 birds about half are likely to remain in the wintering area so will not pass through UK waters during migration periods). However, overseas populations with possible connectivity to UK waters sum to over 130,000 pairs plus associated immatures. This gives an estimated biogeographic population with connectivity to UK waters of 480,000 birds (adults and immatures), of which 40,000 are from the UK and 440,000 from overseas populations. So birds in UK waters during migration may include very large numbers from overseas. Unfortunately it is very uncertain how many of those overseas birds move through UK waters. The best available data suggest that there bare about 209,000 common terns (adults and immatures) in UK waters during migration, with 35,000 of these being from the UK population and 174,000 from overseas populations. Not all birds from the UK population are in UK waters during migration because many young immature birds remain in the winter quarters through their first summer.

Figure 18.2. Breeding population origins of common terns in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

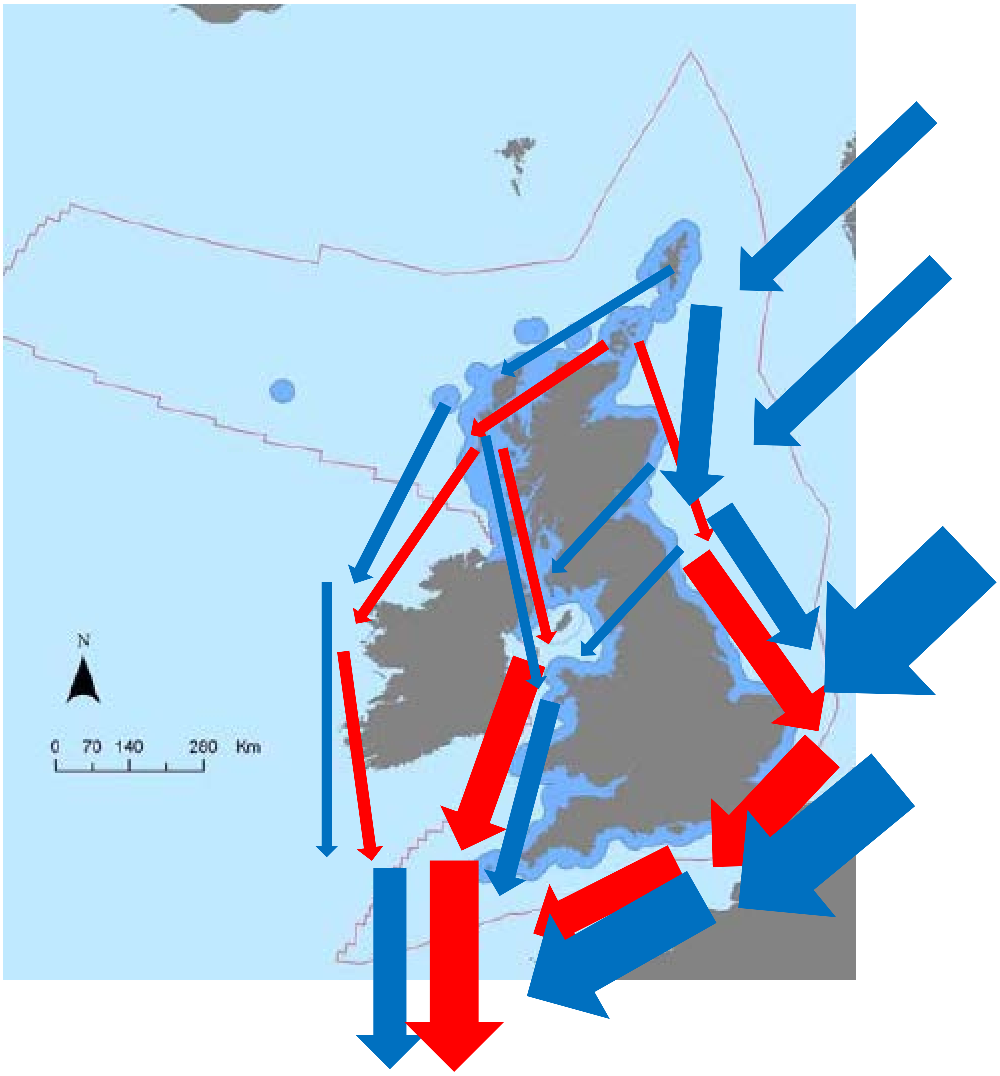

Figure 18.3. Main movements of common terns from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines, but for this species arrows that cross land do imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

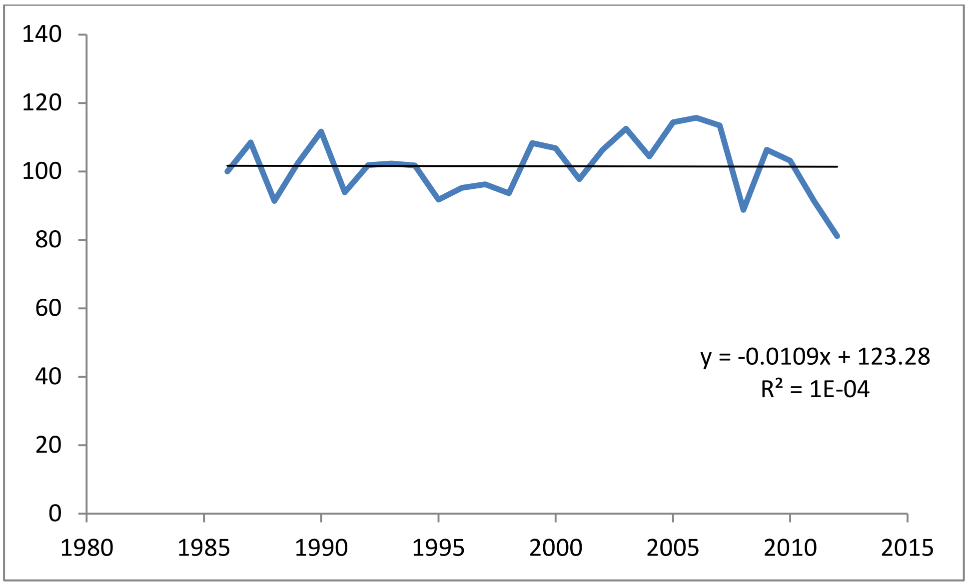

Figure 18.4. Trend in the common tern breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

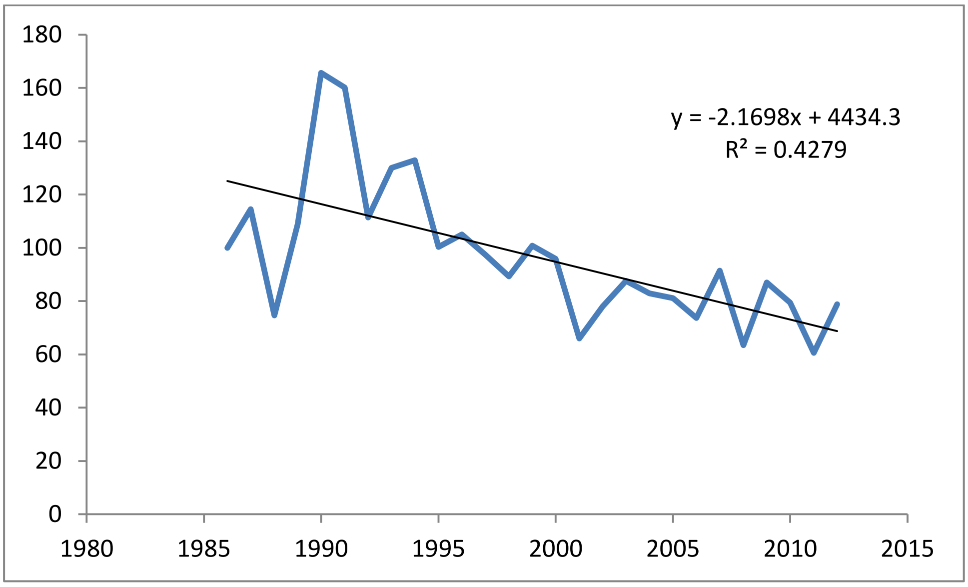

Figure 18.5. Trend in the common tern breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

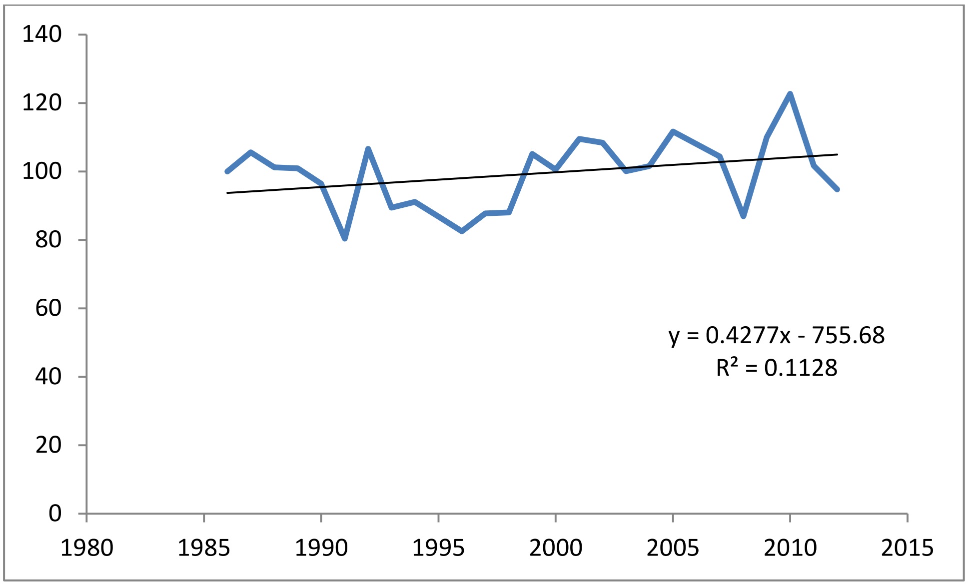

Figure 18.6. Trend in the common tern breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

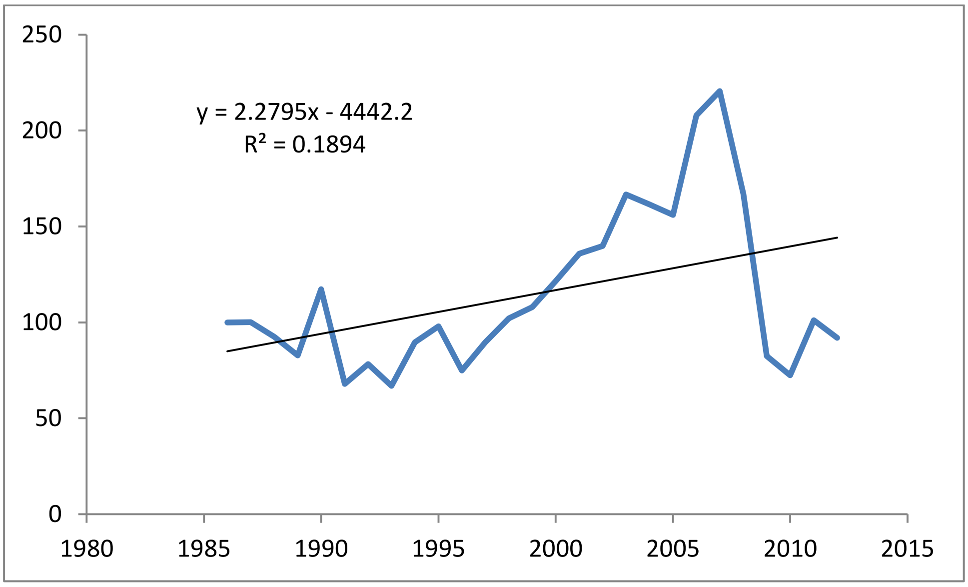

Figure 18.7. Trend in the common tern breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

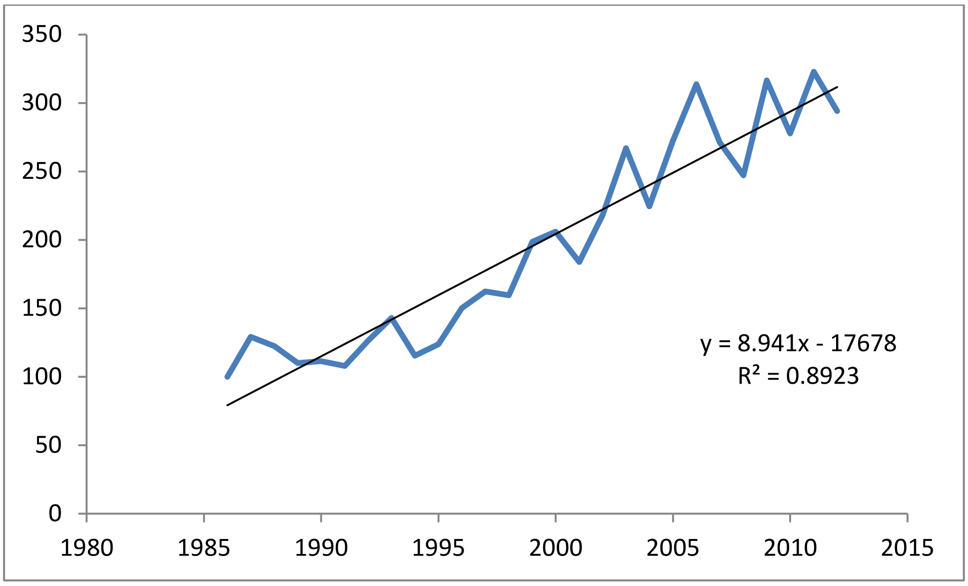

Figure 18.8. Trend in the common tern breeding population index in all-Ireland from 1986-2012. Data from JNCC seabird population monitoring database.

18.9 Proportion of UK population in UK breeding SPAs

The 23 SPAs with breeding common terns as a feature together held 7,551 pairs at designation, estimated to represent ca. 48% of the British breeding population and 42% of the all-Ireland breeding population (Stroud et al. 2001, updated to add Imperial Dock Lock SPA). Stroud et al. (2014) estimated that the GB SPA suite for breeding common terns held 43.8% of the GB population based on counts in 2007-2011.

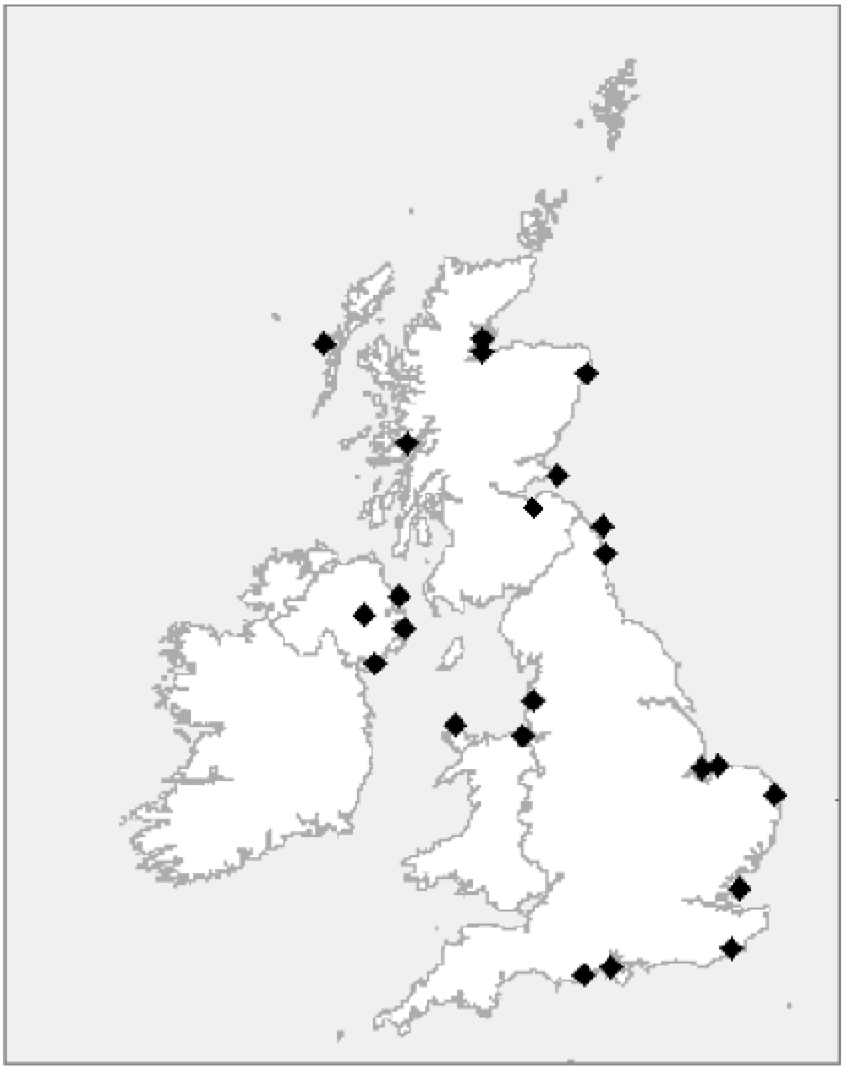

Figure 18.9. UK SPA suite for breeding common terns. These SPA populations are listed in Table 18.1.

Table 18.1. The UK SPA suite for breeding common terns.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent counts**	**Year**	**Reference**
UK North Sea & Channel							
Cromarty Firth	N Scotland	294 (1989-1993)	1999	Declined 2000	16 82 68	2008 2009 2010	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
Inner Moray Firth	N Scotland	310	1999	No change 2000	0 0 0 0 0 0	2008 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database SMP database

Ythan Estuary, Sands of Forvie	NE Scotland	265	1998	No change 2012	19 0 6 4	2004 2005 2006 2010	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012
Forth Islands	E Scotland	334 (1997-2001) Or 800 (Stroud et al. 2001)	1990 (and 2004)	Maintained 2003	191 155 197 17 26	2006 2007 2008 2010 2011	SMP database SMP database Lewis et al. 2012 Lewis et al. 2012 Stroud et al. 2014
Imperial Dock Lock	E Scotland	558	2004	Maintained 2009	989 789 732 818	2007 2008 2009 2010	SMP database Jennings 2012 Jennings 2012 Jennings 2012
Farne Islands	NE England	230 (1993-1997)	1985		118 117 104 98 112 101 88 94	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Coquet Island	NE England	740 (1993-1997)	1985		1,226 1,228 1,022 1,228 1,358 1,193 1,158 1,041	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
The Wash	E England	152 (1993)	1988		115 169 208 221	2010 2011 2012 2013	SMP database SMP database SMP database SMP database
North Norfolk Coast	E England	>460 (1996)	1989		434 437 347 270 198	2007 2008 2010 2011 2012	SMP database SMP database SMP database SMP database SMP database
Breydon Water		155 (1992-1996)	1996		197 181 170 173 158 93 92	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Foulness	S England	220 (1996)	1996		121 130 72 82 25	1998 2000 2002 2004 2008	SMP database SMP database SMP database SMP database SMP database

Dungeness to Pett Level	S England	266 (1993-1997)	1999		170 177 149 236 343 235 149 79	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Poole Harbour (Brownsea Island)	S England	155 (1993-1997)	1999		248 157 180 185 191 222 171 163	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Solent & Southampton Water	S England	267 (1993-1997)	1998		375 200 285 256 371 266 280	2002 2003 2004 2005 2006 2007 2007	SMP database SMP database SMP database SMP database SMP database SMP database Stroud et al. 2014
UK Western waters							
Glas Eileanan	W Scotland	530	1998	Maintained 2005	0 515 0 303 97 22	2006 2007 2008 2009 2011 2012	SMP database SMP database SMP database SMP database Lewis et al. 2012 SMP database
Carlingford Lough	N Ireland	339 (1993-1997)	1998		282 200 11 108 69 130 119	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Larne Lough	N Ireland	199 (1993-1997) Or 180 (Stroud et al. 2001)	1997		530 314 387 380 317 319 231	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Lough Neagh and Lough Beg	N Ireland	185 (1995)	1996		>54 >62 >73 >78	2010 2011 2012 2013	SMP database SMP database SMP database SMP database
Strangford Lough	N Ireland	603 (1993-1997)	1998		762 650 1,174 578 726 84 352	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database

The Dee Estuary	Engl-Wales	392 (1995-1999) Or 277 (Stroud et al. 2001)	1985		136 221 196 202 200 165	2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database
Ribble and Alt Estuaries		182 (1996)	1995		100 137 106 98 111 111	1997 1998 1999 2000 2003 2008	SMP database SMP database SMP database SMP database SMP database SMP database
Ynys Feurig, Cemlyn Bay	Wales	>189 (1992-1996)	1992		180 180 167 170 196 178 592	2005 2006 2007 2008 2009 2011 2011	SMP database SMP database SMP database SMP database SMP database SMP database Stroud et al. 2014

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

18.10 BDMPS

UK waters can be divided into two spatial BDMPS (UK North Sea and Channel, and UK western waters) which are appropriate for the migration seasons of this species (late July to early September, and April-May). This division into two BDMPS is based on the tendency for birds from UK colonies to migrate south after breeding and north back to their colony predominantly through the North Sea if birds breed at colonies in UK North Sea waters, or through UK western waters if birds breed at colonies in UK western waters, and for birds from European continental countries to migrate predominantly through UK North Sea waters rather than UK western waters. However, the common tern shows a greater tendency to migrate overland than seen in most other seabird species, so that use of a single BDMPS for all UK waters would also be a reasonable approach for this species.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 56 and 57.

Based on evidence reviewed in sections 18.5, 18.6 and 18.7, the UK North Sea and Channel migration seasons BDMPS is estimated to hold 70% of adults and 50% of immatures from UK North Sea colonies, 10% of adults and immatures from UK western waters colonies, 30% of birds from Norway, Finland, Sweden, Baltic States, 25% of birds from Germany and The Netherlands, 20% of birds from Ireland (Appendix A Table 56). These proportions give an estimated BDMPS of 144,911 birds, 18,942 from UK and 125,969 from overseas.

Based on evidence reviewed in sections 18.5, 18.6 and 18.7, the UK western waters migration seasons BDMPS is estimated to hold 30% of adults and 20% of immatures from UK North Sea colonies, 90% of adults and 60% of immatures from UK western waters colonies, 20% of birds from Norway, 10% of birds from Finland, Sweden, Baltic States and Germany, 5% of birds from The Netherlands, and 40% of birds from Ireland (Appendix A Table 57). These proportions give an estimated BDMPS of 64,659 birds, 16,212 from UK and 48,447 from overseas.

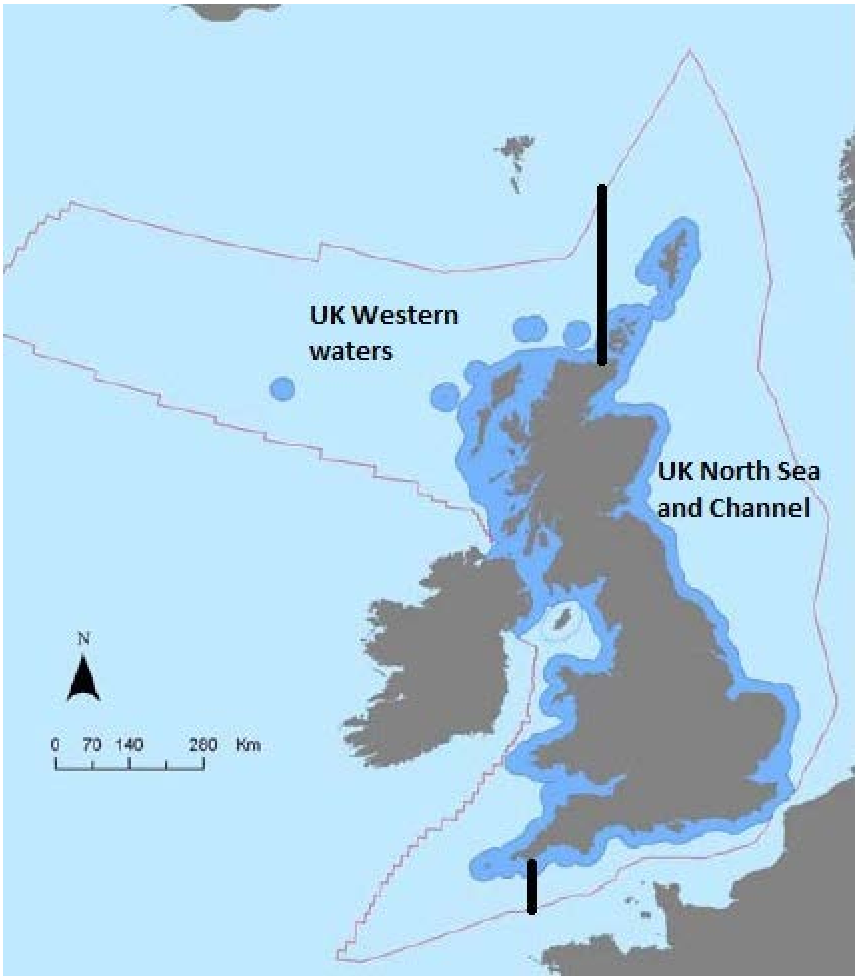

Figure 18.10. Two defined BDMPS spatial areas for common tern: 'UK North sea waters and Channel' and 'UK Western waters'.

18.11 Proportions of UK SPA birds in BDMPS

UK SPAs for common tern are widely distributed across the breeding range of the species in the UK. SPA birds represent about 44% of the UK population, so the main factor determining the proportion of each BDMPS derived from UK SPAs will be the ratio of overseas to UK birds in each BDMPS during the migration season. These percentages depend very much on the estimate of proportions of overseas populations migrating through UK waters so are very tentative estimates, as numbers of birds from overseas populations migrating through UK waters are very uncertain, although clearly are large. Proportions of birds that are adults from UK SPA colonies can be estimated directly from the data in Appendix A Tables 56 and 57. For example, in the UK western waters BDMPS (64,659 birds) there are estimated to be 4,126 adults from SPA colonies, so these represent 6% of the total birds present.

18.12 Spatial distribution of UK breeding SPA birds across the BDMPS

With large numbers of birds migrating through UK waters, and apparently many more overseas birds than UK birds in these migrations, the SPA birds are likely to be well mixed across each of the BDMPS areas.

19. ARCTIC TERN *Sterna paradisaea*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (July to early September, and late April to May) (adults and immatures)
Overseas	470,000	99,780
UK	158,000	135,548
Total	628,000	235,328

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (July to early September, and late April to May)			
UK North Sea and Channel	163,930	82,084	81,846
UK Western waters	71,398	17,696	53,702

Arctic tern numbers in most UK SPA colonies are monitored frequently. However, numbers in UK colonies that are not SPA populations are less well monitored, and do represent a substantial proportion of the UK total. Arctic tern breeding numbers in SPA populations in the UK have declined very considerably, especially in Shetland and most of Orkney. How much numbers in UK non-SPA colonies have declined is far less clear, but numbers may be smaller than in the summary table above if non-SPA colonies have also declined as much as SPA colonies. Arctic tern migrations have not been studied by geolocator deployment except in Iceland (a population that does not pass through UK waters), and ringing recoveries from the migration period in UK waters are very limited. So understanding of details of Arctic tern movements is relatively poor, especially to the extent that birds from overseas populations are concerned. While ring recoveries show that many birds from overseas pass through UK waters, the proportions of those populations doing so are very uncertain since ring recovery data are subject to considerable potential bias. Furthermore, these overseas populations are large, and probably represent a moderate to high proportion of the total of Arctic terns in UK waters during the migration season. Therefore, estimated numbers of birds in the BDMPS are classed as red for the total population and numbers from overseas, and for numbers from the UK population given the uncertainty about breeding numbers in non-SPA colonies at present.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 58 and 59.

19.1 Breeding range and taxa

Arctic tern is monotypic, with a Holarctic breeding distribution, predominantly in Arctic and sub-Arctic regions. There appears to have been no assessment of whether biometrics would allow origins of individuals to be identified, but this seems unlikely as there seems to be no evidence of clinal variation, and birds are known to sometimes recruit to breed in locations far from their natal area.

19.2 Non-breeding component of the population

Arctic terns start to breed when 4 years old (BTO Birdfacts). Adult survival rate is 0.9 (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is 0.402 chicks per pair (JNCC database, n=227 measurements). To obtain a stable population, survival of immatures was adjusted to 0.72 for juveniles, 0.85 for 1-year olds, and 0.9 for 2-year olds and 3-year olds. The model population comprised 63% adults, 13% juveniles and 24% older immatures. There are 0.58 immatures per adult.

19.3 Phenology

Breeding colonies in the UK are deserted by mid-August, with modal departure in late July or early August (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in early July (Pennington et al. 2004; Forrester et al. 2007) or late July (Cramp et al. 1977-94). Peak autumn migration occurs in late July in Shetland (Pennington et al. 2004) and Scotland (Forrester et al. 2007), but continues from August to October when considering the entire migration to Antarctic waters (Cramp et al. 1977-94). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late July and early August (Figure 19.1). Autumn migration is completed in Shetland by late August (Pennington et al. 2004) and in Scotland and England by September (Brown and Grice 2005; Forrester et al. 2007), but in the southern hemisphere may continue until mid-November (Cramp et al. 1977-94).

Spring migration starts in the southern hemisphere in early March (Cramp et al. 1977-94), and the first migrants appear in UK waters in March (Wernham et al. 2002), but in Scottish waters and Shetland not until late April (Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in mid-May in UK waters (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in early May (Figure 19.1). Spring migration is completed by late May (Pennington et al. 2004), early June (Cramp et al. 1977-94), or June (Forrester et al. 2007).

The first spring records of Arctic tern in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 6 April to 9 May but mostly in late April, and the last records were from 9 September to 21 November, but mostly in late October. Peak autumn migration was reported in July or July-August in most years, and peak spring migration was reported in May in almost all years. Birds re-occupy colonies from late April, with modal return in mid-May (Pennington et al. 2004; Forrester et al. 2007).

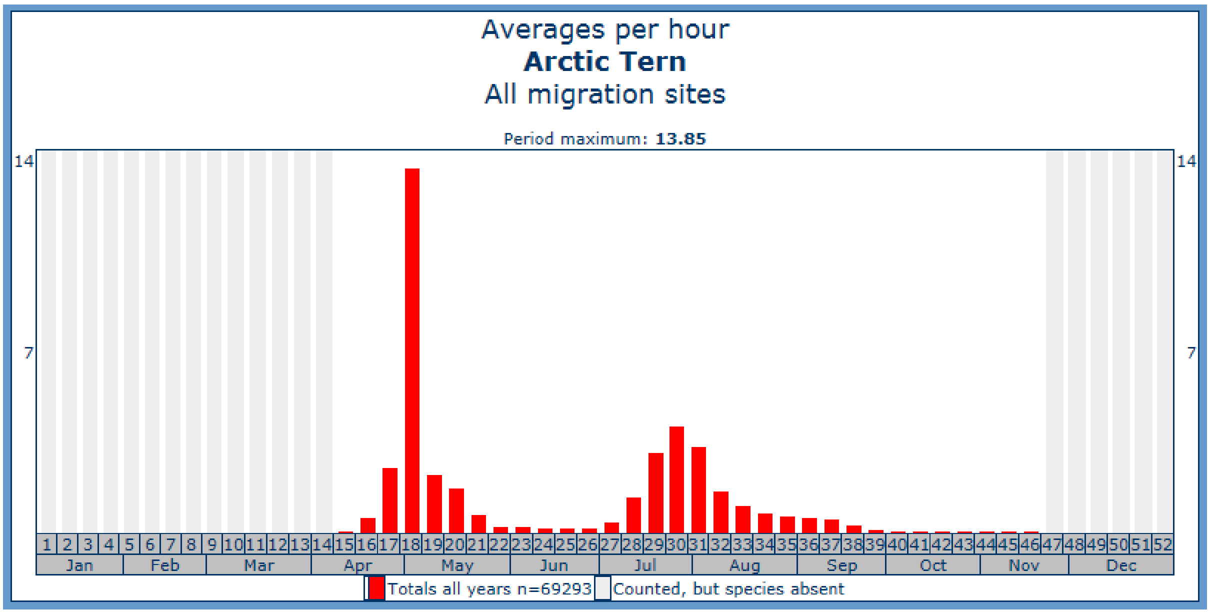

Figure 19.1. Average numbers of Arctic terns counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season birds predominantly absent from UK waters. However, from the data reviewed above, this may be refined to breeding season May-early August, non-breeding season mid-August-April.

19.4 Defined seasons:

- UK Breeding season — May-early August
- Post-breeding migration in UK waters — July-early September (**migration BDMPS**)
- non-breeding season — mid August-April
- Return migration through UK waters late — April-May (**migration BDMPS**)
- Migration-free breeding season — June
- Migration-free winter season — October-March

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for Arctic tern:

Migration periods BDMPS (July-early September, and late April-May).

19.5 Movements of birds from the UK population

Although Post-breeding dispersal occurs from colonies in July (with some UK fledglings moving as far as the Baltic Sea), followed by southwards migration in August-September Wernham et al. 2002; Pennington et al. 2004; Forrester et al. 2007). Several Scandinavian and Baltic fledglings have also been recovered in the UK as early as August, indicating rapid dispersal of some young birds into UK waters. As with other terns, post-fledging dispersal takes birds to areas with high density of prey fish where juveniles have a good chance of learning fishing skills, surviving and putting on weight before the southwards migration. In contrast to many other terns, Arctic terns seem less likely to remain in family groups and chicks seem to become independent rather quickly. Arctic terns are thought to migrate somewhat further offshore than other British tern species, past west Africa to southern Africa then onwards to the edge of Antarctic pack ice (Wernham et al. 2002). Movements of first summer and second summer birds are not well documented, but it appears that most first and second summer birds remain in the southern hemisphere all year, with very few of these birds in immature plumage returning to UK waters in summer (Wernham et al. 2002). Some three year olds breed, while others visit breeding areas to loaf at 'club' sites on the periphery of the colony. Most four year olds breed, but it is likely that many recruit into colonies away from where they were reared, while there is also some evidence for adults moving colony between years (Wernham et al. 2002).

19.6 Movements of birds from overseas into UK waters

Foreign-ringed birds recovered in UK waters, or on shore, mainly originate from Scandinavia and the Baltic (Wernham et al. 2002). Post-breeding dispersal/migration can be very rapid and can bring birds from overseas populations into close contact with local breeding populations in late summer. For example, a bird ringed as a chick in the Baltic States in early July was killed by a great skua hunting for terns roosting adjacent to the Arctic tern colony at Foula in mid-July, just a few days after it had fledged; without the ring this bird would have been assumed to be a local fledgling from the Foula colony. Although there is one recovery in the UK of a chick ringed in Greenland, no birds ringed in Iceland have been found in the UK according to Wernham et al. (2002). However, three out of over 12,000 ringed in Faroe (88% as chicks) were recovered during autumn migration in the British Isles (Hammer et al. 2013). Seabird 2000 reported 53,380 pairs in UK, 2,730 in Ireland, 131,000 pairs in Fennoscandia, 8,000 pairs in the Baltic States, 375,000 pairs in Iceland (Mitchell et al. 2004), and Hammer et al. (2013) report 7,600 pairs in Faroe. Given the evidence for extensive post-breeding dispersal of birds from Fennoscandia and the Baltic into UK waters, and the large populations in those areas, it seems likely that a substantial proportion of Arctic terns in UK waters in August-September will be from those regions. Recent breeding failures of Arctic terns in Iceland, and circumstantial observational evidence at colonies, suggest that numbers there may well have declined considerably (Vigfusdottir et al. 2013). Given the very large size of the Icelandic population, those birds might be expected to form a substantial part of the total in UK waters in August-September. However, deployment of geolocators on ten Arctic terns in Greenland and one in Iceland showed that all eleven birds moved directly south from Iceland to the Newfoundland Basin, where they spent some time before migrating to the South Atlantic (Egevang et al. 2010). All birds showed essentially the same route, with none coming near to UK waters. Return migration in spring was even further to the west, passing close to Newfoundland before completing the journey to Iceland and Greenland. This study suggests that very few Arctic terns from Iceland and Greenland ever visit UK waters, consistent with the lack of recoveries of Arctic terns ringing in Iceland in the British Isles. Spring migration through UK waters (some of which can occur overland; Wernham et al. 2002) may also involve large numbers from colonies in Fennoscandia and the Baltic, but the spring migration produces few ring recoveries so this is uncertain.

19.7 Numbers in UK waters

Terns are very difficult to census during migrations. However, Forrester et al. (2007) suggest that there are 10,000 to 200,000 on passage through Scottish waters in autumn and spring. No equivalent estimates for other parts of UK waters appear to be published. Clearly all UK breeders, and probably about half of the immatures associated with these pass through UK waters during the migration seasons, but so do large numbers of birds from overseas. Numbers from those populations passing through are very uncertain.

19.8 Biogeographic population and relevant smaller units (BDMPS)

Stroud et al. (2001) defined the biogeographic breeding population as that of the European and North Atlantic population, comprising 900,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 493,000-1,800,000 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. Populations with possible connectivity to UK waters are the UK population (50,000 pairs), and the populations of Fennoscandia (131,000 pairs), Faroe (7,600 pairs), Baltic states (8,000 pairs) and Ireland (2,500 pairs) (Figure 19.2). So overseas populations are large relative to the UK population, but the proportion of these overseas birds that pass through UK waters is very uncertain. The biogeographic population with connectivity to UK waters is estimated at 628,000 birds (adults and immatures) with 158,000 from UK and 470,000 from overseas populations. Allowing for the likely proportions of each population that pass through UK waters on migration, the total numbers in UK waters during the migration seasons is estimated at 236,000 birds (adults and immatures) with 136,000 of these from the UK population and 100,000 from overseas.

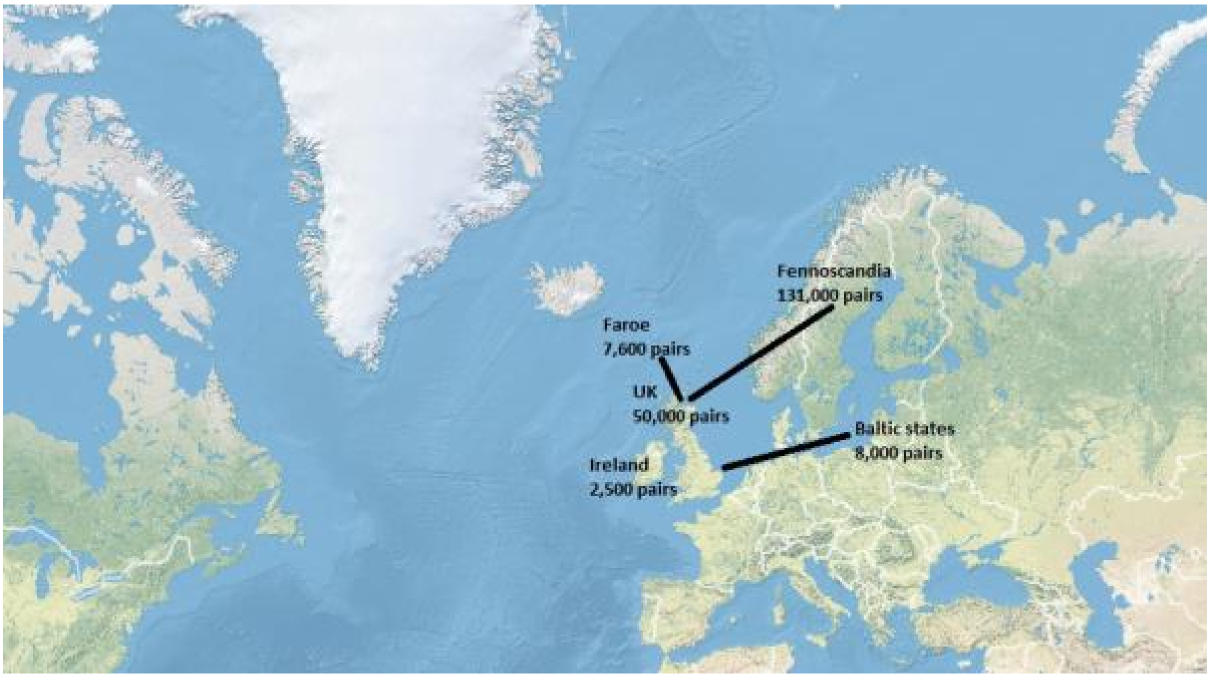

Figure 19.2. Breeding population origins of Arctic terns in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

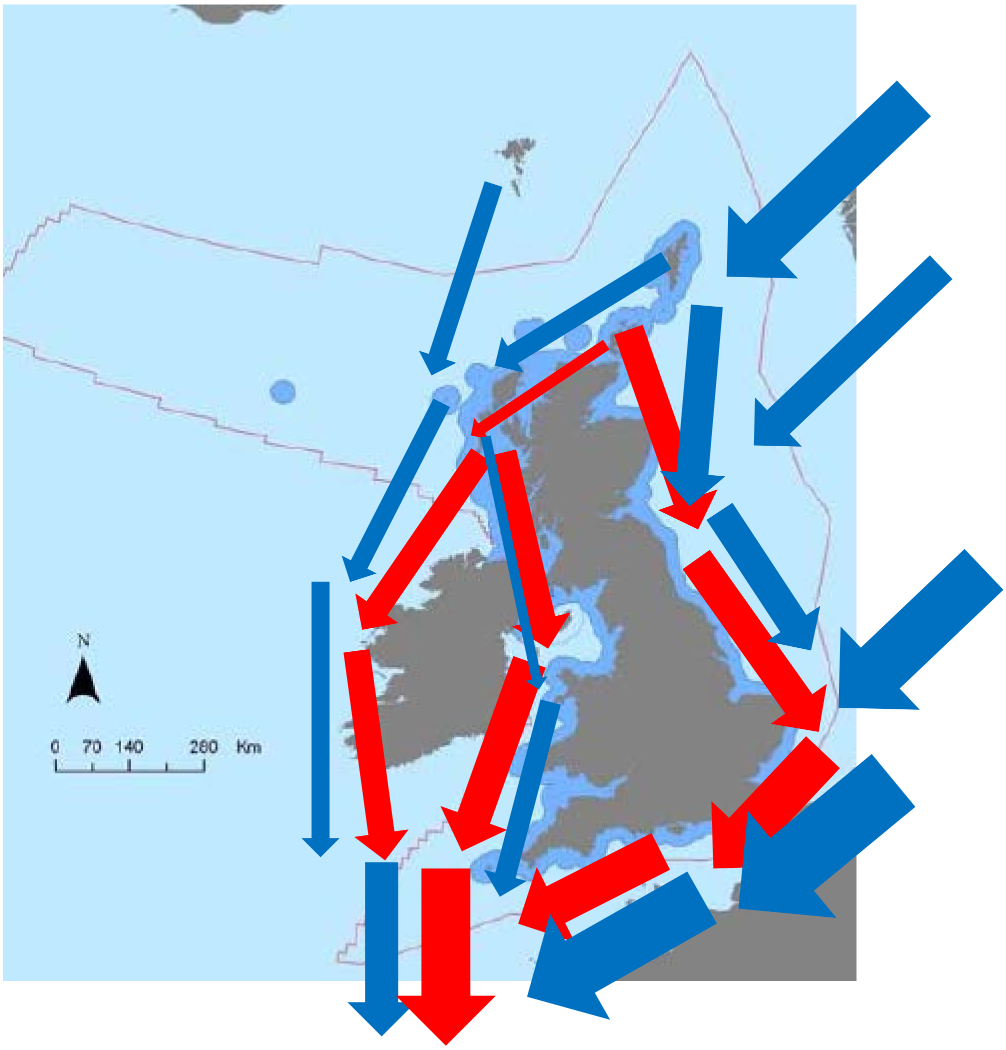

Figure 19.3. Main movements of Arctic terns from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply specific overland migration routes, although this species may sometimes migrate over land. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

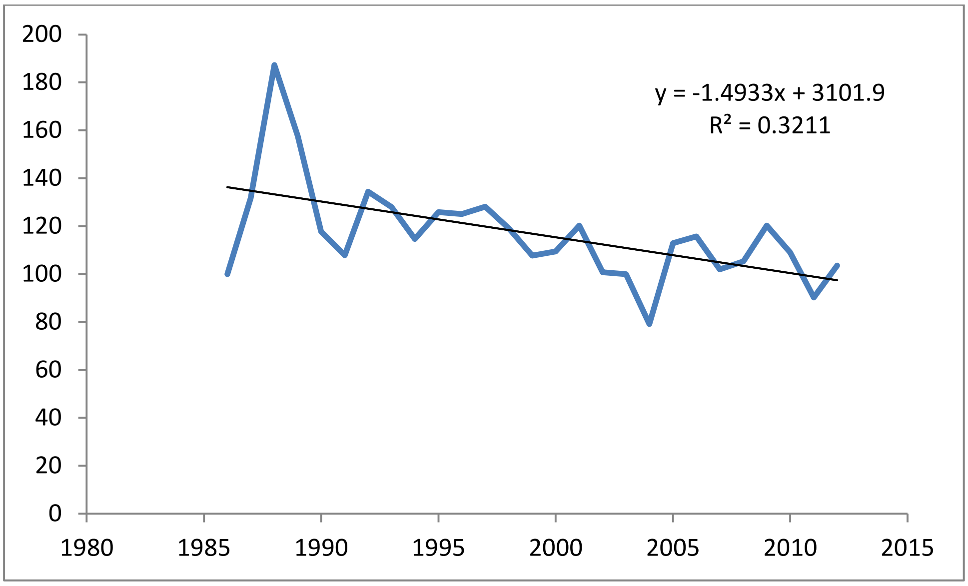

Figure 19.4. Trend in the Arctic tern breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

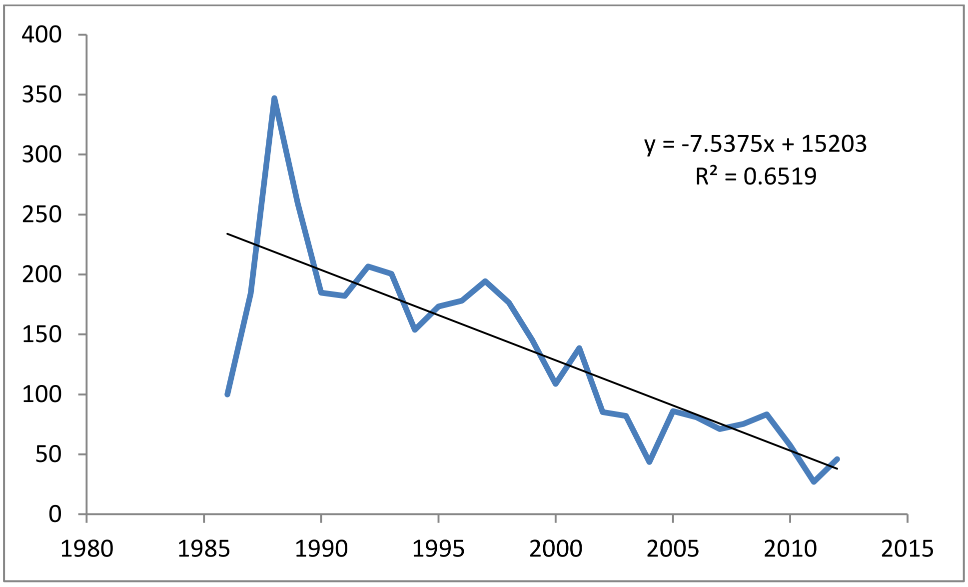

Figure 19.5. Trend in the Arctic tern breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

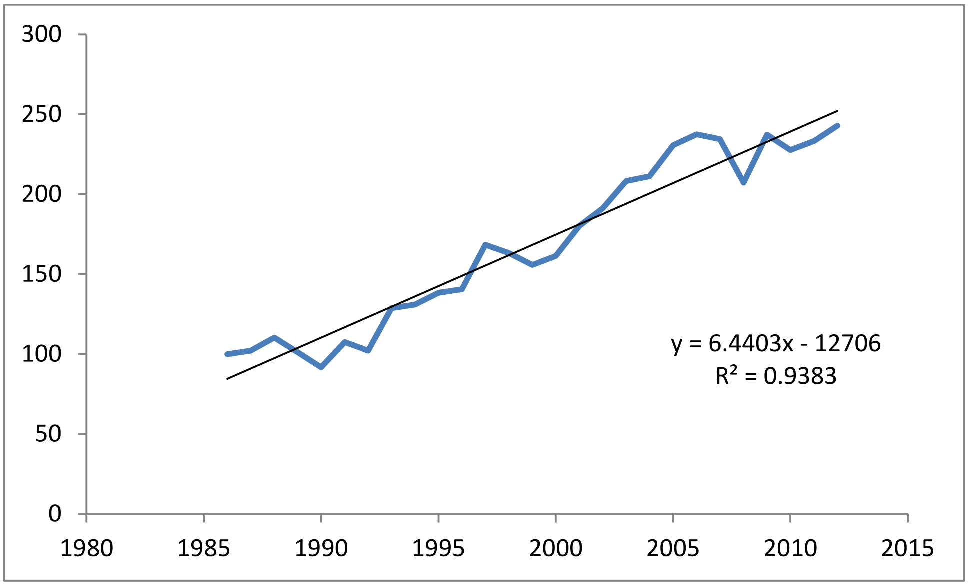

Figure 19.6. Trend in the Arctic tern breeding population index in England from 1986-2012. Data from JNCC seabird population monitoring database.

