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An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs

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Preface

The aim of this report is to document the analysis conducted by the Joint Nature Conservation Committee (JNCC) in 2007-2009 for the identification of the most suitable areas for the protection of seabirds within the British Fishery Limit. It provides a description of the data used, details of the methods, and intermediate and final results. The discussion also contains an assessment of which of the areas identified could be considered as possible Special Protection Areas, and which areas would require further investigation.

The report does not provide a suite of definite sites for submission to the European Commission, but provides necessary information for the responsible authorities to enable an informed decision to be made on the suitability of areas at sea for consideration as possible Special Protection Areas using the best available data. Final recommendations for the consideration of possible SPAs will be given in a separate further paper.

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Summary

In 1979, the European Community adopted the Council Directive 79/409/EEC on the conservation of wild birds (commonly known as the Birds Directive). This requires Member States to identify and classify the most suitable territories as special protection areas (SPAs) for the conservation of rare and vulnerable species listed on Annex I of the Directive as well as regularly occurring migratory species.
A number of potential ways of addressing marine SPAs in the UK are currently being considered:

1. Extensions to existing seabird colony SPAs boundaries into the marine environment;
2. Inshore areas used by waterbirds (e.g. seaduck, divers and grebes) outwith the breeding season;
3. Offshore areas used by seabirds, for feeding and other activities; and
4. Other types of SPA not captured by the above approaches.

This report describes an analysis of European Seabirds at Sea (ESAS) data, conducted to identify and delineate seabird aggregations within the British Fishery Limit that might qualify as SPAs.

ESAS data used in this analysis were collected using standardised transect methods from boats over more than 30 years. The data are counts of seabirds for subsections of a strip transect. All years of data were combined and then split by species and season in order to link possible SPAs to key stages in the seabirds' annual cycle. Some data were excluded because their quality might have been compromised. A correction factor was applied to adjust numbers of species where detection probability decreased with distance from observers.

In order to generate continuous seabird density surface maps from transect data, the spatial interpolation technique known as Poisson kriging was applied. Fifty-seven seabird density surface maps were created. The total number of seabirds per species and season of the maps were compared with populations estimated by the International Council for the Exploration of the Sea Working Group on Seabird Ecology (ICES WGSE). In instances where maps were considered to show artificially high estimates due to birds following the vessel, numbers on maps were rescaled to match ICES estimates. A grid of 6x6km cells was generated and data were summarised per grid cell. Grid cells partially on land were adjusted accordingly to cover only sea area.

To identify bird concentrations on the seabird density surface maps, a local indicator of spatial association, the Getis-Ord Gi* statistic, was calculated for each 6x6 km grid cell. Getis-Ord Gi* is larger the higher and more clustered values are around a central location. In order to delineate bird concentrations on the Getis-Ord Gi* map surfaces, two alternative threshold values were applied and compared: the top 1% and the top 5% of all Getis-Ord Gi*. Getis-Ord Gi* was not considered at locations where bird densities were zero. Grid cells with Getis-Ord Gi* exceeding the threshold were marked and those sharing a boundary were then fused to form larger areas, the so called hotspots. Hotspots were identified on all 57 density surface maps.

Hotspots identified by Getis-Ord Gi* were tested against the UK SPA selection guidelines. These state that an area may be considered for SPA designation (Stage 1) if either a minimum number of individuals of a species or of a species assemblage use the area on a regular basis; if an area does not qualify at Stage 1 of the guidelines, it can still be considered if it meets certain ecological guidelines listed in Stage 2 of the site selection guidelines.

Hotspots identified by Getis-Ord Gi* holding qualifying numbers of either a single species or the seabird assemblage were tested to determine if they occurred regularly. For this, raw ESAS data were split by years. For each year, data falling within a hotspot were tested by a two-tailed Mann-Whitney U test which identified significant differences between seabird numbers in the hotspot and seabird numbers outwith all hotspots. If the median number of birds within a hotspot was significantly higher than those outwith all hotspots during (1) more than three years, and (2) at least two thirds of all years when data were sufficient to apply the test, the hotspot was defined as a regularly occurring hotspot.