19.9 Proportion of UK population from UK breeding SPAs

The 17 SPAs with breeding Arctic terns as a feature together held 17,124 pairs at designation, estimated to represent ca. 38% of the British breeding population and 17% of the all-Ireland breeding population (Stroud et al. 2001). Stroud et al. (2014) suggest on the basis of census data at these sites in 2000-2011 that 20.6% of the GB breeding population is on UK SPAs for breeding Arctic terns. This decrease is consistent with a density-dependent effect of food shortage, reducing breeding numbers proportionately more at larger colonies, which is very likely to occur and has been shown in several other seabird species although not specifically for Arctic tern.

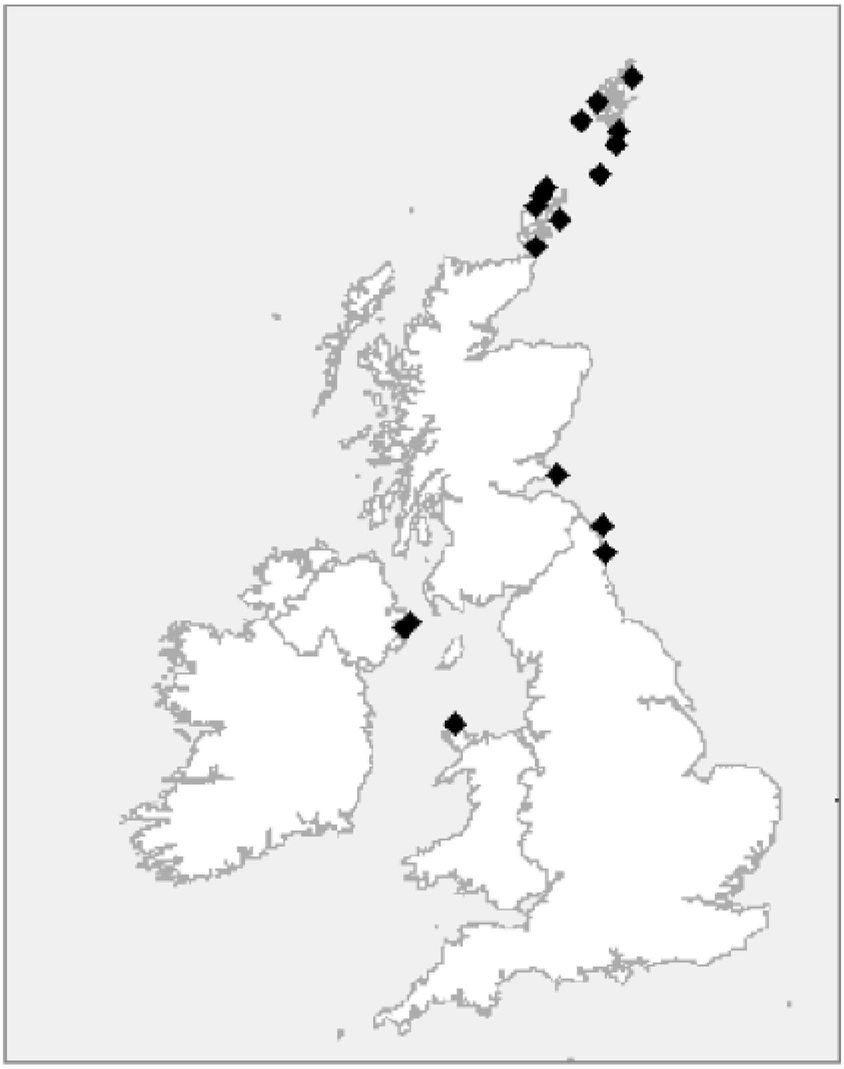

Figure 19.7. The UK SPA suite for breeding Arctic terns. These SPA populations are listed in Table 19.1.

Table 19.1. The UK SPA suite for breeding Arctic terns.

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent count	Year	Reference
UK North Sea & Channel							
Fetlar	Shetland	520 (1994-1997)	1994	Recovering 2002	486 213 16 14 2 0 21	2006 2007 2008 2009 2010 2011 2012	SMP database SMP database Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database
Foula	Shetland	1,100 (1992-1997)	1995	Maintained 2000	0 70 35 100 20	2006 2007 2011 2012 2013	Lewis et al. 2012 SMP database SMP database Gear 2012 Gear 2013
Papa Stour	Shetland	1,000	2000	Declined 2008	1,172	2000	Stroud et al. 2014

Mousa	Shetland	767 (1994)	1995	No change 2000	143 751 400 925 42 0 41 18	2001 -06 2007 2008 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database SMP database SMP database
Sumburgh Head	Shetland	700 (1994)	1996	Declined 2001	ca40 ca150 203	1999 2000 2000	SCM database SCM database Stroud et al. 2014
Fair Isle	Shetland	1,120 (1993-1997)	1994	Declined 2009	818 208 0 283 400 9 227 29	2006 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database FIBO Report SMP database
West Westray	Orkney	1,200	1996	Declined 2007	1,067 ca500	2000 2009	Stroud et al. 2014 SCM database
Papa Westray	Orkney	1,950	1996	Declined 2006	813 556 393 176	2005 2006 2010 2011	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Stroud et al. 2014
Rousay	Orkney	1,000	2000	Declined 2007	707 ca60	2000 2006	Stroud et al. 2014 SCM database
Auskerry	Orkney	780 (1995)	1998	Maintained 2007	0 550 667 0 750	2005 2006 2007 2011 2013	SMP database SMP database SMP database Lewis et al. 2012 SMP database
Pentland Firth Islands	N Scotland	1,200 (1992-1995)	1997	Declined 2007	327 1,400 0 669	2004 2005 2007 2009	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Stroud et al. 2014
Forth Islands	E Scotland	540 (1992-1996)	1990	Declined 2009	515 525 511 316 34 250 265	2006 2007 2008 2009 2010 2011 2012	SMP database SMP database SMP database Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SMP database
Farne Islands	NE England	2,840 (1993-1997)	1985		2,256 2,239 2,198 2,199 1,830 1,866 1,921	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database

Coquet Island	NE England	700 (1993-1997)	1985		1,247 983 1,259 1,046 1,140 1,275 1,224	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database
UK Western waters							
Outer Ards	N Ireland	207 (not stated)	2002		182 215 191 174 108 60	2008 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database
Strangford Lough	N Ireland	210 (1993-1997)	1998		891 559 316 645 373 229 55 164	2006 2007 2008 2009 2010 2011 2012 2013	SCM database SCM database SCM database SCM database SCM database SCM database SCM database SCM database
Ynys Feurig, Cemlyn Bay	Wales	1,290 (1992-1996)	1992		540 493 416 531 550 3,620	2006 2007 2008 2009 2011 2011	SMP database SMP database SMP database SMP database SMP database Stroud et al. 2014

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

19.10 BDMPS

The UK waters can be divided into two spatial BDMPS; UK North Sea and Channel waters, and UK western waters (Figure 19.8), which are appropriate for the migration seasons of this species (July to early September, and late-April to May). This division into two BDMPS is based on the tendency for birds from UK colonies to migrate south after breeding and north back to their colony predominantly through the North Sea if birds breed at colonies in UK North Sea waters, or through UK western waters if birds breed at colonies in UK western waters, and for birds from European continental countries to migrate predominantly through UK North Sea waters rather than UK western waters.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 58 and 59.

Based on evidence reviewed in sections 19.5, 19.6 and 19.7, the UK North Sea and Channel migration seasons BDMPS is estimated to hold 90% of adult and 60% of immature Arctic terns from Orkney and Shetland colonies, 100% of adults and 70% of immatures from colonies along the mainland east coast of Scotland and England, none from colonies in UK western waters, 20% of adults and 15% of immatures from Fennoscandia and Faroe, 10% of birds from the Baltic States, but none from Ireland (Appendix A Table 58). These proportions lead to an estimated BDMPS of 163,930 birds, 81,846 from the UK and 82,084 from overseas populations.

Based on evidence reviewed in sections 19.5, 19.6 and 19.7, the UK western waters migration seasons BDMPS is estimated to hold 10% of adult and 10% of immature Arctic terns from Orkney and Shetland colonies, no adults but 10% of immatures from colonies along the mainland east coast of Scotland and England, 100% of adults and 70% of immatures from colonies in UK western waters, 3% of adults and immatures from Fennoscandia, 10% of adults and immatures from Faroe, 2% of birds from the Baltic States, and 30% of birds from Ireland (Appendix A Table 59). These proportions lead to an estimated BDMPS of 71,398 birds, 53,702 from the UK and 17,696 from overseas populations.

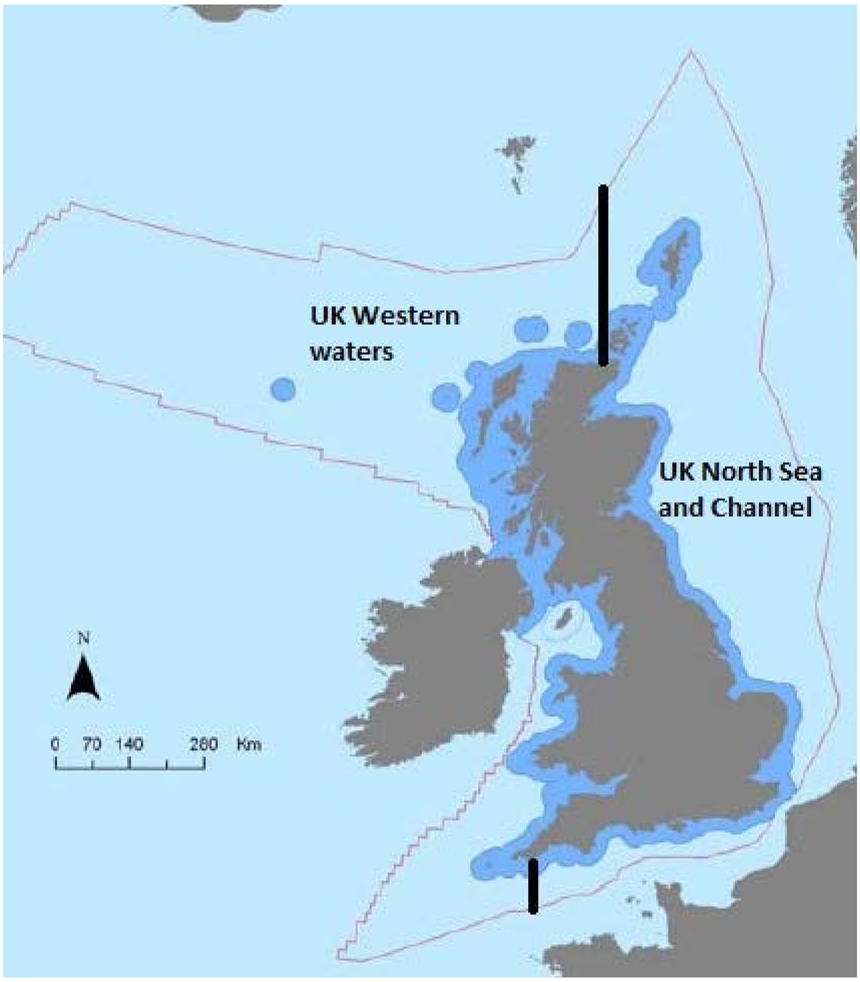

Figure 19.8. Two defined BDMPS spatial areas for Arctic tern: 'UK North Sea waters and Channel'and 'UK Western waters'.

19.11 Proportions of UK SPA birds in BDMPS

UK SPAs for Arctic tern are strongly concentrated in Shetland and Orkney, but with little representation in the west of Scotland. Numbers breeding in Shetland and Orkney have declined very considerably since the 1980s, at least in part as a result of declines in sandeels in the NW North Sea. SPA birds probably represent about 20% of the UK population now (section 19.9), so the main factor determining the proportion of each BDMPS derived from UK SPAs will be the ratio of overseas to UK birds in each of the two BDMPS during the migration season. These percentages depend very much on the estimate of proportions of overseas populations migrating through UK waters so are very tentative estimates, as numbers of birds from overseas populations migrating through UK waters are very uncertain. Proportions of birds that are adults from UK SPA colonies can be estimated directly from the data in Appendix A Tables 58 and 59. For example, in the UK western waters BDMPS (71,398 birds) there are estimated to be 2,138 adults from SPA colonies, so these represent 3% of the total birds present.

19.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Since birds can disperse quickly from colonies, but may stop to feed at locations where there are suitable food stocks, UK SPA birds are likely to be well mixed among non-SPA populations and overseas populations also passing through and responding to the same opportunities.

20. LITTLE TERN *Sternula albifrons*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (late July to early September, and mid-April to May) (adults and immatures)
Overseas	620	514
UK	5,620	4,612
Total	6,240	5,126

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (late July to early September, and mid-April to May)			
UK North Sea and Channel	3,524	0	3,524
UK Western waters	1,602	514	1,088

Little tern breeding numbers are well monitored at most SPA colonies, and the SPA colonies hold a fairly high proportion of the total UK population of this species. The only overseas population of little terns to migrate through UK waters is the Irish population, and it seems almost certain that almost all adult little terns from the well-studied population in Ireland pass through UK waters in SW Approaches during migration. Therefore, all categories are coded green.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 60 and 61.

20.1 Breeding range and taxa

Little tern has a wide breeding range that includes the Palearctic, Afrotropic and Australasian regions. There are six subspecies, but only the nominate *S. a. albifrons* occurs in British waters. That subspecies breeds across most of Europe (but not in northern areas and with largest numbers mainly in southern countries) to central Asia and northern India, and in North Africa. There appears to have been no assessment of whether biometrics would allow origins of individuals to be identified.

20.2 Non-breeding component of the population

Little terns start to breed when 3 years old (BTO Birdfacts). Adult survival rate is 0.899 (BTO Birdfacts), juvenile survival 0.578 (BTO Birdfacts) and mean productivity is 0.521 chicks per pair (JNCC database, n=362 measurements). To obtain a stable population, survival of immatures was adjusted to 0.65 for juveniles, 0.75 for 1-year olds, and 0.8 for 2-year olds. The model population comprised 64% adults, 17% juveniles and 19% older immatures. There are 0.56 immatures per adult.

20.3 Phenology

Breeding colonies in the UK are deserted by August, with modal departure in late July (Forrester et al. 2007). Autumn migration starts in mid-July (Cramp et al. 1977-94) or late July (Forrester et al. 2007). Peak autumn migration occurs in August (Wernham et al. 2002), August-September (Forrester et al. 2007), or August-October considering the entire range in Europe (Cramp et al. 1977-94). Peak numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late July with quite rapid decrease in numbers through August (Figure 20.1). Autumn migration is completed by September (Wernham et al. 2002), early October in Scotland (Forrester et al. 2007), mid-October in England (Brown and Grice 2005).

Spring migration starts in March in southern Europe (Cramp et al. 1977-94), but first migrants arrive in UK waters in April (Wernham et al. 2002) and in mid-April in Scottish waters (Forrester et al. 2007). Peak spring migration occurs in mid-April to mid-May in English waters (Brown and Grice 2005), late April in Scotland (Forrester et al. 2007) or April-May (Cramp et al. 1977-94; Wernham et al. 2002). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in very late April and early May (Figure 20.1). Spring migration is completed by May (Forrester et al. 2007) or late May (Cramp et al. 1977-94).

The first spring records of little tern in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from 9 April to 12 May, but mostly in mid- to late-April, and the last records were from 21 July to 29 September, but mostly in early August. Peak autumn migration was reported in July in most years, and peak spring migration was reported in late April or in May in most years. Birds re-occupy colonies from mid-April, with modal return in late April (Forrester et al. 2007).

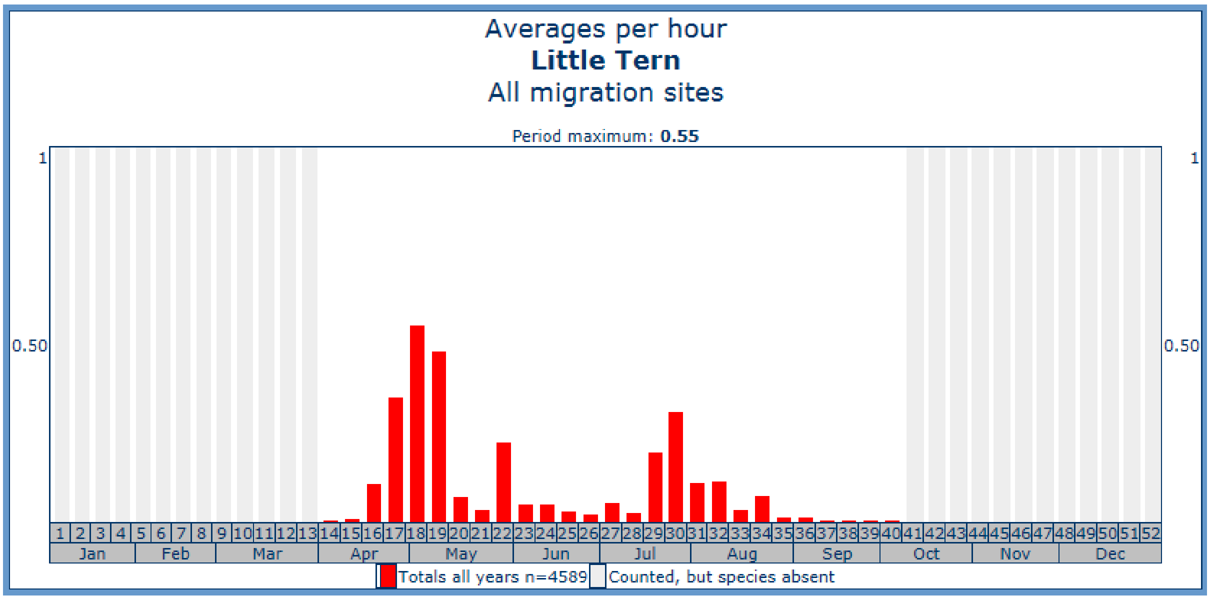

Figure 20.1. Average numbers of little terns counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-August, non-breeding season birds predominantly absent from UK waters. However, from the data reviewed above, this may be refined to breeding season May-early August, non-breeding season mid August-April.

20.4 Defined seasons:

- UK Breeding season — May-early August
- Post-breeding migration in UK waters — late July-early September (**migration BDMPS**)
- non-breeding season — mid August-April
- Return migration through UK waters — mid April-May (**migration BDMPS**)
- Migration-free breeding season — June
- Migration-free winter season — October-March

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for little tern:

Migration periods BDMPS (late July-early September, and mid April-May).

20.5 Movements of birds from the UK population

Birds depart rather rapidly after the breeding season, with ring recoveries from southern Europe as early as August, one within 6 days of ringing at a colony in England (Wernham et al. 2002). Large flocks of little terns in The Netherlands in August suggest that is a staging area used by birds from a wide geographical area during autumn migration (Wernham et al. 2002). Several ring recoveries of birds from Scottish colonies have been in Denmark, whereas most English birds have been recovered in The Netherlands, suggesting that Scottish birds cross the North Sea eastwards from Scotland rather than flying southwards (Wernham et al. 2002). Little terns do not breed until they are at least two years old, and it has been assumed that they spend their first year in African winter quarters, but there is no ringing evidence to support this (Wernham et al. 2002).

20.6 Movements of birds from overseas into UK waters

Wernham et al. (2002) point out that we know little about whether there is passage through UK waters of birds breeding elsewhere. Presumably at least the Irish population (210 pairs in Seabird 2000; Mitchell et al. 2004) must pass through UK waters on migration between Ireland and Africa, but while there are quite large numbers in Fennoscandia (1,019 pairs), the Baltic States (550 pairs), Germany (870 pairs), The Netherlands (500 pairs) and Belgium (224 pairs) (Mitchell et al. 2004) there is no evidence that any of these birds cross the North Sea into UK waters, while ring recovery data suggest that they do not, but that tose populations migrate through continental Europe.

20.7 Numbers in UK waters

Direct observation gives no indication of numbers passing through UK waters, as little terns seem rarely to be observed except in the immediate vicinity of colonies (see for example how few are recorded in the Trektellen data set for UK waters, Figure 20.1). Forrester et al. (2007) refrain from suggesting how many pass through Scottish waters, but comment 'little tern is rare outside its breeding range'. Nevertheless, it is clear that UK and Irish little terns must migrate through UK waters, while it seems that no birds from other populations do so. Therefore, numbers can be estimated from population sizes, which are fairly accurately known.

20.8 Biogeographic population and relevant smaller units (BDMPS)

Stroud et al. (2001) defined the biogeographic breeding population as that of the European population, comprising 20,643 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 17,000-22,000 pairs. Kober et al. (2010) did not present an estimated biogeographic population for this species. In terms of populations with connectivity to UK waters it would appear that only the UK population (1,800 pairs) and Irish population (200 pairs) are likely to migrate through UK waters (Figure 20.2). These 3,600 UK adults will have an associated 2,000 or so immatures, but perhaps half of these may not migrate into UK waters as young immatures, so the UK population in UK waters during the migration seasons may be around 4,600 birds (slightly more in autumn and fewer in spring). The 200 pairs from Ireland will similarly have associated immatures, giving a total population that may migrate through UK waters of about 500 birds. Thus the biogeographic population with connectivity to UK waters is estimated at 6,240 birds (adults and immatures), with 5,620 from UK and 620 from overseas. Of these, it is estimated that 5,120 birds migrate through UK waters, with 4,610 being from the UK population and 510 from overseas. The number from the UK population migrating through UK waters is less than the number contributing to the biogeographic population because it is believed that many first summer birds remain in their winter area rather than returning to the UK.

Figure 20.2. Breeding population origins of little terns in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

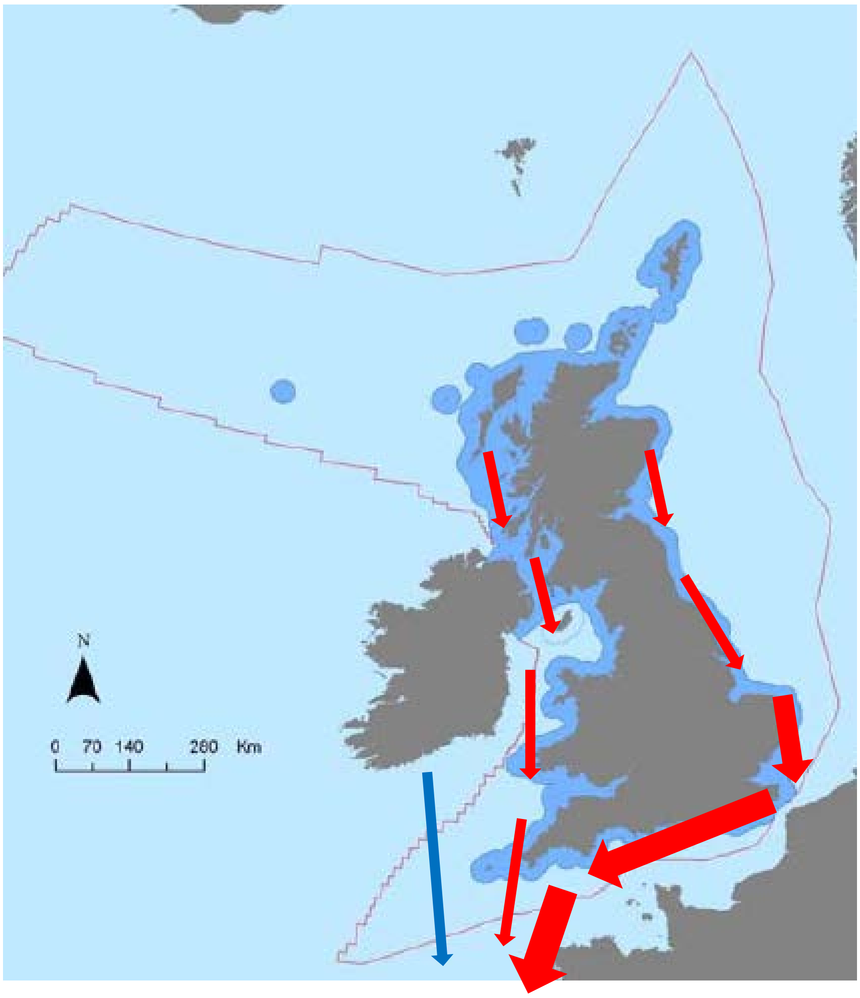

Figure 20.3. Main movements of little terns from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

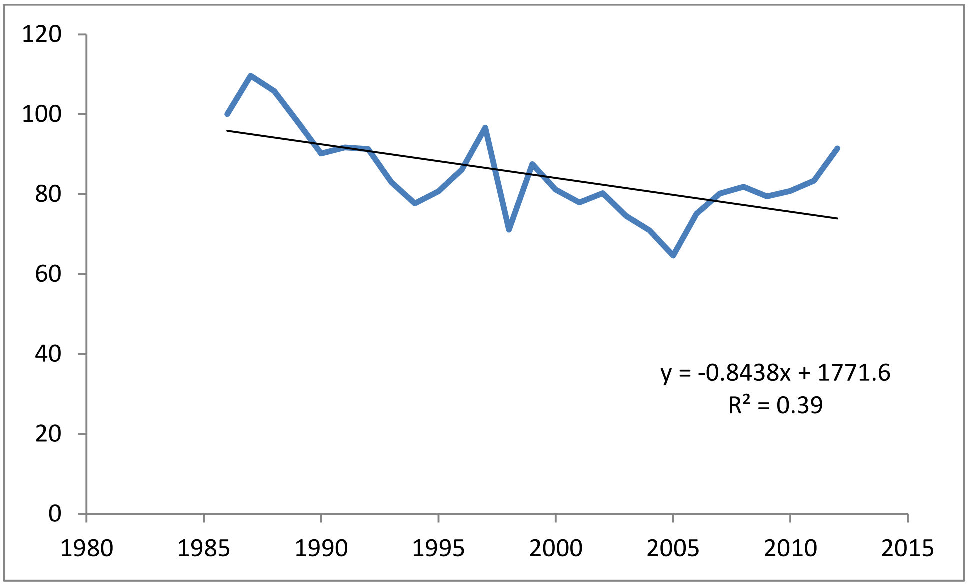

Figure 20.4. Trend in the little tern breeding population index in UK (which come almost entirely from colonies in England) from 1986-2012. Data from JNCC seabird population monitoring database.

20.9 Proportion of UK population in UK breeding SPAs

The 27 SPAs with breeding little terns as a feature together held 1,616 pairs at designation, estimated to represent ca. 67% of the British breeding population (Stroud et al. 2001). Stroud et al. (2014) suggest on the basis of census data for these populations from 2000-2011 (but mostly from 2011) that the GB SPA suite for breeding little terns held 61% of the GB population in that period. Numbers of little terns in the UK appear to have declined only slightly in recent years (Figure 20.4), but the decrease in proportion on SPAs suggests losses from some SPA populations have been greater than in the overall population.

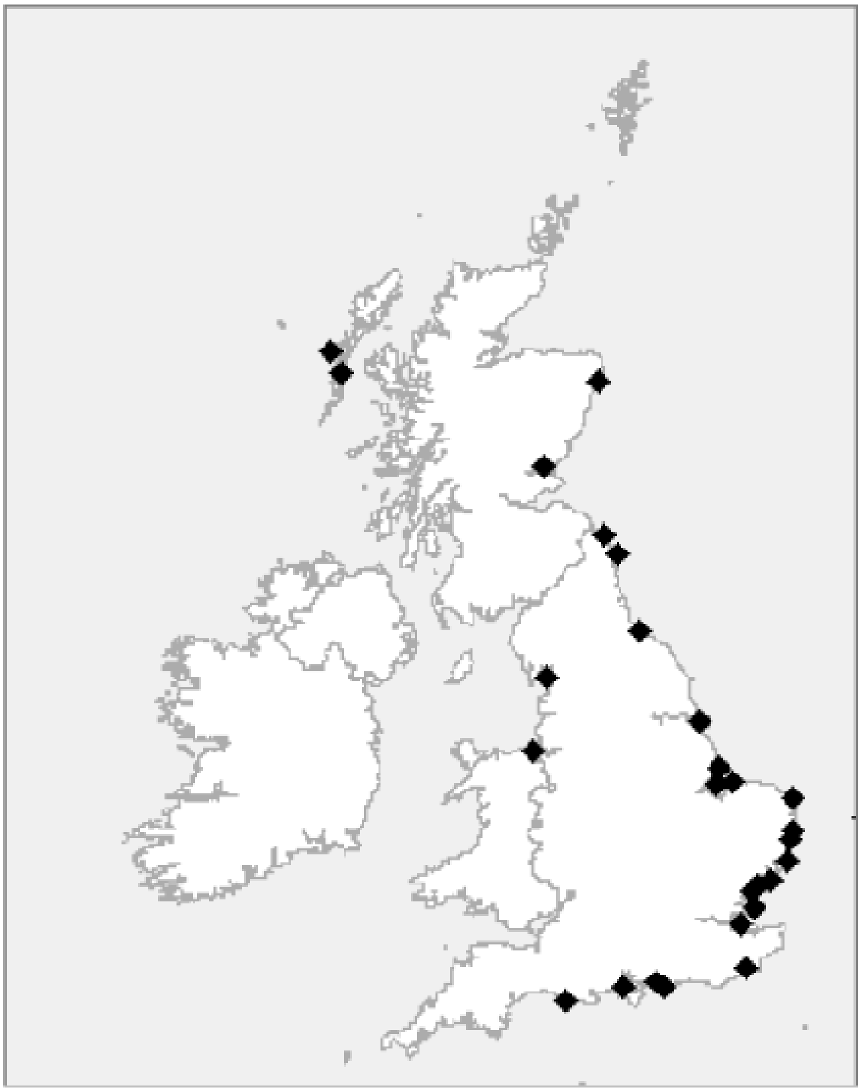

Figure 20.5. UK SPA suite for breeding little terns. These SPA populations are listed in Table 20.1.

Table 20.1. The UK SPA suite for breeding little terns.

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent count	Year	Reference
UK North Sea & Channel							
Ythan Estuary, Sands of Forvie	NE Scotland	41	1998	Maintained 2012	21 36 37 31 27 40	2008 2009 2010 2011 2012 2013	Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 Lewis et al. 2012 SCM database SCM database
Firth of Tay and Eden Estuary	E Scotland	44	2000	No change 2001	1 1	2005 2007	Lewis et al. 2012 Lewis et al. 2012

Lindisfarne	NE England	15 (1992-1996) Or 38 (Stroud et al. 2001)	1992		8	2011	Stroud et al. 2014
Northumbria Coast	NE England	40 (1992-1996)	2000		38	2011	Stroud et al. 2014
Teesmouth & Cleveland Estuary	NE England	40 (1995-1998) Or 37 (Stroud et al. 2001)	1995		84	2011	Stroud et al. 2014
Gibraltar point	Lincs	23 (1992-1996)	1993		12	2011	Stroud et al. 2014
Humber Flats, Marshes & Coast	E England	51 (1998-2002) Or 63 (Stroud et al. 2001)	2007		29	2011	Stroud et al. 2014
The Wash	E England	>33 (1992-1996)	1988		0	2009 - 2010	Stroud et al. 2014
North Norfolk Coast	E England	>330 (1992-1996) Or 377 (Stroud et al. 2001)	1989		409	2011	Stroud et al. 2014
Alde-Ore Estuary	E England	48 (1993-1997)	1996		0	2009	Stroud et al. 2014
Minsmere-Walberswick	E England	28 (1992-1996)	1992		30	2010	Stroud et al. 2014
Great Yarmouth North Denes	E England	220 (1992-1996)	1993		5	2011	Stroud et al. 2014
Foulness	Essex	>24 (1992-1996)	1996		0	2005	Stroud et al. 2014
Dungeness to Pett Level	SE England	35 (1993-1997)	1999		10 14 11	2011 2012 2013	SMP database SMP database SMP database
Medway Estuary and Marshes	Kent	28	1995		18	2009	Stroud et al. 2014
Benacre to Easton Bavents	E England	21 (1992-1996) Or 53 (Stroud et al. 2001)	1996		45	2011	Stroud et al. 2014

Blackwater Estuary	Essex	>21 (1992-1996) Or 36 (Stroud et al. 2001)	1995		99	2000	Stroud et al. 2014
Colne Estuary	Essex	>38 (1992-1996)	1994		0	2011	Stroud et al. 2014
Hamford Water	Essex	55 (1992-1995)	1993		45	2011	Stroud et al. 2014
Chesil Beach and The Fleet	S England	55	1985		19	2011	Stroud et al. 2014
Chichester & Langstone Harb	S England	100 (1992-1996)	1987		60	2011	Stroud et al. 2014
Pagham Harbour	Sussex	7 (1992-1996) Or 12 (Stroud et al. 2001)	1988		6	2011	Stroud et al. 2014
Solent & Southampton Water	S England	49 (1993-1997)	1998		0	2007	Stroud et al. 2014
UK Western waters							
Monach Isles	Western Isles	26 (1992)	1994	Declined 2001	2	2001	Seabird2000
South Uist Machair & Lochs	Western Isles	31 (1986-1990)	1997	Declined 2009	7 17	1999 2002	Seabird2000 Stroud et al. 2014
The Dee Estuary	Cheshire & Flintshire	69 (1995-1999) Or 56 (Stroud et al. 2001)	1985		126	2011	Stroud et al. 2014
Morecambe Bay	NW England	26	1996		62	2011	Stroud et al. 2014

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

20.10 BDMPS

UK waters can be split into two distinct spatial BDMPS which are appropriate for the migration periods (late July to early September, and mid-April to May): UK North Sea and Channel waters, and UK western waters. These are distinct for little tern because the evidence suggests that birds from colonies in the North Sea and Channel rarely migrate into UK western waters and vice versa. In addition, although birds from Ireland migrate through UK western waters so contribute to that BDMPS, no significant numbers of little terns from overseas populations are thought to migrate through UK North Sea waters. Numbers of this species predominantly occur in the southern parts of each of these BDMPS areas. Numbers in the NW part of the North Sea BDMPS are very small. About 100 pairs breed in this area, with 41 pairs on SPAs (Ythan Estuary, Firth of Tay). Numbers in the West of Scotland part of the UK western waters BDMPS are also small. About 220 pairs breed in this area, with about 19 pairs on SPAs (Monach Isles, S Uist Machair).

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 60 and 61.

Based on evidence reviewed in sections 20.5, 20.6 and 20.7, the UK North Sea and Channel migration seasons BDMPS is estimated to hold 100% of adults and 60% of immatures from colonies in the UK North Sea and Channel, but no birds from colonies in the UK western waters area or from Ireland (Appendix A Table 60). These proportions give an estimated BDMPS of 3,524 birds (adults and immatures) with 3,524 of these from the UK population and none from overseas.

Based on evidence reviewed in sections 20.5, 20.6 and 20.7, the UK western waters migration seasons BDMPS is estimated to no birds from colonies in the UK North Sea and Channel, but 100% of adults and 60% of immatures from colonies in the UK western waters area, and 95% of adults and 60% of immatures from Ireland (Appendix A Table 61). These proportions give an estimated BDMPS of 1,602 birds (adults and immatures) with 1,088 of these from the UK population and 514 from overseas.

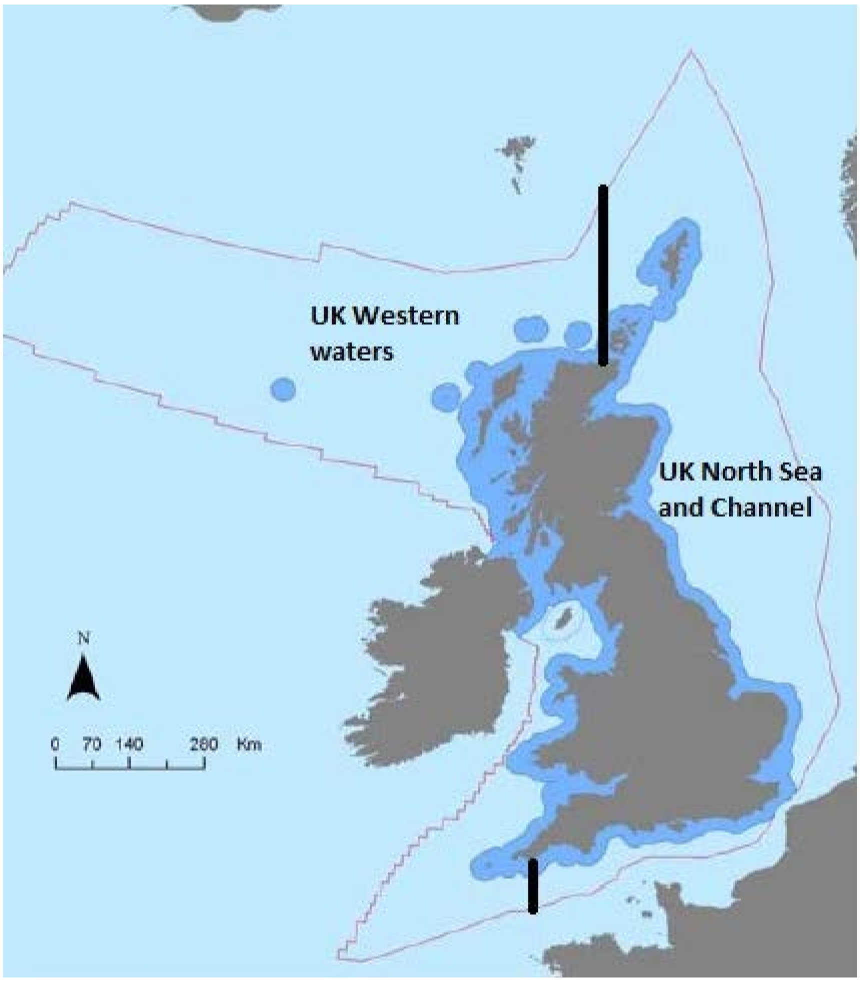

Figure 20.6. Two defined BDMPS spatial areas for little tern: ‘UK North Sea waters and Channel’ and ‘UK Western waters’.

20.11 Proportions of UK SPA birds in BDMPS

SPA birds represent about 40% of the UK population. Proportions of birds that are adults from UK SPA colonies in each BDMPS can be estimated directly from the data in Appendix A Tables 60 and 61. For example, in the UK North Sea and Channel BDMPS (3,524 birds) there are estimated to be 1,918 adults from SPA colonies, so these represent 54% of the total birds present.

20.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Although the general migration pattern of little terns is understood and colony sizes are rather well documented, almost nothing is known about the details of local (colony-specific) patterns of dispersal and migration behaviour of little terns through UK waters. However, it seems likely that birds will mix across the BDMPS when away from colonies, particularly because there are numerous but mostly fairly small colonies in each of the two BDMPS areas.

21. COMMON GUILLEMOT *Uria aalge*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (August to February) (adults and immatures)
Overseas	993,000	128,360
UK	3,132,000	2,628,166
Total	4,125,000	2,756,526

Non-breeding season BDMPS (August to February)	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
UK North Sea and Channel	1,617,306	94,160	1,523,146
UK Western waters	1,139,220	34,200	1,105,020

Colour coding is amber for numbers of birds in the UK population in the biogeographic total and in UK waters and each BDMPS since the locations and sizes of colonies in the UK are well known. Only a few colonies have not been censused since Seabird 2000, and population monitoring by JNCC has a strong focus on common guillemot so national and regional trends in numbers are well monitored. Dispersal and migratory movements of common guillemots from UK colonies are broadly well known based on ring recovery data, seawatching and at sea observations, although there is evidence for long term changes in migration patterns that relate to changes in availability of small pelagic fish (e.g. Heubeck et al. 1991), and the details of post-breeding dispersal of males with chicks are not well understood at a local level where interactions with renewables might be an issue as birds disperse rapidly from breeding areas. Numbers of birds from overseas populations that visit UK waters are much less well known, and there is much more uncertainty about population sizes in many overseas populations and whether those numbers are changing. Therefore the data for overseas contributions to the biogeographic population and BDMPS are coded red. However, because total numbers in the BDMPS are mainly determined by numbers in the UK component of the BDMPS, the totals are coded amber rather than red, as the influence of uncertainty in numbers from overseas on the total numbers present seems to be relatively small.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 62 and 63.

21.1 Breeding range and taxa

Common guillemot has a Holarctic breeding distribution. There are five subspecies, three of which occur in UK waters. *U. a. hyperborea* breeds in Svalbard and northern Norway, east to Novaya Zemlya in northern Russia, and has been recorded in very small numbers in the UK in winter. *U. a. albionis* breeds in Ireland, Britain south of 55° 38'N, at Helgoland (Germany) and from Brittany to northern Portugal. Nominate *U. a. aalge* breeds in Britain north of 55° 38'N, in southern Norway and the Baltic Sea (Peterz and Blomqvist 2010), Faroe, Iceland, Greenland and the northern Atlantic coast of North America. However, these subspecies may really represent clinal variation in size and plumage rather than discrete types, as colonies close to 55° 38'N may contain a mixture of birds that could be assigned to either *albionis* or *aalge*, and several chicks ringed in one subspecies have subsequently recruited into a colony of a different subspecies (for example *aalge* from Shetland found breeding in Arctic Norway where the subspecies is *hyperborea*). However, birds can generally be identified to subspecies from plumage and biometrics, and there is clinal variation in size (Hope Jones 1988, 1995) with larger birds further north, and in the presence of 'bridled' plumage with a higher frequency further north (Birkhead 1984; Reiertsen et al. 2012). As a result, there is scope to assess origins of birds sampled in winter (most frequently from beached birds associated with oil spills or winter wrecks or as a result of chronic winter mortality), although Barrett et al. (2008) concluded that biometrics only allow the most likely sea area of origin to be estimated rather than the specific colony. Attempts have also been made to use DNA markers to identify origins of common guillemots, but there is little variation in common guillemot DNA between populations (Moum et al. 1991; Moum and Arnason 2001; Cadiou et al. 2004; Riffaut et al. 2005).

21.2 Non-breeding component of the population

Common guillemots start to breed when 5 years old (BTO Birdfacts). Adult survival rate is 0.946 (BTO Birdfacts; Harris et al. 2000), juvenile survival 0.56 (BTO Birdfacts; Harris et al. 2007) and mean productivity is 0.678 chicks per pair (JNCC database, n=191 measurements). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.6 for 1-year olds, 0.7 for 2-year olds, 0.85 for 3-year olds and 0.9 for 4-year olds. The model population comprised 57% adults, 19% juveniles and 24% older immatures. There are 0.74 immatures per adult.