Of the 6013 hotspots identified by the top 5% of Getis-Ord Gi*, 127 held qualifying numbers of the species for which they were generated, but only 28 of these hotspots occurred regularly. These 28 areas were identified for northern fulmar (breeding), Manx shearwater (breeding), Leach's storm-petrel (breeding), northern gannet (breeding), great cormorant (winter), European shag (breeding and winter), great skua (breeding), black-legged kittiwake (breeding), common guillemot (breeding, additional season and winter), Atlantic puffin (breeding and winter), and for the species assemblage as a whole (summer). In addition, nine areas hosted qualifying numbers of birds at some times of the year but failed to meet the criterion of regularity by a narrow margin. These near-qualifying areas belonged to northern gannet (breeding), common guillemot (additional season and winter), Atlantic puffin (breeding), and all species (breeding and summer).

A total of 2201 hotspots were identified based on the top 1% of Getis-Ord Gi*. Of these, 63 held qualifying numbers but only eight met the criterion of regularity. These areas were identified for Manx shearwater (breeding), northern gannet (breeding), European shag (breeding and winter), great skua (breeding), common guillemot (breeding), and Atlantic puffin (breeding). In addition, three near-qualifying areas, hosting qualifying numbers but missing to meet the criterion of regularity by a narrow margin, emerged from the analysis - northern fulmar (breeding), Manx shearwater (breeding) and the species assemblage (breeding).

For a variety of species no possible SPAs could be identified, either because they occurred throughout the area of interest in very low numbers (Cory's shearwater; Manx shearwater (winter); pomarine and Arctic skua; Mediterranean, Iceland, glaucous, black-headed and common gull (the latter during breeding); and Sandwich tern) or their hotspots were too restricted to hold birds in qualifying numbers (great cormorant (breeding), long-tailed skua (summer), great black-backed gull (winter), little gull (winter), great and sooty shearwater (summer), black-legged kittiwake (winter), common gull and black-headed gull).

Four regions were identified as particularly important, as they had a large number of repeatedly occurring qualifying areas, these were: (1) the outer Firth of Forth including the Wee Bankie and Marr Bank, (2) the inner Firth of Forth, (3) the Moray Firth, and (4) the sea areas to the north and west of the Shetland Islands.

The suitability of all areas that qualify as additions to the SPA network is discussed.

1 Introduction

1.1 Background

In 1979, the European Community adopted the Council Directive on the conservation of wild birds (commonly known as the Birds Directive), which addresses 'the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the treaty applies' (79/409/EEC). It requires Member States to identify and classify in particular the most suitable territories in number and size as special protection areas (termed Special Protection Areas or SPAs by Member States) for the conservation of rare and vulnerable species listed on Annex I of the Directive as well as regularly occurring migratory species.

Although this Directive states that conservation measures should be taken both in 'the geographical sea and land area', most SPAs in the United Kingdom (UK) do not extend further than mean low water mark (or mean low water springs in Scotland). Work to facilitate consideration of SPAs below this datum is currently being undertaken by the Joint Nature Conservation Committee (JNCC) in collaboration with the four statutory country conservation agencies in the UK: Council for Nature Conservation and the Countryside, the Countryside Council for Wales, Natural England and Scottish Natural Heritage.

A number of potential ways of addressing marine SPAs in the UK are currently being considered:

1. Marine extensions to existing seabird colony SPAs (McSorley *et al* 2003, Webb and Reid 2004, McSorley *et al* 2008);

2. Inshore areas used by waterbirds (e.g. seaduck, divers and grebes) outwith the breeding season (e.g. Webb *et al* 2006);

3. Offshore areas used by wide-ranging seabirds, for feeding and for other activities; and

4. Other types of SPA not captured by these three categories.

These four strands form part of the Marine Natura Project, currently extending the coverage of SPAs under the Birds Directive, and Special Areas of Conservation (SACs) under the Habitats Directive, into the marine environment (Johnston *et al* 2002).