21.3 Phenology

Breeding colonies in the UK are deserted in August, with modal departure in July (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007). Autumn dispersal/migration starts in mid-July (Cramp et al. 1977-94), July (Pennington et al. 2004), late July (Forrester et al. 2007) or August (Wernham et al. 2002). The late start date noted by Wernham et al. (2002) may be because that analysis is based primarily on ring recoveries, and there may be a lag before recoveries are found. Peak autumn migration occurs in August according to Pennington et al. (2004) and Forrester et al. (2007), in August-October (Cramp et al. 1977-94), in September-October (Wernham et al. 2002), or October-December in Belgium (Vanermen et al. 2013). Numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) are remarkably small, and do not indicate timing of autumn migration, presumably because birds from breeding sites move eastwards across the North Sea rather than southwards along the coast past most of these seawatching sites (Figure 21.1). Autumn migration is completed by September (Pennington et al. 2004; Forrester et al. 2007) or October (Cramp et al. 1977-94) or November (Wernham et al. 2002). Again the estimate from ring recovery data may be a little late by comparison with estimates based on direct observations.

Spring migration starts in October-November (Cramp et al. 1977-94; Pennington et al. 2004), October-February (Forrester et al. 2007) or December (Wernham et al. 2002). Peak spring migration occurs in December-February (Cramp et al. 1977-94; Forrester et al. 2007), January-February (Pennington et al. 2004), January-March (Wernham et al. 2002) and January-March in Belgium (Vanermen et al. 2013). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in early February (Figure 21.1). Spring migration is completed by March (Pennington et al. 2004; Forrester et al. 2007), mid-April (Cramp et al. 1977-94), or April-May (Wernham et al. 2002).

The first spring records of common guillemot in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were predominantly from 1 January and the last records were predominantly at 31 December, as large numbers of common guillemots overwinter, while peak autumn migration was reported in July in most years, and peak spring migration was reported in January-March in most years. Birds re-occupy colonies from November, with modal return in January (Mudge et al. 1987; Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

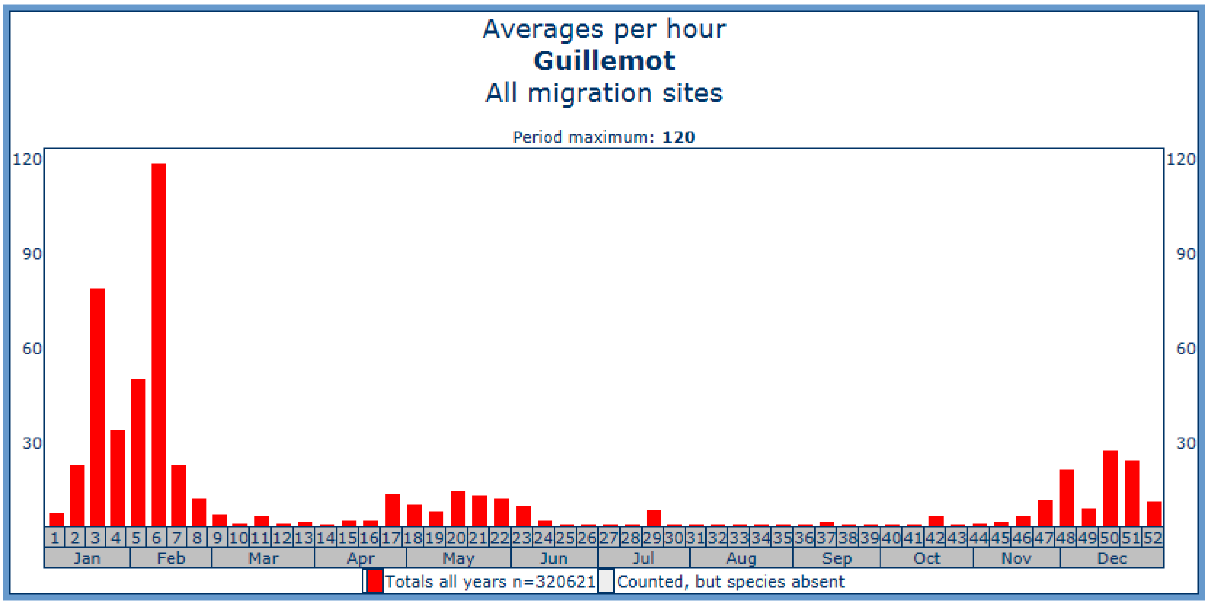

Figure 21.1. Average numbers of common guillemots counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-June, non-breeding season October-April. However, from the data reviewed above, this could be refined to breeding season March-July, non-breeding season August-February.

21.4 Defined seasons:

- UK Breeding season — March-July
- Post-breeding migration in UK waters — July-October
- non-breeding season — August-February (**non-breeding BDMPS**)
- Return migration through UK waters — December-February
- Migration-free breeding season — March-June
- Migration-free winter season — November

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for common guillemot:

Non-breeding season BDMPS (August-February).

21.5 Movements of birds from the UK population

Common guillemots in Britain and Ireland are considered to be dispersive rather than migratory (Wernham et al. 2002). Many adults remain close to their colony throughout the year (Brown and Grice 2005). With the exception of August-September, when adults moult and are flightless for about six to seven weeks (Brown and Grice 2005), adults can be seen at breeding sites occupying ledges, though sporadically through winter. Young birds disperse further than adults, and juveniles from UK colonies have been recovered in October onwards from north Norway to Portugal, whereas few adults move beyond UK waters (Wernham et al. 2002). There is a slight indication for birds from different parts of the UK wintering in different areas, as suggested by Mead (1974). Birds from northern Britain move furthest (and include most of the recoveries in north Norway) (Wernham et al. 2002; see also Heubeck et al. 1991). Those from colonies in SW England mostly move southwards into the Bay of Biscay and travel least (Wernham et al. 2002). Common guillemots from colonies in the east coasts of England and Scotland mostly remain in the North Sea in winter (Wernham et al. 2002). Although typical patterns of distribution and seasonal movements are described above, there is very strong evidence indicating that common guillemot seasonal movements, distribution patterns and overwinter survival are strongly affected by the distribution and abundance of prey fish stocks, and especially the distribution and abundance of sprats. Since sprat stock biomass can vary considerably from year to year, common guillemot seasonal movements can vary according to the availability of their winter prey. Blake (1984) suggested that guillemot survival in winter was influenced by abundance of small prey fish stocks within local areas. Mass mortality of guillemots in 1983 correlated with apparent low abundance of sprat, one of their main winter foods in areas of the North Sea (Underwood and Stowe 1984). Blake et al. (1984) suggested that guillemot distribution across the North Sea related to presence of sprat stocks, while Peterz and Olden (1987) found that increased numbers of common guillemots wintering off the west coast of Sweden related to high abundance of young herring in that area at the time. Skov et al. (2000) also found that the distribution of common guillemots in winter in the Skagerrak and Kattegat correlated with the distribution of young herring. Harris and Bailey (1992) showed that first year common guillemot survival rates in the North Sea were best explained by sprat stock biomass. Although Pennington et al. (2004) stated that the breeding numbers and breeding success of common guillemots in Shetland was primarily determined by the biomass of the Shetland sandeel stock, sandeels remain buried in the sea bed during autumn and winter so are not readily available at that time of year (although common guillemots have been recorded to dig sandeels out of the sand in winter). Their winter prey is predominantly sprats and young herring (Blake 1984).

When common guillemot chicks fledge from Shetland colonies in July, in most years the chicks swim eastwards accompanied by the male parent, arriving off the coast of Norway within a few weeks (Pennington 2004). During 1982-84, many thousands remained in inshore waters around Shetland instead of travelling to Norway. This altered behaviour coincided with a high abundance of sandeels at Shetland and low sprat biomass in the North Sea. No such large numbers were encountered there post-fledging during the late 1980s or 1990s when sandeel stocks had declined to very low abundance at Shetland. These observations suggest that the movements and resulting winter distribution of common guillemots, perhaps especially first year birds, are highly flexible, with birds aggregating in areas where there are high concentrations of food fish. In English waters, post-breeding aggregations are particularly found in August over Dogger Bank, off East England northwards of Flamborough, and in the Irish Sea (Brown and Grice 2005); these birds become more widely dispersed from October to February. There is concern that common guillemots dispersing from breeding areas may possibly aggregate in, or pass through, sites being considered for marine renewables development during their dispersal phase. Since that can be very rapid, lasting just two or three weeks in July, such aggregations could easily be overlooked by a survey protocol of monthly counts at a proposed development site, while such aggregations may not necessarily occur in the same place in successive years, depending on fish stocks. There is, therefore, much uncertainty about local aggregations post-breeding, and where these might be located. More work is required to map dispersal by males and chicks before it is possible to define a BDMPS or set of BDMPSs for the dispersal phase. Therefore in this report the dispersal phase is not treated separately, but is subsumed into the defined breeding season (March to July) or non-breeding season (August to February).

21.6 Movements of birds from overseas into UK waters

Wernham et al. (2002) report 69 foreign ringed common guillemots recovered in the British Isles (i.e. not including birds ringed in Ireland as foreign). These included 8 ringed in Netherlands, 29 in Germany, 23 in Faroes, 5 in Norway, 3 in France, and 1 in Russia. Some of these were ringed as rehabilitated birds (e.g. those from Netherlands, and probably those from France and some from Germany). From this they concluded that small numbers of common guillemots from Scandinavian and Faroese colonies reach northern Britain in autumn and winter and some enter the North Sea (Wernham et al. 2002). Deployment of geolocators on breeding common guillemots at colonies in Central Norway found that all moved northwards up the Norwegian Sea after the breeding season (Lorentsen and May 2012). 80% of these then moved into the Barents Sea, while 20% remained in the north Norwegian Sea. After moult, some moved back into the north Norwegian Sea so that 50% overwintered in the Barents Sea and 50% in the north Norwegian Sea. Lorentsen and May (2012) point out that there are ring recoveries of common guillemots from Central Norway in southern Norway as well as to the north, and caution that their geolocator results may represent only the year of deployment (2009-10) and that patterns may differ in other years, but they suggest that the Barents Sea may represent the main moulting area and a major wintering area for common guillemots from colonies in Central Norway (see also Steen et al. 2013). Most of the recoveries abroad of common guillemots ringed in the Faroes that were recovered in September to November were from the coast of Norway, with only two from UK coasts (Hammer et al. 2013). Later in the winter, in December to February, 7 were recovered on UK North Sea coasts (including Shetland), 18 on the Norwegian coast, 1 in Denmark and 1 in Iceland (Hammer et al. 2013). Birds from Germany (Helgoland) winter in the North Sea and some may enter UK waters (Wernham et al. 2002). The Baltic population apparently remains within the Baltic Sea (Wernham et al. 2002). Wernham et al. (2002) did not report any common guillemots from Iceland recovered in UK waters. Pennington et al. (2004) reported that the only foreign-ringed common guillemots recovered in Shetland were three birds ringed in Faroe. A very few birds found in Shetland in winter appear from measurements to be from the subspecies *hyperborea* which breeds in Arctic Norway, Bear Island, Svalbard and northern Russia (Pennington et al. 2004) but these have only been found on a very few occasions so numbers coming from far northern populations appear to be negligible. Fort et al. (2013) report on deployment of geolocators on common guillemots breeding at a northern Barents Sea colony. Those birds remained within the Barents Sea, White Sea or north Norwegian Sea throughout the winter, so geolocator data suggest that high latitude common guillemots are unlikely to reach UK waters except as vagrants. This supports conclusions based on ringing, which also indicated that common guillemots from colonies in the southern Barents Sea (north Norwegian coast) spend the winter either in the Barents Sea, or in the north Norwegian Sea (Nikolaeva et al. 1996). A small number of birds ringed as chicks have been recovered at breeding colonies far from their natal origins; two chicks from UK colonies were recovered at a colony in north Norway, two from UK colonies were recovered at colonies in the Baltic, and one from the Baltic bred at Skomer in the Irish Sea (Wernham et al. 2002). However, these long-distance natal dispersals are very exceptional. Anker-Nilssen et al. (1988) used biometrics of 826 common guillemots (18% of which were adults) killed by oil in the Skagerrak in January 1981 to infer that most were probably from Scottish or south Norwegian colonies. Cadiou et al. (2004) used ring recoveries and biometrics of 1,851 common guillemots killed in the 'Erika' oil spill in the Bay of Biscay to infer that birds originated from a large area that included colonies from across the British Isles, along with some from more northerly colonies, but with most birds coming from colonies between west Scotland and the Celtic Sea. Grantham (2004) identified differences in wintering areas used by birds from different colonies as recovered in major oil spills; birds wintering in the southwestern approaches to the English Channel and in the Bay of Biscay tended to be immature birds from colonies in west Britain and Ireland, whereas birds wintering in the English Channel and southern North Sea tended to be adults from colonies in eastern Britain. Seabird 2000 reported 965,000 pairs in UK, 80,000 pairs in Ireland, 101,000 pairs in Norway, 175,000 pairs in Faroe, 990,000 pairs in Iceland, 2,500 pairs in Germany, 2,500 pairs in Denmark, and 250 pairs in France (Mitchell et al. 2004). More recently, Hammer et al. (2013) estimated that there are about 100,000 pairs in Faroe, while Gardarsson (2006) suggested that breeding numbers in Iceland had declined by 30% between 1983-86 and 2005-08, with 693,000 pairs in 2005-08. In the UK, changes in numbers are uncertain as no complete survey has been carried out since 2000, but JNCC monitoring data from a selection of colonies suggest a decrease in breeding numbers of about 40% in Scotland between 2000 and 2011 with the decrease most evident in Shetland (Foster and Marrs 2012) whereas numbers breeding in Wales have increased by a similar percentage (JNCC database).

21.7 Numbers in UK waters

Forrester et al. (2007) suggest that in winter there are around 750,000 individuals of *Uria aalge aalge* in Scottish waters. Numbers of *Uria aalge albionis* in Scottish waters in winter are uncertain, but there may be around 20,000, with most of those birds (which breed mostly on Ailsa Craig and Sanda) being in SW Scotland in winter. A small proportion of those birds may originate from colonies in England, Wales and Ireland, as some of those birds may disperse northwards in autumn (Forrester et al. 2007). Blake et al. (1984) estimated from ESAS data that common guillemots moved rapidly out of waters adjacent to breeding colonies in July, with perhaps 1,500,000 birds in North Sea waters in autumn and winter. Numbers in waters to the west of the UK appear to be similar in total to numbers in UK North Sea waters, so perhaps about 1,500,000 birds are in waters west of the UK in autumn and winter. Those totals would suggest that most of the UK population (900,000 pairs so 1,800,000 adults which would probably have an associated 1,300,000 immature birds) are in UK waters in autumn and winter, or that the birds from the UK population that move into overseas waters are similar in number to the totals that enter UK waters from overseas. This total would suggest that the estimate presented by Forrester et al. (2007) is most likely an underestimate of numbers in Scottish waters. For this reason, estimated numbers in the BDMPS have been set between the (lower) numbers thought to be at sea based on ESAS survey data and (higher) numbers thought to be present based on known population size and movement patterns.

21.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the North Atlantic population, comprising 2,250,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 2,800,000-2,900,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 8,500,000 individuals. Populations with connectivity to UK waters include UK (900,000 pairs), Ireland (80,000 pairs), Faroe (100,000 pairs), Norway (100,000 pairs), Germany and Denmark (5,000 pairs) and France (250 pairs). Therefore the biogeographic population with connectivity to UK waters sums to 4,125,000 birds (including adults and immatures), with 3,132,000 in UK, and 993,000 in overseas, populations. The UK population represents a high proportion of this total, and many of the birds from these overseas populations do not visit UK waters, so the birds in UK waters are, at all times of year, predominantly birds from UK colonies. The estimated total numbers in UK waters in the non-breeding season (August to February) are 2,708,000 birds, with 2,580,000 of these from the UK. The slightly smaller number of UK birds in UK waters than in the biogeographic population recognises that some younger immature birds from the UK will be in overseas waters.

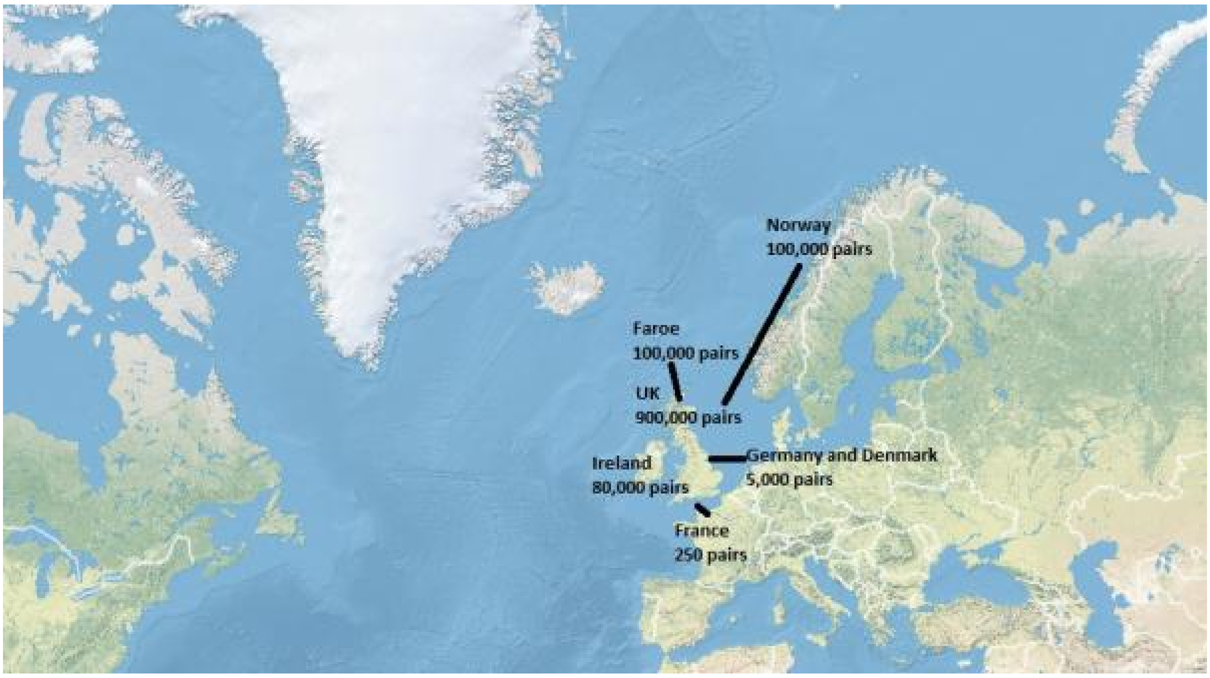

Figure 21.2. Breeding population origins of common guillemots in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

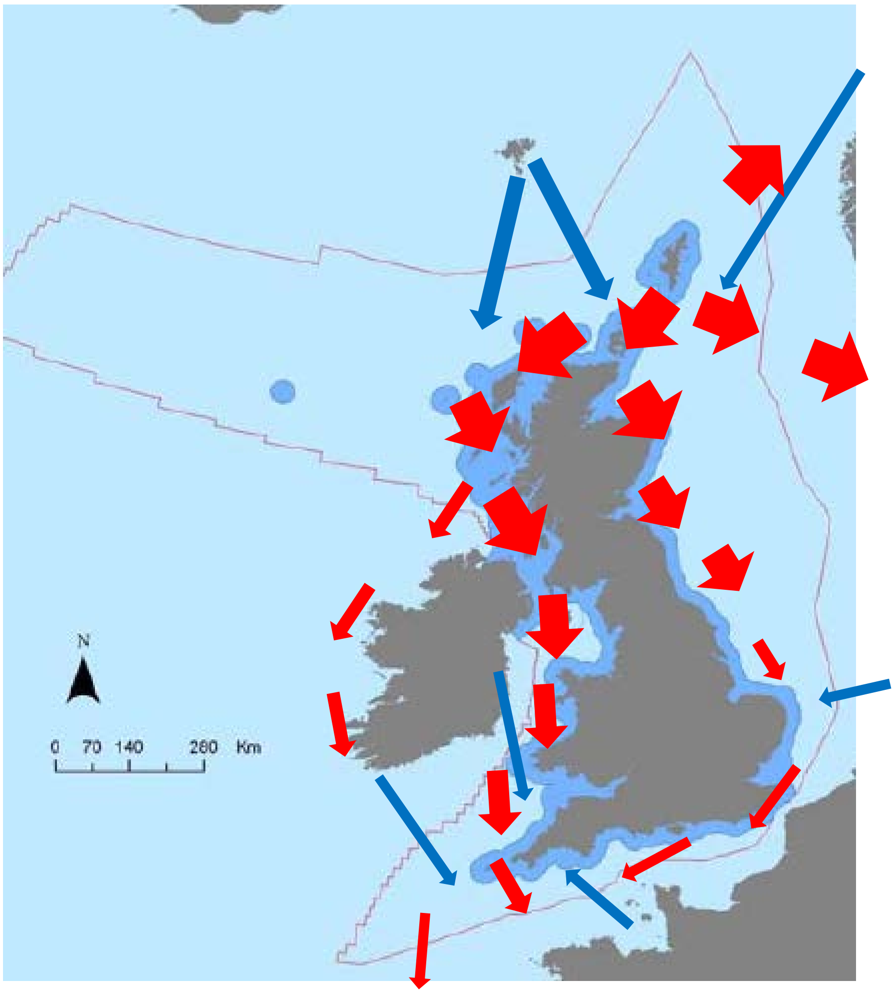

Figure 21.3. Main movements of common guillemots from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

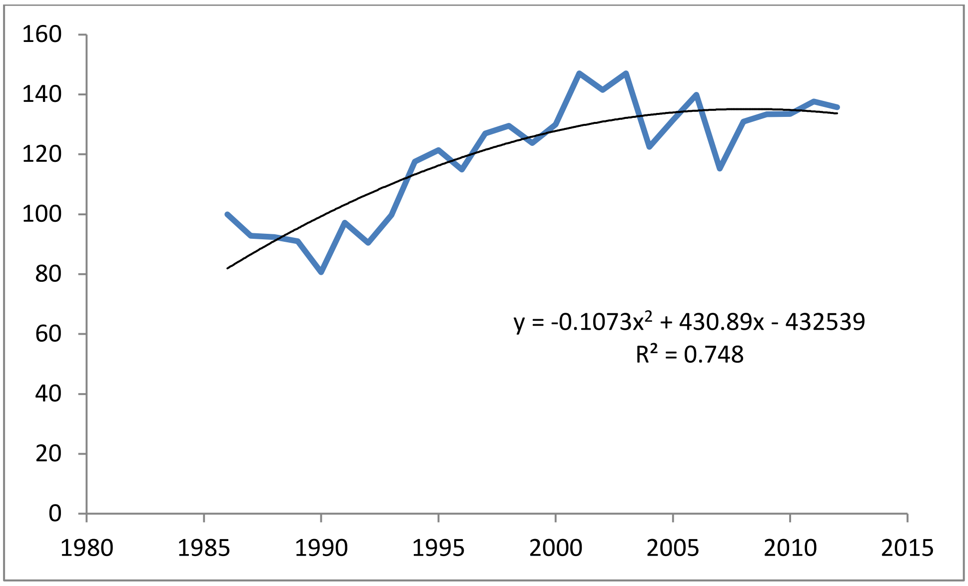

Figure 21.4. Trend in the common guillemot breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

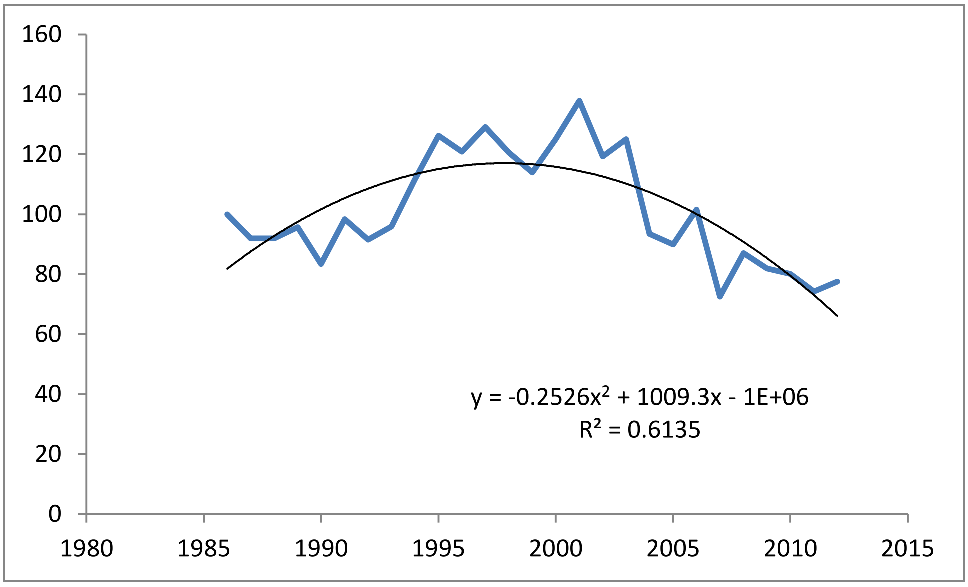

Figure 21.5. Trend in the common guillemot breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

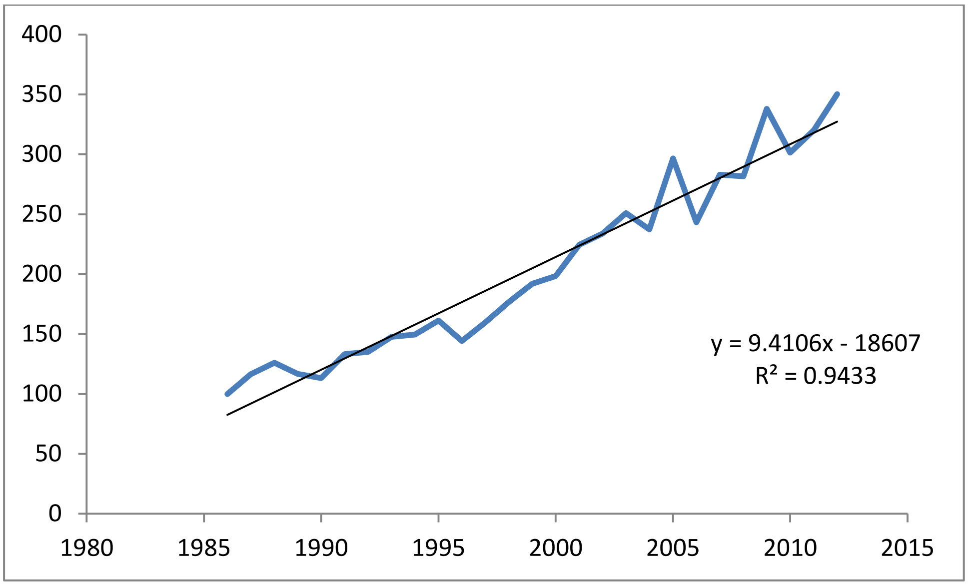

Figure 21.6. Trend in the common guillemot breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

21.9 Proportion of BDMPS from UK breeding SPAs

The 34 SPAs with breeding common guillemots as a feature together held 693,120 pairs at designation, estimated to represent ca. 95% of the British breeding population and ca. 27% of the all-Ireland breeding population (Stroud et al. 2001). Stroud et al. (2014) considered the two subspecies that occur in the UK separately. The subspecies *Uria aalge aalge* breeding populations are features in 30 GB SPAs, and survey data from 1999-2011 showed that those then held an estimated 75% of the GB population of that subspecies. The subspecies *Uria aalge albionis* breeding populations are features in 3 GB SPAs, and survey data from 2009-2011 showed that those then held an estimated 68% of the GB population of that subspecies. The single SPA for *Uria aalge albionis* in Northern Ireland then held an estimated 55% of the all-Ireland population of that subspecies. Since the surveys reported in Stroud et al. (2014) numbers have declined further in northern Scotland but increased in England and Wales; the proportion in the SPA suite may have further reduced slightly, but probably very little overall.

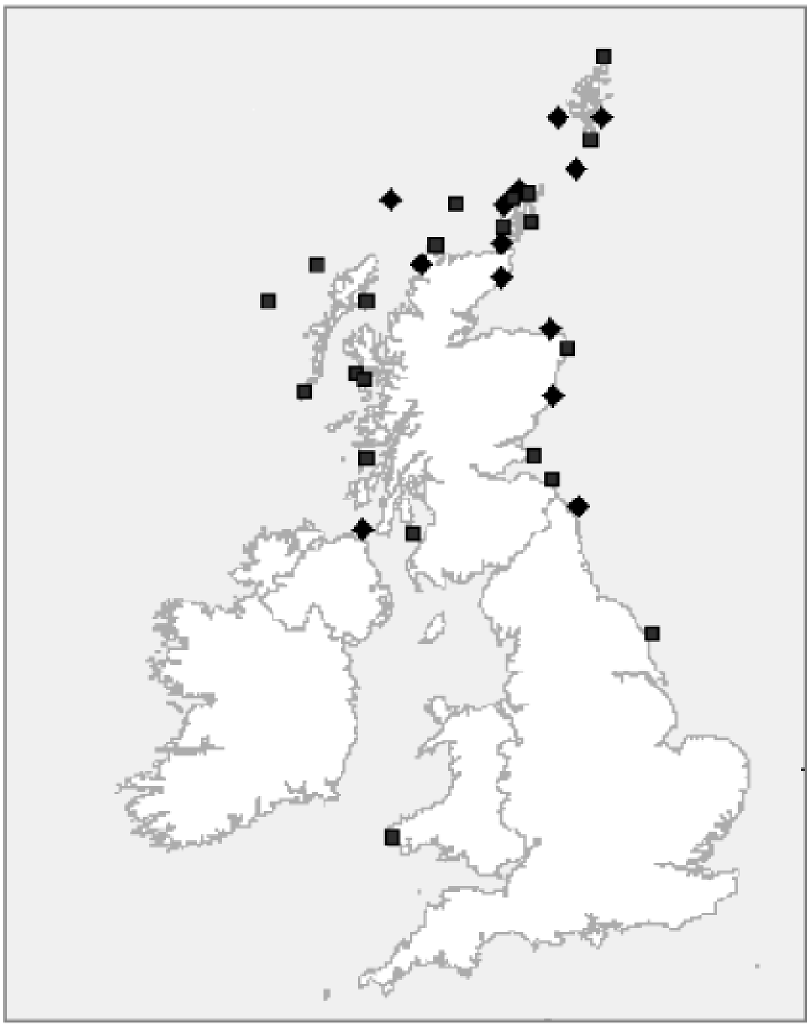

Figure 21.7. The UK SPA suite for breeding common guillemots. These SPA populations are listed in Table 21.1.

Table 21.1. The UK SPA suite for breeding common guillemots (counts expressed as individual birds are converted to pairs by multiplying by 0.67).

SPA	Location	Pairs	Year desig-nated	Site Condition Monitoring*	Recent count (pairs)	Year	Reference
UK North Sea & Channel							
Hermaness, Saxavord & Valla	Shetland	11,363	1994	Maintained 2000	6,994 4,020 4,620	2000 2004 2009	SMP database SMP database SMP database
Foula	Shetland	25,125 (1987)	1995	Declined 2007	27,805 16,615	2000 2007	SMP database SMP database
Noss	Shetland	30,619	1996	Declined 2005	30,671 14,908 16,172 14,783	2001 2004 2005 2009	SMP database SMP database SMP database SMP database
Sumburgh Head	Shetland	10,752	1996	Declined 2007	10,269 5,109 4,908 5,314 4,762 3,323 4,896 4,207	2001 2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database

Fair Isle	Shetland	25,165 (1994)	1994	Maintained 1999	26,302 18,304 13,066	1999 2005 2010	SMP database SMP database SMP database
West Westray	Orkney	28,274	1996	Maintained 2007	36,700 33,900	1999 2007	Seabird2000 Lewis et al. 2012
Calf of Eday	Orkney	8,241	1998	No change 2006	1,715 6,300	2002 2006	SMP database Lewis et al. 2012
Rousay	Orkney	7,102	2000	Recovered 2009	4,300 6,200	1999 2009	Seabird2000 Lewis et al. 2012
Marwick Head	Orkney	24,388	1994	Maintained 1999	23,235 7,019 11,267 11,097	1999 2004 2006 2012	SMP database SMP database SMP database SMP database
Hoy	Orkney	13,400	2000	Declined 2007	6,300	2007	Lewis et al. 2012
Copinsay	Orkney	13,333	1994	Declined 2008	9,166 5,607	2008 2012	SMP database SMP database
North Caithness Cliffs	N Scotland	26,994	1996	Maintained 2000	47,000	2000	Lewis et al. 2012
East Caithness Cliffs	N Scotland	71,509 (1986)	1996	Maintained 1999	120,789 or 158,895 individuals	1999	Lewis et al. 2012
Troup, Pennan & Lion's Heads	NE Scotland	29,902 (1995)	1997	Declined 2007	30,300 10,938	2001 2007	Seabird2000 SMP database
Buchan Ness - Collieston Coast	NE Scotland	8,640	1998	Declining 2007	19,691 12,928	2001 2007	SMP database SMP database
Fowlsheugh	NE Scotland	40,140	1992	Maintained 1999	41,800 36,300 33,900 30,100	1999 2006 2009 2012	SMP database SMP database SMP database SMP database
Forth Islands	E Scotland	16,000 (1985) Or 22,452 (Stroud et al. 2001)	1990	Maintained 2007	14,096 15,829 16,091 15,779 14,674	2007 2008 2009 2010 2011	SMP database SMP database SMP database SMP database SMP database
St Abb's Head to Fast Castle	E Scotland	20,971	1997	Maintained 1998	27,282 27,061 22,231 22,103	1998 2003 2008 2013	SMP database SMP database SMP database SMP database
Farne Islands	NE England	23,499	1985		32,596 29,390 32,244 31,058 32,145 32,881 33,532	2007 2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database

Flamborough Head & Bempton (to be subsumed into Flamborough and Filey Coast SPA)	E England	16,150	1993		31,279 39,641	2000 2008	SMP database SMP database
Flamborough and Filey Coast	E England	41,607 (2008-2011)	Not yet				See row above
UK Western waters							
Sule Skerry and Sule Stack	N Scotland	6,298 (1986)	1994	Maintained 1998	7,633	1998	SMP database
North Rona and Sula Sgeir	N Scotland	28,944 (1986)	2001	Declined 2012	21,021 North Rona only: 7,033 4,096 3,324	1998 1998 2005 2012	SMP database SMP database SMP database SMP database
Cape Wrath	NW Scotland	9,159	1996	Maintained 2000	27,359	2000	SMP database
Handa	NW Scotland	76,105 (1994)	1990	Declined 2007	75,493 60,370 30,550 37,993	1998 2003 2007 2011	SMP database SMP database SMP database SMP database
Shiant Isles	Western Isles	12,315	1992	Declined 2008	11,026 5,148	1999 2008	SMP database SMP database
Flannan Isles	Western Isles	14,693	1992	Declined 2013	9,807	1998	Mitchell et al. 2004
St Kilda	Western Isles	15,209	1992	Maintained 2000	15,700	1999	Seabird2000
Canna and Sanday	W Scotland	3,858	1998	Maintained 2001	3,913	1999	SMP database
Rum	W Scotland	2,680	1982	No change 2000	1,644	2000	SMP database
Mingulay and Berneray	Western Isles	20,703	1994	Declined 2009	21,835 29,725 13,527	1998 2003 2009	SMP database SMP database SMP database
North Colonsay & West Cliffs	W Scotland	6,656	1997	Maintained 2008	13,500	2000	Seabird2000
Ailsa Craig	W Scotland	3,350 (1987)	1990	Maintained 2003	7,818 5,247	2009 2013	SMP database SMP database
Rathlin Island	N Ireland	28,064 (1985)	1999		54,473 87,398	2007 2011	SMP database SMP database
Skomer and Skokholm	Wales	7,067	1982		12,479 14,210 14,577 16,375 16,641 16,300	2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

21.10 BDMPS

UK waters can be split into two spatial BDMPS for common guillemots, the UK North Sea and Channel, and the UK western waters (Figure 21.8). This split is based on the fact that very few common guillemots from colonies in western Britain move into the North Sea during autumn migration or vice versa. In addition, birds from overseas are likely to show a tendency to occur more in one side of the UK than the other, with birds from continental Europe more frequent in the North Sea than in western waters. While there is a possibility that spatial distribution patterns may differ in the immediate post-breeding dispersal period in July-August, the details of distribution and movements at that time are not well known except broadly. There have not yet been any tracking studies of males with dependent chicks as they disperse, so details of colony-specific patterns of dispersal and how much these vary from year to year are uncertain. Until such data are available it seems best to define just two seasonal periods; breeding season (March to July) and non-breeding season (August to February).

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 62 and 63.

Based on evidence reviewed in sections 21.5, 21.6 and 21.7, the UK North Sea and Channel non-breeding season BDMPS is estimated to hold 70% of adults and 60% of immatures from North Sea colonies in Shetland to Aberdeenshire, 80% of adults and 70% of immatures from Aberdeenshire to Fife, 90% of adults and 80% of immatures from Fife to Humberside, 5% of adults and 10% of immatures from colonies from NW Scotland to Argyll, 0% of adults and 5% of immatures from Argyll to Northern Ireland, 5% of adults and 10% of immatures from Wales, 10% of adults and 20% of immatures from Faroes, 5% of adults and 20% of immatures from Norway, 20% of adults and 40% of immatures from Germany and Denmark (Appendix A Table 62). These proportions result in an estimated BDMPS of 1,617,306 birds (adults and immatures) with 1,523,146 of these from UK and 94,160 from overseas populations.

Based on evidence reviewed in sections 21.5, 21.6 and 21.7, the UK western waters non-breeding season BDMPS is estimated to hold 2% of adults and 5% of immatures from North Sea colonies in Shetland, Orkney and north Caithness, no birds from colonies between East Caithness and East Anglia, 95% of adults and 90% of immatures from colonies from NW Scotland to Argyll, 100% of adults and 95% of immatures from Argyll to Northern Ireland, 90% of adults and 80% of immatures from Wales, 5% of adults and 10% of immatures from Faroes, 1% of adults and 5% of immatures from Norway (Appendix A Table 63). These proportions result in an estimated BDMPS of 1,139,220 birds (adults and immatures) with 1,105,020 of these from UK and 34,200 from overseas populations.

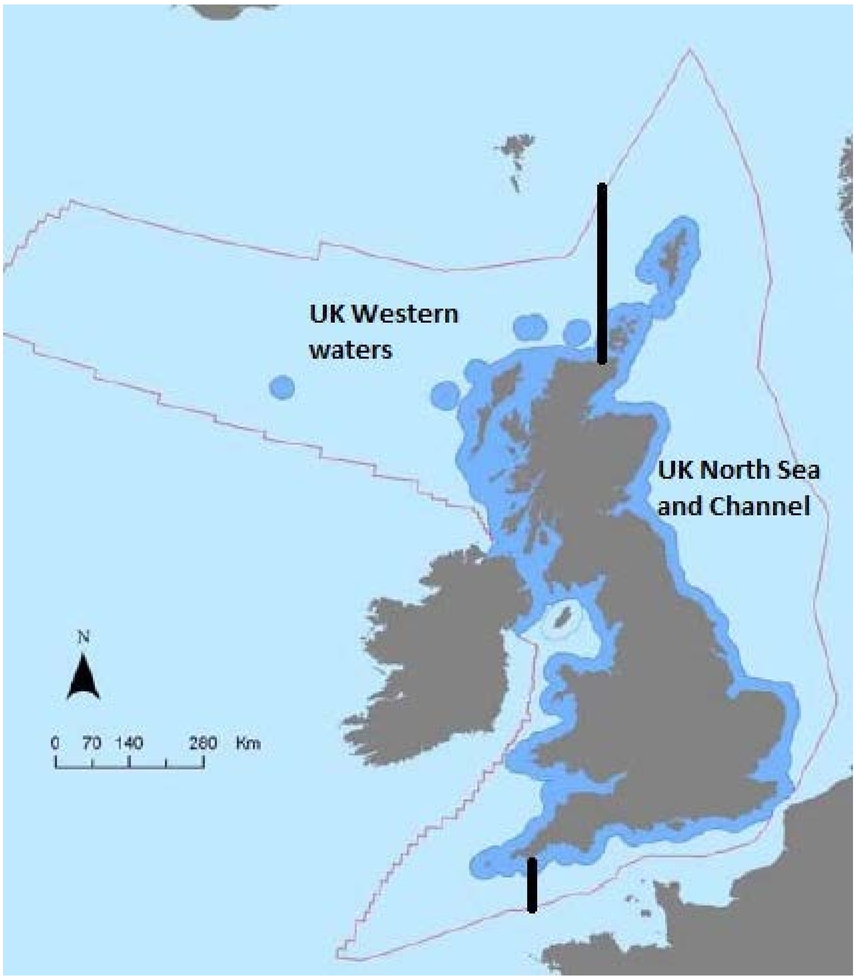

Figure 21.8. Two defined BDMPS spatial areas for common guillemot: ‘UK North Sea waters and Channel’ and ‘UK Western waters’.

21.11 Proportions of UK SPA birds in BDMPS

SPA birds represent about 70-75% of the UK population. Proportions of birds that are adults from UK SPA colonies in each BDMPS can be estimated directly from the data in Appendix A Tables 62 and 63. For example, in the UK North Sea and Channel BDMPS (1,617,306 birds) there are estimated to be 684,920 adults from SPA colonies, so these represent 42% of the total birds present.

21.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Given the large number of SPA populations distributed through UK coasts, the SPA birds are likely to be well mixed with birds from non-SPA colonies and from overseas. In autumn shortly after dispersal from colonies there may be aggregations of SPA birds close to Flamborough Head & Bempton SPA, close to Farne Islands SPA, and close to Skokholm and Skomer SPA. These aggregations are likely to become less pronounced through the autumn as birds move offshore during winter, but may recur in late winter as adult birds move back towards breeding colonies. However, such aggregations appear to be very short-lived in the transition between breeding and non-breeding distributions. More research is needed to determine whether there are consistent ‘hot-spots’ where common guillemots aggregate during the brief post-breeding dispersal stage in late July.

22. RAZORBILL *Alca torda*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in migration seasons (August-October, and January-March) (adults and immatures)	Numbers in UK waters in winter (November-December) (adults and immatures)
Overseas	1,350,000	851,310	461,228
UK	357,000	347,478	98,816
Total	1,707,000	1,198,788	560,044

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Migration seasons BDMPS (August-October, and January-March)			
UK North Sea and Channel	591,874	434,431	157,443
UK Western waters	606,914	416,879	190,035
Winter BDMPS (November and December)			
UK North Sea and Channel	218,622	172,869	45,753
UK Western waters	341,422	288,359	53,063

Colour coding is amber for numbers of birds in the UK population in the biogeographic total and in UK waters and each BDMPS since the locations and sizes of colonies in the UK are well known. Only a few colonies have not been censused since Seabird 2000, and population monitoring by JNCC has meant that national and regional trends in numbers can be assessed. Dispersal and migratory movements of razorbills from UK colonies are broadly known based on ring recovery data, seawatching and at sea observations, although there may be long term changes in migration patterns that relate to changes in availability of small pelagic fish (as is more clearly known for common guillemot), and the details of post-breeding dispersal of males with chicks are not well understood at a local level where interactions with renewables might be an issue as birds disperse rapidly from breeding areas. Numbers of birds from overseas populations that visit UK waters are much less well known, and there is much more uncertainty about population sizes in many overseas populations and whether those numbers are changing. Therefore the data for overseas contributions to the biogeographic population and BDMPS are coded red. Because it appears that total numbers are strongly influenced by these numbers from overseas, the totals are also coded red.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 64 to 67.

22.1 Breeding range and taxa

Razorbills breed around the North Atlantic. There are two subspecies; nominate *A. t. torda* breeds in eastern North America, Greenland, Bear Island, White Sea, Norway, Denmark, and Baltic Sea. Subspecies *islandica* breeds in in Iceland, Faroe, British Isles, Germany, and France. There is considerable variation in size with latitude of breeding colony (Hope Jones 1995; Barrett et al. 1997), providing an opportunity to assess origins of individuals sampled in winter. Although genetic differentiation between razorbills in different colonies was considered by Moum and Arnason (2001) to be moderately high, genetic comparisons do not seem to have been used to infer seasonal movements of razorbills.

22.2 Non-breeding component of the population

Razorbills start to breed when 4 years old (BTO Birdfacts). Adult survival rate is 0.9 (BTO Birdfacts; Chapdelaine 1997), juvenile survival 0.38 to 4 years old (BTO Birdfacts; Chapdelaine 1997) and mean productivity is 0.633 chicks per pair (JNCC database, n=87 measurements). To obtain a stable population, survival of immatures was adjusted to 0.6 for juveniles, 0.7 for 1-year olds, 0.8 for 2-year olds, and 0.9 for 3-year olds. The model population comprised 57% adults, 18% juveniles and 25% older immatures. There are 0.75 immatures per adult.

22.3 Phenology

Breeding colonies in the UK are deserted in August, with modal departure in July (Pennington et al. 2004; Forrester et al. 2007). Autumn dispersal/migration starts in July (Pennington et al. 2004), mid-July (Cramp et al. 1977-94), July-August (Wernham et al. 2002), or August (Forrester et al. 2007). Peak autumn migration occurs in late July in Shetland (Pennington et al. 2004), August-October (Cramp et al. 1977-94), September-October (Wernham et al. 2002; Forrester et al. 2007), and October-November in Belgium (Vanermen et al. 2013). Numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) are so small that no peak in autumn migration can be detected (Figure 22.1). Autumn migration is completed by mid-August in Shetland (Pennington et al. 2004), but by October in southern UK waters (Cramp et al. 1977-94), November (Forrester et al. 2007) or November-December (Wernham et al. 2002).

Spring migration starts in November-December (Cramp et al. 1977-94), or January (Pennington et al. 2004; Forrester et al. 2007). Peak spring migration occurs in January-February (Cramp et al. 1977-94), February-March (Pennington et al. 2004; Forrester et al. 2007), and February-April in Belgium (Vanermen et al. 2013). Peak numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in late January and early February (Figure 22.1). Spring migration is completed by March (Cramp et al. 1977-94) or April (Pennington et al. 2004; Forrester et al. 2007).

The first spring records of razorbill in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from January to March, and the last records were mostly in December. Peak autumn migration was not well defined and was reported in July to November in different areas and years, and peak spring migration was reported in January to April, but mostly in March. Birds re-occupy colonies from February, with modal return in late March or early April (Pennington et al. 2004; Forrester et al. 2007).

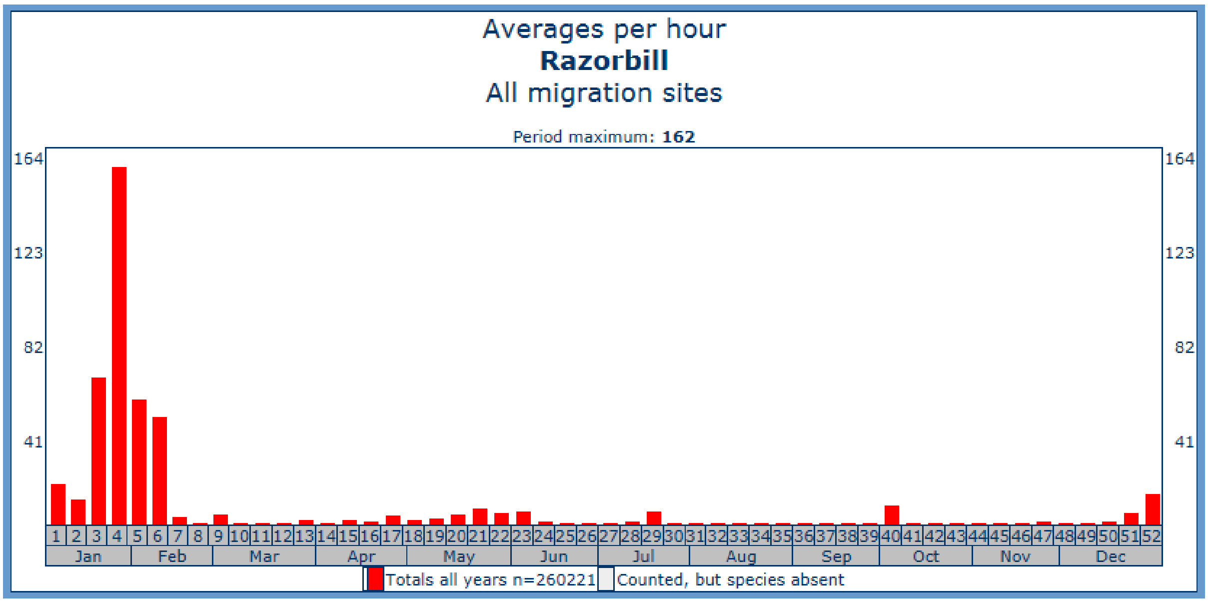

Figure 22.1. Average numbers of razorbills counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as May-June, non-breeding season October-April. However, from the data reviewed above, a more appropriate definition would be breeding season April-July, non-breeding season August-March.

22.4 Defined seasons:

• UK Breeding season	April-July
• Post-breeding migration in UK waters	August-October (**migration BDMPS**)
• non-breeding season	August-March
• Return migration through UK waters	January-March (**migration BDMPS**)
• Migration-free breeding season	April-June
• Migration-free winter season	November-December (**winter BDMPS**)

Apart from the breeding season, two seasonal BDMPS periods are considered to be appropriate for razorbill:

Migration seasons BDMPS (August-October, and January-March); and

Winter BDMPS (November-December).

22.5 Movements of birds from the UK population

During late summer and early autumn (July and August) when the fledged young are completing growth at sea and adults are undertaking their post-breeding moult, most recoveries of UK ringed adults and juveniles occur close to the colony, though by this time immature birds may be further afield (Wernham et al. 2002). During September, breeders and juveniles move predominantly southwards, with recoveries from southern Norway to Portugal, and predominantly in the southern North Sea, Celtic Sea, Channel or Bay of Biscay (Wernham et al. 2002). The majority of those ringed in the SW of Britain are recovered in autumn in the Channel, the southern North Sea, western France, Iberia, the western Mediterranean and northwest Africa. Razorbills from colonies in NW Britain are predominantly recovered from the North Sea, Channel, southern and western Britain and France. Birds from north Scotland and the northern isles tend to move east, to southwest

Norway and Denmark or to the southern North Sea with relatively few reaching France and Iberia. Skov et al. (2000) found that the distribution of razorbills in winter in the Skagerrak and Kattegat, some of which originate from UK colonies, correlated with the distribution of young herring. Too few birds have been ringed in east Britain to indicate their movement pattern. Immature birds, especially the youngest age classes, tend to travel further south in winter than adults, and may remain in wintering areas through the year, but older immatures tend to move back to breeding colonies in summer though some may visit areas beyond their natal colony such as Greenland, Iceland and Faroe. Adults return to their colonies in spring, with older immatures following later.

22.6 Movements of birds from overseas into UK waters

Only 26 razorbills ringed abroad have been recovered in Britain and Ireland; 14 of these were ringed in Iceland, 4 in Russia, 3 in Norway, 2 in France, and one each in Finland, Sweden and The Netherlands (Wernham et al. 2002). The birds from Russia, Norway, Finland and Sweden are from the subspecies *torda*, and these birds tend to be significantly larger than birds from the subspecies *islandica* which is found breeding in the UK, Iceland, Faroe, Ireland and France. Measurements of beached corpses of razorbills in winter have confirmed presence of birds of the subspecies *torda* at a frequency of up to 4% of beached razorbills in the British Isles in winter, suggesting that these larger birds from the nominate subspecies are present in UK waters in winter as a small minority of the razorbill population (Wernham et al. 2002). In Shetland, only very small numbers of birds with wing lengths indicative of the subspecies *torda* have been found in winter beached bird surveys, suggesting that rather few *torda* birds winter near to Shetland (Pennington et al. 2002). Anker-Nilssen et al. (1988) used biometrics of 308 razorbills (66% of which were adults) killed by oil in the Skagerrak in January 1981 to infer that 55% were probably from Scottish colonies, and 45% from Baltic colonies. Seabird 2000 reported populations as 126,400 pairs in UK, 17,000 pairs in Ireland, 380,000 pairs in Iceland (Gardarsson 2006 suggested this had decreased to 315,400 pairs by 2005-08), 4,500 pairs in Faroe (all these being populations of the subspecies *islandica*), 30,300 pairs in Norway, 3,500pairs in Russia, 10,000 pairs in Sweden, 6,000 pairs in Finland (all those being populations of the subspecies *torda*).

22.7 Numbers in UK waters

During post-breeding dispersal, about 220,000 birds are present in the North Sea (Tasker et al. 1987). Forrester et al. (2007) suggest that about 50,000 to 250,000 birds winter in Scottish waters, the high range indicating a low confidence in numbers. Higher numbers occur in English waters in winter, but a substantial (but uncertain) proportion of the UK population winters in southern Europe or in the eastern North Sea.

22.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *islandica* population, comprising 575,000 pairs. However, Mitchell et al. (2004) provided a revised estimate of this population as 530,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 1,950,000 individuals. Populations with connectivity to UK waters in migration or winter (Figure 22.2) include the UK (120,000 pairs), Iceland (315,000 pairs), Faroe (4,500 pairs), Norway (30,300 pairs), Russia (3,500 pairs), Sweden, Finland and Denmark (16,000 pairs), Ireland (17,000 pairs), and France (25 pairs). It is very uncertain what proportions of birds from these populations migrate through UK waters, or winter in UK waters. The biogeographic population with connectivity to UK waters comprises 1,707,000 birds (adults and immatures) with 357,000 of these from the UK population and 1,350,000 from overseas populations. Numbers estimated to be present in UK waters in the migration seasons (August to October, and January to March) are 1,197,000 birds in total, with 347,000 of these from the UK and 850,000 from overseas populations. Numbers estimated to be present in UK waters in winter (November-December) are 559,000 birds in total, with 99,000 of these from the UK and 460,000 from overseas populations.

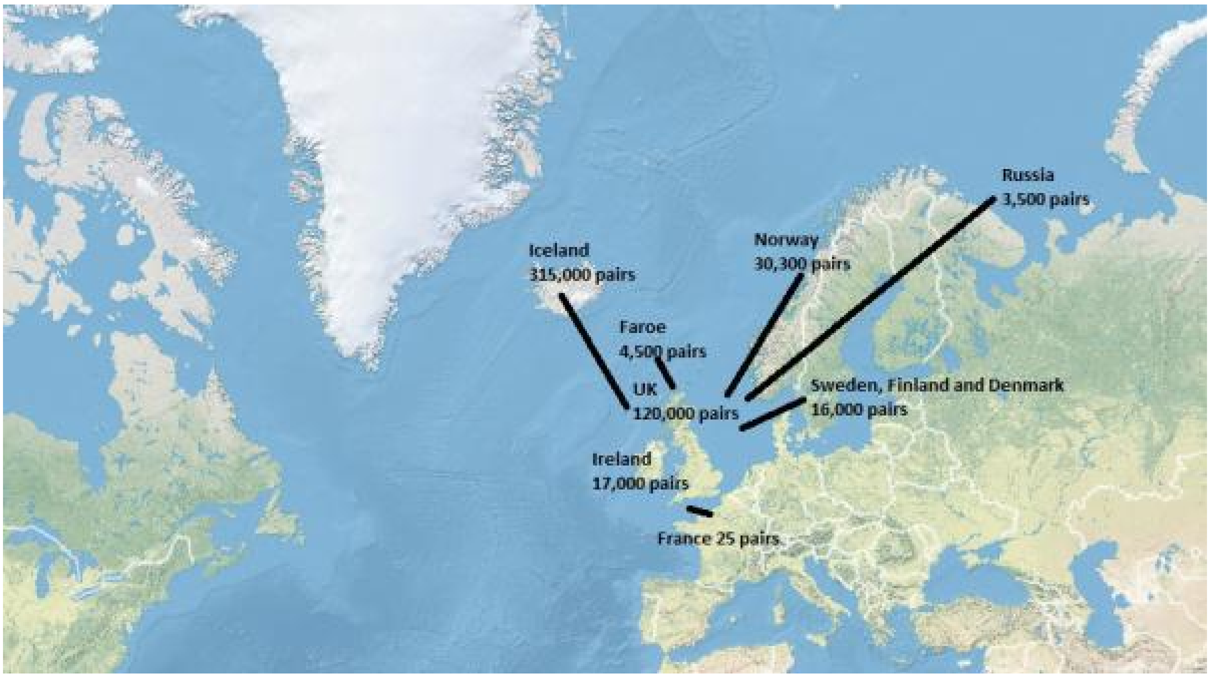

Figure 22.2. Breeding population origins of razorbills in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

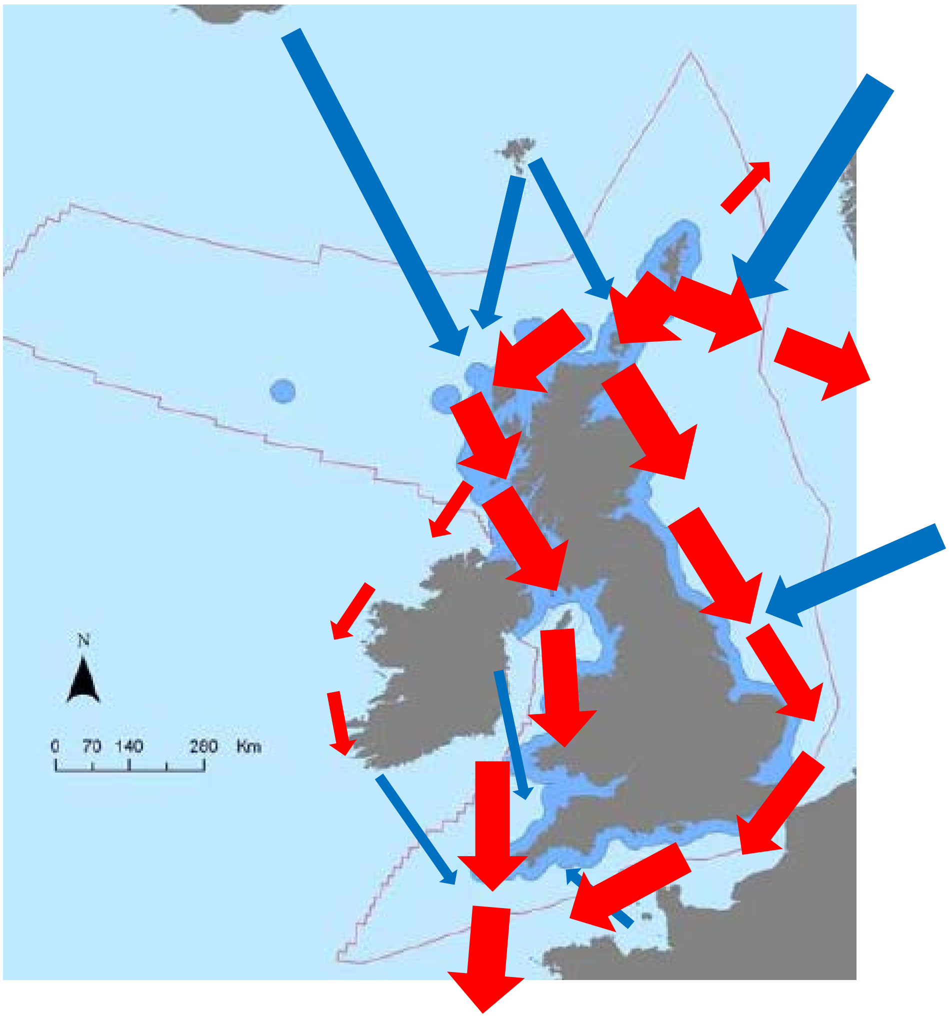

Figure 22.3. Main movements of razorbills from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

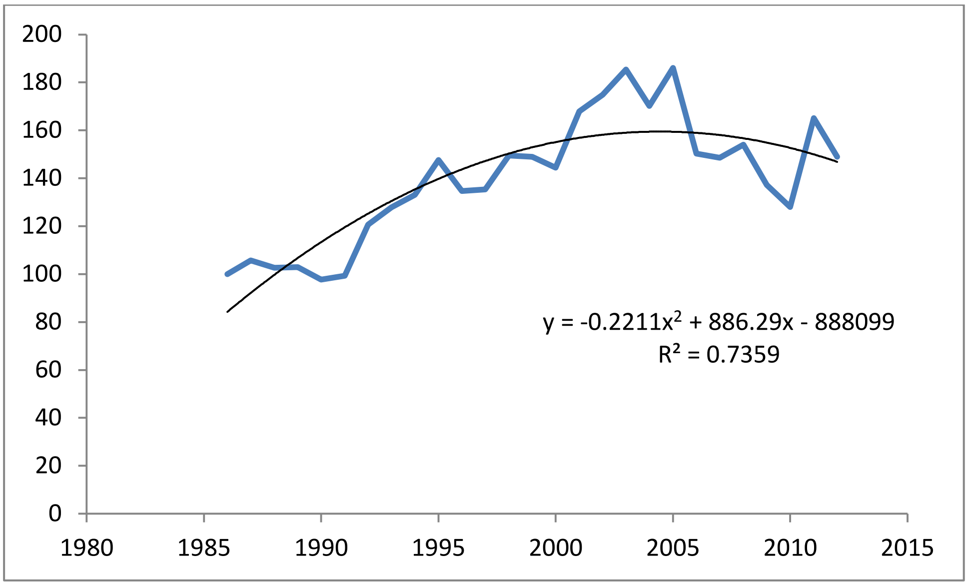

Figure 22.4. Trend in the razorbill breeding population index in UK from 1986-2012. Data from JNCC seabird population monitoring database.

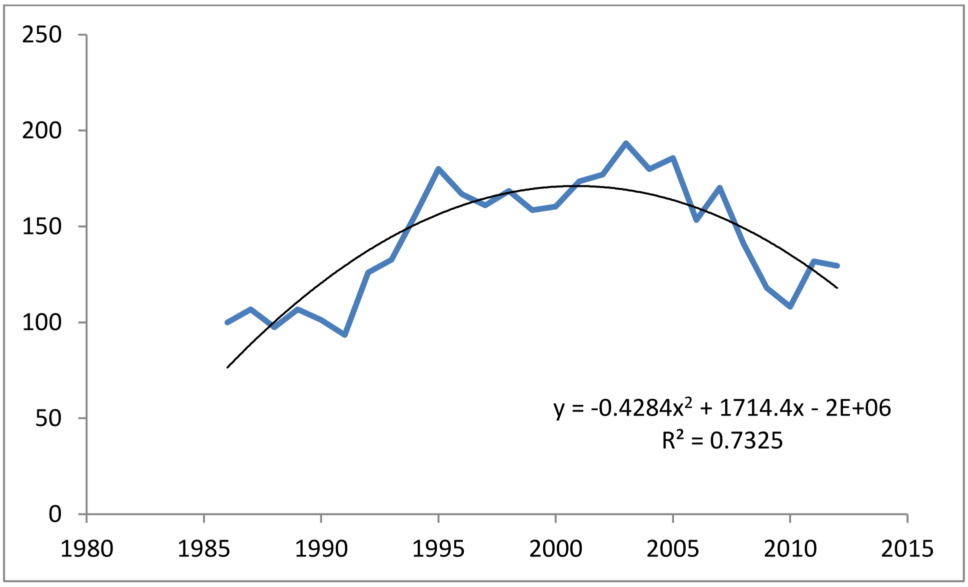

Figure 22.5. Trend in the razorbill breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

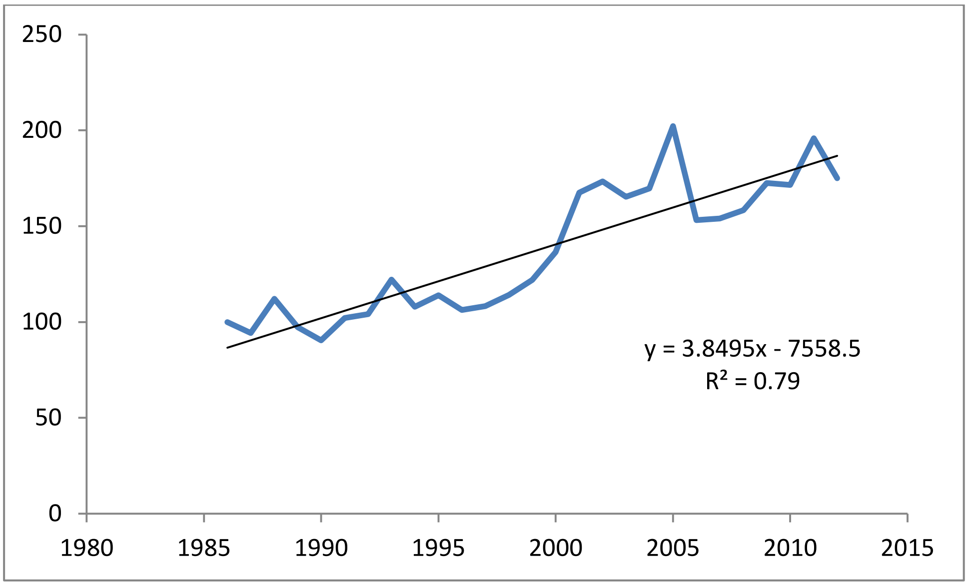

Figure 22.6. Trend in the razorbill breeding population index in Wales from 1986-2012. Data from JNCC seabird population monitoring database.

22.9 Proportion of BDMPS from UK breeding SPAs

The 19 SPAs with breeding razorbills as a feature together held 81,335 pairs at designation, estimated to represent ca. 76% of the British breeding population and ca. 26% of the all-Ireland breeding population (Stroud et al. 2001). From survey data in 1998-2011, Stroud et al. (2014) estimated that the 18 SPA populations designated in Britain held 92.9% of the British population, while the single SPA designated for razorbill in Northern Ireland held about 66% of the all-Ireland population.

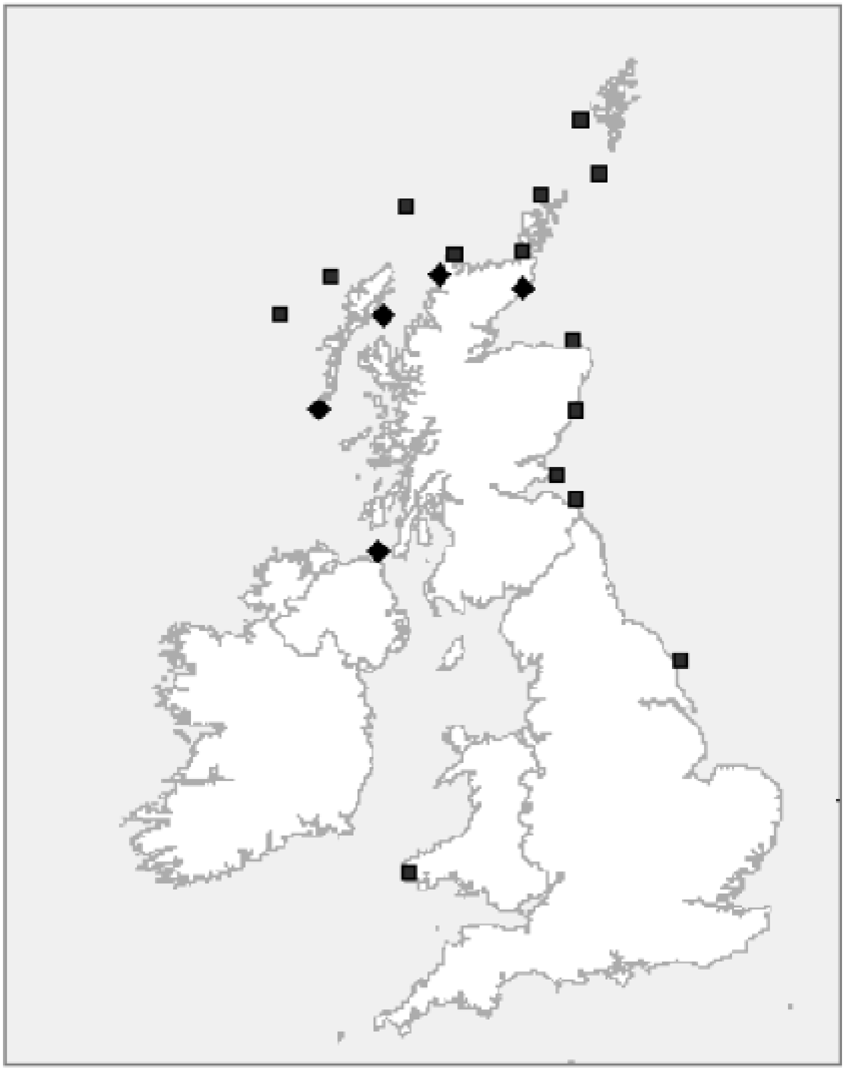

Figure 22.7. UK SPA suite for razorbill. These SPA populations are listed in Table 22.1.

Table 22.1. The UK SPA suite for breeding razorbills.

SPA	**Location**	**Pairs**	**Year desig-nated**	**Site Condition Monitoring***	**Recent count (pairs)**	**Year**	**Reference**
UK North Sea & Channel							
Foula	Shetland	4,154	1995	Declined 2007	2,814 375	2000 2007	SMP database SMP database
Fair Isle	Shetland	2,044	1994	Maintained 2005	2,292 915	2005 2010	SMP database SMP database
West Westray	Orkney	1,307	1996	Maintained 2007	1,600 550	1999 2007	Seabird2000 Lewis et al. 2012
North Caithness Cliffs	N Scotland	2,212	1996	Declined 2000	1,700	2000	Seabird2000
East Caithness Cliffs	N Scotland	9,259 (1986)	1996	Maintained 1999	12,500	1999	Seabird2000
Troup, Pennan & Lion's Heads	NE Scotland	3,216 (1995)	1997	Declined 2007	3,237 1,743	2001 2007	SMP database SMP database

Fowlsheugh	NE Scotland	4,576	1992	Maintained 1999	4,263 2,868 3,103 3,524	1999 2006 2009 2012	SMP database SMP database SMP database SMP database
Forth Islands	E Scotland	1,400 (1985) Or 2,693 (Stroud et al. 2001)	1990	Maintained 2007	2,403 2,534 2,489 2,625	2009 2010 2011 2012	SMP database SMP database SMP database SMP database
St Abb's Head to Fast Castle	E Scotland	1,407	1997	Maintained 1998	1,483 1,486 1,130 1,219	1998 2003 2008 2013	SMP database SMP database SMP database SMP database
Flamborough Head & Bempton (to be subsumed into Flamborough and Filey Coast SPA)	E England	5,133 (1987)	1993		5,721 10,001	2000 2008	SMP database SMP database
Flamborough and Filey Coast	E England	10,570 (2008-2011)	Not yet				See row above
UK Western waters							
North Rona and Sula Sgeir	N Scotland	1,541 (1986)	2001	Declined 2012	1,089 North Rona only: 552 344	1998 1998 2012	SMP database SMP database SMP database
Cape Wrath	NW Scotland	1,206	1996	Maintained 2000	2,090	2000	Seabird2000
Handa	NW Scotland	10,432 (1997)	1990	Declining 2006	11,384 8,660 5,165	2001 2006 2010	SMP database SMP database SMP database
St Kilda	Western Isles	2,546	1992	Maintained 2000	1,700	1999	Seabird2000
Shiant Isles	Western Isles	7,337 (1986)	1992	Declined 2008	5,391 4,248	1999 2008	SMP database SMP database
Flannan Isles	Western Isles	2,117 (1988)	1992	Recovering 2013	1,051	1998	SMP database
Mingulay and Berneray	Western Isles	11,323 (1985)	1994	Declined 2009	15,343 22,633 10,111	1998 2003 2009	SMP database SMP database SMP database
Rathlin Island	N Ireland	5,978 (1985)	1999		13,976 7,158 15,393	1999 2007 2011	SMP database SMP database SMP database
Skomer and Skokholm	Wales	2,854 (1997)	1982		2,800 2,631 2,198 2,699 2,607 6,001	2008 2009 2010 2011 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

22.10 BDMPS

Two spatial BDMPS areas can be defined; the UK North Sea and Channel, and UK western waters. Birds from colonies in the UK North Sea tend to remain in the North Sea or to migrate south through the North Sea and Channel to reach winter quarters in southern Europe. Birds from colonies in UK western waters tend to migrate south through UK western waters, and very few from those colonies enter the North Sea. So these two BDMPS are fairly discrete populations. However, razorbills migrate further southwards than common guillemots, and relatively few razorbills from UK colonies remain in UK waters in winter, so there is a need to separate two distinct seasonal BDMPS periods; migration seasons (August-October, and January-March), and winter (November-December).

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 64 to 67.

Based on evidence reviewed in sections 22.5, 22.6 and 22.7, the UK North Sea and Channel non-breeding season BDMPS is estimated to hold 95% of adults and 90% of immatures from colonies in Shetland, Orkney and north Caithness, 100% of adults and 90% of immatures from colonies on the UK North Sea coast from Caithness to East Anglia, 2% of adults and 5% of immatures from colonies in UK western waters from NW Scotland to SW England, 5% of adults and 10% of immatures from Russia, 30% of adults and 40% of immatures from Iceland, 20% of adults and 50% of immatures from Norway, 10% of adults and 30% of immatures from Denmark, Finland and Sweden, 50% of birds from Faroe, 2% of adults and 5% of immatures from Ireland, 1% of adults and 2% of immatures from France. These proportions result in an estimated BDMPS for the migration seasons of 591,874 birds, 157,443 from UK and 434,431 from overseas populations (Appendix A Table 64).

Based on evidence reviewed in sections 22.5, 22.6 and 22.7, the UK western waters non-breeding season BDMPS is estimated to hold 5% of adults and immatures from colonies in Shetland, Orkney and north Caithness, 0% of adults and 2% of immatures from colonies on the UK North Sea coast from Caithness to East Anglia, 98% of adults and 90% of immatures from colonies in UK western waters from NW Scotland to SW England, 5% of adults and 10% of immatures from Russia, 30% of adults and 40% of immatures from Iceland, 10% of adults and 30% of immatures from Norway, 5% of adults and 10% of immatures from Denmark, Finland and Sweden, 50% of birds from Faroe, 10% of adults and immatures from Ireland, 5% of adults and immatures from France. These proportions result in an estimated BDMPS for the migration seasons of 606,914 birds, 190,035 from UK and 416,879 from overseas populations (Appendix A Table 65).

Based on evidence reviewed in sections 22.5, 22.6 and 22.7, the UK North Sea and Channel winter season BDMPS is estimated to hold 30% of adults and 10% of immatures from UK North Sea colonies, 10% of adults and 5% of immatures from colonies in UK western waters in Scotland, 5% of adults and no immatures from colonies in Northern Ireland, Wales and SW England, 1% of adults and 2% of immatures from Russia, 10% of adults and 20% of immatures from Iceland, 5% of adults and 10% of immatures from Norway, 2% of adults and 5% of immatures from Denmark, Finland and Sweden, 30% of birds from Faroe, 1% of adults and 2% of immatures from Ireland, 5% of adults and 5% of immatures from France. These proportions result in an estimated BDMPS for the winter season of 218,622 birds, 45,753 from UK and 172,869 from overseas populations (Appendix A Table 66).

Based on evidence reviewed in sections 22.5, 22.6 and 22.7, the UK western waters winter season BDMPS is estimated to hold 1% of adults and 2% of immatures from colonies in the UK North Sea coast, 40% of adults and 10% of immatures from colonies in UK western waters from NW Scotland to Northern Ireland, 30% of adults and 10% of immatures from colonies in Wales and SW England, 1% of adults and 2% of immatures from Russia, 20% of adults and 30% of immatures from Iceland, 5% of adults and 10% of immatures from Norway, 2% of adults and 5% of immatures from Denmark, Finland and Sweden, 30% of birds from Faroe, 10% of adults and 10% of immatures from Ireland, 5% of adults and 5% of immatures from France. These proportions result in an estimated BDMPS for the winter season of 341,422 birds, 53,063 from UK and 288,359 from overseas populations (Appendix A Table 67).

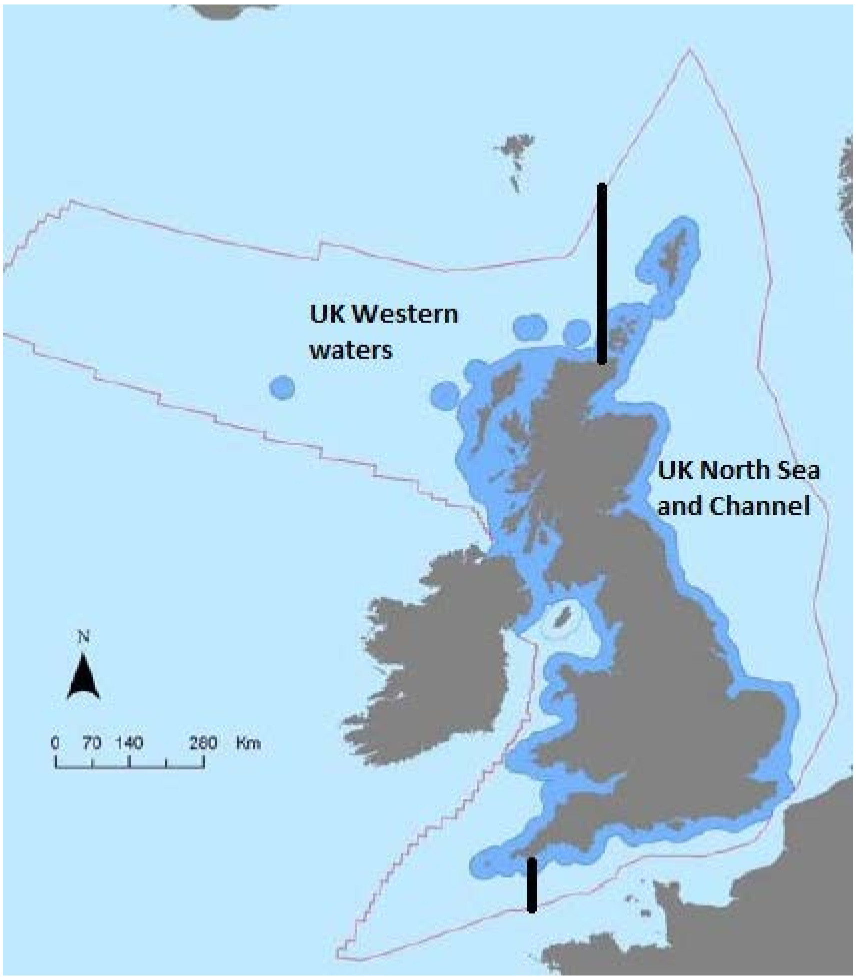

Figure 22.8. Two defined BDMPS spatial areas for razorbill: 'UK North Sea waters and Channel' and 'UK Western waters'.

22.11 Proportions of UK SPA birds in BDMPS

A very high proportion of razorbills in the UK are from UK SPA populations, estimated at around 90%. Given the large number of designated colonies and the high proportion of the total population in those sites, the proportion of the BDMPS that is from UK SPAs will mainly be determined by relative numbers of birds coming from overseas populations into these areas. Those numbers of overseas birds are very uncertain. Proportions of birds that are adults from UK SPA colonies in each BDMPS can be estimated directly from the data in Appendix A Tables 64 to 67. For example, in the UK North Sea and Channel migration seasons BDMPS (591,874 birds) there are estimated to be 71,824 adults from SPA colonies, so these represent 12% of the total birds present. In the UK western waters migration seasons BDMPS (606,914 birds) there are estimated to be 92,176 adults from SPA colonies, so these also represent 15% of the total birds present.

22.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Given the high mobility of razorbills, their relatively long distance migrations, and the large numbers of migrants from overseas passing through and wintering in UK waters, birds from UK SPA populations are likely to be very well mixed within each of the BDMPS populations in migration seasons and in winter.

23. BLACK GUILLEMOT *Cepphus grylle*

Black guillemot BDMPS is defined as the population of birds resident within a circle or buffer zone of 20 km radius around any focal site. There are 26,000 pairs in UK so 52,000 adults plus 1.32 immatures/adult. No birds from overseas populations are known to visit UK waters except as rare vagrants.

23.1 Breeding range and taxa

Black guillemot has an almost circumpolar breeding range in Arctic and sub-Arctic latitudes. There are five subspecies. *C. g. arcticus* breeds in Britain, eastern North America, southern Greenland, Denmark, SW Sweden and from Norway to the White Sea. Nominate *C. g. grylle* breeds only in the Baltic. Subspecies *faeroeensis* only in Faroe. Subspecies *islandicus* only in Iceland. Subspecies *mandtii* from northern Siberia to arctic Canada and northern Greenland. There appears to have been no assessment of whether biometrics would allow origins of individuals to be identified, but evidence indicates that hardly any birds from overseas have ever reached UK waters, so in view of the highly sedentary nature of this species within the British Isles and in nearby countries, there is unlikely to be any detectable numbers of birds from overseas reaching the UK.

23.2 Non-breeding component of the population

Black guillemots start to breed when 4 years old (BTO Birdfacts). Adult survival rate is 0.87 (BTO Birdfacts), juvenile survival unknown (BTO Birdfacts) and mean productivity is 1.295 chicks per pair (JNCC database, n=58 measurements). To obtain a stable population, survival of immatures was adjusted to 0.5 for juveniles, 0.6 for 1-year olds, 0.77 for 2-year olds, and 0.87 for 3-year olds. The model population comprised 43% adults, 28% juveniles and 29% older immatures. There are 1.32 immatures per adult.

23.3 Phenology

Breeding colonies in the UK are deserted in September, with modal departure in August (Pennington et al. 2004; Forrester et al. 2007). Black guillemots in the UK do not migrate, and rarely disperse far from their colonies. The Trektellen seawatching UK sites (predominantly in south and east England) reported only extremely low numbers of birds per hour, with no clear seasonal patterns apart from a slightly higher mean number in autumn and winter than in spring or summer, suggesting a slight post-breeding dispersal in August (Figure 23.1). However, it is noteworthy that numbers of black guillemots reported were considerably lower than even the numbers of roseate terns at these seawatching sites. Birds re-occupy colonies from late March, with modal return in early April (Pennington et al. 2004; Forrester et al. 2007).

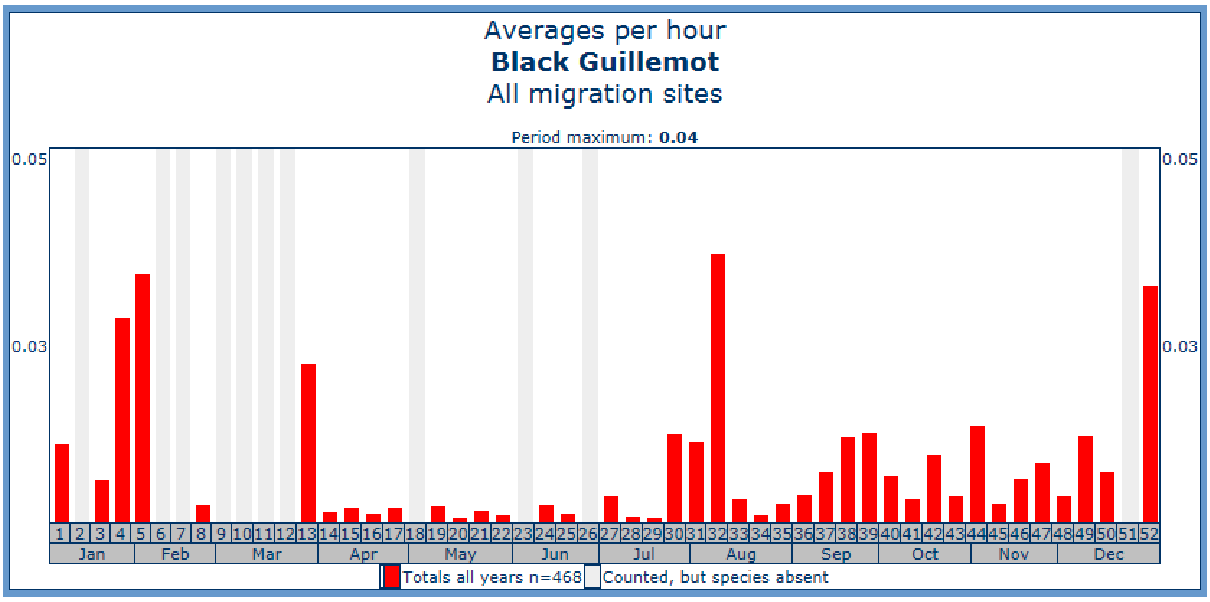

Figure 23.1. Average numbers of black guillemots counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) did not consider seasonality of black guillemot. From the data reviewed above, an appropriate definition would be breeding season April-August, non-breeding season September-March, but with negligible dispersal/migration occurring.

23.4 Defined seasons:

• UK Breeding season	April-August
• Post-breeding migration in UK waters	not evident
• **non-breeding season**	**September-March**
• Return migration through UK waters	not evident
• Migration-free breeding season	April-August
• Migration-free winter season	September-March

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for black guillemot:

Non-breeding season BDMPS (September-March).

23.5 Movements of birds from the UK population

Black guillemot populations in Britain and Ireland are considered to be sedentary, with no seasonal migration and negligible seasonal dispersal; no British ringed black guillemot has been recovered abroad (Wernham et al. 2002). However, there is evidence from counts at different times of year for birds moving away from particularly exposed coasts during winter to more sheltered coasts (e.g. from Foula and Fair Isle which are very exposed coastlines; Ewins and Kirk 1988; Pennington et al. 2004). Ring recoveries from Fair Isle include several birds that moved as far as Orkney or the north coast of Scotland and two cases where young birds were recovered in winter in east England (Wernham et al. 2002). However, Ewins and Kirk (1988) concluded that most black guillemots in Shetland never move more than 10-15 km from their natal site. Timing of such migration is difficult to assess, and probably occurs in response to severe weather so tends to occur in autumn and winter. The Trektellen seawatching data for UK, which mainly come from sites in Yorkshire, suggests that the few records of black guillemot occur mostly between late July and March, which fits in with the idea that these birds are predominantly storm-driven juveniles seeking shelter. Shetland, Fair Isle, and Orkney Bird Reports provide very little indication of dispersal movements by black guillemots as the species is present throughout the year in those areas and there is little or no evident seasonal variation in numbers present.

23.6 Movements of birds from overseas into UK waters

Black guillemots in Faroe are also sedentary; no black guillemots ringed in Faroe have been recovered away from the archipelago (Hammer et al. 2013) and the same applies in Iceland, where only short-distance (longest documented movement 10.5 km) natal dispersal occurs (Frederiksen and Petersen 2000). The lack of movement between Iceland, Faroe and UK is also suggested by the fact that these three populations are classified into three distinct subspecies: *islandicus* in Iceland, *faeroeensis* in Faroe, and *arcticus* in UK. There are no records of *islandicus* or *faeroeensis* in Scotland (Forrester et al. 2007). Numbers of black guillemots arriving in UK waters from overseas are apparently most likely to be occasional birds from southern Norway (where there are thousands) and southern Sweden (where there are thousands) (Mitchell et al. 2004). In relation to resident populations on northern Scottish coasts (Shetland, Orkney, NE Scotland) the numbers of arrivals from Scandinavia are likely to be negligible, while along the English east coast and south-east coast of Scotland, where the species is not resident (Mitchell et al. 2004), the very small numbers that arrive there (the 2007-11 Atlas suggests some 19 records in those 5 years of survey; Balmer et al. 2013) are probably about as likely to originate from Scandinavia as from Scotland. There are two recoveries of young birds from southern Sweden recovered on the coast of east England (Wernham et al. 2002). The 2007-11 Atlas also shows 6 records in the 5 years of survey in SW England, where the species is also not resident, and those birds are likely to have originated from populations in Wales or Ireland; if exposed areas are the likely source then probably these birds moved from SW or S Ireland where there are large breeding numbers on relatively exposed coast. Apart from these very small numbers moving beyond normal breeding range, most areas hold the same population in winter as in the breeding season.

23.7 Numbers in UK waters

The black guillemot only occurs in English waters in extremely small numbers, mostly in autumn, although there are about 7 resident in Cumbria (Mitchell et al. 2014). The population in Wales is extremely small (Seabird 2000 suggested 28 resident individuals), while there are 602 at the Isle of Man (again resident so unlikely to move from there). Northern Ireland holds about 1,200 birds, Scotland about 37,000 to 38,000 birds (Mitchell et al. 2014). The Scottish population is distributed along all western and northern coasts, but is scarce in SW Scotland. In east Scotland, there are very few south of Caithness.

23.8 Biogeographic population

Stroud et al. (2001) did not define the biogeographic breeding population of this species as it is not relevant in terms of the Birds Directive because it is not migratory. However, Mitchell et al. (2004) provided an estimate of the population of the subspecies *arcticus* as 72,377-142,321 pairs. Kober et al. (2010) did not present an estimate for the biogeographic population of this species. Only UK birds and a very few from Ireland occur in UK waters, so the only populations with connectivity to UK waters are the 26,000 pairs in the UK and a very small fraction of the population in Ireland (which comprises about 2,200 pairs (Figure 23.2). No other overseas populations show significant connectivity with UK waters, although a handful of birds that reach the southern North Sea coast of England might possibly originate from Scandinavia as well as from Scotland. The biogeographic population with connectivity to UK waters can be defined as the populations of the UK and Ireland, a total of 28,200 pairs, so 56,400 adults plus 74,000 immatures. This indicates a total of 130,000 birds.