This report describes analyses of data of the European Seabirds at Sea (ESAS) database. The aim is to determine the presence of aggregations of seabirds within the British Fishery Limit. The outcome can be used by the competent authorities to make an informed decision on the suitability areas to protect seabirds in the offshore environment

1.2 Area of interest and progress on the designation of SPAs

The British Fishery Limit extends up to 200 nautical miles from the baseline adjacent to the United Kingdom, the Channel Islands and the Isle of Man. It comprises an area of more than 750,000 km^2, stretching over a large variety of marine habitats, seabed and water column features (Connor *et al* 2006). Water depth ranges within the British Fishery Limit between 0 to more than 2.5 km.

The UK hosts a multi-species breeding seabird assemblage of outstanding international importance. More than 50% of the biogeographic populations of Manx shearwater, northern gannet, great skua and lesser black-backed gull breed in Britain. More than 30% of the

biogeographic population of European shag, common guillemot, and more than 10% of at least another seven species (northern fulmar, great cormorant, herring gull, great black-backed gull, black-legged kittiwake, Sandwich tern and razorbill, Mitchell *et al* 2004) breed here. A significant proportion of the population of these species uses the UK offshore area for foraging, resting, travelling and maintenance behaviours during the breeding season and during other times of the year.

To date, the UK has designated 73 SPAs with marine components in the inshore area (within 12 nautical miles, Figure 1). Of these, only Bae Caerfyrddin/Carmarthen Bay SPA (Wales) is entirely marine and was classified in 2003 for its non-breeding aggregations of common scoter. Detailed descriptions of these SPAs can be found at http://www.jncc.gov.uk/page-4559.

In addition, JNCC has recommended marine extensions to the boundaries of 38 existing seabird colonies (Figure 1). Three of the recommended extensions are in England, three in Wales, one in Northern Ireland and 31 in Scotland. In summer 2008, Scottish Natural Heritage carried out a consultation on behalf of Scottish Government, on proposals to extend 31 existing seabird colony SPAs into the marine environment, and on 25 September 2009 Scottish Government announced that they were to be classified. More information about existing seabird colonies for which JNCC has recommended marine extensions is contained at http://www.jncc.gov.uk/page-4562.

An extensive inshore survey programme is currently being conducted of 55 inshore areas of search that are used by waterbirds (seaducks, divers and grebes) outwith the breeding season. A map of these areas of search can be found at http://www.jncc.gov.uk/images/AOS_points_inshoreSPAs.jpg.

To summarize, although UK waters host seabird assemblages of outstanding international importance, so far only one wholly marine inshore SPA has been classified. This report describes analyses aimed at identifying possible SPAs in all UK waters represented in the ESAS database.

The methods used in this report are targeted towards identifying areas with high and aggregated seabird densities, as we consider these to be most suitable for the location of possible offshore SPAs. Species which are well dispersed, which occur in very low numbers or which do not exhibit spatially stable aggregations are not well captured with this approach. Indeed, there are a number of species for which we could not identify areas that might be deemed suitable as SPAs.