Figure 23.2. Breeding population origins of black guillemots in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

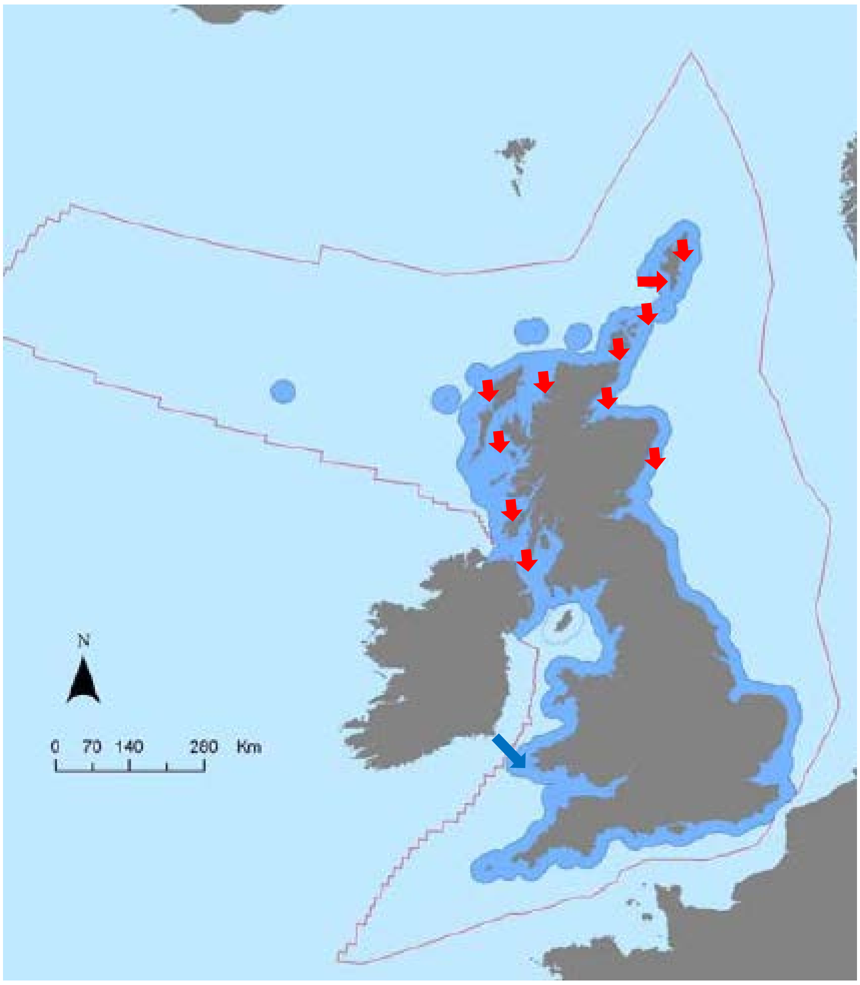

Figure 23.3. Main movements of black guillemots from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

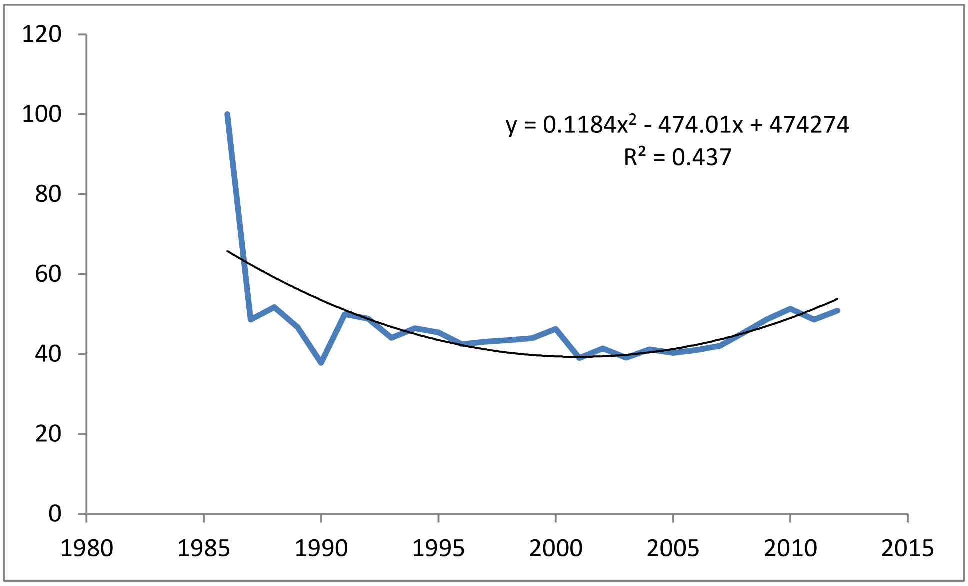

Figure 23.4. Trend in the black guillemot breeding population index in Scotland from 1986-2012. Data from JNCC seabird population monitoring database.

23.9 Proportion of UK population from UK breeding MPAs

There are no SPAs in the UK with black guillemot designated as a feature, since this species does not qualify as a migratory species. However, a number of sites are being considered for designation as Marine Protected Areas in Scottish waters with black guillemot as a designated feature. These include Clyde Sea Sill pMPA (>400 birds), East Caithness Cliffs pMPA (1,500 birds), Fetlar to Haroldswick pMPA (>2,000 birds), Monach Isles pMPA (820 birds), Papa Westray pMPA (>400 birds), and Small Isles pMPA (1,200 birds). These populations together sum to about 6,000 birds, so represent somewhere around 16% of the UK population.

23.10 BDMPS

Occasional birds that disperse exceptionally large distances (in this case exceptionally large means more than about 10-15 km) can be considered as truly exceptional. Since UK black guillemots only rarely move more than a maximum of 15 km from their natal site throughout their lifetime, almost all birds will have connectivity only with sites that are within about a 20 km radius. This allows a BDMPS to be defined as those birds found within 20 km of a specific site.

23.11 Proportions of UK MPA birds in BDMPS

This proportion will be zero for all locations except those that lie at least in part within 20 km of one of the six pMPA populations (recognising that the black guillemot feature in those pMPAs is not necessarily distributed throughout the boundary of that pMPA but may be found only in a small part of the pMPA if that is designated for multiple features rather than just for black guillemot).

23.12 Spatial distribution of UK MPA birds across the BDMPS

Within areas that overlap in their 20 km distance envelope with a pMPA black guillemot feature, the spatial distribution of MPA birds within the BDMPS is likely to be highly aggregated at the pMPA site.

24. ATLANTIC PUFFIN *Fratercula arctica*

	Biogeographic population with connectivity to UK waters (adults and immatures)	Numbers in UK waters in non-breeding season (mid-August to March) (adults and immatures)
Overseas	9,470,000	188,586
UK	2,370,000	347,928
Total	11,840,000	536,514

	Total number of birds in BDMPS (adults plus immatures)	Number from overseas populations (adults plus immatures)	Number from UK population (adults plus immatures)
Non-breeding season BDMPS (mid-August to March)			
UK North Sea and Channel	231,957	69,896	162,061
UK Western waters	304,557	118,690	185,867

Puffins are especially difficult to census because they are burrow-nesters and many of the very large colonies are partly or completely inaccessible, or in habitat where burrows cannot be identified (e.g. cliff fissures and boulder fields). Numbers of puffins are sometimes censused by counting birds on the colony surface, but such numbers fluctuate dramatically from hour to hour, day to day, and through the summer. As a result, the sizes of many puffin breeding populations are only very approximately known. This results in colour coding the estimated biogeographic population size as red. Puffins are also particularly difficult to count at sea because thyey are small, dark, spend much time underwater, and tend to dive as boats approach. So at sea surveys apparently underestimate puffin numbers. They disperse over huge areas of ocean at low densities. In addition, although large numbers have been ringed, the ring recovery rate is especially low, and probably presents a highly biased picture of where puffins die, never mind where they live during the non-breeding period. For all these reasons, the estimation of numbers of puffins in BDMPS populations is especially uncertain, so is coded red. There have been a few small projects deploying geolocators on breeding adult puffins which do provide some insights into their movements in the non-breeding season. Those studies found results that are rather divergent from the picture based on ring recovery data and at sea studies, and suggest that puffin migrations may well be changing over time in response to population density and food resources, but may also indicate large variations in behaviour between colonies, or between years. Much more deployment of geolocators, including at colonies of overseas populations would be necessary to provide higher confidence in puffin BDMPS population sizes and geographic distributions.

Calculations on which these summary tables are based, and contributions of individual SPA populations to each BDMPS, are tabulated in Appendix A Tables 68 and 69.

24.1 Breeding range and taxa

The Atlantic puffin has been split into three subspecies, nominate *arctica* in Iceland, north Norway, east Canada and most of Greenland, *naumanni* in the far north of Greenland and in Svalbard, and *grabae* in Faroe, Britain, Ireland, and southwest Norway (Wernham et al. 2002). However, the validity of these subspecies has been challenged and it is often treated as a monotypic species (e.g. Forrester et al. 2007). There is very considerable clinal variation in size, with birds from northern colonies very much larger (Barrett et al. 1985; Harris and Wanless 2011 Appendix 1). Birds from the Channel Islands have a mean wing length of 157.9 mm, while birds from Hornøya north Norway have a mean winglength of 177.6 mm and those from Spitsbergen a mean winglength over 184 mm. Such biometric variation could potentially be used to assess origins of birds sampled in winter. However, this could be complicated at a local scale where there can be significant differences in biometrics between colonies at similar latitudes. For example, puffins from St Kilda (winglength 158.2 mm) are significantly smaller than puffins from SE Scotland (winglength 161.8 mm).

24.2 Non-breeding component of the population

According to the BTO, Atlantic puffins start to breed when 5 years old (BTO Birdfacts; source of data not presented), and this value was initially used in the model, although Harris and Wanless (2011) found that the median age of first breeding on the Isle of May was at 7 years old. Adult survival rate is 0.924 (BTO Birdfacts; Harris et al. 1997), juvenile survival unknown (BTO Birdfacts) and mean productivity is 0.67 chicks per pair (JNCC database, n=94 measurements). Harris and Wanless (2011) point out that adult survival rate varied in the Isle of May population from high levels around 0.97 in the 1970s to about 0.9 in the 2000s, so adult survival is not a species-specific constant but is affected by environmental conditions. Survival rates of adults have been estimated at 0.93 in Skomer, 0.935 in Isle of May, Fair Isle, Rost and Hornoya (Harris and Wanless 2011). To obtain a stable population for a model based on the BTO data summaries, survival of adults was set at 0.924, survival of immatures was adjusted to 0.56 for juveniles, 0.66 for 1-year olds, 0.75 for 2-year olds, 0.9 for 3-year olds and 0.91 for 4-year olds. The model population comprised 55% adults, 18% juveniles and 27% older immatures. There are 0.82 immatures per adult. However, altering the age of first breeding to 7 years but retaining adult survival as 0.924 generates a model population with 1.08 immatures per adult. For the population based on Isle of May demographic data (taking average adult survival as 0.93 and age of first breeding as 7 years) there are 1.04 immatures per adult. This last scenario seems to be the most appropriate from these alternatives.

24.3 Phenology

Breeding colonies in the UK are deserted around mid-August, with modal departure in mid-July to early August (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007). Autumn dispersal/migration starts in early July (Forrester et al. 2007), late July (Pennington et al. 2004) or early August (Cramp et al. 1977-94; Wernham et al. 2002). Peak autumn migration occurs in late July (Forrester et al. 2007), early August (Pennington et al. 2004; Brown and Grice 2005), August (Wernham et al. 2002), or September-November throughout Europe (Cramp et al. 1977-94). Peak rate of change in numbers observed in autumn at Trektellen seawatching UK sites (predominantly in south and east England) occurred in July-early August, suggesting dispersal away from the coast in that period (Figure 24.1). Autumn migration is completed by August (Forrester et al. 2007), late-August (Wernham et al. 2002; Pennington et al. 2007) or December when considering the entire North Atlantic range (Cramp et al. 1977-94).

Spring migration starts in January (Cramp et al. 1977-94), February (Wernham et al. 2002; Forrester et al. 2007) or March in Shetland (Pennington et al. 2004). Peak spring migration occurs in February (Cramp et al. 1977-94), in March (Forrester et al. 2007), in March-April (Wernham et al. 2002) or in Shetland in mid-April (Pennington et al. 2004). Increase in numbers observed in spring at Trektellen seawatching UK sites (predominantly in south and east England) occurred in March-April (Figure 24.1). Spring migration is completed by March (Cramp et al. 1977-94), April (Wernham et al. 2002; Forrester et al. 2007) or May in Shetland (Pennington et al. 2004).

The first spring records of Atlantic puffin in Shetland, Fair Isle, Orkney, and Argyll Bird Reports for 2007 to 2012 were from January to 24 April, but mostly in February or March, and the last records were from 23 August to 23 December, but mostly in October. Peak autumn migration was reported in July or August in most years, and peak spring migration was reported in April in most years. Birds re-occupy colonies from late February to late March, with modal return in March to mid-April (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

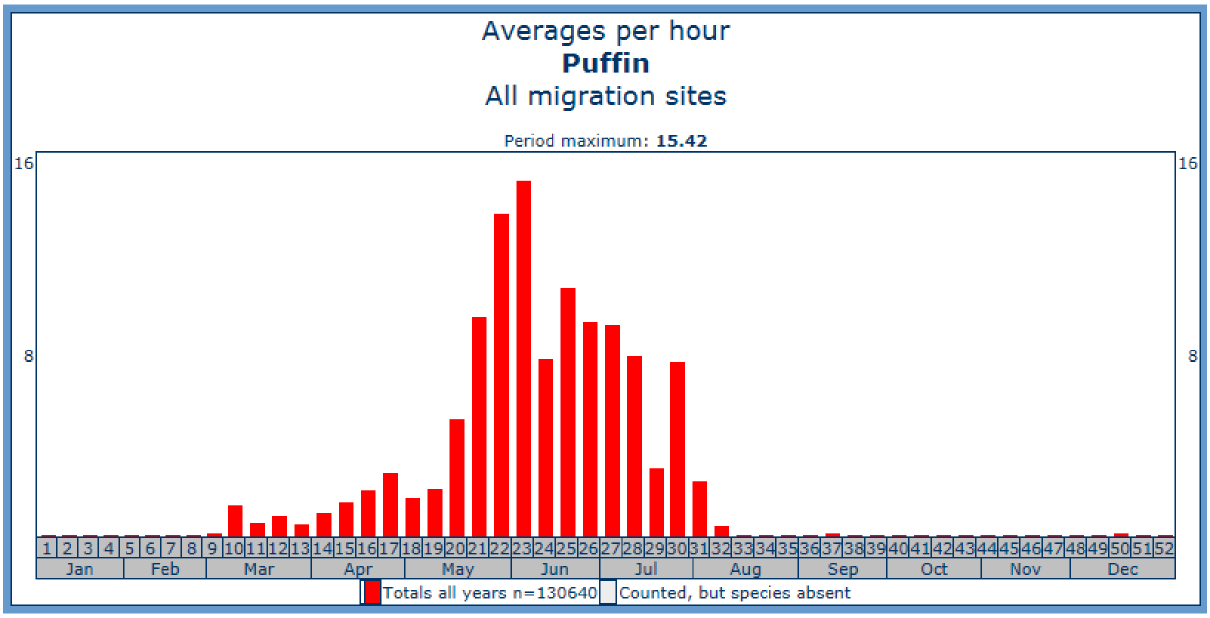

Figure 24.1. Average numbers of Atlantic puffins counted per hour at migration sites in the UK (which are mostly in south or east England). Data from Trektellen database accessed from the internet in January 2014.

Kober et al. (2010) defined breeding season as April-June, non-breeding season August-March. However, from the data reviewed above, a more appropriate definition would be breeding season April-early August, non-breeding season mid August-March.

24.4 Defined seasons:

- UK Breeding season — April-early August
- Post-breeding migration in UK waters — late July-August
- non-breeding season — mid-August-March (**non-breeding BDMPS**)
- Return migration through UK waters — March-April
- Migration-free breeding season — May-June
- Migration-free winter season — September-February

Apart from the breeding season, one seasonal BDMPS period is considered to be appropriate for Atlantic puffin:

Non-breeding season BDMPS (mid-August to March).

24.5 Movements of birds from the UK population

All puffins leave UK colonies and the immediately adjacent sea area by late August (Wernham et al. 2002; Harris and Wanless 2011). Birds apparently migrate rapidly away from breeding areas, fledglings travelling independently of adults (Harris and Wanless 2011). It used to be thought that adults undergo moult of flight feathers in mid-winter rather than immediately after chicks fledge (Harris and Yule 1977), although flightlessness in puffins due to moult has been found in all months between September and April (Harris and Wanless 2011). Recent data suggest that most adult puffins become flightless due to moult in October-November, and have generally completed renewal of primaries by December (Harris and Wanless 2011). The youngest age-classes of immature puffins apparently moult primaries in summer rather than in winter but details of how moult changes with age are rather unclear (Harris and Wanless 2011). Autumn migration takes puffins into the open sea or ocean, where they spread out thinly over huge areas. Ring recoveries come from Faroe and southern Norway to north Africa, from the western Mediterranean Sea to Newfoundland. It is thought that many puffins from UK colonies overwinter in the central North Atlantic (Wernham et al. 2002), although there is little evidence on this from ringing (Harris and Wanless 2011). All the ring recoveries of British puffins from Canadian waters were from juveniles. No adults are known from ringing to have wintered in the western North Atlantic (Wernham et al. 2002). However, geolocation data loggers deployed on breeding puffins at a colony in SW Ireland showed that most of these birds went to the Newfoundland-Labrador Shelf and remained there during August-September, moving in October back to the mid-Atlantic (Jessopp et al. 2013). This was interpreted as a strategy to exploit the abundant stock of capelin in Newfoundland waters in late summer which is seasonally concentrated in that area. That stock is the main food of puffins from local Newfoundland colonies in late summer (Hedd et al. 2010). It is possible that puffins from many colonies in the British Isles show this migration pattern, but Jessopp et al. (2013) also suggest the possibility that this might be a feature of the particular colony they studied rather than a widespread general pattern. Deployment of geolocators on breeding adult puffins at a colony in Wales (Guilford et al. 2011) also showed very rapid movement of birds westwards in August, with median positions of individuals in August from the Bay of Biscay to Newfoundland, but with most birds in an area between Newfoundland and waters south of Iceland. By October, median positions had moved to a large area between north of Iceland and west of Scotland, and by February birds were distributed widely, but much further south in an area from west of Scotland to the western Mediterranean (see figure 1 in Guilford et al. 2009). This suggests that an early migration to Newfoundland-Labrador in August may be typical for many adult puffins from British colonies, but that birds only stay in that area for a few weeks before moving eastwards, then southwards during the early winter. Guilford et al. (2009) suggest (speculatively) that this long distance but predominantly dispersive migration of puffins may be an exploratory response, rather than being based on genetic inheritance of compass instructions or cultural inheritance of traditional routes, since birds from their study colony became so widely dispersed over large areas that it is difficult to see how this would be under genetic control. Abundance of capelin in Newfoundland-Labrador waters varies enormously over the years as this is a short-lived fish which is affected by climate, and by abundance of predatory fish (especially cod) (Davoren and Montevecchi 2003; Gaston et al. 2010), so the extent to which puffins from British colonies visit Newfoundland-Labrador waters to exploit capelin in late summer may vary over years/decades as the biomass of this stock fluctuates. Ring recoveries had suggested that puffins from colonies in NE England and SE Scotland winter predominantly within the North Sea, with very few of those birds passing through the English Channel, so possibly those birds do not cross the Atlantic in the way that birds from SW Ireland and Wales have been shown to do. It had been suggested that a slight increase in numbers from North Sea colonies reaching France may reflect the increase in population size at UK North Sea colonies and so increased competition for food (Harris 1984). However, deployment of geolocators on breeding adult puffins at the Isle of May indicated that in August-December 2007 about one-third of these birds moved into the east Atlantic, mostly off west Scotland and SW Ireland, rather than remaining in the North Sea, while most birds were distributed throughout the NW North Sea (Harris et al. 2010; 2013). This was interpreted by Harris et al. (2010) as supporting evidence from ringing that an increasing proportion of North Sea puffins were moving beyond the North Sea in response to increased population size and deteriorating conditions in the North Sea. A further deployment of geolocators on breeding adult puffins at the Isle of May in 2009 showed similar results. Interestingly, puffin survival was very poor in 2007-08 but was high in 2009-10, yet the distributions of birds overwinter in these two winters were very similar. Moving out of the North Sea into the Atlantic does not seem to correlate with over-winter survival. The geolocator data do suggest, however, that there may be substantial mixing of puffins from east and west Britain in waters west of Britain and Ireland in winter, though probably very few, if any, puffins from western colonies enter the North Sea to mix with local birds there (Harris and Wanless 2011). As with most other seabirds, ring recoveries indicate that young birds tend to travel further (south and west) from their colonies than do adults, although in the case of the puffin, the non-breeding range is not dramatically different between juveniles and adults (Wernham et al. 2002; Harris and Wanless 2011). In east Scotland, adult puffins may return to the colony in late February or March (Harris and Wanless 2011 Appendix 3), but elsewhere in the UK adults tend to return to colonies in late March or April (Wernham et al. 2002; see also Harris and Wanless 2011 Appendix 4 for Skokholm, Wales). Studies on the Isle of May indicate that about 50% of puffins reared there recruited back into that colony while 50% emigrated to breed elsewhere; birds ringed as chicks on the Isle of May have been found breeding in colonies all around the British Isles (Wernham et al. 2002). As immatures, puffins may visit several colonies before deciding where to settle to breed. These prospecting movements can take immatures to colonies hundreds of kilometres apart during the breeding season, although once a puffin has bred, which usually occurs first when 5 to 7 years old, they then remain highly faithful to their breeding site (Harris and Wanless 2011).

24.6 Movements of birds from overseas into UK waters

A total of 21 puffins ringed abroad have been recovered in the British Isles, 15 from Norway, one from Faroe, and 5 from France (Wernham et al. 2002). The one recovery of a puffin from Faroe was one of only four Faroese puffins recovered away from those islands, the others being found in France, Iceland and Greenland. So details of the migrations of Faroese puffins are unclear (Hammer et al. 2013). Although no Icelandic-ringed puffins have been recovered in the British Isles, three have been recovered in Faroe (Hammer et al. 2013) so it is reasonable to infer that some Icelandic puffins might visit UK waters during migration or winter. However, Petersen (1982, 1998) considered that SW Icelandic puffin adults most likely winter between Iceland, Greenland and Newfoundland, while those from N and E Iceland may winter from Iceland towards Norway and Faroe; there is therefore no reason to think that Icelandic puffins migrate through, or overwinter in, UK waters. According to Anker-Nilssen et al. (2000), puffins ringed in northern Norway (Barents Sea colonies) have been reported in winter from Iceland, Greenland and Newfoundland, but most recoveries have come from the southern part of the Norwegian Sea, especially around the Faroes, and in the northern part of the North Sea. However, it may be inappropriate to infer that larger numbers of recoveries in the Norwegian and North Sea imply that more puffins winter there than in the west Atlantic, since the probability of a bird being recovered may be dramatically different between these regions. Satellite tracking of five adult puffins immediately after breeding on Røst, Norway, showed all of those birds moving northwards into the Barents Sea, where densities of puffins in late summer are known to be very high (Anker-Nilssen and Aarvak 2009), suggesting that puffins from Norwegian colonies mainly disperse northwards post-breeding before moving westwards into the northern North Atlantic. Ringing data indicate that juvenile puffins from Norway are more likely to be recovered in the west Atlantic than are adults (Harris and Wanless 2011), but this may in part reflect differences in mortality risk rather than just differences in distribution between age classes. Measurements of 98 puffins collected from beaches during a wreck in Shetland in winter 1990-91 indicated that almost all of those birds originated from colonies around the North Sea, with all age classes similarly affected; only two first-winter birds in that sample had wing lengths suggesting they came from the far north (Harris et al. 1991; Pennington et al. 2004).

24.7 Numbers in UK waters

Harris and Wanless (2011) report densities of puffins at sea in winter in the North Sea as around one bird per 20 km^2 and one bird per 5-10 km^2 in areas of the North Sea where puffins are seen regularly. European Seabirds at Sea (ESAS) data indicate a similar density in winter in waters to the west and northwest of Scotland, but somewhat lower density in waters SW of Scotland and west of Ireland, in the SE North Sea, and in the Irish and Celtic Seas (Harris and Wanless 2011). Although puffin distribution at sea in the North Sea during the breeding season reflects the distribution of colonies, birds quickly move away from colony areas in August, and form concentrations about 50 km offshore off south-east Scotland or north-east England (Harris and Wanless 2011). This concentration persists through September, but densities then decline slightly, until February-March when puffins move back to breeding sites (Harris and Wanless 2011). Fauchald and Tveraa (2009) estimated that between November and March, total numbers of puffins were 29,000 in the North Sea, 103,000 in the Norwegian Sea, and 31,000 in the Barents Sea. However, Harris and Wanless (2011) point out that if 75% of puffins from North Sea colonies are in the North Sea by January, as suggested by geolocator data from Isle of May puffins, then there should be at least 200,000 puffins in the North Sea at that time, rather than the 29,000 estimated by Fauchald and Tveraa (2009) based on the ESAS data. Harris and Wanless (2011) suggest that ESAS data may detect only about 20% or fewer of the puffins that are present, so that at-sea survey data seriously underestimate numbers of puffins dispersed over large areas of sea and ocean.

24.8 Biogeographic population

Stroud et al. (2001) defined the biogeographic breeding population as that of the subspecies *grabae* population, comprising 901,000 pairs. However, the validity of that subspecies is questionable. Mitchell et al. (2004) provided an estimate of the population of the subspecies *arcticus* (including birds of the supposed form *grabae*) as 5,500,000-6,600,000 pairs. Kober et al. (2010) presented an estimated biogeographic population of 13,500,000 individuals based on the appropriate biogeographic population being the subspecies *arcticus*. The biogeographic population with connectivity to UK waters includes populations from UK, Norway, Faroe, Ireland and France. These sum to 11,840,000 birds (adults and immatures) with 2,370,000 from UK and 9,470,000 from overseas populations. Total numbers in UK waters in the non-breeding season sum to an estimated 537,000 birds, 348,000 from the UK population and 189,000 from overseas populations, as most of the UK population moves rapidly out into the open North Atlantic across to Canada and southern Greenland rather than spending the non-breeding period in UK waters. However, we can have very little confidence in the accuracy of these estimates, and true totals may be very considerably different from these estimates. It does appear, however, that numbers present in UK waters in the non-breeding season are very small compared to the size of the biogeographic population.

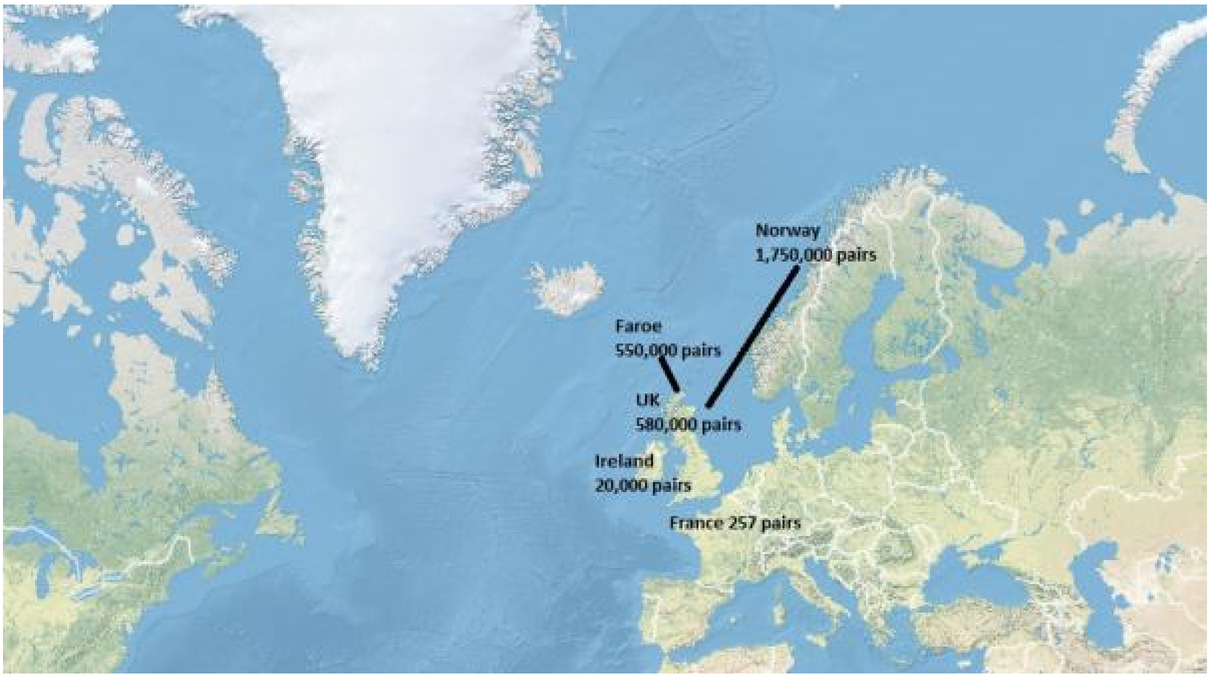

Figure 24.2. Breeding population origins of puffins in UK waters during migrations and winter. Estimated numbers of breeding pairs in each population are given. Base map from OpenStreetMap www.openstreetmap.org ©OpenStreetMap contributors.

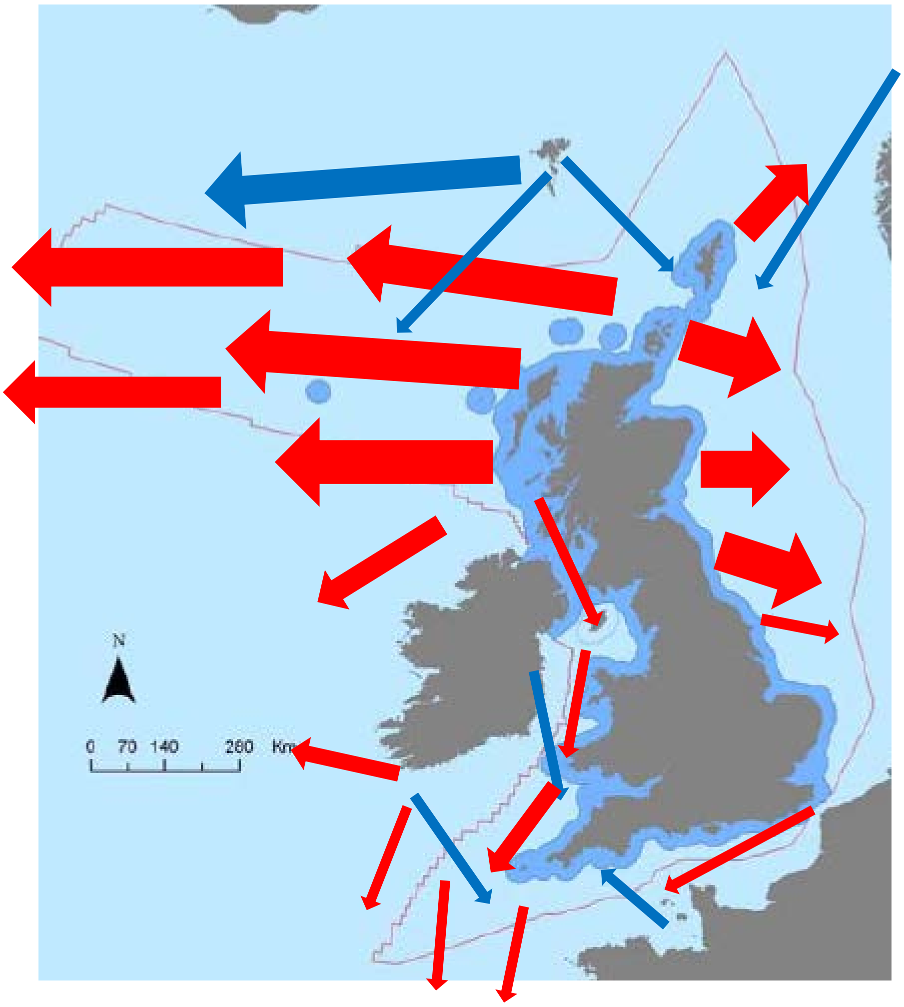

Figure 24.3. Main movements of puffins from UK breeding areas (red arrows) and from overseas populations (blue arrows) into UK waters during post-breeding dispersal/migration. Arrows imply general patterns of movement and should not be taken literally as indicating exact routes or exact starting and end points. Similarly, small numbers of birds occur in areas not marked by arrows and some birds may move in different directions from those broad patterns indicated. Movements probably tend to follow coastlines and arrows that cross land do not imply overland migration routes. As far as is known, spring return migration represents a reversal of the pattern shown in this figure.

24.9 Proportion of UK population from UK breeding SPAs

The 21 SPAs with breeding Atlantic puffins as a feature together held 470,284 pairs at designation, estimated to represent ca. 100% of the British breeding population and ca. 12% of the all-Ireland breeding population (Stroud et al. 2001). Based on survey data from 1997-2010, Stroud et al. (2014) estimated that the British SPA suite for puffin held 85.4% of the population, while the single SPA in Northern Ireland held 3.5% of the all-Ireland population.

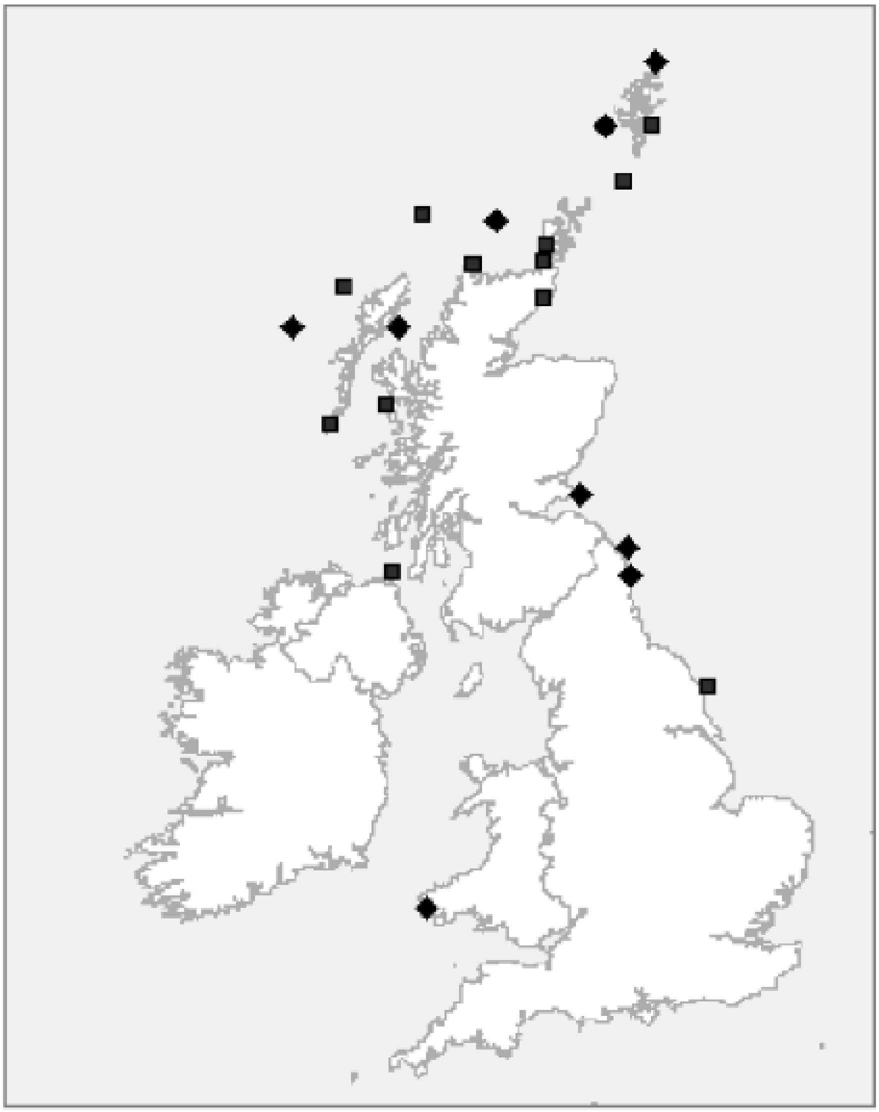

Figure 24.4. UK SPA suite for Atlantic puffin. These SPA populations are listed in Table 24.1.

Table 24.1. The UK SPA suite for breeding puffins.

SPA	Location	Pairs (or birds)	Year desig-nated	Site Condition Monitoring*	Recent count (pairs)	Year	Reference
UK North Sea & Channel							
Hermaness, Saxavord & Valla	Shetland	25,400	1994	Maintained 2002	28,300 23,661	1997 2002	Lewis et al. 2012 Lewis et al. 2012
Foula	Shetland	48,000 (1987)	1995	Declined 2007	22,500	2000	SMP database
Noss	Shetland	2,348	1996	Declined 2007	1,927 900 802	2006 2007 2007	SMP database Lewis et al. 2012 Stroud et al. 2014

Fair Isle	Shetland	8,700	1994	Declined 2009	20,244 42,500 42,000 80,000 54,000 16,700 7,278 10,706	1986 1989 1995 2000 2001 2007 2009 2012	SMP database SMP database SMP database SMP database SMP database SMP database SMP database SMP database
Hoy	Orkney	3,500	2000	Declined 2004	No recent count		No data in SMP
North Caithness Cliffs	N Scotland	(1,750) (1985-1986) in Stroud et al. 2001 but is not accurate	1996	Maintained 2000	976 7,045	2000 1999-2000	SMP database Stroud et al. 2014
East Caithness Cliffs	N Scotland	(1,750) (1985-86) in Stroud et al. 2001 but is not accurate	1996	Maintained 1999	274	1999	SMP database
Forth Islands	E Scotland	14,000 (1985) Or 21,000 (Stroud et al. 2001)	1990	Maintained 2003	21,000 62,500 83,000 50,500 62,231	1992 1998 2003 2009 2008-2010	SMP database SMP database SMP database SMP database Stroud et al. 2014
Farne Islands	NE England	34,710 (1993)	1985		55,674 36,835 39,962	2003 2008 2013	SMP database SMP database SMP database
Coquet Island	NE England	11,400 (1995)	1985		12,075 19,374 15,812 12,344	2004 2008 2009 2013	SMP database SMP database SMP database SMP database
Flamborough Head & Bempton	E England	3,473	1993		2,615 958	2000 2008	SMP database SMP database
UK Western waters							
Cape Wrath	NW Scotland	5,900	1996	Declined 2000	1,602	2000	SMP database
North Rona and Sula Sgeir	N Scotland	5,250	2001	No change 2012	5,442	2001	Mitchell et al. 2004
Sule Skerry and Sule Stack	N Scotland	43,380 (1993)	1994	Maintained 1998	59,471	1998	Seabird2000
St Kilda	Western Isles	155,000 (1989)	1992	Maintained 2000	142,264	2000	Seabird2000
Shiant Isles	Western Isles	76,100 (1970)	1992	Maintained 1999	65,170	2000	Seabird2000

Flannan Isles	Western Isles	5,500	1992	Maintained 1999	15,600	1998or 2001	SMP database
Canna and Sanday	W Scotland	1,225	1998	Maintained 1999	945	1999	SMP database
Mingulay and Berneray	Western Isles	4,000	1994	Maintained 2009	8,406 3,126	2003 2009	SMP database SMP database
Rathlin Island	N Ireland	2,398 (1985)	1999		1,579 731 695	1999 2007 2011	SMP database SMP database SMP database
Skomer and Skokholm	Wales	9,500 (mid-1980s)	1982		12,706 14,996 15,227 15,678 16,721 16,134 24,114	2003 2004 2005 2006 2007 2012 2013	SMP database SMP database SMP database SMP database SMP database SMP database SMP database

*Site Condition Monitoring data are taken from SNH Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature.

24.10 BDMPS

UK birds from North Sea colonies mostly remain in winter in the North Sea, whereas western populations disperse across the North Atlantic. It is therefore appropriate to define two spatial BDMPS for puffin; UK North Sea and Channel waters, and UK western waters. Autumn dispersal is very rapid, so a single non-breeding season seems appropriate to consider, as many birds departing at the end of the breeding season spend very little time in UK waters so do not contribute to the BDMPS.

Apportioning of numbers from SPA populations, non-SPA colonies and from overseas populations is presented in Appendix A Tables 68 and 69.

Based on evidence reviewed in sections 24.5, 24.6 and 24.7, the UK North Sea and Channel non-breeding season BDMPS is estimated to hold 15% of adults and 2% of immatures from colonies in Shetland, Orkney and Caithness, 50% of adults and 2% of immatures from colonies on the east coast of the UK from Invernessshire to Humberside, 0.1% of adults and immatures from colonies in UK western waters, 0.1% of adults and 0.3% of immatures from Norway, 4% of adults and 1% of immatures from Faroe, no birds from Ireland, 5% of adults and 2% of immatures from France (Appendix A Table 68). These proportions result in an estimated non-breeding season BDMPS population of 231,957 birds, with 162,061 from the UK and 69,896 from overseas populations.

Based on evidence reviewed in sections 24.5, 24.6 and 24.7, the UK western waters non-breeding season BDMPS is estimated to hold 8% of adults and 2% of immatures from colonies in Shetland, Orkney and Caithness, 7% of adults and 2% of immatures from colonies on the east coast of the UK from Invernessshire to Humberside, 18% of adults and 2% of immatures from colonies in UK western waters, 0.2% of adults and 0.1% of immatures from Norway, 7% of adults and 2% of immatures from Faroe, 10% of birds from Ireland, 1% of birds from France (Appendix A Table 69). These proportions result in an estimated non-breeding season BDMPS population of 304,557 birds, with 185,867 from the UK and 118,690 from overseas populations.

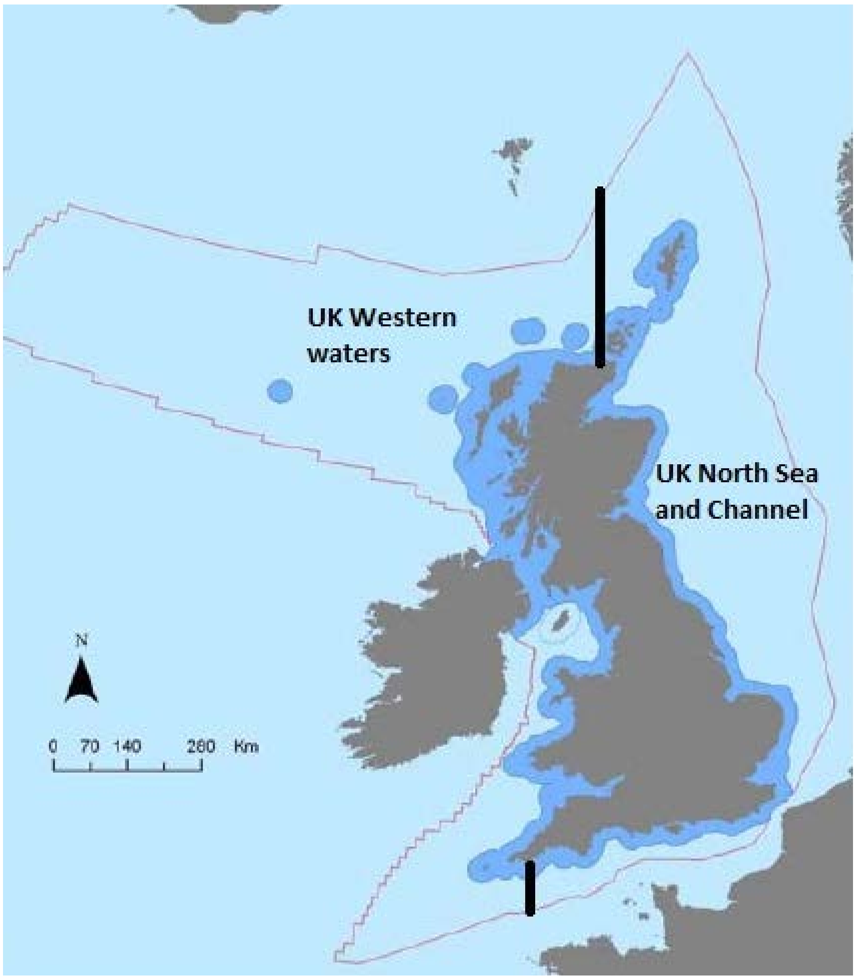

Figure 21.8. Two defined BDMPS spatial areas for Atlantic puffin: 'UK North Sea waters and Channel' and 'UK Western waters'.

24.11 Proportions of UK SPA birds in BDMPS

Proportions of birds that are adults from UK SPA colonies in each BDMPS can be estimated directly from the data in Appendix A Tables 68 and 69. For example, in the UK North Sea and Channel BDMPS (231,957 birds) there are estimated to be 134,858 adults from SPA colonies, so these represent 58% of the total birds present.

24.12 Spatial distribution of UK breeding SPA birds across the BDMPS

Given apparent high mobility of puffins, their long and rapid migrations, UK SPA birds at sea in UK waters are likely to be well mixed with birds from non-SPA colonies and from overseas.

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26. APPENDIX A.Contributions of individual SPA populations and of UK non-SPA populations and overseas populations to each BDMPS

Table 1. BDMPS for red-throated diver in winter season (December and January) in 'NW North Sea' area.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in NW North Sea waters in winter	Proportion immatures in NW North Sea waters in winter	NW N Sea Number adults	NW N Sea Number immatures	NW N Sea Total birds
Greenland	1990s	1000	2000	1480	0.05	0.05	100	74	174
Fennoscandia	1990s	5500	11000	8140	0.01	0.01	110	81	191
Hermaness, Saxavord	2013	16	32	24	0.5	0.2	16	5	21
Otterswick & Graveland	2006	25	50	37	0.5	0.2	25	7	32
Ronas Hill, North Roe	2006	50	100	74	0.5	0.2	50	15	65
Foula	2013	12	24	18	0.5	0.2	12	4	16
Orkney Mainland Moors	2007	28	56	41	0.5	0.2	28	8	36
Hoy	2007	60	120	89	0.5	0.2	60	18	78
Caithness & Sutherland	2006	46	92	68	0.5	0.2	46	14	60
Non-SPA UK North Sea	2005	600	1200	888	0.5	0.2	600	178	778
Lewis Peatlands	2006	80	160	118	0.05	0.05	8	6	14
Mointeach Scadabhaigh	2006	17	34	25	0.05	0.05	2	1	3
Rum	2013	11	22	16	0.05	0.05	1	1	2
Non-SPA UK western	2005	310	620	459	0.05	0.05	31	23	54
Overseas birds							210	155	365
UK birds							879	279	1,158
Total							1,089	434	1,523

Table 2. BDMPS for red-throated diver in winter season (December and January) in 'SW North Sea' area.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in SW North Sea waters in winter	Proportion of immatures in SW North Sea waters in winter	SW N Sea Number adults	SW N Sea Number immatures	SW N Sea Total birds
Greenland	1990s	1000	2000	1480	0.02	0.05	40	74	114
Fennoscandia	1990s	5500	11000	8140	0.4	0.6	4400	4884	9284
Hermaness, Saxavord	2013	16	32	24	0.2	0.3	6	7	14
Otterswick & Graveland	2006	25	50	37	0.2	0.3	10	11	21
Ronas Hill, North Roe	2006	50	100	74	0.2	0.3	20	22	42
Foula	2013	12	24	18	0.2	0.3	4.8	5	10
Orkney Mainland Moors	2007	28	56	41	0.2	0.3	11	12	24
Hoy	2007	60	120	89	0.2	0.3	24	27	51
Caithness & Sutherland	2006	46	92	68	0.2	0.3	18	20	39
Non-SPA UK North Sea	2005	600	1200	888	0.2	0.3	240	266	506
Lewis Peatlands	2006	80	160	118	0.05	0.05	8	6	14
Mointeach Scadabhaigh	2006	17	34	25	0.05	0.05	2	1	3
Rum	2013	11	22	16	0.05	0.05	1	1	2
Non-SPA UK western	2005	310	620	459	0.05	0.05	31	23	54
Overseas birds							4,440	4,958	9,398
UK birds							377	403	779
Total							4,817	5,361	10,177

Table 3. BDMPS for red-throated diver in winter season (December and January) in 'West of Scotland' area.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in West of Scotland waters in winter	Proportion immatures in West of Scotland waters in winter	West of Scotland Number adults	West of Scotland Number immatures	West of Scotland Total birds
Greenland	1990s	1000	2000	1480	0.02	0.05	40	74	114
Fennoscandia	1990s	5500	11000	8140	0	0.01	0	81	81
Hermaness, Saxavord	2013	16	32	24	0.05	0.1	2	2	4
Otterswick & Graveland	2006	25	50	37	0.05	0.1	2	4	6
Ronas Hill, North Roe	2006	50	100	74	0.05	0.1	5	7	12
Foula	2013	12	24	18	0.05	0.1	1	2	3
Orkney Mainland Moors	2007	28	56	41	0.05	0.1	3	4	7
Hoy	2007	60	120	89	0.05	0.1	6	9	15
Caithness & Sutherland	2006	46	92	68	0.05	0.1	5	7	11
Non-SPA UK North Sea	2005	600	1200	888	0.05	0.1	60	89	149
Lewis Peatlands	2006	80	160	118	0.4	0.2	64	24	88
Mointeach Scadabhaigh	2006	17	34	25	0.4	0.2	14	5	19
Rum	2013	11	22	16	0.4	0.2	9	3	12
Non-SPA UK western	2005	310	620	459	0.4	0.2	248	92	340
Overseas birds							40	155	195
UK birds							418	248	666
Total							458	403	861

Table 4. BDMPS for red-throated diver in winter season (December and January) in 'NW England and Wales' area.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in NW E & Wales in winter	Proportion immatures in NW E & Wales in winter	NW E & Wales Number adults	NW E & Wales Number immatures	NW E & Wales Total birds
Greenland	1990s	1000	2000	1480	0.1	0.3	200	444	644
Fennoscandia	1990s	5500	11000	8140	0.02	0.05	220	407	627
Hermaness, Saxavord	2013	16	32	24	0.02	0.05	1	1	2
Otterswick & Graveland	2006	25	50	37	0.02	0.05	1	2	3
Ronas Hill, North Roe	2006	50	100	74	0.02	0.05	2	4	6
Foula	2013	12	24	18	0.02	0.05	0	1	1
Orkney Mainland Moors	2007	28	56	41	0.02	0.05	1	2	3
Hoy	2007	60	120	89	0.02	0.05	2	4	7
Caithness & Sutherland	2006	46	92	68	0.02	0.05	2	3	5
Non-SPA UK North Sea	2005	600	1200	888	0.02	0.05	24	44	68
Lewis Peatlands	2006	80	160	118	0.2	0.2	32	24	56
Mointeach Scadabhaigh	2006	17	34	25	0.2	0.2	7	5	12
Rum	2013	11	22	16	0.2	0.2	4	3	8
Non-SPA UK western	2005	310	620	459	0.2	0.2	124	92	216
Overseas birds							420	851	1,271
UK birds							201	186	386
Total							621	1,037	1,657

Table 5. BDMPS for red-throated diver in winter season (December and January) in 'SW England and Channel' area.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in SW E & Channel in winter	Proportion immatures in SW E & Channel in winter	SW E & Channel Number adults	SW E & Channel Number immatures	SW E & Channel Total birds
Greenland	1990s	1000	2000	1480	0.1	0.2	200	296	496
Fennoscandia	1990s	5500	11000	8140	0.01	0.03	110	244	354
Hermaness, Saxavord	2013	16	32	24	0.02	0.05	1	1	2
Otterswick & Graveland	2006	25	50	37	0.02	0.05	1	2	3
Ronas Hill, North Roe	2006	50	100	74	0.02	0.05	2	4	6
Foula	2013	12	24	18	0.02	0.05	0	1	1
Orkney Mainland Moors	2007	28	56	41	0.02	0.05	1	2	3
Hoy	2007	60	120	89	0.02	0.05	2	4	7
Caithness & Sutherland	2006	46	92	68	0.02	0.05	2	3	5
Non-SPA UK North Sea	2005	600	1200	888	0.02	0.05	24	44	68
Lewis Peatlands	2006	80	160	118	0.1	0.2	16	24	40
Mointeach Scadabhaigh	2006	17	34	25	0.1	0.2	3	5	8
Rum	2013	11	22	16	0.1	0.2	2	3	5
Non-SPA UK western	2005	310	620	459	0.1	0.2	62	92	154
Overseas birds							310	540	850
UK birds							117	186	303
Total							427	726	1,153

Table 6. BDMPS for red-throated diver in migration seasons (September-November and February-April) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters in migration seasons	Proportion of immatures in UK North Sea waters in migration seasons	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Greenland	1990s	1000	2000	1480	0.08	0.15	160	222	382
Fennoscandia	1990s	5500	11000	8140	0.45	0.65	4950	5291	10241
Hermaness, Saxavord	2013	16	32	24	0.95	0.8	30	19	49
Otterswick & Graveland	2006	25	50	37	0.95	0.8	48	30	77
Ronas Hill, North Roe	2006	50	100	74	0.95	0.8	95	59	154
Foula	2013	12	24	18	0.95	0.8	23	14	37
Orkney Mainland Moors	2007	28	56	41	0.95	0.8	53	33	86
Hoy	2007	60	120	89	0.95	0.8	114	71	185
Caithness & Sutherland	2006	46	92	68	0.95	0.8	87	54	142
Non-SPA UK North Sea	2005	600	1200	888	0.95	0.8	1140	710	1850
Lewis Peatlands	2006	80	160	118	0.05	0.05	8	6	14
Mointeach Scadabhaigh	2006	17	34	25	0.05	0.05	2	1	3
Rum	2013	11	22	16	0.05	0.05	1	1	2
Non-SPA UK western	2005	310	620	459	0.05	0.05	31	23	54
Overseas birds							5,110	5,513	10,623
UK birds							1,632	1,022	2,654
Total							6,742	6,535	13,277

Table 7. BDMPS for red-throated diver in migration seasons (September-November and February-April) in 'UK western waters plus Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in migration seasons	Proportion of immatures in UK western waters & Channel in migration seasons	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Greenland	1990s	1000	2000	1480	0.25	0.6	500	888	1388
Fennoscandia	1990s	5500	11000	8140	0.05	0.1	550	814	1364
Hermaness, Saxavord	2013	16	32	24	0.05	0.2	2	5	6
Otterswick & Graveland	2006	25	50	37	0.05	0.2	2	7	10
Ronas Hill, North Roe	2006	50	100	74	0.05	0.2	5	15	20
Foula	2013	12	24	18	0.05	0.2	1	4	5
Orkney Mainland Moors	2007	28	56	41	0.05	0.2	3	8	11
Hoy	2007	60	120	89	0.05	0.2	6	18	24
Caithness & Sutherland	2006	46	92	68	0.05	0.2	5	14	18
Non-SPA UK North Sea	2005	878	1756	1299	0.05	0.2	88	260	348
Lewis Peatlands	2006	80	160	118	0.95	0.8	152	95	247
Mointeach Scadabhaigh	2006	17	34	25	0.95	0.8	32	20	52
Rum	2013	11	22	16	0.95	0.8	21	13	34
Non-SPA UK western	2005	400	800	592	0.95	0.8	760	474	1234
Overseas birds							1,050	1,702	2,752
UK birds							878	743	1,621
Total							1,928	2,445	4,373

Table 8. BDMPS for northern fulmar in winter (November) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters in winter	Proportion of immatures in UK North Sea waters in winter	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Iceland	2008	1,000,000	2000000	1240000	0.01	0.02	20000	24800	44800
Norway	1990s	386,000	772000	478640	0.01	0.02	7720	9573	17293
Faroe	1990s	600,000	1200000	744000	0.01	0.03	12000	22320	34320
Hermaness, Saxavord	2011	7,000	14000	8680	0.7	0.3	9800	2604	12404
Fetlar	2000	8,912	17824	11051	0.7	0.3	12477	3315	15792
Foula	2007	19,758	39516	24500	0.7	0.3	27661	7350	35011
Noss	2011	5,248	10496	6508	0.7	0.3	7347	1952	9299
Sumburgh Head	2009	233	466	289	0.7	0.3	326	87	413
Fair Isle	2011	29,649	59298	36765	0.7	0.3	41509	11029	52538
West Westray	2007	677	1354	839	0.7	0.3	948	252	1200
Calf of Eday	2002	1,842	3684	2284	0.7	0.3	2579	685	3264
Rousay	2009	1,030	2060	1277	0.7	0.3	1442	383	1825
Hoy	2007	19,586	39172	24287	0.7	0.3	27420	7286	34706
Copinsay	2008	1,630	3260	2021	0.7	0.3	2282	606	2888
North Caithness Cliffs	2000	14,250	28500	17670	0.7	0.3	19950	5301	25251
East Caithness Cliffs	1999	14,202	28404	17610	0.7	0.3	19883	5283	25166
Buchan Ness to Collieston	2007	1,367	2734	1695	0.7	0.3	1914	509	2422
Troup, Pennan & Lions Heads	2007	1,795	3590	2226	0.7	0.3	2513	668	3181
Fowlsheugh	2009	193	386	239	0.7	0.3	270	72	342
Forth Islands	2010	832	1664	1032	0.7	0.3	1165	310	1474
Flamborough & Filey Coast	2008	878	1756	1089	0.7	0.3	1229	327	1556
UK North Sea non-SPA	2000	129,000	258000	159960	0.7	0.3	180600	47988	228588
Cape Wrath	2000	2,115	4230	2623	0.02	0.03	85	79	163
Handa	2012	1,870	3740	2319	0.02	0.03	75	70	144
Flannan Isles	1998	7,328	14656	9087	0.02	0.03	293	273	566

North Rona & Sula Sgeir	2012	5,000	10000	6200	0.02	0.03	200	186	386
Shiant Isles	1999	4,387	8774	5440	0.02	0.03	175	163	339
St Kilda	1999	66,055	132110	81908	0.02	0.03	2642	2457	5099
Mingulay & Berneray	2009	9,046	18092	11217	0.02	0.03	362	337	698
Rathlin Island	2011	1,518	3036	1882	0.02	0.03	61	56	117
UK Western non-SPA	2000	97,000	194000	120280	0.02	0.03	3880	3608	7488
Overseas birds							39,720	56,693	96,413
UK birds							369,088	103,235	472,323
Total							408,808	159,928	568,736

Table 9. BDMPS for northern fulmar in winter (November) in 'UK western waters & Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters & Channel in winter	Proportion of immatures in UK western waters & Channel in winter	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Iceland	2008	1,000,000	2000000	1240000	0.01	0.02	20000	24800	44800
Norway	1990s	386,000	772000	478640	0.01	0.02	7720	9573	17293
Faroe	1990s	600,000	1200000	744000	0.01	0.03	12000	22320	34320
Hermaness, Saxavord	2011	7,000	14000	8680	0.1	0.2	1400	1736	3136
Fetlar	2000	8,912	17824	11051	0.1	0.2	1782	2210	3993
Foula	2007	19,758	39516	24500	0.1	0.2	3952	4900	8852
Noss	2011	5,248	10496	6508	0.1	0.2	1050	1302	2351
Sumburgh Head	2009	233	466	289	0.1	0.2	47	58	104
Fair Isle	2011	29,649	59298	36765	0.1	0.2	5930	7353	13283
West Westray	2007	677	1354	839	0.1	0.2	135	168	303
Calf of Eday	2002	1,842	3684	2284	0.1	0.2	368	457	825
Rousay	2009	1,030	2060	1277	0.1	0.2	206	255	461
Hoy	2007	19,586	39172	24287	0.1	0.2	3917	4857	8775
Copinsay	2008	1,630	3260	2021	0.1	0.2	326	404	730
North Caithness Cliffs	2000	14,250	28500	17670	0.1	0.2	2850	3534	6384
East Caithness Cliffs	1999	14,202	28404	17610	0.1	0.2	2840	3522	6362
Buchan Ness to Collieston	2007	1,367	2734	1695	0.1	0.2	273	339	612
Troup, Pennan & Lions Heads	2007	1,795	3590	2226	0.1	0.2	359	445	804
Fowlsheugh	2009	193	386	239	0.1	0.2	39	48	86
Forth Islands	2010	832	1664	1032	0.1	0.2	166	206	373
Flamborough & Filey Coast	2008	878	1756	1089	0.1	0.2	176	218	393
UK North Sea non-SPA	2000	129,000	258000	159960	0.1	0.2	25800	31992	57792
Cape Wrath	2000	2,115	4230	2623	0.7	0.3	2961	787	3748
Handa	2012	1,870	3740	2319	0.7	0.3	2618	696	3314
Flannan Isles	1998	7,328	14656	9087	0.7	0.3	10259	2726	12985

North Rona & Sula Sgeir	2012	5,000	10000	6200	0.7	0.3	7000	1860	8860
Shiant Isles	1999	4,387	8774	5440	0.7	0.3	6142	1632	7774
St Kilda	1999	66,055	132110	81908	0.7	0.3	92477	24572	117049
Mingulay & Berneray	2009	9,046	18092	11217	0.7	0.3	12664	3365	16030
Rathlin Island	2011	1,518	3036	1882	0.7	0.3	2125	565	2690
UK Western non-SPA	2000	97,000	194000	120280	0.7	0.3	135800	36084	171884
Overseas birds							39,720	56,693	96,413
UK birds							323,663	136,291	459,954
Total							363,383	192,984	556,367

Table 10. BDMPS for northern fulmar in migration seasons (September & October, December to March) in 'UK North sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters in migration	Proportion of immatures in UK North Sea waters in migration	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Iceland	2008	1,000,000	2000000	1240000	0.02	0.04	40000	49600	89600
Norway	1990s	386,000	772000	478640	0.02	0.04	15440	19146	34586
Faroe	1990s	600,000	1200000	744000	0.02	0.06	24000	44640	68640
Hermaness, Saxavord	2011	7,000	14000	8680	0.9	0.8	12600	6944	19544
Fetlar	2000	8,912	17824	11051	0.9	0.8	16042	8841	24882
Foula	2007	19,758	39516	24500	0.9	0.8	35564	19600	55164
Noss	2011	5,248	10496	6508	0.9	0.8	9446	5206	14652
Sumburgh Head	2009	233	466	289	0.9	0.8	419	231	651
Fair Isle	2011	29,649	59298	36765	0.9	0.8	53368	29412	82780
West Westray	2007	677	1354	839	0.9	0.8	1219	672	1890
Calf of Eday	2002	1,842	3684	2284	0.9	0.8	3316	1827	5143
Rousay	2009	1,030	2060	1277	0.9	0.8	1854	1022	2876
Hoy	2007	19,586	39172	24287	0.9	0.8	35255	19429	54684
Copinsay	2008	1,630	3260	2021	0.9	0.8	2934	1617	4551
North Caithness Cliffs	2000	14,250	28500	17670	0.9	0.8	25650	14136	39786
East Caithness Cliffs	1999	14,202	28404	17610	1	0.8	28404	14088	42492
Buchan Ness to Collieston	2007	1,367	2734	1695	1	0.8	2734	1356	4090
Troup, Pennan & Lions Heads	2007	1,795	3590	2226	1	0.8	3590	1781	5371
Fowlsheugh	2009	193	386	239	1	0.8	386	191	577
Forth Islands	2010	832	1664	1032	1	0.8	1664	825	2489
Flamborough & Filey Coast	2008	878	1756	1089	1	0.8	1756	871	2627
UK North Sea non-SPA	2000	129,000	258000	159960	1	0.8	258000	127968	385968
Cape Wrath	2000	2,115	4230	2623	0	0.06	0	157	157
Handa	2012	1,870	3740	2319	0	0.06	0	139	139
Flannan Isles	1998	7,328	14656	9087	0	0.06	0	545	545

North Rona & Sula Sgeir	2012	5,000	10000	6200	0	0.06	0	372	372
Shiant Isles	1999	4,387	8774	5440	0	0.06	0	326	326
St Kilda	1999	66,055	132110	81908	0	0.06	0	4914	4914
Mingulay & Berneray	2009	9,046	18092	11217	0	0.06	0	673	673
Rathlin Island	2011	1,518	3036	1882	0	0.06	0	113	113
UK Western non-SPA	2000	97,000	194000	120280	0	0.06	0	7217	7217
Overseas birds							79,440	113,386	192,826
UK birds							494,201	270,475	764,676
Total							573,641	383,861	957,502

Table 11. BDMPS for northern fulmar in migration seasons (September & October, December to March) in 'UK western waters & Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters & Channel in migration	Proportion of immatures in UK western waters & Channel in migration	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Iceland	2008	1,000,000	2000000	1240000	0.02	0.04	40000	49600	89600
Norway	1990s	386,000	772000	478640	0.02	0.04	15440	19146	34586
Faroe	1990s	600,000	1200000	744000	0.02	0.06	24000	44640	68640
Hermaness, Saxavord	2011	7,000	14000	8680	0.1	0.1	1400	868	2268
Fetlar	2000	8,912	17824	11051	0.1	0.1	1782	1105	2887
Foula	2007	19,758	39516	24500	0.1	0.1	3952	2450	6402
Noss	2011	5,248	10496	6508	0.1	0.1	1050	651	1700
Sumburgh Head	2009	233	466	289	0.1	0.1	47	29	75
Fair Isle	2011	29,649	59298	36765	0.1	0.1	5930	3676	9606
West Westray	2007	677	1354	839	0.1	0.1	135	84	219
Calf of Eday	2002	1,842	3684	2284	0.1	0.1	368	228	597
Rousay	2009	1,030	2060	1277	0.1	0.1	206	128	334
Hoy	2007	19,586	39172	24287	0.1	0.1	3917	2429	6346
Copinsay	2008	1,630	3260	2021	0.1	0.1	326	202	528
North Caithness Cliffs	2000	14,250	28500	17670	0.1	0.1	2850	1767	4617
East Caithness Cliffs	1999	14,202	28404	17610	0	0.1	0	1761	1761
Buchan Ness to Collieston	2007	1,367	2734	1695	0	0.1	0	170	170
Troup, Pennan & Lions Heads	2007	1,795	3590	2226	0	0.1	0	223	223
Fowlsheugh	2009	193	386	239	0	0.1	0	24	24
Forth Islands	2010	832	1664	1032	0	0.1	0	103	103
Flamborough & Filey Coast	2008	878	1756	1089	0	0.1	0	109	109
UK North Sea non-SPA	2000	129,000	258000	159960	0	0.1	0	15996	15996
Cape Wrath	2000	2,115	4230	2623	1	0.8	4230	2098	6328
Handa	2012	1,870	3740	2319	1	0.8	3740	1855	5595

Flannan Isles	1998	7,328	14656	9087	1	0.8	14656	7269	21925
North Rona & Sula Sgeir	2012	5,000	10000	6200	1	0.8	10000	4960	14960
Shiant Isles	1999	4,387	8774	5440	1	0.8	8774	4352	13126
St Kilda	1999	66,055	132110	81908	1	0.8	132110	65527	197637
Mingulay & Berneray	2009	9,046	18092	11217	1	0.8	18092	8974	27066
Rathlin Island	2011	1,518	3036	1882	1	0.8	3036	1506	4542
UK Western non-SPA	2000	97,000	194000	120280	1	0.8	194000	96224	290224
Overseas birds							79,440	113,386	192,826
UK birds							410,601	224,767	635,368
Total							490,041	338,153	828,194

Table 12. BDMPS for Manx shearwater in migration seasons (August to early October, late March to May) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK N Sea in migration	Proportion of immatures in UK N Sea in migration	UK North Sea number of adults	UK North Sea number of immatures	UK North Sea total birds
Iceland	1990s	8500	17000	14280	0	0.001	0	14	14
Faroe	2012	25000	50000	42000	0	0.001	0	42	42
Ireland	2000	32600	65200	54768	0	0.001	0	55	55
St Kilda	1999	4802	9604	8067	0	0.01	0	81	81
Rum	2001	120000	240000	201600	0	0.01	0	2016	2016
Aberdaron Coast & Bardsey	2001	16183	32366	27187	0	0.01	0	272	272
Skomer, Skokholm & Middleh	2011	350000	700000	588000	0	0.01	0	5880	5880
UK non-SPA colonies	2000	4000	8000	6720	0.01	0.01	80	67	147
Total overseas							0	111	111
Total UK							80	8,316	8,396
Total							80	8,427	8,507

Table 13. BDMPS for Manx shearwater in migration seasons (August to early October, late March to May) in 'UK western waters & Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters & Channel in migration	Proportion of immatures in UK western waters & Channel in migration	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Iceland	1990s	8500	17000	14280	0.01	0.03	170	428	598
Faroe	2012	25000	50000	42000	0.01	0.03	500	1260	1760
Ireland	2000	32600	65200	54768	0.05	0.1	3260	5477	8737
St Kilda	1999	4802	9604	8067	1	0.7	9604	5647	15251
Rum	2001	120000	240000	201600	1	0.7	240000	141120	381120
Aberdaron Coast & Bardsey	2001	16183	32366	27187	1	0.7	32366	19031	51397
Skomer, Skokholm & Middleh	2011	350000	700000	588000	1	0.7	700000	411600	1111600
UK non-SPA colonies	2000	4000	8000	6720	0.8	0.6	6400	4032	10432
Total overseas							3,930	7,165	11,095
Total UK							988,370	581,430	1,569,800
Total							992,300	588,595	1,580,895

Table 14. BDMPS for northern gannet in autumn (September to November) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in autumn	Proportion immatures in UK North Sea & Channel waters in autumn	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	2010	28500	57000	46170	0.3	0.3	17100	13851	30951
Norway	2010	4500	9000	7290	0.3	0.3	2700	2187	4887
Faroe	2012	2500	5000	4050	0.3	0.3	1500	1215	2715
Hermaness, Saxavord	2008	24353	48706	39452	0.8	0.8	38965	31561	70526
Noss	2008	9767	19534	15823	0.8	0.8	15627	12658	28285
Fair Isle	2013	3924	7848	6357	0.8	0.8	6278	5086	11364
Forth Islands	2009	55482	110964	89881	1	0.9	110964	80893	191857
Flamborough & Filey	2012	11061	22122	17919	1	0.9	22122	16127	38249
UK North Sea non-SPA colonies	2004	6000	12000	9720	1	0.9	12000	8748	20748
Sule Skerry & Sule Stack	2004	4675	9350	7574	0.1	0.2	935	1515	2450
North Rona & Sula Sgeir	2004	9225	18450	14944	0.1	0.2	1845	2989	4834
St Kilda	2004	59622	119244	96588	0.1	0.2	11924	19318	31242
Ailsa Craig	2004	27130	54260	43951	0	0.1	0	4395	4395
Grassholm	2009	39292	78584	63653	0	0.1	0	6365	6365
UK western non-SPA colonies	2004	5000	10000	8100	0	0.1	0	810	810
Ireland	2004	36000	72000	58320	0	0.1	0	5832	5832
Germany	2013	632	1264	1024	0.3	0.4	379	410	789
Total overseas							21,679	23,495	45,174
Total UK							220,661	190,464	411,125
Total							242,340	213,959	456,299

Table 15. BDMPS for northern gannet in autumn (September to November) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in autumn	Proportion immatures in UK western waters in autumn	UK west Number adults	UK west Number immatures	UK west Total birds
Iceland	2010	28500	57000	46170	0.2	0.3	11400	13851	25251
Norway	2010	4500	9000	7290	0.2	0.3	1800	2187	3987
Faroe	2012	2500	5000	4050	0.2	0.3	1000	1215	2215
Hermaness, Saxavord	2008	24353	48706	39452	0.2	0.1	9741	3945	13686
Noss	2008	9767	19534	15823	0.2	0.1	3907	1582	5489
Fair Isle	2013	3924	7848	6357	0.2	0.1	1570	636	2205
Forth Islands	2009	55482	110964	89881	0	0.1	0	8988	8988
Flamborough & Filey	2012	11061	22122	17919	0	0.1	0	1792	1792
UK North Sea non-SPA cols	2004	6000	12000	9720	0	0.1	0	972	972
Sule Skerry & Sule Stack	2004	4675	9350	7574	0.9	0.7	8415	5301	13716
North Rona & Sula Sgeir	2004	9225	18450	14944	0.9	0.7	16605	10461	27066
St Kilda	2004	59622	119244	96588	0.9	0.7	107320	67611	174931
Ailsa Craig	2004	27130	54260	43951	1	0.8	54260	35160	89420
Grassholm	2009	39292	78584	63653	1	0.8	78584	50922	129506
UK western non-SPA cols	2004	4500	9000	7290	1	0.8	9000	5832	14832
Ireland	2004	36000	72000	58320	0.2	0.3	14400	17496	31896
Germany	2013	632	1264	1024	0	0	0	0	0
Total overseas							28,600	34,749	63,349
Total UK							289,401	193,204	482,605
Total							318,001	227,953	545,954

Table 16. BDMPS for northern gannet in spring (December to March) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in spring	Proportion immatures in UK North Sea & Channel waters in spring	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	2010	28500	57000	46170	0.1	0.1	5700	4617	10317
Norway	2010	4500	9000	7290	0.2	0.2	1800	1458	3258
Faroe	2012	2500	5000	4050	0.2	0.2	1000	810	1810
Hermaness, Saxavord	2008	24353	48706	39452	0.7	0.4	34094	15781	49875
Noss	2008	9767	19534	15823	0.7	0.4	13674	6329	20003
Fair Isle	2013	3924	7848	6357	0.7	0.4	5494	2543	8036
Forth Islands	2009	55482	110964	89881	0.7	0.4	77675	35952	113627
Flamborough & Filey	2012	11061	22122	17919	0.7	0.4	15485	7168	22653
UK North Sea non-SPA cols	2004	6000	12000	9720	0.7	0.4	8400	3888	12288
Sule Skerry & Sule Stack	2004	4675	9350	7574	0	0	0	0	0
North Rona & Sula Sgeir	2004	9225	18450	14944	0	0	0	0	0
St Kilda	2004	59622	119244	96588	0	0	0	0	0
Ailsa Craig	2004	27130	54260	43951	0	0	0	0	0
Grassholm	2009	39292	78584	63653	0	0	0	0	0
UK western non-SPA cols	2004	5000	10000	8100	0	0	0	0	0
Ireland	2004	36000	72000	58320	0	0.1	0	5832	5832
Germany	2013	632	1264	1024	0.3	0.3	379	307	686
Total overseas							8,879	13,024	21,903
Total UK							154,822	71,660	226,482
Total							163,701	84,684	248,385

Table 17. BDMPS for northern gannet in spring (December to March) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in spring	Proportion immatures in UK western waters in spring	UK west Number adults	UK west Number immatures	UK west Total birds
Iceland	2010	28500	57000	46170	0.2	0.2	11400	9234	20634
Norway	2010	4500	9000	7290	0.2	0.2	1800	1458	3258
Faroe	2012	2500	5000	4050	0.3	0.3	1500	1215	2715
Hermaness, Saxavord	2008	24353	48706	39452	0.3	0.3	14612	11836	26447
Noss	2008	9767	19534	15823	0.3	0.3	5860	4747	10607
Fair Isle	2013	3924	7848	6357	0.3	0.3	2354	1907	4261
Forth Islands	2009	55482	110964	89881	0.3	0.3	33289	26964	60253
Flamborough & Filey	2012	11061	22122	17919	0.3	0.3	6637	5376	12012
UK North Sea non-SPA cols	2004	6000	12000	9720	0.3	0.3	3600	2916	6516
Sule Skerry & Sule Stack	2004	4675	9350	7574	1	0.8	9350	6059	15409
North Rona & Sula Sgeir	2004	9225	18450	14944	1	0.8	18450	11956	30406
St Kilda	2004	59622	119244	96588	1	0.8	119244	77270	196514
Ailsa Craig	2004	27130	54260	43951	1	0.8	54260	35160	89420
Grassholm	2009	39292	78584	63653	1	0.8	78584	50922	129506
UK western non-SPA cols	2004	4500	9000	7290	1	0.8	9000	5832	14832
Ireland	2004	36000	72000	58320	0.3	0.3	21600	17496	39096
Germany	2013	632	1264	1024	0	0	0	0	0
Total overseas							36,300	29,403	65,703
Total UK							355,240	240,945	596,185
Total							391,540	270,348	661,888

Table 18. BDMPS for great cormorant in non-breeding season (September to March) in 'UK NW North Sea'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK NW North Sea waters in non-breeding season	Proportion of immatures in UK NW North Sea waters in non-breeding season	UK NW N Sea Number adults	UK NW N Sea Number immatures	UK NW N Sea Total birds
Denmark	1990s	40000	80000	93600	0	0.001	0	94	94
Netherlands	1990s	20000	40000	46800	0	0.0001	0	5	5
Ireland	2000	4100	8200	9594	0	0	0	0	0
France	1990s	1500	3000	3510	0	0	0	0	0
Calf of Eday	2012	181	362	424	1	1	362	424	786
East Caithness Cliffs	2013	52	104	122	1	1	104	122	226
Forth Islands	2013	80	160	187	0.6	0.5	96	94	190
UK non-SPA NW N S	2000	1200	2400	2808	0.8	0.8	1920	2246	4166
Farne Islands	2013	87	174	204	0.1	0.2	17	41	58
Abberton Reservoir	2005	216	432	505	0	0	0	0	0
UK non-SPA SW N S	2000	2200	4400	5148	0.05	0.05	220	257	477
Sheep Island NI	2013	112	224	262	0	0.001	0	0	0
UK non-SPA W Scotland	2000	2570	5140	6014	0	0.001	0	6	6
Puffin Island Wales	2013	448	896	1048	0	0.001	0	1	1
UK non-SPA Wales SW E	2000	1750	3500	4095	0	0.001	0	4	4
Overseas total							0	98	98
UK total							2,719	3,195	5,914
Total							2,719	3,293	6,012

Table 19. BDMPS for great cormorant in non-breeding season (September to March) in 'UK SW North Sea & Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK SW North Sea & Channel waters in non-breeding season	Proportion of immatures in UK SW North Sea & Channel waters in non-breeding season	UK SW N Sea & Channel Number adults	UK SW N Sea & Channel Number immatures	UK SW N Sea & Channel Total birds
Denmark	1990s	40000	80000	93600	0	0.005	0	468	468
Netherlands	1990s	20000	40000	46800	0.001	0.01	40	468	508
Ireland	2000	4100	8200	9594	0	0.01	0	96	96
France	1990s	1500	3000	3510	0	0.01	0	35	35
Calf of Eday	2012	181	362	424	0	0	0	0	0
East Caithness Cliffs	2013	52	104	122	0	0	0	0	0
Forth Islands	2013	80	160	187	0.4	0.5	64	94	158
UK non-SPA NW N S	2000	1200	2400	2808	0.2	0.2	480	562	102
Farne Islands	2013	87	174	204	0.9	0.8	157	163	319
Abberton Reservoir	2005	216	432	505	0.8	0.7	346	354	699
UK non-SPA SW N S	2000	2200	4400	5148	0.8	0.7	3520	3604	7124
Sheep Island NI	2013	112	224	262	0	0.001	0	0	0
UK non-SPA W Scotland	2000	2570	5140	6014	0	0.001	0	6	6
Puffin Island Wales	2013	448	896	1048	0	0.001	0	1	1
UK non-SPA Wales SW E	2000	1750	3500	4095	0	0.001	0	4	4
Overseas total							40	1,067	1,107
UK total							4,566	4,787	9,353
Total							4,606	5,854	10,460

Table 20. BDMPS for great cormorant in non-breeding season (September to March) in 'UK West of Scotland waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK West of Scotland waters in non-breeding season	Proportion of immatures in UK west of Scotland waters in non-breeding season	UK West of Scotland Number adults	UK west of Scotland Number immatures	UK west of Scotland Total birds
Denmark	1990s	40000	80000	93600	0	0.0005	0	47	47
Netherlands	1990s	20000	40000	46800	0	0	0	0	0
Ireland	2000	4100	8200	9594	0	0.001	0	10	10
France	1990s	1500	3000	3510	0	0	0	0	0
Calf of Eday	2012	181	362	424	0	0	0	0	0
East Caithness Cliffs	2013	52	104	122	0	0	0	0	0
Forth Islands	2013	80	160	187	0	0	0	0	0
UK non-SPA NW N S	2000	1200	2400	2808	0	0	0	0	0
Farne Islands	2013	87	174	204	0	0	0	0	0
Abberton Reservoir	2005	216	432	505	0	0	0	0	0
UK non-SPA SW N S	2000	2200	4400	5148	0	0	0	0	0
Sheep Island NI	2013	112	224	262	0.8	0.6	179	157	336
UK non-SPA W Scotland	2000	2570	5140	6014	0.7	0.5	3598	3007	6605
Puffin Island Wales	2013	448	896	1048	0	0.01	0	10	10
UK non-SPA Wales SW E	2000	1750	3500	4095	0	0.01	0	41	41
Overseas total							0	56	56
UK total							3,777	3,216	6,993
Total							3,777	3,272	7,049

Table 21. BDMPS for great cormorant in non-breeding season (September to March) in 'UK Wales & SW England waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in Wales & SW E waters in non-breeding season	Proportion immatures in Wales & SW E waters in non-breeding season	Wales & SW E Number adults	Wales & SW E Number immatures	Wales & SW E Total birds
Denmark	1990s	40000	80000	93600	0	0.0001	0	9	9
Netherlands	1990s	20000	40000	46800	0	0.0001	0	5	5
Ireland	2000	4100	8200	9594	0	0.02	0	192	192
France	1990s	1500	3000	3510	0	0.001	0	4	4
Calf of Eday	2012	181	362	424	0	0	0	0	0
East Caithness Cliffs	2013	52	104	122	0	0	0	0	0
Forth Islands	2013	80	160	187	0	0	0	0	0
UK non-SPA NW N S	2000	1200	2400	2808	0	0	0	0	0
Farne Islands	2013	87	174	204	0	0	0	0	0
Abberton Reservoir	2005	216	432	505	0	0	0	0	0
UK non-SPA SW N S	2000	2200	4400	5148	0	0	0	0	0
Sheep Island NI	2013	112	224	262	0.2	0.4	45	105	150
UK non-SPA W Scotland	2000	2570	5140	6014	0.3	0.5	1542	3007	4549
Puffin Island Wales	2013	448	896	1048	0.6	0.4	538	419	957
UK non-SPA Wales SW E	2000	1750	3500	4095	0.6	0.4	2100	1638	3738
Overseas total							0	209	209
UK total							4,224	5,169	9,393
Total							4,224	5,378	9,602

Table 22. BDMPS for European shag in non-breeding season (September to January) in 'UK NW North Sea'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK NW North Sea in non-breeding season	Proportion immatures in UK NW North Sea in non-breeding season	UK NW N Sea Number adults	UK NW N Sea Number immatures	UK NW N Sea Total birds
Hermaness, Saxavord	2002	41	82	107	1	1	82	107	189
Foula	2013	200	400	524	1	1	400	524	924
Fair Isle	2013	204	408	534	1	1	408	534	942
East Caithness Cliffs	1999	1056	2112	2767	1	1	2112	2767	4879
Buchan Ness to Collieston	2007	331	662	867	1	1	662	867	1529
Forth Islands	2013	850	1700	2227	1	0.9	1700	2004	3704
St Abbs Head to Fast Castle	2011	160	320	419	1	0.8	320	335	655
UK NW N Sea non-SPA	2000	6000	12000	15720	1	1	12000	15720	27720
Farne Islands	2013	582	1164	1525	0.3	0.4	349	610	959
UK SW N Sea non-SPA	2000	500	1000	1310	0	0	0	0	0
Sule Skerry & Sule Stack	2011	200	400	524	0	0	0	0	0
Shiant Islands	1999	506	1012	1326	0	0	0	0	0
Canna & Sanday	2013	255	510	668	0	0	0	0	0
Mingulay & Berneray	2009	115	230	301	0	0	0	0	0
UK West of Scotld non-SPA	2000	7000	14000	18340	0	0	0	0	0
Isles of Scilly	2006	1296	2592	3396	0	0	0	0	0
UK Wales & SW E non-SPA	2000	1500	3000	3930	0	0	0	0	0
Ireland	2000	2000	4000	5240	0	0	0	0	0
Overseas total							0	0	0
UK total							18,033	23,469	41,503
Total							18,033	23,469	41,503

Table 23. BDMPS for European shag in non-breeding season (September to January) in ‘UK SW North Sea & Channel waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK SW North Sea & Channel waters in non-breeding season	Proportion of immatures in UK SW North Sea & Channel waters in non-breeding season	UK SW N Sea & Channel Number adults	UK SW N Sea & Channel Number immatures	UK SW N Sea & Channel Total birds
Hermaness, Saxavord	2002	41	82	107	0	0	0	0	0
Foula	2013	200	400	524	0	0	0	0	0
Fair Isle	2013	204	408	534	0	0	0	0	0
East Caithness Cliffs	1999	1056	2112	2767	0	0	0	0	0
Buchan Ness to Collieston	2007	331	662	867	0	0	0	0	0
Forth Islands	2013	850	1700	2227	0	0.1	0	223	223
St Abbs Head to Fast Castle	2011	160	320	419	0	0.2	0	84	84
UK NW N Sea non-SPA	2000	6000	12000	15720	0	0	0	0	0
Farne Islands	2013	582	1164	1525	0.7	0.6	815	915	1730
UK SW N Sea non-SPA	2000	500	1000	1310	1	1	1000	1310	2310
Sule Skerry & Sule Stack	2011	200	400	524	0	0	0	0	0
Shiant Islands	1999	506	1012	1326	0	0	0	0	0
Canna & Sanday	2013	255	510	668	0	0	0	0	0
Mingulay & Berneray	2009	115	230	301	0	0	0	0	0
UK West of Scotland non-SPA	2000	7000	14000	18340	0	0	0	0	0
Isles of Scilly	2006	1296	2592	3396	0	0	0	0	0
UK Wales & SW E non-SPA	2000	1500	3000	3930	0	0	0	0	0
Ireland	2000	2000	4000	5240	0	0	0	0	0
Overseas total							0	0	0
UK total							1,815	2,531	4,346
Total							1,815	2,531	4,346

Table 24. BDMPS for European shag in non-breeding season (September to January) in 'UK West of Scotland waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK west of Scotland waters in non-breeding season	Proportion of immatures in UK west of Scotland waters in non-breeding season	UK west of Scotland Number adults	UK west of Scotland Number immatures	UK west of Scotland Total birds
Hermaness, Saxavord	2002	41	82	107	0	0	0	0	0
Foula	2013	200	400	524	0	0	0	0	0
Fair Isle	2013	204	408	534	0	0	0	0	0
East Caithness Cliffs	1999	1056	2112	2767	0	0	0	0	0
Buchan Ness to Collieston	2007	331	662	867	0	0	0	0	0
Forth Islands	2013	850	1700	2227	0	0	0	0	0
St Abbs Head to Fast Castle	2011	160	320	419	0	0	0	0	0
UK NW N Sea non-SPA	2000	6000	12000	15720	0	0	0	0	0
Farne Islands	2013	582	1164	1525	0	0	0	0	0
UK SW N Sea non-SPA	2000	500	1000	1310	0	0	0	0	0
Sule Skerry & Sule Stack	2011	200	400	524	1	1	400	524	924
Shiant Islands	1999	506	1012	1326	1	1	1012	1326	2338
Canna & Sanday	2013	255	510	668	1	1	510	668	1178
Mingulay & Berneray	2009	115	230	301	1	1	230	301	531
UK West of Scotland non-SPA	2000	7000	14000	18340	1	1	14000	18340	32340
Isles of Scilly	2006	1296	2592	3396	0	0	0	0	0
UK Wales & SW E non-SPA	2000	1500	3000	3930	0	0	0	0	0
Ireland	2000	2000	4000	5240	0	0.01	0	52	52
Overseas total							0	52	52
UK total							16,152	21,159	37,311
Total							16,152	21,211	37,363

Table 25. BDMPS for European shag in non-breeding season (September to January) in ‘UK Wales & SW England waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in Wales & SW E waters in non-breeding season	Proportion immatures in Wales & SW E waters in non-breeding season	UK Wales & SW E Number adults	UK Wales & SW E Number immatures	UK Wales & SW E Total birds
Hermaness, Saxavord	2002	41	82	107	0	0	0	0	0
Foula	2013	200	400	524	0	0	0	0	0
Fair Isle	2013	204	408	534	0	0	0	0	0
East Caithness Cliffs	1999	1056	2112	2767	0	0	0	0	0
Buchan Ness to Collieston	2007	331	662	867	0	0	0	0	0
Forth Islands	2013	850	1700	2227	0	0	0	0	0
St Abbs Head to Fast Castle	2011	160	320	419	0	0	0	0	0
UK NW N Sea non-SPA	2000	6000	12000	15720	0	0	0	0	0
Farne Islands	2013	582	1164	1525	0	0	0	0	0
UK SW N Sea non-SPA	2000	500	1000	1310	0	0	0	0	0
Sule Skerry & Sule Stack	2011	200	400	524	0	0	0	0	0
Shiant Islands	1999	506	1012	1326	0	0	0	0	0
Canna & Sanday	2013	255	510	668	0	0	0	0	0
Mingulay & Berneray	2009	115	230	301	0	0	0	0	0
UK West of Scotland non-SPA	2000	7000	14000	18340	0	0	0	0	0
Isles of Scilly	2006	1296	2592	3396	1	1	2592	3396	5988
UK Wales & SW E non-SPA	2000	1500	3000	3930	1	1	3000	3930	6930
Ireland	2000	2000	4000	5240	0	0.03	0	157	157
Overseas total							0	157	157
UK total							5,592	7,326	12,918
Total							5,592	7,483	13,075

Table 26. BDMPS for Arctic skua in autumn migration season (August to October) in ‘UK North Sea & Channel waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in autumn	Proportion of immatures in UK North Sea & Channel waters in autumn	UK N Sea & Channel waters Number adults	UK N Sea & Channel waters Number immatures	UK N Sea & Channel waters Total birds
High Arctic tundra	1990s	50,000	100000	71000	0.01	0.01	1000	710	1710
Iceland	1990s	7500	15000	10650	0.02	0.02	300	213	513
Fennoscandia	1990s	8000	16000	11360	0.1	0.1	1600	1136	2736
Faroe	2012	750	1500	1065	0.1	0.1	150	106	256
Fetlar	2002	83	166	118	0.6	0.4	100	47	147
Foula	2013	35	70	50	0.6	0.4	42	20	62
Fair Isle	2013	19	38	27	0.6	0.4	23	11	34
West Westray	2010	27	54	38	0.6	0.4	32	15	48
Papa Westray	2012	22	44	31	0.6	0.4	26	12	39
Hoy	2010	12	24	17	0.6	0.4	14	7	21
Rousay	2010	37	74	53	0.6	0.4	44	21	65
UK non-SPA North Sea colonies	2000*	450	900	639	0.6	0.4	540	256	796
UK non-SPA western colonies	2000*	200	400	284	0	0	0	0	0
Total overseas							3,050	2,166	5,216
Total UK							822	389	1,211
Total							3,872	2,555	6,427

*updated to 2012 using trend reported in Foster and Marrs (2012)

Table 27. BDMPS for Arctic skua in autumn migration season (August to October) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in autumn	Proportion of immatures in UK western waters in autumn	UK western Number adults	UK western Number immatures	UK western Total birds
High Arctic tundra	1990s	50,000	100000	71000	0.01	0.01	1000	710	1710
Iceland	1990s	7500	15000	10650	0.02	0.02	300	213	513
Fennoscandia	1990s	8000	16000	11360	0.05	0.05	800	568	1368
Faroe	2012	750	1500	1065	0.1	0.1	150	106	256
Fetlar	2002	83	166	118	0.4	0.3	66	35	102
Foula	2013	35	70	50	0.4	0.3	28	15	43
Fair Isle	2013	19	38	27	0.4	0.3	15	8	23
West Westray	2010	27	54	38	0.4	0.3	22	12	33
Papa Westray	2012	22	44	31	0.4	0.3	18	9	27
Hoy	2010	12	24	17	0.4	0.3	10	5	15
Rousay	2010	37	74	53	0.4	0.3	30	16	45
UK non-SPA North Sea colonies	2000*	450	900	639	0.4	0.3	360	192	552
UK non-SPA western colonies	2000*	200	400	284	1	0.7	400	199	599
Total overseas							2,250	1,598	3,848
Total UK							948	491	1,439
Total							3,198	2,089	5,287

*updated to 2012 using trend reported in Foster and Marrs (2012)