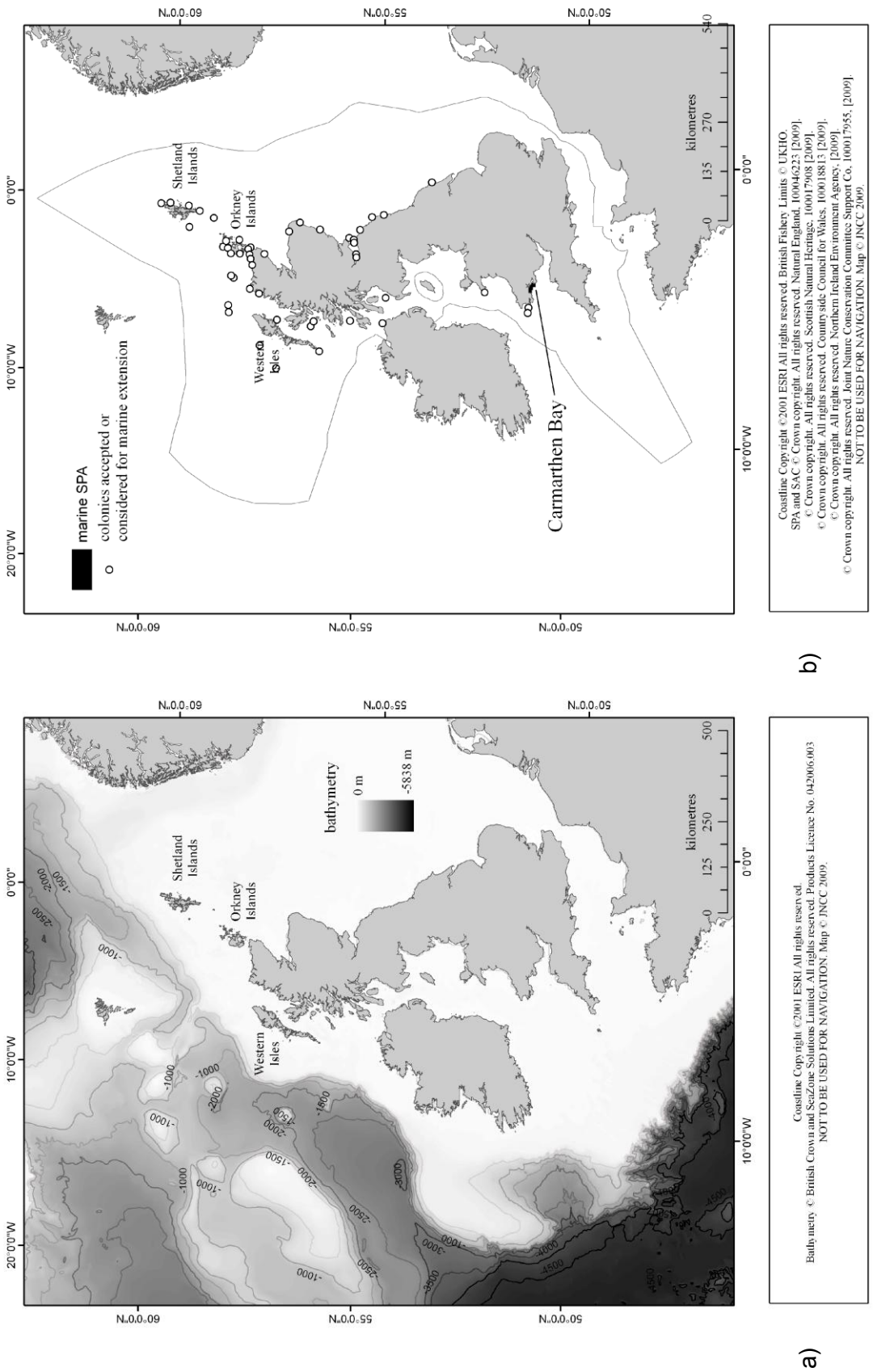


Figure 1. Area of interest, shown with a) bathymetry, and with b) British Fishery Limit, existing SPAs, and colonies considered for marine extension of existing seabird colony SPAs.

2 Methods

2.1 Data

2.1.1 The European Seabirds at Sea database

Data for the analysis was extracted from the European Seabirds at Sea (ESAS) database. With over two million records, the ESAS database represents the most comprehensive and longest running dataset for the distribution of seabirds at sea (Pollock and Barton 2006). Boat and airplane based transect data, from North western European waters were collected using standardised methods following Tasker *et al* (1984), Webb and Durinck (1992) and Camphuysen *et al* (2004) over a period of 29 years (1980-2009), of which 25 years of data (1980-2004) were used in the analysis for this report. ESAS data provides information on location, observation platform, observer, methods and time of observation, observation effort (area observed), weather- and sea-conditions, number of birds (with species, behaviour and plumage characteristics), the birds' distance to the observation platform and their flight direction. For further details see Reid and Camphuysen (1998).