Table 28. BDMPS for Arctic skua in spring migration season (April-May) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in spring	Proportion of immatures in UK North Sea & Channel waters in spring	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
High Arctic tundra	1990s	50,000	100000	71000	0.002	0.001	200	71	271
Iceland	1990s	7500	15000	10650	0.005	0.001	75	11	86
Fennoscandia	1990s	8000	16000	11360	0.01	0.005	160	57	217
Faroe	2012	750	1500	1065	0.005	0.001	8	1	9
Fetlar	2002	83	166	118	0.4	0.1	66	12	78
Foula	2013	35	70	50	0.4	0.1	28	5	33
Fair Isle	2013	19	38	27	0.4	0.1	15	3	18
West Westray	2010	27	54	38	0.4	0.1	22	4	25
Papa Westray	2012	22	44	31	0.4	0.1	18	3	21
Hoy	2010	12	24	17	0.4	0.1	10	2	11
Rousay	2010	37	74	53	0.4	0.1	30	5	35
UK non-SPA North Sea colonies	2000*	450	900	639	0.4	0.1	360	64	424
UK non-SPA western colonies	2000*	200	400	284	0	0	0	0	0
Total overseas							442	140	582
Total UK							548	97	645
Total							990	237	1,227

*updated to 2012 using trend reported in Foster and Marrs (2012)

Table 29. BDMPS for Arctic skua in spring migration season (April-May) in ‘UK western waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in spring	Proportion of immatures in UK western waters in spring	UK western Number adults	UK western Number immatures	UK western Total birds
High Arctic tundra	1990s	50,000	100000	71000	0.01	0.01	1000	710	1710
Iceland	1990s	7500	15000	10650	0.01	0.01	150	106	256
Fennoscandia	1990s	8000	16000	11360	0.05	0.03	800	341	1141
Faroe	2012	750	1500	1065	0.05	0.02	75	21	96
Fetlar	2002	83	166	118	0.6	0.5	100	59	159
Foula	2013	35	70	50	0.6	0.5	42	25	67
Fair Isle	2013	19	38	27	0.6	0.5	23	13	36
West Westray	2010	27	54	38	0.6	0.5	32	19	52
Papa Westray	2012	22	44	31	0.6	0.5	26	16	42
Hoy	2010	12	24	17	0.6	0.5	14	9	23
Rousay	2010	37	74	53	0.6	0.5	44	26	71
UK non-SPA North Sea colonies	2000*	450	900	639	0.6	0.5	540	320	860
UK non-SPA western colonies	2000*	200	400	284	1	0.7	400	199	599
Total overseas							2,025	1,179	3,204
Total UK							1,222	685	1,907
Total							3,247	1,864	5,111

*updated to 2012 using trend reported in Foster and Marrs (2012)

Table 30. BDMPS for great skua in autumn migration season (August to October) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in autumn	Proportion of immatures in UK North Sea & Channel waters in autumn	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1980s	5400	10800	15336	0.1	0.05	1080	767	1847
Norway	2010	360	720	1022	0.1	0.05	72	51	123
Faroe	2012	500	1000	1420	0.1	0.05	100	71	171
Hermaness, Saxavord	2013	979	1958	2780	0.6	0.3	1175	834	2009
Fetlar	2002	585	1170	1661	0.6	0.3	702	498	1200
Ronas Hill, North Roe	2002	189	378	537	0.6	0.3	227	161	388
Foula	2007	1657	3314	4706	0.6	0.3	1988	1412	3400
Noss	2013	465	930	1321	0.6	0.3	558	396	954
Fair Isle	2013	266	532	755	0.6	0.3	319	227	546
Hoy	2010	1346	2692	3823	0.6	0.3	1615	1147	2762
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0.6	0.3	3600	2556	6156
Handa	2013	135	270	383	0	0	0	0	0
St Kilda	2012	181	362	514	0	0	0	0	0
UK Non-SPA western colonies	2000	100	200	284	0	0	0	0	0
Total overseas							1,252	889	2,141
Total UK							10,184	7,231	17,415
Total							11,436	8,120	19,556

Table 31. BDMPS for great skua in autumn migration season (August to October) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in autumn	Proportion of immatures in UK western waters in autumn	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1980s	5400	10800	15336	0.2	0.05	2160	767	2927
Norway	2010	360	720	1022	0.1	0.05	72	51	123
Faroe	2012	500	1000	1420	0.3	0.05	300	71	371
Hermaness, Saxavord	2013	979	1958	2780	0.4	0.2	783	556	1339
Fetlar	2002	585	1170	1661	0.4	0.2	468	332	800
Ronas Hill, North Roe	2002	189	378	537	0.4	0.2	151	107	259
Foula	2007	1657	3314	4706	0.4	0.2	1326	941	2267
Noss	2013	465	930	1321	0.4	0.2	372	264	636
Fair Isle	2013	266	532	755	0.4	0.2	213	151	364
Hoy	2010	1346	2692	3823	0.4	0.2	1077	765	1841
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0.4	0.2	2400	1704	4104
Handa	2013	135	270	383	1	0.4	270	153	423
St Kilda	2012	181	362	514	1	0.4	362	206	568
UK Non-SPA western colonies	2000	100	200	284	1	0.4	200	114	314
Total overseas							2,532	889	3,421
Total UK							7,622	5,293	12,915
Total							10,154	6,182	16,336

Table 32. BDMPS for great skua in winter (November to February) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in winter	Proportion of immatures in UK North Sea & Channel waters in winter	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1980s	5400	10800	15336	0.01	0.001	108	15	123
Norway	2010	360	720	1022	0.01	0.001	7	1	8
Faroe	2012	500	1000	1420	0.01	0.001	10	1	11
Hermaness, Saxavord	2013	979	1958	2780	0	0	0	0	0
Fetlar	2002	585	1170	1661	0	0	0	0	0
Ronas Hill, North Roe	2002	189	378	537	0	0	0	0	0
Foula	2007	1657	3314	4706	0	0	0	0	0
Noss	2013	465	930	1321	0	0	0	0	0
Fair Isle	2013	266	532	755	0	0	0	0	0
Hoy	2010	1346	2692	3823	0	0	0	0	0
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0	0	0	0	0
Handa	2013	135	270	383	0	0	0	0	0
St Kilda	2012	181	362	514	0	0	0	0	0
UK Non-SPA western colonies	2000	100	200	284	0	0	0	0	0
Total overseas							125	18	143
Total UK							0	0	0
Total							125	18	143

Table 33. BDMPS for great skua in winter (November to February) in ‘UK western waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in winter	Proportion of immatures in UK western waters in winter	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1980s	5400	10800	15336	0.1	0.001	1080	15	1095
Norway	2010	360	720	1022	0.1	0.001	72	1	73
Faroe	2012	500	1000	1420	0.05	0.001	50	1	51
Hermaness, Saxavord	2013	979	1958	2780	0.01	0	20	0	20
Fetlar	2002	585	1170	1661	0.01	0	12	0	12
Ronas Hill, North Roe	2002	189	378	537	0.01	0	4	0	4
Foula	2007	1657	3314	4706	0.01	0	33	0	33
Noss	2013	465	930	1321	0.01	0	9	0	9
Fair Isle	2013	266	532	755	0.01	0	5	0	5
Hoy	2010	1346	2692	3823	0.01	0	27	0	27
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0.01	0	60	0	60
Handa	2013	135	270	383	0.01	0	3	0	3
St Kilda	2012	181	362	514	0.01	0	4	0	4
UK Non-SPA western colonies	2000	100	200	284	0.01	0	2	0	2
Total overseas							1,202	18	1,220
Total UK							178	0	178
Total							1,380	18	1,398

Table 34. BDMPS for great skua in spring migration (March-April) in ‘UK North Sea & Channel waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in spring	Proportion of immatures in UK North Sea & Channel waters in spring	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1980s	5400	10800	15336	0.05	0.02	540	307	847
Norway	2010	360	720	1022	0.05	0.02	36	20	56
Faroe	2012	500	1000	1420	0.05	0.02	50	28	78
Hermaness, Saxavord	2013	979	1958	2780	0.3	0.1	587	278	865
Fetlar	2002	585	1170	1661	0.3	0.1	351	166	517
Ronas Hill, North Roe	2002	189	378	537	0.3	0.1	113	54	167
Foula	2007	1657	3314	4706	0.3	0.1	994	471	1465
Noss	2013	465	930	1321	0.3	0.1	279	132	411
Fair Isle	2013	266	532	755	0.3	0.1	160	76	235
Hoy	2010	1346	2692	3823	0.3	0.1	808	382	1190
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0.3	0.1	1800	852	2652
Handa	2013	135	270	383	0	0	0	0	0
St Kilda	2012	181	362	514	0	0	0	0	0
UK Non-SPA western colonies	2000	100	200	284	0	0	0	0	0
Total overseas							626	356	982
Total UK							5,092	2,410	7,503
Total							5,718	2,766	8,485

Table 35. BDMPS for great skua in spring migration (March-April) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in spring	Proportion of immatures in UK western waters in spring	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1980s	5400	10800	15336	0.3	0.05	3240	767	4007
Norway	2010	360	720	1022	0.2	0.05	144	51	195
Faroe	2012	500	1000	1420	0.4	0.05	400	71	471
Hermaness, Saxavord	2013	979	1958	2780	0.7	0.3	1371	834	2205
Fetlar	2002	585	1170	1661	0.7	0.3	819	498	1317
Ronas Hill, North Roe	2002	189	378	537	0.7	0.3	265	161	426
Foula	2007	1657	3314	4706	0.7	0.3	2320	1412	3732
Noss	2013	465	930	1321	0.7	0.3	651	396	1047
Fair Isle	2013	266	532	755	0.7	0.3	372	227	599
Hoy	2010	1346	2692	3823	0.7	0.3	1884	1147	3031
UK Non-SPA North Sea colonies	2000	3000	6000	8520	0.7	0.3	4200	2556	6756
Handa	2013	135	270	383	1	0.4	270	153	423
St Kilda	2012	181	362	514	1	0.4	362	206	568
UK Non-SPA western colonies	2000	100	200	284	1	0.4	200	114	314
Total overseas							3,784	889	4,673
Total UK							12,714	7,704	20,417
Total							16,498	8,593	25,090

Table 36. BDMPS for lesser black-backed gull in autumn migration (August-October) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in autumn	Proportion of immatures in UK North Sea & Channel waters in autumn	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1990s	25000	50000	34000	0.2	0.1	10000	3400	13400
Norway	1990s	30000	60000	40800	0.3	0.1	18000	4080	22080
Faroe	2012	9000	18000	12240	0.4	0.2	7200	2448	9648
Sweden	1990s	18000	36000	24480	0.1	0.05	3600	1224	4824
Denmark	1990s	4400	8800	5984	0.1	0.05	880	299	1179
Ireland	2000	3800	7600	5168	0.1	0.05	760	258	1018
Netherlands	2012	80000	160000	108800	0.05	0.025	8000	2720	10720
Forth Islands	2005-09	1608	3216	2187	1	0.7	3216	1531	4747
Alde-Ore Estuary	2012	640	1280	870	1	0.7	1280	609	1889
UK North Sea non-SPA cols	2000	13000	26000	17680	1	0.7	26000	12376	38376
Ailsa Craig	2010	183	366	249	0.5	0.4	183	100	283
Rathlin Island	2011	107	214	146	0.5	0.4	107	58	165
Lough Neagh & Lough Beg	2000	493	986	670	0.5	0.4	493	268	761
Bowland Fells	2008-12	4575	9150	6222	0.5	0.4	4575	2489	7064
Morcambe Bay	2012	4987	9974	6782	0.5	0.4	4987	2713	7700
Ribble & Alt Estuaries	2012	8267	16534	11243	0.5	0.4	8267	4497	12764
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.3	0.3	5784	3933	9717
Isles of Scilly	2006	3400	6800	4624	0.1	0.05	680	231	911
UK Western non-SPA colonies	2000	40000	80000	54400	0.5	0.4	40000	21760	61760
Total overseas							48,440	14,430	62,870
Total UK							95,572	50,565	146,137
Total							144,012	64,995	209,007

Table 37. BDMPS for lesser black-backed gull in autumn migration (August-October) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in autumn	Proportion immatures in UK western waters in autumn	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1990s	25000	50000	34000	0.2	0.1	10000	3400	13400
Norway	1990s	30000	60000	40800	0.1	0.05	6000	2040	8040
Faroe	2012	9000	18000	12240	0.4	0.2	7200	2448	9648
Sweden	1990s	18000	36000	24480	0.05	0.02	1800	490	2290
Denmark	1990s	4400	8800	5984	0.05	0.02	440	120	560
Ireland	2000	3800	7600	5168	0.4	0.2	3040	1034	4074
Netherlands	2012	80000	160000	108800	0.025	0.01	4000	1088	5088
Forth Islands	2005-09	1608	3216	2187	0	0.1	0	219	219
Alde-Ore Estuary	2012	640	1280	870	0	0.1	0	87	87
UK North Sea non-SPA cols	2000	13000	26000	17680	0	0.1	0	1768	1768
Ailsa Craig	2010	183	366	249	0.5	0.4	183	100	283
Rathlin Island	2011	107	214	146	0.5	0.4	107	58	165
Lough Neagh & Lough Beg	2000	493	986	670	0.5	0.4	493	268	761
Bowland Fells	2008-12	4575	9150	6222	0.5	0.4	4575	2489	7064
Morcambe Bay	2012	4987	9974	6782	0.5	0.4	4987	2713	7700
Ribble & Alt Estuaries	2012	8267	16534	11243	0.5	0.4	8267	4497	12764
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.7	0.4	13496	5244	18740
Isles of Scilly	2006	3400	6800	4624	0.9	0.6	6120	2774	8894
UK Western non-SPA cols	2000	40000	80000	54400	0.5	0.4	40000	21760	61760
Total overseas							32,480	10,619	43,099
Total UK							78,228	41,977	120,205
Total							110,708	52,596	163,304

Table 38. BDMPS for lesser black-backed gull in winter (November to February) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in winter	Proportion immatures in UK North Sea & Channel waters in winter	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1990s	25000	50000	34000	0.05	0	2500	0	2500
Norway	1990s	30000	60000	40800	0.05	0	3000	0	3000
Faroe	2012	9000	18000	12240	0.05	0	900	0	900
Sweden	1990s	18000	36000	24480	0.01	0	360	0	360
Denmark	1990s	4400	8800	5984	0.01	0	88	0	88
Ireland	2000	3800	7600	5168	0.01	0	76	0	76
Netherlands	2012	80000	160000	108800	0.005	0	800	0	800
Forth Islands	2005-09	1608	3216	2187	0.5	0.05	1608	109	1717
Alde-Ore Estuary	2012	640	1280	870	0.5	0.05	640	44	684
UK North Sea non-SPA cols	2000	13000	26000	17680	0.5	0.05	13000	884	13884
Ailsa Craig	2010	183	366	249	0.1	0.01	37	2	39
Rathlin Island	2011	107	214	146	0.1	0.01	21	1	23
Lough Neagh & Lough Beg	2000	493	986	670	0.1	0.01	99	7	105
Bowland Fells	2008-12	4575	9150	6222	0.1	0.01	915	62	977
Morcambe Bay	2012	4987	9974	6782	0.1	0.01	997	68	1065
Ribble & Alt Estuaries	2012	8267	16534	11243	0.1	0.01	1653	112	1766
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.1	0.01	1928	131	2059
Isles of Scilly	2006	3400	6800	4624	0.1	0.01	680	46	726
UK Western non-SPA cols	2000	40000	80000	54400	0.1	0.01	8000	544	8544
Total overseas							7,724	0	7,724
Total UK							29,578	2,011	31,590
Total							37,302	2,011	39,314

Table 39. BDMPS for lesser black-backed gull in winter (November to February) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in winter	Proportion immatures in UK western waters in winter	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1990s	25000	50000	34000	0.05	0	2500	0	2500
Norway	1990s	30000	60000	40800	0.02	0	1200	0	1200
Faroe	2012	9000	18000	12240	0.05	0	900	0	900
Sweden	1990s	18000	36000	24480	0.01	0	360	0	360
Denmark	1990s	4400	8800	5984	0.01	0	88	0	88
Ireland	2000	3800	7600	5168	0.2	0.05	1520	258	1778
Netherlands	2012	80000	160000	108800	0.005	0	800	0	800
Forth Islands	2005-09	1608	3216	2187	0	0	0	0	0
Alde-Ore Estuary	2012	640	1280	870	0	0	0	0	0
UK North Sea non-SPA cols	2000	13000	26000	17680	0	0	0	0	0
Ailsa Craig	2010	183	366	249	0.2	0.05	73	12	86
Rathlin Island	2011	107	214	146	0.2	0.05	43	7	50
Lough Neagh & Lough Beg	2000	493	986	670	0.2	0.05	197	34	231
Bowland Fells	2008-12	4575	9150	6222	0.2	0.05	1830	311	2141
Morcambe Bay	2012	4987	9974	6782	0.2	0.05	1995	339	2334
Ribble & Alt Estuaries	2012	8267	16534	11243	0.2	0.05	3307	562	3869
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.2	0.05	3856	656	4511
Isles of Scilly	2006	3400	6800	4624	0.2	0.05	1360	231	1591
UK Western non-SPA cols	2000	40000	80000	54400	0.2	0.05	16000	2720	18720
Total overseas							7,368	258	7,626
Total UK							28,661	4,872	33,533
Total							36,029	5,130	41,159

Table 40. BDMPS for lesser black-backed gull in spring migration (March-April) in ‘UK North Sea & Channel waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in spring	Proportion immatures in UK North Sea & Channel waters in spring	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Iceland	1990s	25000	50000	34000	0.1	0.05	5000	1700	6700
Norway	1990s	30000	60000	40800	0.3	0.1	18000	4080	22080
Faroe	2012	9000	18000	12240	0.2	0.1	3600	1224	4824
Sweden	1990s	18000	36000	24480	0.1	0.05	3600	1224	4824
Denmark	1990s	4400	8800	5984	0.1	0.05	880	299	1179
Ireland	2000	3800	7600	5168	0.1	0.05	760	258	1018
Netherlands	2012	80000	160000	108800	0.05	0.025	8000	2720	10720
Forth Islands	2005-09	1608	3216	2187	1	0.7	3216	1531	4747
Alde-Ore Estuary	2012	640	1280	870	1	0.7	1280	609	1889
UK North Sea non-SPA cols	2000	13000	26000	17680	1	0.7	26000	12376	38376
Ailsa Craig	2010	183	366	249	0.5	0.4	183	100	283
Rathlin Island	2011	107	214	146	0.5	0.4	107	58	165
Lough Neagh & Lough Beg	2000	493	986	670	0.5	0.4	493	268	761
Bowland Fells	2008-12	4575	9150	6222	0.5	0.4	4575	2489	7064
Morcambe Bay	2012	4987	9974	6782	0.5	0.4	4987	2713	7700
Ribble & Alt Estuaries	2012	8267	16534	11243	0.5	0.4	8267	4497	12764
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.3	0.3	5784	3933	9717
Isles of Scilly	2006	3400	6800	4624	0.1	0.05	680	231	911
UK Western non-SPA cols	2000	40000	80000	54400	0.5	0.4	40000	21760	61760
Total overseas							39,840	11,506	51,346
Total UK							95,572	50,565	146,137
Total							135,412	62,071	197,483

Table 41. BDMPS for lesser black-backed gull in spring migration (March-April) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in spring	Proportion immatures in UK western waters in spring	UK western Number adults	UK western Number immatures	UK western Total birds
Iceland	1990s	25000	50000	34000	0.2	0.1	10000	3400	13400
Norway	1990s	30000	60000	40800	0.1	0.05	6000	2040	8040
Faroe	2012	9000	18000	12240	0.4	0.2	7200	2448	9648
Sweden	1990s	18000	36000	24480	0.05	0.02	1800	490	2290
Denmark	1990s	4400	8800	5984	0.05	0.02	440	120	560
Ireland	2000	3800	7600	5168	0.4	0.2	3040	1034	4074
Netherlands	2012	80000	160000	108800	0.025	0.01	4000	1088	5088
Forth Islands	2005-09	1608	3216	2187	0	0.1	0	219	219
Alde-Ore Estuary	2012	640	1280	870	0	0.1	0	87	87
UK North Sea non-SPA	2000	13000	26000	17680	0	0.1	0	1768	1768
Ailsa Craig	2010	183	366	249	0.5	0.4	183	100	283
Rathlin Island	2011	107	214	146	0.5	0.4	107	58	165
Lough Neagh & L. Beg	2000	493	986	670	0.5	0.4	493	268	761
Bowland Fells	2008-12	4575	9150	6222	0.5	0.4	4575	2489	7064
Morcambe Bay	2012	4987	9974	6782	0.5	0.4	4987	2713	7700
Ribble & Alt Estuaries	2012	8267	16534	11243	0.5	0.4	8267	4497	12764
Skokholm, Skomer, Mholm	2013	9640	19280	13110	0.7	0.4	13496	5244	18740
Isles of Scilly	2006	3400	6800	4624	0.9	0.6	6120	2774	8894
UK Western non-SPA cols	2000	40000	80000	54400	0.5	0.4	40000	21760	61760
Total overseas							32,480	10,619	43,100
Total UK							78,228	41,977	120,205
Total							110,708	52,596	163,305

Table 42. BDMPS for herring gull in non-breeding season (September to February) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters non-breeding season	Proportion immatures in UK North Sea & Channel waters non-breeding season	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Barents Sea	2000	126000	252000	274680	0.2	0.3	50400	82404	132804
Faroe	2012	1500	3000	3270	0.2	0.3	600	981	1581
Ireland	2000	5000	10000	10900	0.02	0.05	200	545	745
East Caithness Cliffs	1999	3393	6786	7397	0.99	0.95	6718	7027	13745
Troup, Pennan & Lions	2007	1597	3194	3481	0.99	0.95	3162	3307	6469
Buchan Ness to Collieston	2010	3114	6228	6789	0.99	0.95	6166	6449	12615
Fowlsheugh	2012	259	518	565	0.99	0.95	513	536	1049
Forth Islands	2005-09	2827	5654	6163	0.99	0.95	5597	5855	11452
St Abbs Head/ Fast Castle	2013	239	478	521	0.99	0.95	473	495	968
Flamborough & Filey Coast	2010	495	990	1079	0.99	0.95	980	1025	2005
Alde-Ore Estuary	2006	800	1600	1744	0.99	0.95	1584	1657	3241
UK North Sea non-SPA cols	2000	65000	130000	141700	0.99	0.95	128700	134615	263315
Canna & Sanday	2011	63	126	137	0.05	0.1	6	14	20
Ailsa Craig	2013	129	258	281	0.05	0.1	13	28	41
Rathlin Island	2011	28	56	61	0.05	0.1	3	6	9
Morecambe Bay	2012	1734	3468	3780	0.05	0.1	173	378	551
UK western non-SPA cols	2000	50000	100000	109000	0.05	0.1	5000	10900	15900
Total overseas							51,200	83,930	135,130
Total UK							159,089	172,292	331,381
Total							210,289	256,222	466,511

Table 43. BDMPS for herring gull in non-breeding season (September to February) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters non-breeding season	Proportion immatures in UK western waters non-breeding season	UK western Number adults	UK western Number immatures	UK western Total birds
Barents Sea	2000	126000	252000	274680	0.001	0.005	252	1373	1625
Faroe	2012	1500	3000	3270	0.2	0.3	600	981	1581
Ireland	2000	5000	10000	10900	0.3	0.4	3000	4360	7360
East Caithness Cliffs	1999	3393	6786	7397	0.001	0.001	7	7	14
Troup, Pennan & Lions	2007	1597	3194	3481	0.001	0.001	3	3	7
Buchan Ness to Collieston	2010	3114	6228	6789	0.001	0.001	6	7	13
Fowlsheugh	2012	259	518	565	0.001	0.001	1	1	1
Forth Islands	2005-09	2827	5654	6163	0.001	0.001	6	6	12
St Abbs Head/ Fast Castle	2013	239	478	521	0.001	0.001	0	1	1
Flamborough & Filey Coast	2010	495	990	1079	0.001	0.001	1	1	2
Alde-Ore Estuary	2006	800	1600	1744	0.001	0.001	2	2	3
UK North Sea non-SPA cols	2000	65000	130000	141700	0.001	0.001	130	142	272
Canna & Sanday	2011	63	126	137	0.8	0.7	101	96	197
Ailsa Craig	2013	129	258	281	0.8	0.7	206	197	403
Rathlin Island	2011	28	56	61	0.8	0.7	45	43	88
Morecambe Bay	2012	1734	3468	3780	0.8	0.7	2774	2646	5420
UK western non-SPA cols	2000	50000	100000	109000	0.8	0.7	80000	76300	156300
Total overseas							3,852	6,714	10,566
Total UK							83,282	79,451	162,733
Total							87,134	86,165	173,299

Table 44. BDMPS for great black-backed gull in non-breeding season (September to March) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters non-breeding season	Proportion of immatures in UK North Sea waters non-breeding season	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Barents Sea	1990s*	33000	66000	83160	0.3	0.5	19800	41580	61380
Faroe	2012	1000	2000	2520	0.3	0.3	600	756	1356
Ireland	2000	2000	4000	5040	0	0	0	0	0
Calf of Eday	2006	281	562	708	1	1	562	708	1270
Copinsay	2010	218	436	549	1	1	436	549	985
Hoy	2011	60	120	151	1	1	120	151	271
East Caithness Cliffs	1999	175	350	441	1	1	350	441	791
UK North Sea non-SPA colonies	2000	5000	10000	12600	1	1	10000	12600	22600
North Rona & Sula Sgeir	2012	191	382	481	0.01	0.1	4	48	52
Isles of Scilly	2006	901	1802	2271	0.01	0.1	18	227	245
UK western non-SPA colonies	2000	9000	18000	22680	0.01	0.1	180	2268	2448
Total overseas							20,400	42,336	62,736
Total UK							11,670	16,993	28,663
Total							32,070	59,329	91,399

*updated to 2012 by R.T. Barrett pers. comm.

Table 45. BDMPS for great black-backed gull in non-breeding season (September to March) in 'UK west of Scotland waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in west of Scotland waters non-breeding season	Proportion of immatures in UK west of Scotland waters non-breeding season	west of Scotland Number adults	west of Scotland Number immatures	west of Scotland Total birds
Barents Sea	1990s*	33000	66000	83160	0.01	0.08	660	6653	7313
Faroe	2012	1000	2000	2520	0.1	0.3	200	756	956
Ireland	2000	2000	4000	5040	0.1	0.2	400	1008	1408
Calf of Eday	2006	281	562	708	0	0	0	0	0
Copinsay	2010	218	436	549	0	0	0	0	0
Hoy	2011	60	120	151	0	0	0	0	0
East Caithness Cliffs	1999	175	350	441	0	0	0	0	0
UK North Sea non-SPA colonies	2000	5000	10000	12600	0	0	0	0	0
North Rona & Sula Sgeir	2012	191	382	481	0.99	0.8	378	385	763
Isles of Scilly	2006	901	1802	2271	0	0	0	0	0
UK western non-SPA colonies	2000	9000	18000	22680	0.7	0.5	12600	11340	23940
Total overseas							1,260	8,417	9,677
Total UK							12,978	11,725	24,703
Total							14,238	20,142	34,380

*updated to 2012 by R.T. Barrett pers. comm.

Table 46. BDMPS for great black-backed gull in non-breeding season (September to March) in 'UK south-west & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK south-west & Channel waters non-breeding season	Proportion of immatures in UK south-west & Channel waters non-breeding season	UK south-west & Channel Number adults	UK south-west & Channel Number immatures	UK south-west & Channel Total birds
Barents Sea	1990s*	33000	66000	83160	0	0.02	0	1663	1663
Faroe	2012	1000	2000	2520	0	0.2	0	504	504
Ireland	2000	2000	4000	5040	0.1	0.3	400	1512	1912
Calf of Eday	2006	281	562	708	0	0	0	0	0
Copinsay	2010	218	436	549	0	0	0	0	0
Hoy	2011	60	120	151	0	0	0	0	0
East Caithness Cliffs	1999	175	350	441	0	0	0	0	0
UK North Sea non-SPA colonies	2000	5000	10000	12600	0	0	0	0	0
North Rona & Sula Sgeir	2012	191	382	481	0	0.1	0	48	48
Isles of Scilly	2006	901	1802	2271	0.9	0.7	1622	1589	3211
UK western non-SPA colonies	2000	9000	18000	22680	0.2	0.3	3600	6804	10404
Total overseas							400	3,679	4,079
Total UK							5,222	8,441	13,663
Total							5,622	12,120	17,742

*updated to 2012 by R.T. Barrett pers. comm.

Table 47. BDMPS for black-legged kittiwake in autumn migration (August to December) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters in autumn	Proportion of immatures in UK North Sea waters in autumn	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Russia	2000	140000	280000	246400	0.1	0.1	28000	24640	52640
Norway	2010	700000	1400000	1232000	0.1	0.1	140000	123200	263200
Faroe	2012	200000	400000	352000	0.1	0.1	40000	35200	75200
Germany	2010	6000	12000	10560	0.1	0.1	1200	1056	2256
France	2010	4000	8000	7040	0.05	0.05	400	352	752
Ireland	2000	20000	40000	35200	0.05	0.05	2000	1760	3760
Hermaness, Saxavord	2009	391	782	688	0.6	0.4	469	275	744
Foula	2013	327	654	576	0.6	0.4	392	230	623
Noss	2010	507	1014	892	0.6	0.4	608	357	965
Sumburgh Head	2013	210	420	370	0.6	0.4	252	148	400
Fair Isle	2013	771	1542	1357	0.6	0.4	925	543	1468
West Westray	2007	12055	24110	21217	0.6	0.4	14466	8487	22953
Calf of Eday	2006	747	1494	1315	0.6	0.4	896	526	1422
Marwick Head	2013	526	1052	926	0.6	0.4	631	370	1002
Rousay	2009	1764	3528	3105	0.6	0.4	2117	1242	3359
Copinsay	2012	666	1332	1172	0.6	0.4	799	469	1268
Hoy	2007	397	794	699	0.6	0.4	476	279	756
North Caithness Cliffs	2000	10150	20300	17864	0.6	0.4	12180	7146	19326
East Caithness Cliffs	1999	40410	80820	71122	0.6	0.4	48492	28449	76941
Troup, Pennan & Lions Heads	2007	14896	29792	26217	0.6	0.4	17875	10487	28362
Buchan Ness to Collieston	2007	12542	25084	22074	0.6	0.4	15050	8830	23880
Fowlsheugh	2012	9337	18674	16433	0.6	0.4	11204	6573	17778
Forth Islands	2013	3100	6200	5456	0.6	0.4	3720	2182	5902
St Abbs Head to Fast Castle	2013	3403	6806	5989	0.6	0.4	4084	2396	6479
Farne Islands	2013	3443	6886	6060	0.6	0.4	4132	2424	6555

Flamborough and Filey	2008	37617	75234	66206	0.6	0.4	45140	26482	71623
UK North Sea non-SPA colonies	2000*	70000	140000	123200	0.6	0.4	84000	49280	133280
Cape Wrath	2000	10344	20688	18205	0.01	0.05	207	910	1117
North Rona & Sula Sgeir	2012	1253	2506	2205	0.01	0.05	25	110	135
Handa	2013	1872	3744	3295	0.01	0.05	37	165	202
St Kilda	2008	957	1914	1684	0.01	0.05	19	84	103
Flannan Isles	1998	1392	2784	2450	0.01	0.05	28	122	150
Shiant Isles	2008	549	1098	966	0.01	0.05	11	48	59
Canna & Sanday	2013	820	1640	1443	0.01	0.05	16	72	89
Rum	2000	788	1576	1387	0.01	0.05	16	69	85
Mingulay & Berneray	2009	2228	4456	3921	0.01	0.05	45	196	241
North Colonsay & Western Cliffs	2000	5563	11126	9791	0.01	0.05	111	490	601
Ailsa Craig	2013	489	978	861	0.01	0.05	10	43	53
Rathlin Island	2011	7922	15844	13943	0.01	0.05	158	697	856
Skomer, Skokholm, Middleholm	2013	1045	2090	1839	0.01	0.05	21	92	113
UK Western non-SPA colonies	2000*	30000	60000	52800	0.01	0.05	600	2640	3240
Total overseas							211,600	186,208	397,808
Total UK							269,215	162,914	432,129
Total							480,815	349,122	829,937

*updated to 2012 using trend in Foster & Marrs 2012 and JNCC database

Table 48. BDMPS for black-legged kittiwake in autumn migration (August to December) in 'UK western waters & Channel'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters (including Channel) in autumn	Proportion of immatures in UK western waters (including Channel) waters in autumn	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Russia	2000	140000	280000	246400	0.1	0.1	28000	24640	52640
Norway	2010	700000	1400000	1232000	0.15	0.15	210000	184800	394800
Faroe	2012	200000	400000	352000	0.2	0.2	80000	70400	150400
Germany	2010	6000	12000	10560	0.05	0.05	600	528	1128
France	2010	4000	8000	7040	0.1	0.1	800	704	1504
Ireland	2000	20000	40000	35200	0.3	0.2	12000	7040	19040
Hermaness, Saxavord	2009	391	782	688	0.2	0.2	156	138	294
Foula	2013	327	654	576	0.2	0.2	131	115	246
Noss	2010	507	1014	892	0.2	0.2	203	178	381
Sumburgh Head	2013	210	420	370	0.2	0.2	84	74	158
Fair Isle	2013	771	1542	1357	0.2	0.2	308	271	580
West Westray	2007	12055	24110	21217	0.2	0.2	4822	4243	9065
Calf of Eday	2006	747	1494	1315	0.2	0.2	299	263	562
Marwick Head	2013	526	1052	926	0.2	0.2	210	185	396
Rousay	2009	1764	3528	3105	0.2	0.2	706	621	1327
Copinsay	2012	666	1332	1172	0.2	0.2	266	234	501
Hoy	2007	397	794	699	0.2	0.2	159	140	299
North Caithness Cliffs	2000	10150	20300	17864	0.2	0.2	4060	3573	7633
East Caithness Cliffs	1999	40410	80820	71122	0.2	0.2	16164	14224	30388
Troup, Pennan & Lions Heads	2007	14896	29792	26217	0.2	0.2	5958	5243	11202
Buchan Ness to Collieston	2007	12542	25084	22074	0.2	0.2	5017	4415	9432
Fowlsheugh	2012	9337	18674	16433	0.2	0.2	3735	3287	7021
Forth Islands	2013	3100	6200	5456	0.2	0.2	1240	1091	2331

St Abbs Head to Fast Castle	2013	3403	6806	5989	0.2	0.2	1361	1198	2559
Farne Islands	2013	3443	6886	6060	0.2	0.2	1377	1212	2589
Flamborough and Filey	2008	37617	75234	66206	0.2	0.2	15047	13241	28288
UK North Sea non-SPA colonies	2000*	70000	140000	123200	0.2	0.2	28000	24640	52640
Cape Wrath	2000	10344	20688	18205	0.6	0.4	12413	7282	19695
North Rona & Sula Sgeir	2012	1253	2506	2205	0.6	0.4	1504	882	2386
Handa	2013	1872	3744	3295	0.6	0.4	2246	1318	3564
St Kilda	2008	957	1914	1684	0.6	0.4	1148	674	1822
Flannan Isles	1998	1392	2784	2450	0.6	0.4	1670	980	2650
Shiant Isles	2008	549	1098	966	0.6	0.4	659	386	1045
Canna & Sanday	2013	820	1640	1443	0.6	0.4	984	577	1561
Rum	2000	788	1576	1387	0.6	0.4	946	555	1500
Mingulay & Berneray	2009	2228	4456	3921	0.6	0.4	2674	1569	4242
North Colonsay & Western Cliffs	2000	5563	11126	9791	0.6	0.4	6676	3916	10592
Ailsa Craig	2013	489	978	861	0.6	0.4	587	344	931
Rathlin Island	2011	7922	15844	13943	0.6	0.4	9506	5577	15083
Skomer, Skokholm, Middleholm	2013	1045	2090	1839	0.6	0.4	1254	736	1990
UK Western non-SPA colonies	2000*	30000	60000	52800	0.6	0.4	36000	21120	57120
Total overseas							331,400	288,112	619,512
Total UK							167,570	124,503	292,074
Total							498,970	412,615	911,586

*updated to 2012 using trend in Foster & Marrs 2012 and JNCC database

Table 49. BDMPS for black-legged kittiwake in spring migration (January to April) in 'UK North Sea waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea waters in spring	Proportion of immatures in UK North Sea waters in spring	UK N Sea Number adults	UK N Sea Number immatures	UK N Sea Total birds
Russia	2000	140000	280000	246400	0.05	0.07	14000	17248	31248
Norway	2010	700000	1400000	1232000	0.05	0.07	70000	86240	156240
Faroe	2012	200000	400000	352000	0.05	0.07	20000	24640	44640
Germany	2010	6000	12000	10560	0.15	0.25	1800	2640	4440
France	2010	4000	8000	7040	0.05	0.1	400	704	1104
Ireland	2000	20000	40000	35200	0.01	0.01	400	352	752
Hermaness, Saxavord	2009	391	782	688	0.6	0.3	469	206	676
Foula	2013	327	654	576	0.6	0.3	392	173	565
Noss	2010	507	1014	892	0.6	0.3	608	268	876
Sumburgh Head	2013	210	420	370	0.6	0.3	252	111	363
Fair Isle	2013	771	1542	1357	0.6	0.3	925	407	1332
West Westray	2007	12055	24110	21217	0.6	0.3	14466	6365	20831
Calf of Eday	2006	747	1494	1315	0.6	0.3	896	394	1291
Marwick Head	2013	526	1052	926	0.6	0.3	631	278	909
Rousay	2009	1764	3528	3105	0.6	0.3	2117	931	3048
Copinsay	2012	666	1332	1172	0.6	0.3	799	352	1151
Hoy	2007	397	794	699	0.6	0.3	476	210	686
North Caithness Cliffs	2000	10150	20300	17864	0.6	0.3	12180	5359	17539
East Caithness Cliffs	1999	40410	80820	71122	0.6	0.3	48492	21336	69828
Troup, Pennan & Lions Heads	2007	14896	29792	26217	0.6	0.3	17875	7865	25740
Buchan Ness to Collieston	2007	12542	25084	22074	0.6	0.3	15050	6622	21673
Fowlsheugh	2012	9337	18674	16433	0.6	0.3	11204	4930	16134
Forth Islands	2013	3100	6200	5456	0.6	0.3	3720	1637	5357
St Abbs Head to Fast Castle	2013	3403	6806	5989	0.6	0.3	4084	1797	5880
Farne Islands	2013	3443	6886	6060	0.6	0.3	4132	1818	5950

Flamborough and Filey	2008	37617	75234	66206	0.6	0.3	45140	19862	65002
UK North Sea non-SPA colonies	2000*	70000	140000	123200	0.6	0.3	84000	36960	120960
Cape Wrath	2000	10344	20688	18205	0.01	0.02	207	364	571
North Rona & Sula Sgeir	2012	1253	2506	2205	0.01	0.02	25	44	69
Handa	2013	1872	3744	3295	0.01	0.02	37	66	103
St Kilda	2008	957	1914	1684	0.01	0.02	19	34	53
Flannan Isles	1998	1392	2784	2450	0.01	0.02	28	49	77
Shiant Isles	2008	549	1098	966	0.01	0.02	11	19	30
Canna & Sanday	2013	820	1640	1443	0.01	0.02	16	29	45
Rum	2000	788	1576	1387	0.01	0.02	16	28	43
Mingulay & Berneray	2009	2228	4456	3921	0.01	0.02	45	78	123
North Colonsay & Western Cliffs	2000	5563	11126	9791	0.01	0.02	111	196	307
Ailsa Craig	2013	489	978	861	0.01	0.02	10	17	27
Rathlin Island	2011	7922	15844	13943	0.01	0.02	158	279	437
Skomer, Skokholm, Middleholm	2013	1045	2090	1839	0.01	0.02	21	37	58
UK Western non-SPA colonies	2000*	30000	60000	52800	0.01	0.02	600	1056	1656
Total overseas							106,600	131,824	238,424
Total UK							269,215	120,177	389,392
Total							375,815	252,001	627,816

*updated to 2012 using trend in Foster & Marrs 2012 and JNCC database

Table 50. BDMPS for black-legged kittiwake in spring migration (January to April) in ‘UK western waters & Channel’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters (including Channel) in spring	Proportion of immatures in UK western waters (including Channel) waters in spring	UK western waters & Channel Number adults	UK western waters & Channel Number immatures	UK western waters & Channel Total birds
Russia	2000	140000	280000	246400	0.05	0.1	14000	24640	38640
Norway	2010	700000	1400000	1232000	0.05	0.1	70000	123200	193200
Faroe	2012	200000	400000	352000	0.1	0.1	40000	35200	75200
Germany	2010	6000	12000	10560	0.05	0.05	600	528	1128
France	2010	4000	8000	7040	0.1	0.1	800	704	1504
Ireland	2000	20000	40000	35200	0.3	0.2	12000	7040	19040
Hermaness, Saxavord	2009	391	782	688	0.3	0.2	235	138	372
Foula	2013	327	654	576	0.3	0.2	196	115	311
Noss	2010	507	1014	892	0.3	0.2	304	178	483
Sumburgh Head	2013	210	420	370	0.3	0.2	126	74	200
Fair Isle	2013	771	1542	1357	0.3	0.2	463	271	734
West Westray	2007	12055	24110	21217	0.3	0.2	7233	4243	11476
Calf of Eday	2006	747	1494	1315	0.3	0.2	448	263	711
Marwick Head	2013	526	1052	926	0.3	0.2	316	185	501
Rousay	2009	1764	3528	3105	0.3	0.2	1058	621	1679
Copinsay	2012	666	1332	1172	0.3	0.2	400	234	634
Hoy	2007	397	794	699	0.3	0.2	238	140	378
North Caithness Cliffs	2000	10150	20300	17864	0.3	0.2	6090	3573	9663
East Caithness Cliffs	1999	40410	80820	71122	0.3	0.2	24246	14224	38470
Troup, Pennan & Lions Heads	2007	14896	29792	26217	0.3	0.2	8938	5243	14181
Buchan Ness to Collieston	2007	12542	25084	22074	0.3	0.2	7525	4415	11940
Fowlsheugh	2012	9337	18674	16433	0.3	0.2	5602	3287	8889
Forth Islands	2013	3100	6200	5456	0.3	0.2	1860	1091	2951

St Abbs Head to Fast Castle	2013	3403	6806	5989	0.3	0.2	2042	1198	3240
Farne Islands	2013	3443	6886	6060	0.3	0.2	2066	1212	3278
Flamborough and Filey	2008	37617	75234	66206	0.3	0.2	22570	13241	35811
UK North Sea non-SPA colonies	2000*	70000	140000	123200	0.3	0.2	42000	24640	66640
Cape Wrath	2000	10344	20688	18205	0.8	0.4	16550	7282	23833
North Rona & Sula Sgeir	2012	1253	2506	2205	0.8	0.4	2005	882	2887
Handa	2013	1872	3744	3295	0.8	0.4	2995	1318	4313
St Kilda	2008	957	1914	1684	0.8	0.4	1531	674	2205
Flannan Isles	1998	1392	2784	2450	0.8	0.4	2227	980	3207
Shiant Isles	2008	549	1098	966	0.8	0.4	878	386	1265
Canna & Sanday	2013	820	1640	1443	0.8	0.4	1312	577	1889
Rum	2000	788	1576	1387	0.8	0.4	1261	555	1816
Mingulay & Berneray	2009	2228	4456	3921	0.8	0.4	3565	1569	5133
North Colonsay & Western Cliffs	2000	5563	11126	9791	0.8	0.4	8901	3916	12817
Ailsa Craig	2013	489	978	861	0.8	0.4	782	344	1127
Rathlin Island	2011	7922	15844	13943	0.8	0.4	12675	5577	18252
Skomer, Skokholm, Middleholm	2013	1045	2090	1839	0.8	0.4	1672	736	2408
UK Western non-SPA colonies	2000*	30000	60000	52800	0.8	0.4	48000	21120	69120
Total overseas							137,400	191,312	328,712
Total UK							238,311	124,503	362,814
Total							375,711	315,815	691,526

*updated to 2012 using trend in Foster & Marrs 2012 and JNCC database

Table 51. BDMPS for Sandwich tern in migration seasons (July-September and March-May) in ‘UK North Sea & Channel waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters migration	Proportion of immatures in UK North Sea & Channel waters on migration	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Norway & Sweden	1990s	700	1400	882	0.1	0.1	140	88	228
Denmark	1990s	4500	9000	5670	0.1	0.1	900	567	1467
Germany	1990s	9700	19400	12222	0.1	0.1	1940	1222	3162
Netherlands	1990s	14500	29000	18270	0.1	0.1	2900	1827	4727
Belgium	2000	1550	3100	1953	0.1	0.1	310	195	505
Ireland	2000	1800	3600	2268	0	0	0	0	0
Loch of Strathbeg	2013	0	0	0	1	0.7	0	0	0
Ythan Estuary	2013	565	1130	712	1	0.7	1130	498	1628
Forth Islands	2013	0	0	0	1	0.7	0	0	0
Farne Islands	2013	824	1648	1038	1	0.7	1648	727	2375
Coquet Island	2013	670	1340	844	1	0.7	1340	591	1931
North Norfolk Coast	2012	4135	8270	5210	1	0.7	8270	3647	11917
Alde-Ore Estuary	2009	2	4	3	1	0.7	4	2	6
Foulness	2006	0	0	0	1	0.7	0	0	0
Chichester & Langstone Harb	2013	6	12	8	1	0.7	12	5	17
Solent & Southampton Water	2008	0	0	0	1	0.7	0	0	0
UK North Sea non-SPA colonies	2000	3500	7000	4410	1	0.7	7000	3087	10087
Carlingford Lough	2013	0	0	0	0	0	0	0	0
Larne Lough	2013	257	514	324	0	0	0	0	0
Strangford Lough	2012	771	1542	971	0	0	0	0	0
Morecambe Bay	2011	1	2	1	0	0	0	0	0
Duddon Estuary	2012	1	2	1	0	0	0	0	0
Ynys Feurig, Cemlyn Bay	2009	0	0	0	0	0	0	0	0
UK Western non-SPA colonies	2000	1500	3000	1890	0	0	0	0	0

Total overseas	6,190	3,900	10,090
Total UK	19,404	8,557	27,961
Total	25,594	12,457	38,051

Table 52. BDMPS for Sandwich tern in migration seasons (July-September and March-May) in ‘UK western waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters on migration	Proportion of immatures in UK western waters on migration	UK western Number adults	UK western Number immatures	UK western Total birds
Norway & Sweden	1990s	700	1400	882	0.05	0.05	70	44	114
Denmark	1990s	4500	9000	5670	0.03	0.03	270	170	440
Germany	1990s	9700	19400	12222	0.02	0.02	388	244	632
Netherlands	1990s	14500	29000	18270	0.01	0.01	290	183	473
Belgium	2000	1550	3100	1953	0.01	0.01	31	20	51
Ireland	2000	1800	3600	2268	0.3	0.3	1080	680	1760
Loch of Strathbeg	2013	0	0	0	0	0	0	0	0
Ythan Estuary	2013	565	1130	712	0	0	0	0	0
Forth Islands	2013	0	0	0	0	0	0	0	0
Farne Islands	2013	824	1648	1038	0	0	0	0	0
Coquet Island	2013	670	1340	844	0	0	0	0	0
North Norfolk Coast	2012	4135	8270	5210	0	0	0	0	0
Alde-Ore Estuary	2009	2	4	3	0	0	0	0	0
Foulness	2006	0	0	0	0	0	0	0	0
Chichester & Langstone Harb	2013	6	12	8	0	0	0	0	0
Solent & Southampton Water	2008	0	0	0	0	0	0	0	0
UK North Sea non-SPA colonies	2000	3500	7000	4410	0	0	0	0	0
Carlingford Lough	2013	0	0	0	1	0.7	0	0	0
Larne Lough	2013	257	514	324	1	0.7	514	227	741
Strangford Lough	2012	771	1542	971	1	0.7	1542	680	2222
Morecambe Bay	2011	1	2	1	1	0.7	2	1	3
Duddon Estuary	2012	1	2	1	1	0.7	2	1	3
Ynys Feurig, Cemlyn Bay	2009	0	0	0	1	0.7	0	0	0
UK Western non-SPA colonies	2000	1500	3000	1890	1	0.7	3000	1323	4323

Total overseas	2,129	1,341	3,470
Total UK	5,060	2,231	7,291
Total	7,189	3,572	10,761

Table 53. BDMPS for roseate tern in migration seasons (August-September and late-April-May) in 'UK East Coast & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK east coast & Channel waters on migration	Proportion of immatures in UK east coast & Channel waters on migration	UK east coast & Channel Number adults	UK east coast & Channel Number immatures	UK east coast & Channel Total birds
Germany, Netherlands, Belgium	2010	3	6	4	0.05	0.1	0	0	1
Ireland	2010	750	1500	1125	0.002	0.003	3	3	6
Forth Islands	2005-09	3	6	4	1	0.6	6	3	9
Farne Islands	2011	0	0	0	1	0.6	0	0	0
Coquet Island	2011	78	156	117	1	0.6	156	70	226
North Norfolk Coast	2010	0	0	0	1	0.6	0	0	0
Solent & Southampton Water	2009	0	0	0	1	0.6	0	0	0
UK North Sea non-SPA colonies	2010	3	6	4	1	0.6	6	3	9
Larne Lough	2011	0	0	0	0	0	0	0	0
Ynys Feurig, Cemlyn Bay & Skerries	2011	0	0	0	0	0	0	0	0
UK western non-SPA colonies	2010	0	0	0	0	0	0	0	0
Total overseas							3	4	7
Total UK							168	76	244
Total							171	80	251

Table 54. BDMPS for roseate tern in migration seasons (August-September and late-April-May) in 'north and west Scottish waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in N & W Scottish waters on migration	Proportion of immatures in N & W Scottish waters on migration	N & W Scottish Number adults	N & W Scottish Number immatures	N & W Scottish Total birds
Germany, Netherlands, Belgium	2010	3	6	4	0	0.001	0	0	0
Ireland	2010	750	1500	1125	0.0005	0.003	1	3	4
Forth Islands	2005-09	3	6	4	0	0	0	0	0
Farne Islands	2011	0	0	0	0	0	0	0	0
Coquet Island	2011	78	156	117	0	0	0	0	0
North Norfolk Coast	2010	0	0	0	0	0	0	0	0
Solent & Southampton Water	2009	0	0	0	0	0	0	0	0
UK North Sea non-SPA colonies	2010	3	6	4	0	0	0	0	0
Larne Lough	2011	0	0	0	0	0	0	0	0
Ynys Feurig, Cemlyn Bay & Skerries	2011	0	0	0	0	0	0	0	0
UK western non-SPA colonies	2010	0	0	0	0	0	0	0	0
Total overseas							1	3	4
Total UK							0	0	0
Total							1	3	4

Table 55. BDMPS for roseate tern in migration seasons (August-September and late-April-May) in 'Wales and west England waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in Wales & West England waters on migration	Proportion of immatures in Wales & West England waters on migration	Wales & West England Number adults	Wales & West England Number immatures	Wales & West England Total birds
Germany, Netherlands, Belgium	2010	3	6	4	0	0.001	0	0	0
Ireland	2010	750	1500	1125	0.95	0.6	1425	675	2100
Forth Islands	2005-09	3	6	4	0	0	0	0	0
Farne Islands	2011	0	0	0	0	0	0	0	0
Coquet Island	2011	78	156	117	0	0	0	0	0
North Norfolk Coast	2010	0	0	0	0	0	0	0	0
Solent & Southampton Water	2009	0	0	0	0	0	0	0	0
UK North Sea non-SPA colonies	2010	3	6	4	0	0	0	0	0
Larne Lough	2011	0	0	0	1	0.6	0	0	0
Ynys Feurig, Cemlyn Bay & Skerries	2011	0	0	0	1	0.6	0	0	0
UK western non-SPA colonies	2010	0	0	0	1	0.6	0	0	0
Total overseas							1,425	675	2,100
Total UK							0	0	0
Total							1,425	675	2,100

Table 56. BDMPS for common tern in migration seasons (late July-early September and April-May) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters on migration	Proportion of immatures in UK North Sea & Channel waters on migration	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Norway	1990s	15000	30000	20100	0.3	0.3	9000	6030	15030
Finland	1990s	50000	100000	67000	0.3	0.3	30000	20100	50100
Sweden	1990s	22000	44000	29480	0.3	0.3	13200	8844	22044
Baltic States	1990s	12750	25500	17085	0.3	0.3	7650	5126	12776
Germany & Denmark	1990s	10000	20000	13400	0.25	0.25	5000	3350	8350
Netherlands	1990s	19000	38000	25460	0.25	0.25	9500	6365	15865
Ireland	2000	2700	5400	3618	0.2	0.2	1080	724	1804
Cromarty Firth	2010	68	136	91	0.7	0.5	95	46	141
Inner Moray Firth	2013	0	0	0	0.7	0.5	0	0	0
Ythan Estuary, Sands of Forvie	2010	4	8	5	0.7	0.5	6	3	8
Forth Islands	2011	26	52	35	0.7	0.5	36	17	54
Imperial Dock Lock	2010	818	1636	1096	0.7	0.5	1145	548	1693
Farne Islands	2013	94	188	126	0.7	0.5	132	63	195
Coquet Island	2013	1041	2082	1395	0.7	0.5	1457	697	2155
The Wash	2013	221	442	296	0.7	0.5	309	148	457
North Norfolk Coast	2012	198	396	265	0.7	0.5	277	133	410
Breydon Water	2013	92	184	123	0.7	0.5	129	62	190
Foulness	2008	25	50	34	0.7	0.5	35	17	52
Dungeness to Pett Level	2013	79	158	106	0.7	0.5	111	53	164
Poole Harbour	2013	163	326	218	0.7	0.5	228	109	337
Solent & Southampton Water	2007	280	560	375	0.7	0.5	392	188	580
UK North Sea non-SPA colonies	2000	5500	11000	7370	0.7	0.5	7700	3685	11385
Glas Eileanan	2012	22	44	29	0.1	0.1	4	3	7
Carlingford Lough	2013	119	238	159	0.1	0.1	24	16	30

Larne Lough	2013	231	462	310	0.1	0.1	46	31	77
Lough Neagh & Lough Beg	2013	78	156	105	0.1	0.1	16	10	26
Strangford Lough	2013	352	704	472	0.1	0.1	70	47	118
The Dee Estuary	2013	165	330	221	0.1	0.1	33	22	55
Ribble & Alt Estuaries	2008	111	222	149	0.1	0.1	22	15	37
Ynys Feurig, Cemlyn Bay & Skerries	2011	178	356	239	0.1	0.1	36	24	59
UK western non-SPA colonies	2000	2100	4200	2814	0.1	0.1	420	281	701
Total overseas							75,430	50,539	125,969
Total UK							12,724	6,218	18,942
Total							88,154	56,757	144,911

Table 57. BDMPS for common tern in migration seasons (late July-early September and April-May) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters on migration	Proportion of immatures in UK western waters on migration	UK western waters Number adults	UK western waters Number immatures	UK western waters Total birds
Norway	1990s	15000	30000	20100	0.2	0.2	6000	4020	10020
Finland	1990s	50000	100000	67000	0.1	0.1	10000	6700	16700
Sweden	1990s	22000	44000	29480	0.1	0.1	4400	2948	7348
Baltic States	1990s	12750	25500	17085	0.1	0.1	2550	1708	4258
Germany & Denmark	1990s	10000	20000	13400	0.1	0.1	2000	1340	3340
Netherlands	1990s	19000	38000	25460	0.05	0.05	1900	1273	3173
Ireland	2000	2700	5400	3618	0.4	0.4	2160	1447	3607
Cromarty Firth	2010	68	136	91	0.3	0.2	41	18	59
Inner Moray Firth	2013	0	0	0	0.3	0.2	0	0	0
Ythan Estuary, Sands of Forvie	2010	4	8	5	0.3	0.2	2	1	3
Forth Islands	2011	26	52	35	0.3	0.2	16	7	23
Imperial Dock Lock	2010	818	1636	1096	0.3	0.2	491	219	710
Farne Islands	2013	94	188	126	0.3	0.2	56	25	82
Coquet Island	2013	1041	2082	1395	0.3	0.2	625	279	904
The Wash	2013	221	442	296	0.3	0.2	133	59	192
North Norfolk Coast	2012	198	396	265	0.3	0.2	119	53	172
Breydon Water	2013	92	184	123	0.3	0.2	55	25	80
Foulness	2008	25	50	34	0.3	0.2	15	7	22
Dungeness to Pett Level	2013	79	158	106	0.3	0.2	47	21	69
Poole Harbour	2013	163	326	218	0.3	0.2	98	44	141
Solent & Southampton Water	2007	280	560	375	0.3	0.2	168	75	243
UK North Sea non-SPA colonies	2000	5500	11000	7370	0.3	0.2	3300	1474	4774
Glas Eileanan	2012	22	44	29	0.9	0.6	40	18	57
Carlingford Lough	2013	119	238	159	0.9	0.6	214	96	310
Larne Lough	2013	231	462	310	0.9	0.6	416	186	602

Lough Neagh & Lough Beg	2013	78	156	105	0.9	0.6	140	63	203
Strangford Lough	2013	352	704	472	0.9	0.6	634	283	917
The Dee Estuary	2013	165	330	221	0.9	0.6	297	133	430
Ribble & Alt Estuaries	2008	111	222	149	0.9	0.6	200	89	289
Ynys Feurig, Cemlyn Bay & Skerries	2011	178	356	239	0.9	0.6	320	143	464
UK western non-SPA colonies	2000	2100	4200	2814	0.9	0.6	3780	1688	5468
Total overseas							29,010	19,437	48,447
Total UK							11,206	5,005	16,212
Total							40,216	24,442	64,659

Table 58. BDMPS for Arctic tern in migration seasons (July-early September and late April-May) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters on migration	Proportion of immatures in UK North Sea & Channel waters on migration	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Fennoscandia	1990s	131000	262000	151960	0.2	0.15	52400	22794	75194
Faroe	2012	7600	15200	8816	0.2	0.15	3040	1322	4362
Baltic States	1990s	8000	16000	9280	0.1	0.1	1600	928	2528
Ireland	2000	2500	5000	2900	0	0	0	0	0
Fetlar	2012	21	42	24	0.9	0.6	38	15	52
Foula	2013	20	40	23	0.9	0.6	36	14	50
Papa Stour	2000	1172	2344	1360	0.9	0.6	2110	816	2925
Mousa	2013	18	36	21	0.9	0.6	32	13	45
Sumburgh Head	2000	203	406	235	0.9	0.6	365	141	507
Fair Isle	2013	29	58	34	0.9	0.6	52	20	72
West Westray	2009	500	1000	580	0.9	0.6	900	348	1248
Papa Westray	2011	176	352	204	0.9	0.6	317	122	439
Rousay	2006	60	120	70	0.9	0.6	108	42	150
Auskerry	2013	750	1500	870	0.9	0.6	1350	522	1872
Pentland Firth Islands	2007	0	0	0	0.9	0.6	0	0	0
Forth Islands	2012	265	530	307	1	0.7	530	215	745
Farne Islands	2013	1921	3842	2228	1	0.7	3842	1560	5402
Coquet Island	2013	1224	2448	1420	1	0.7	2448	994	3442
UK North Sea non-SPA colonies	2000	26000	52000	30160	0.9	0.6	46800	18096	64896
Outer Ards	2013	60	120	70	0	0	0	0	0
Strangford Lough	2013	164	328	190	0	0	0	0	0
Ynys Feurig, Cemlyn Bay, Skerries	2011	550	1100	638	0	0	0	0	0
UK western non-SPA colonies	2000	15000	30000	17400	0	0	0	0	0

Total overseas	57,040	25,044	82,084
Total UK	58,928	22,917	81,846
Total	115,968	47,961	163,930

Table 59. BDMPS for Arctic tern in migration seasons (July-early September and late April-May) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters on migration	Proportion of immatures in UK western waters on migration	UK western waters Number adults	UK western waters Number immatures	UK western waters Total birds
Fennoscandia	1990s	131000	262000	151960	0.03	0.03	7860	4559	12419
Faroe	2012	7600	15200	8816	0.1	0.1	1520	882	2402
Baltic States	1990s	8000	16000	9280	0.02	0.02	320	186	506
Ireland	2000	2500	5000	2900	0.3	0.3	1500	870	2370
Fetlar	2012	21	42	24	0.1	0.1	4	2	7
Foula	2013	20	40	23	0.1	0.1	4	2	6
Papa Stour	2000	1172	2344	1360	0.1	0.1	234	136	370
Mousa	2013	18	36	21	0.1	0.1	4	2	6
Sumburgh Head	2000	203	406	235	0.1	0.1	41	24	64
Fair Isle	2013	29	58	34	0.1	0.1	6	3	9
West Westray	2009	500	1000	580	0.1	0.1	100	58	158
Papa Westray	2011	176	352	204	0.1	0.1	35	20	56
Rousay	2006	60	120	70	0.1	0.1	12	7	19
Auskerry	2013	750	1500	870	0.1	0.1	150	87	237
Pentland Firth Islands	2007	0	0	0	0.1	0.1	0	0	0
Forth Islands	2012	265	530	307	0	0.05	0	15	15
Farne Islands	2013	1921	3842	2228	0	0.05	0	111	111
Coquet Island	2013	1224	2448	1420	0	0.05	0	71	71
UK North Sea non-SPA colonies	2000	26000	52000	30160	0.1	0.1	5200	3016	8216
Outer Ards	2013	60	120	70	1	0.7	120	49	169
Strangford Lough	2013	164	328	190	1	0.7	328	133	461
Ynys Feurig, Cemlyn Bay, Skerries	2011	550	1100	638	1	0.7	1100	447	1547
UK western non-SPA colonies	2000	15000	30000	17400	1	0.7	30000	12180	42180
Total overseas							11,200	6,496	17,696

Total UK	37,338	16,364	53,702
Total	48,538	22,860	71,398

Table 60. BDMPS for little tern in migration seasons (late July to early September, and mid-April to May) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters on migration	Proportion of immatures in UK North Sea & Channel waters on migration	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Ireland	2000	200	400	224	0	0	0	0	0
Ythan Estuary, Sands of Forvie	2013	40	80	45	1	0.6	80	27	107
Firth of Tay & Eden Estuary	2007	1	2	1	1	0.6	2	1	3
Lindisfarne	2011	8	16	9	1	0.6	16	5	21
Northumbria Coast	2000	38	76	43	1	0.6	76	26	102
Teesmouth & Cleveland Est	2011	84	168	94	1	0.6	168	56	224
Gibraltar point	2011	12	24	13	1	0.6	24	8	32
Humber Flats, Marshes & Coast	2011	29	58	32	1	0.6	58	19	77
The Wash	2009	0	0	0	1	0.6	0	0	0
North Norfolk Coast	2011	409	818	458	1	0.6	818	275	1093
Alde-Ore Estuary	2009	0	0	0	1	0.6	0	0	0
Minsmere-Walberswick	2010	30	60	34	1	0.6	60	20	80
Great Yarmouth North Denes	2011	5	10	6	1	0.6	10	3	13
Foulness	2005	0	0	0	1	0.6	0	0	0
Dungeness to Pett Level	2013	11	22	12	1	0.6	22	7	29
Medway Estuary & Marshes	2009	18	36	20	1	0.6	36	12	48
Benacre to Easton Bavents	2011	45	90	50	1	0.6	90	30	120
Blackwater Estuary	2000	99	198	111	1	0.6	198	67	265
Colne Estuary	2011	0	0	0	1	0.6	0	0	0
Hamford Water	2011	45	90	50	1	0.6	90	30	120
Chesil Beach	2011	19	38	21	1	0.6	38	13	51
Chichester Harbour	2011	60	120	67	1	0.6	120	40	160
Pagham Harbour	2011	6	12	7	1	0.6	12	4	16
Solent & Southampton Water	2007	0	0	0	1	0.6	0	0	0

UK N Sea & Channel non-SPA colonies	2000	360	720	403	1	0.6	720	242	962
Monach Isles	2001	2	4	2	0	0	0	0	0
South Uist Machair & Lochs	2002	17	34	19	0	0	0	0	0
The Dee Estuary	2011	126	252	141	0	0	0	0	0
Morecambe Bay	2011	62	124	69	0	0	0	0	0
UK western non-SPA colonies	2000	200	400	224	0	0	0	0	0
Total overseas							0	0	0
Total UK							2,638	886	3,524
Total							2,638	886	3,524

Table 61. BDMPS for little tern in migration seasons (late July to early September, and mid-April to May) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters on migration	Proportion of immatures in UK western waters on migration	UK western waters Number adults	UK western waters Number immatures	UK western waters Total birds
Ireland	2000	200	400	224	0.95	0.6	380	134	514
Ythan Estuary, Sands of Forvie	2013	40	80	45	0	0	0	0	0
Firth of Tay & Eden Estuary	2007	1	2	1	0	0	0	0	0
Lindisfarne	2011	8	16	9	0	0	0	0	0
Northumbria Coast	2000	38	76	43	0	0	0	0	0
Teesmouth & Cleveland Est	2011	84	168	94	0	0	0	0	0
Gibraltar point	2011	12	24	13	0	0	0	0	0
Humber Flats, Marshes & Coast	2011	29	58	32	0	0	0	0	0
The Wash	2009	0	0	0	0	0	0	0	0
North Norfolk Coast	2011	409	818	458	0	0	0	0	0
Alde-Ore Estuary	2009	0	0	0	0	0	0	0	0
Minsmere-Walberswick	2010	30	60	34	0	0	0	0	0
Great Yarmouth North Denes	2011	5	10	6	0	0	0	0	0
Foulness	2005	0	0	0	0	0	0	0	0
Dungeness to Pett Level	2013	11	22	12	0	0	0	0	0
Medway Estuary & Marshes	2009	18	36	20	0	0	0	0	0
Benacre to Easton Bavents	2011	45	90	50	0	0	0	0	0
Blackwater Estuary	2000	99	198	111	0	0	0	0	0
Colne Estuary	2011	0	0	0	0	0	0	0	0
Hamford Water	2011	45	90	50	0	0	0	0	0
Chesil Beach	2011	19	38	21	0	0	0	0	0
Chichester Harbour	2011	60	120	67	0	0	0	0	0
Pagham Harbour	2011	6	12	7	0	0	0	0	0
Solent & Southampton Water	2007	0	0	0	0	0	0	0	0
UK N Sea & Channel non-SPA colonies	2000	360	720	403	0	0	0	0	0

Monach Isles	2001	2	4	2	1	0.6	4	1	5
South Uist Machair & Lochs	2002	17	34	19	1	0.6	34	11	45
The Dee Estuary	2011	126	252	141	1	0.6	252	85	337
Morecambe Bay	2011	62	124	69	1	0.6	124	42	166
UK western non-SPA colonies	2000	200	400	224	1	0.6	400	134	534
Total overseas							380	134	514
Total UK							814	274	1,088
Total							1,194	408	1,602

Table 62. BDMPS for common guillemot in non-breeding season (August to February) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in non-breeding season	Proportion of immatures in UK North Sea & Channel waters in non-breeding season	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Faroe Islands	c2000	100,000	200,000	148000	0.1	0.2	20000	29600	49600
Norway	c2000	100,000	200,000	148000	0.05	0.2	10000	29600	39600
Hermaness, Saxavord & Valla Field SPA	2009	4620	9,240	6838	0.7	0.6	6468	4103	10571
Foula SPA	2007	16615	33,230	24590	0.7	0.6	23261	14754	38015
Noss SPA	2009	14783	29,566	21879	0.7	0.6	20696	13127	33824
Sumburgh SPA	2010	4762	9,524	7048	0.7	0.6	6667	4229	10896
Fair Isle SPA	2010	13066	26,132	19338	0.7	0.6	18292	11603	29895
West Westray SPA	2007	33900	67,800	50172	0.7	0.6	47460	30103	77563
Calf of Eday SPA	2006	6300	12,600	9324	0.7	0.6	8820	5594	14414
Rousay SPA	2009	6200	12,400	9176	0.7	0.6	8680	5506	14186
Marwick Head SPA	2012	11097	22,194	16424	0.7	0.6	15536	9854	25390
Hoy SPA	2007	6300	12,600	9324	0.7	0.6	8820	5594	14414
Copinsay SPA	2012	5607	11,214	8298	0.7	0.6	7850	4979	12829
North Caithness Cliffs SPA	2000	47000	94,000	69560	0.7	0.6	65800	41736	107536
East Caithness Cliffs SPA	1999	106500	213,000	157620	0.7	0.6	149100	94572	243672
Troup, Pennan & Lion's Heads SPS	2007	10938	21,876	16188	0.7	0.6	15313	9713	25026
Buchan Ness to Collieston Coast SPA	2007	12928	25,856	19133	0.8	0.7	20685	13393	34078
Fowlsheugh SPA	2012	30100	60,200	44548	0.8	0.7	48160	31184	79344
Forth Islands SPA	2011	14674	29,348	21718	0.9	0.8	26413	17374	43787
St Abb's Head to Fast Castle SPA	2013	22103	44,206	32712	0.9	0.8	39785	26170	65955
Farne Islands SPA	2013	33532	67,064	49627	0.9	0.8	60358	39702	100059

Flamborough and Filey Coast pSPA	2008	39641	79,282	58669	0.9	0.8	71354	46935	118289
Germany and Denmark	2005	5,000	10,000	7400	0.2	0.4	2000	2960	4960
UK North Sea non-SPA populations	2000	147000	294,000	217560	0.8	0.6	235200	130536	365736
Sule Skerry & Sule Stack SPA	1998	7633	15,266	11297	0.05	0.1	763	1130	1893
North Rona & Sula Sgeir SPA	2012	5000	10,000	7400	0.05	0.1	500	740	1240
Cape Wrath SPA	2000	27359	54,718	40491	0.05	0.1	2736	4049	6785
Handa SPA	2011	37993	75,986	56230	0.05	0.1	3799	5623	9422
Shiant Isles SPA	2008	5148	10,296	7619	0.05	0.1	515	762	1277
Flannan Isles SPA	1999	9807	19,614	14514	0.05	0.1	981	1451	2432
St Kilda SPA	1999	15700	31,400	23236	0.05	0.1	1570	2324	3893
Canna & Sanday SPA	1999	3913	7,826	5791	0.05	0.1	391	579	970
Rum SPA	2000	1644	3,288	2433	0.05	0.1	164	243	408
Mingulay & Berneray SPA	2009	13527	27,054	20020	0.05	0.1	1353	2002	3355
North Colonsay & western cliffs SPA	2000	13500	27,000	20000	0	0.05	0	1000	1000
Ailsa Craig SPA	2013	5247	10,494	7766	0	0.05	0	388	388
Rathlin Island SPA	2011	87398	174,796	129349	0	0.05	0	6467	6467
Skomer & Skokholm SPA	2013	16300	32,600	24124	0.05	0.1	1630	2412	4042
UK West coast non-SPA populations	2000	79000	158,000	116920	0.03	0.08	4740	9354	14094
Total overseas							32,000	62,160	94,160
Total UK							923,860	599,286	1,523,146
Total							955,860	661,446	1,617,306

Table 63. BDMPS for common guillemot in non-breeding season (August to February) in ‘UK western waters’.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in non-breeding season	Proportion of immatures in UK western waters in non-breeding season	UK western waters number of adults	UK western waters number of immatures	UK western waters Total birds
Faroe Islands	c2000	100,000	200,000	148000	0.05	0.1	10000	14800	24800
Norway	c2000	100,000	200,000	148000	0.01	0.05	2000	7400	9400
Hermaness, Saxavord & Valla Field SPA	2009	4620	9,240	6838	0.02	0.05	185	342	527
Foula SPA	2007	16615	33,230	24590	0.02	0.05	665	1230	1894
Noss SPA	2009	14783	29,566	21879	0.02	0.05	591	1094	1685
Sumburgh SPA	2010	4762	9,524	7048	0.02	0.05	190	352	543
Fair Isle SPA	2010	13066	26,132	19338	0.02	0.05	523	967	1490
West Westray SPA	2007	33900	67,800	50172	0.02	0.05	1356	2509	3865
Calf of Eday SPA	2006	6300	12,600	9324	0.02	0.05	252	466	718
Rousay SPA	2009	6200	12,400	9176	0.02	0.05	248	459	707
Marwick Head SPA	2012	11097	22,194	16424	0.02	0.05	444	821	1265
Hoy SPA	2007	6300	12,600	9324	0.02	0.05	252	466	718
Copinsay SPA	2012	5607	11,214	8298	0.02	0.05	224	415	639
North Caithness Cliffs SPA	2000	47000	94,000	69560	0.02	0.05	1880	3478	5358
East Caithness Cliffs SPA	1999	106500	213,000	157620	0	0	0	0	0
Troup, Pennan & Lion's Heads SPS	2007	10938	21,876	16188	0	0	0	0	0
Buchan Ness to Collieston Coast SPA	2007	12928	25,856	19133	0	0	0	0	0
Fowlsheugh SPA	2012	30100	60,200	44548	0	0	0	0	0
Forth Islands SPA	2011	14674	29,348	21718	0	0	0	0	0
St Abb's Head to Fast Castle SPA	2013	22103	44,206	32712	0	0	0	0	0
Farne Islands SPA	2013	33532	67,064	49627	0	0	0	0	0
Flamborough and Filey Coast pSPA	2008	39641	79,282	58669	0	0	0	0	0
Germany and Denmark	2005	5,000	10,000	7400	0	0	0	0	0
North Sea UK non-SPA populations	2000	147000	294,000	217560	0.01	0.02	2940	4351	7291

Sule Skerry & Sule Stack SPA	1998	7633	15,266	11297	0.95	0.9	14503	10167	24670
North Rona & Sula Sgeir SPA	2012	5000	10,000	7400	0.95	0.9	9500	6660	16160
Cape Wrath SPA	2000	27359	54,718	40491	0.95	0.9	51982	36442	88424
Handa SPA	2011	37993	75,986	56230	0.95	0.9	72187	50607	122793
Shiant Isles SPA	2008	5148	10,296	7619	0.95	0.9	9781	6857	16638
Flannan Isles SPA	1999	9807	19,614	14514	0.95	0.9	18633	13063	31696
St Kilda SPA	1999	15700	31,400	23236	0.95	0.9	29830	20912	50742
Canna & Sanday SPA	1999	3913	7,826	5791	0.95	0.9	7435	5212	12647
Rum SPA	2000	1644	3,288	2433	0.95	0.9	3124	2190	5313
Mingulay & Berneray SPA	2009	13527	27,054	20020	0.95	0.9	25701	18018	43719
North Colonsay and western cliffs SPA	2000	13500	27,000	20000	1	0.95	27000	19000	46000
Ailsa Craig SPA	2013	5247	10,494	7766	1	0.95	10494	7377	17871
Rathlin Island SPA	2011	87398	174,796	129349	1	0.95	174796	122882	297678
Skomer & Skokholm SPA	2013	16300	32,600	24124	0.9	0.8	29340	19299	48639
West coast UK non-SPA populations	2000	79000	158,000	116920	0.95	0.9	150100	105228	255328
Total overseas							12,000	22,200	34,200
Total UK							644,156	460,864	1,105,020
Total							656,156	483,064	1,139,220

Table 64. BDMPS for razorbill in migration seasons (August to October, and January to March) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in migration	Proportion of immatures in UK North Sea & Channel waters in migration	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Russia	1990s	3500	7000	5250	0.05	0.1	350	525	875
Iceland	2008	315400	630800	473100	0.3	0.4	189240	189240	378480
Norway	1990s	30300	60600	45450	0.2	0.5	12120	22725	34845
Denmark, Finland, Sweden	1990s	16000	32000	24000	0.1	0.3	3200	7200	10400
Faroe	2012	4500	9000	6750	0.5	0.5	4500	3375	7875
Foula	2007	375	750	562	0.95	0.9	712	506	1219
Fair Isle	2010	915	1830	1372	0.95	0.9	1738	1235	2974
West Westray	2007	550	1100	825	0.95	0.9	1045	742	1788
North Caithness Cliffs	2000	1700	3400	2550	0.95	0.9	3230	2295	5525
East Caithness Cliffs	1999	12500	25000	18750	1	0.9	25000	16875	41875
Troup, Pennan & Lions	2007	1743	3486	2614	1	0.9	3486	2353	5839
Fowlsheugh	2012	3524	7048	5286	1	0.9	7048	4757	11805
Forth Islands	2012	2625	5250	3938	1	0.9	5250	3544	8794
St Abbs to Fast Castle	2013	1219	2438	1828	1	0.9	2438	1646	4084
Flamborough & Filey	2008	10001	20002	15002	1	0.9	20002	13501	33503
UK North Sea non-SPA colonies	2000	10000	20000	15000	1	0.9	20000	13500	33500
North Rona & Sula Sgeir	1998	1089	2178	1634	0.02	0.05	44	82	125
Cape Wrath	2000	2090	4180	3135	0.02	0.05	84	157	240
Handa	2010	5165	10330	7748	0.02	0.05	207	387	594
St Kilda	1999	1700	3400	2550	0.02	0.05	68	128	196
Shiants	2008	4248	8496	6372	0.02	0.05	170	319	489
Flannan Islands	1998	1051	2102	1576	0.02	0.05	42	79	121
Mingulay & Berneray	2009	10111	20222	15166	0.02	0.05	404	758	1163
Rathlin Island	2011	15393	30786	23090	0.02	0.05	616	1154	1770

Skomer & Skokholm	2013	6001	12002	9002	0.02	0.05	240	450	690
UK Western non-SPA colonies	2000	10000	20000	15000	0.02	0.05	400	750	1150
Ireland	2000	17000	34000	25500	0.02	0.05	680	1275	1955
France	2000	25	50	38	0.01	0.02	0	1	1
Total overseas							210,090	224,341	434,431
Total UK							92,224	65,219	157,443
Total							302,314	289,560	591,874

Table 65. BDMPS for razorbill in migration seasons (August to October, and January to March) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in migration	Proportion of immatures in UK western waters in migration	UK western waters number of adults	UK western waters number of immatures	UK western waters Total birds
Russia	1990s	3500	7000	5250	0.05	0.1	350	525	875
Iceland	2008	315400	630800	473100	0.3	0.4	189240	189240	378480
Norway	1990s	30300	60600	45450	0.1	0.3	6060	13635	19695
Denmark, Finland, Sweden	1990s	16000	32000	24000	0.05	0.1	1600	2400	4000
Faroe	2012	4500	9000	6750	0.5	0.5	4500	3375	7875
Foula	2007	375	750	562	0.05	0.05	38	28	66
Fair Isle	2010	915	1830	1372	0.05	0.05	92	69	160
West Westray	2007	550	1100	825	0.05	0.05	55	41	96
North Caithness Cliffs	2000	1700	3400	2550	0.05	0.05	170	128	298
East Caithness Cliffs	1999	12500	25000	18750	0	0.02	0	375	375
Troup, Pennan & Lions	2007	1743	3486	2614	0	0.02	0	52	52
Fowlsheugh	2012	3524	7048	5286	0	0.02	0	106	106
Forth Islands	2012	2625	5250	3938	0	0.02	0	79	79
St Abbs to Fast Castle	2013	1219	2438	1828	0	0.02	0	37	37
Flamborough & Filey	2008	10001	20002	15002	0	0.02	0	300	300
UK North Sea non-SPA colonies	2000	10000	20000	15000	0	0.02	0	300	300
North Rona & Sula Sgeir	1998	1089	2178	1634	0.98	0.9	2134	1470	3605
Cape Wrath	2000	2090	4180	3135	0.98	0.9	4096	2822	6918
Handa	2010	5165	10330	7748	0.98	0.9	10123	6973	17096
St Kilda	1999	1700	3400	2550	0.98	0.9	3332	2295	5627
Shiants	2008	4248	8496	6372	0.98	0.9	8326	5735	14061
Flannan Islands	1998	1051	2102	1576	0.98	0.9	2060	1419	3479
Mingulay & Berneray	2009	10111	20222	15166	0.98	0.9	19818	13650	33467
Rathlin Island	2011	15393	30786	23090	0.98	0.9	30170	20781	50951
Skomer & Skokholm	2013	6001	12002	9002	0.98	0.9	11762	8101	19863

UK Western non-SPA colonies	2000	10000	20000	15000	0.98	0.9	19600	13500	33100
Ireland	2000	17000	34000	25500	0.1	0.1	3400	2550	5950
France	2000	25	50	38	0.05	0.05	2	2	4
Total overseas							205,152	211,727	416,879
Total UK							111,776	78,259	190,035
Total							316,928	289,986	606,914

Table 66. BDMPS for razorbill in winter (November and December) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in winter	Proportion of immatures in UK North Sea & Channel waters in winter	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Russia	1990s	3500	7000	5250	0.01	0.02	70	105	175
Iceland	2008	315400	630800	473100	0.1	0.2	63080	94620	157700
Norway	1990s	30300	60600	45450	0.05	0.1	3030	4545	7575
Denmark, Finland, Sweden	1990s	16000	32000	24000	0.02	0.05	640	1200	1840
Faroe	2012	4500	9000	6750	0.3	0.3	2700	2025	4725
Foula	2007	375	750	562	0.3	0.1	225	56	281
Fair Isle	2010	915	1830	1372	0.3	0.1	549	137	686
West Westray	2007	550	1100	825	0.3	0.1	330	82	412
North Caithness Cliffs	2000	1700	3400	2550	0.3	0.1	1020	255	1275
East Caithness Cliffs	1999	12500	25000	18750	0.3	0.1	7500	1875	9375
Troup, Pennan & Lions	2007	1743	3486	2614	0.3	0.1	1046	261	1307
Fowlsheugh	2012	3524	7048	5286	0.3	0.1	2114	529	2643
Forth Islands	2012	2625	5250	3938	0.3	0.1	1575	394	1969
St Abbs to Fast Castle	2013	1219	2438	1828	0.3	0.1	731	183	914
Flamborough & Filey	2008	10001	20002	15002	0.3	0.1	6001	1500	7501
UK North Sea non-SPA colonies	2000	10000	20000	15000	0.3	0.1	6000	1500	7500
North Rona & Sula Sgeir	1998	1089	2178	1634	0.1	0.05	218	82	299
Cape Wrath	2000	2090	4180	3135	0.1	0.05	418	157	575
Handa	2010	5165	10330	7748	0.1	0.05	1033	387	1420
St Kilda	1999	1700	3400	2550	0.1	0.05	340	128	468
Shiants	2008	4248	8496	6372	0.1	0.05	850	319	1168
Flannan Islands	1998	1051	2102	1576	0.1	0.05	210	79	289
Mingulay & Berneray	2009	10111	20222	15166	0.1	0.05	2022	758	2781
Rathlin Island	2011	15393	30786	23090	0.05	0	1539	0	1539

Skomer & Skokholm	2013	6001	12002	9002	0.05	0	600	0	600
UK Western non-SPA colonies	2000	10000	20000	15000	0.1	0.05	2000	750	2750
Ireland	2000	17000	34000	25500	0.01	0.02	340	510	850
France	2000	25	50	38	0.05	0.05	2	2	4
Total overseas							69,862	103,007	172,869
Total UK							36,321	9,432	45,753
Total							106,183	112,439	218,622

Table 67. BDMPS for razorbill in winter (November and December) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in winter	Proportion of immatures in UK western waters in winter	UK western waters number of adults	UK western waters number of immatures	UK western waters Total birds
Russia	1990s	3500	7000	5250	0.01	0.02	70	105	175
Iceland	2008	315400	630800	473100	0.2	0.3	126160	141930	268090
Norway	1990s	30300	60600	45450	0.05	0.1	3030	4545	7575
Denmark, Finland, Sweden	1990s	16000	32000	24000	0.02	0.05	640	1200	1840
Faroe	2012	4500	9000	6750	0.3	0.3	2700	2025	4725
Foula	2007	375	750	562	0.01	0.02	8	11	19
Fair Isle	2010	915	1830	1372	0.01	0.02	18	27	46
West Westray	2007	550	1100	825	0.01	0.02	11	16	28
North Caithness Cliffs	2000	1700	3400	2550	0.01	0.02	34	51	85
East Caithness Cliffs	1999	12500	25000	18750	0.01	0.02	250	375	625
Troup, Pennan & Lions	2007	1743	3486	2614	0.01	0.02	35	52	87
Fowlsheugh	2012	3524	7048	5286	0.01	0.02	70	106	176
Forth Islands	2012	2625	5250	3938	0.01	0.02	52	79	131
St Abbs to Fast Castle	2013	1219	2438	1828	0.01	0.02	24	37	61
Flamborough & Filey	2008	10001	20002	15002	0.01	0.02	200	300	500
UK North Sea non-SPA colonies	2000	10000	20000	15000	0.01	0.02	200	300	500
North Rona & Sula Sgeir	1998	1089	2178	1634	0.4	0.1	871	163	1035
Cape Wrath	2000	2090	4180	3135	0.4	0.1	1672	314	1986
Handa	2010	5165	10330	7748	0.4	0.1	4132	775	4907
St Kilda	1999	1700	3400	2550	0.4	0.1	1360	255	1615
Shiants	2008	4248	8496	6372	0.4	0.1	3398	637	4036
Flannan Islands	1998	1051	2102	1576	0.4	0.1	841	158	998
Mingulay & Berneray	2009	10111	20222	15166	0.4	0.1	8089	1517	9605
Rathlin Island	2011	15393	30786	23090	0.4	0.1	12314	2309	14623
Skomer & Skokholm	2013	6001	12002	9002	0.3	0.1	3601	900	4501

UK Western non-SPA colonies	2000	10000	20000	15000	0.3	0.1	6000	1500	7500
Ireland	2000	17000	34000	25500	0.1	0.1	3400	2550	5950
France	2000	25	50	38	0.05	0.05	2	2	4
Total overseas							136,002	152,357	288,359
Total UK							43,181	9,882	53,063
Total							179,183	162,239	341,422

Table 68. BDMPS for Atlantic puffin in non-breeding season (mid-August to March) in 'UK North Sea & Channel waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK North Sea & Channel waters in non-breeding season	Proportion of immatures in UK North Sea & Channel waters in non-breeding season	UK N Sea & Channel Number adults	UK N Sea & Channel Number immatures	UK N Sea & Channel Total birds
Norway	2000	1750000	3500000	3640000	0.001	0.003	3500	10920	14420
Faroe	2012	550000	1100000	1144000	0.04	0.01	44000	11440	55440
Ireland	2000	20000	40000	41600	0	0	0	0	0
France	2000	257	514	535	0.05	0.02	26	11	36
Hermaness, Saxavord	2002	23661	47322	49215	0.15	0.02	7098	984	8083
Foula	2000	22500	45000	46800	0.15	0.02	6750	936	7686
Noss	2007	802	1604	1668	0.15	0.02	241	33	274
Fair Isle	2012	10706	21412	22268	0.15	0.02	3212	445	3657
Hoy	2000	3500	7000	7280	0.15	0.02	1050	146	1196
North Caithness Cliffs	2000	976	1952	2030	0.15	0.02	293	41	333
East Caithness Cliffs	1999	274	548	570	0.15	0.02	82	11	94
Forth Islands	2008-10	62231	124462	129440	0.5	0.02	62231	2589	64820
Farne Islands	2013	39962	79924	83121	0.5	0.02	39962	1662	41624
Coquet Island	2013	12344	24688	25676	0.5	0.02	12344	514	12858
Flamborough & Filey	2008	958	1916	1993	0.5	0.02	958	40	998
UK N Sea non-SPA colonies	2000	35000	70000	72800	0.25	0.02	17500	1456	18956
Cape Wrath	2000	1602	3204	3332	0.001	0.001	3	3	7
North Rona & Sula Sgeir	2001	5442	10884	11319	0.001	0.001	11	11	22
Sule Skerry & Sule Stack	1998	59471	118942	123700	0.001	0.001	119	124	243
St Kilda	2000	142264	284528	295909	0.001	0.001	285	296	580
Shiant Isles	2000	65170	130340	135554	0.001	0.001	130	136	266
Flannan Isles	2001	15600	31200	32448	0.001	0.001	31	32	63
Canna & Sanday	1999	945	1890	1966	0.001	0.001	2	2	4
Mingulay & Berneray	2009	3126	6252	6502	0.001	0.001	6	7	13

Rathlin Island	2011	695	1390	1446	0.001	0.001	1	1	3
Skomer &Skokholm	2013	24114	48228	50157	0.001	0.001	48	50	98
UK western non-SPA colonies	2000	45000	90000	93600	0.001	0.001	90	94	184
Overseas total							47,526	22,371	69,896
UK total							152,448	9,613	162,061
Total							199,974	31,984	231,957

Table 69. BDMPS for Atlantic puffin in non-breeding season (mid-August to March) in 'UK western waters'.

Population	Most recent count	Pairs	Breeding adults	Immatures	Proportion of adults in UK western waters in non-breeding season	Proportion of immatures in UK western waters in non-breeding season	UK western waters Number adults	UK western waters Number immatures	UK western waters Total birds
Norway	2000	1750000	3500000	3640000	0.002	0.001	7000	3640	10640
Faroe	2012	550000	1100000	1144000	0.07	0.02	77000	22880	99880
Ireland	2000	20000	40000	41600	0.1	0.1	4000	4160	8160
France	2000	257	514	535	0.01	0.01	5	5	10
Hermaness, Saxavord	2002	23661	47322	49215	0.08	0.02	3786	984	4770
Foula	2000	22500	45000	46800	0.08	0.02	3600	936	4536
Noss	2007	802	1604	1668	0.08	0.02	128	33	162
Fair Isle	2012	10706	21412	22268	0.08	0.02	1713	445	2158
Hoy	2000	3500	7000	7280	0.08	0.02	560	146	706
North Caithness Cliffs	2000	976	1952	2030	0.08	0.02	156	41	197
East Caithness Cliffs	1999	274	548	570	0.08	0.02	44	11	55
Forth Islands	2008-10	62231	124462	129440	0.07	0.02	8712	2589	11301
Farne Islands	2013	39962	79924	83121	0.07	0.02	5595	1662	7257
Coquet Island	2013	12344	24688	25676	0.07	0.02	1728	514	2242
Flamborough & Filey	2008	958	1916	1993	0.07	0.02	134	40	174
UK N Sea non-SPA colonies	2000	35000	70000	72800	0.07	0.02	4900	1456	6356
Cape Wrath	2000	1602	3204	3332	0.18	0.02	577	67	643
North Rona & Sula Sgeir	2001	5442	10884	11319	0.18	0.02	1959	226	2186
Sule Skerry & Sule Stack	1998	59471	118942	123700	0.18	0.02	21410	2474	23884
St Kilda	2000	142264	284528	295909	0.18	0.02	51215	5918	57133
Shiant Isles	2000	65170	130340	135554	0.18	0.02	23461	2711	26172
Flannan Isles	2001	15600	31200	32448	0.18	0.02	5616	649	6265
Canna & Sanday	1999	945	1890	1966	0.18	0.02	340	39	380
Mingulay & Berneray	2009	3126	6252	6502	0.18	0.02	1125	130	1255

Rathlin Island	2011	695	1390	1446	0.18	0.02	250	29	279
Skomer &Skokholm	2013	24114	48228	50157	0.18	0.02	8681	1003	9684
UK western non-SPA colonies	2000	45000	90000	93600	0.18	0.02	16200	1872	18072
Overseas total							88,005	30,685	118,690
UK total							161,891	23,976	185,867
Total							249,896	54,661	304,557