Aerial survey data were usually limited to inshore areas and the methodology differed from that used on boats. Consequently, data collected from aircraft were excluded from the analysis. The boat-based survey methodology involved counting all birds sitting on the water within a 200m or 300m wide strip transect (split into three or four distance bands: 0-50m, 50-100m, 100-200m and 200-300m) running parallel to the track line of the boat (Webb and Durinck 1992). Flying birds above the transect area were counted using the snapshot method (Tasker *et al* 1984).

Raw data were pooled for transect sections and assigned to the location of the starting point of each section.

2.1.2 Species of interest

The analysis was constrained to seabird species found in the British Fishery Limit, including the offshore area. Of these 35 species, four were too scarce in the British Fishery Limit to produce meaningful seabird density surfaces and had to be excluded from the analysis - Balearic shearwater, Sabine's gull, roseate tern and little tern. Species restricted to the inshore area were not considered.

Table 1. Seabird species and seasons of interest

common name	scientific name	season		
		breeding/summer	winter	additional season
northern fulmar	*Fulmarus glacialis*	March - July	Aug - Feb	
Cory's shearwater	*Calonectris diomedea*	July - Oct		
great shearwater	*Puffinus gravis*	July - Oct		
sooty shearwater	*Puffinus griseus*	July - Nov		
Manx shearwater	*Puffinus puffinus*	May - Sep		Oct - Nov
Balearic shearwater	*Puffinus mauretanicus*	April - Sep		
European storm-petrel	*Hydrobates pelagicus*	June - Oct		
Leach's Storm-petrel	*Oceanodroma leucorhoa*	June - Oct		
northern gannet	*Morus bassanus*	May - Sep	Oct - April	
great cormorant	*Phalacrocorax carbo*	April - Aug	Sep - March	
European shag	*Phalacrocorax aristotelis*	March - Sep	Oct - Feb	
pomarine skua	*Stercorarius pomarinus*			March - June, Aug - Nov
Arctic skua	*Stercorarius parasiticus*	May - Aug		Sep - Nov
long-tailed skua	*Stercorarius longicaudus*			May - June, Sep - Nov
great skua	*Stercorarius skua*	May - Aug	Sep - April	
Sabine's gull	*Larus sabini*	July - Oct		
black-legged kittiwake	*Rissa tridactyla*	May - Sep	Oct - April	
black-headed gull	*Larus ridibundus*	April - Aug	Sep - March	
little gull	*Larus minutes*	May - July	Dec - April	Aug - Nov
great black-backed gull	*Larus marinus*	April - Aug	Sep - March	
Mediterranean gull	*Larus melanocephalus*			All year
common gull	*Larus canus*	May - Aug	Sep - April	
lesser Black-backed gull	*Larus fuscus*	May - Aug	Sep - April	
herring gull	*Larus argentatus*	April - Aug	Sep - March	
Iceland gull	*Larus glaucoides*		Nov - April	
glaucous gull	*Larus hyperboreus*		Oct - March	
little tern	*Sternula albifrons*	May - Aug		
Sandwich tern	*Sterna sandvicensis*	May - Aug	Sep - Oct	
common tern	*Sterna hirundo*	May - Sep		
roseate tern	*Sterna dougallii*	May - Aug		
Arctic tern	*Sterna paradisaea*	May - Aug		
common guillemot	*Uria aalge*	May - June	Oct - April	Aug - Sep
razorbill	*Alca torda*	May - June	Oct - April	Aug - Sep
little auk	*Alle alle*		Nov - March	
Atlantic puffin	*Fratercula arctica*	April - July	Aug - March	
All species		All breeding months	Nov - March	July - Aug

2.1.3 Spatial extent and resolution

The area of interest was delineated by the British Fishery Limit. In order to avoid handling large data-sets and to account for ecological differences between marine areas, data were assigned to smaller study regions based on the Defra regional seas classification (Defra 2004). As these regional seas are based on planktonic zones, our study regions were adjusted by merging regional seas belonging to five ecologically similar seabird regions (Figure 2).

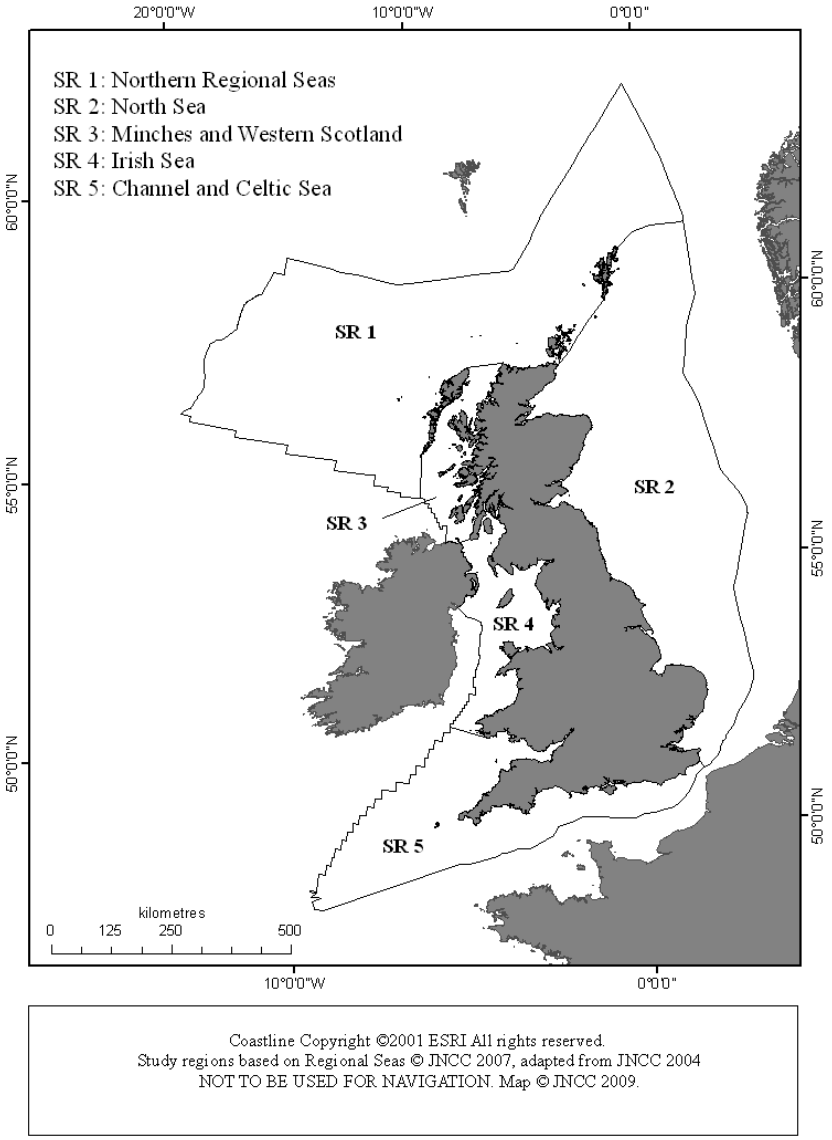


Figure 2. Study regions used for the data analysis.

Continuous density surface maps were generated in this analysis using a method for data interpolation that uses neighbouring data points within a predefined range to predict seabird abundance at unsampled locations (Zuur *et al* 2008). To allow for data interpolation at the outer limits of the study regions, data within a buffer zone of 100km around it were included in the analysis for that region. The buffer width was defined by the maximum distance over

which spatial autocorrelation in data was detected in an empirical semivariogram (Cressie 1991).

Because part of the analysis (Poisson kriging, see below) would have required unreasonable computing time when applied to the original data, data-sets were reduced by summarising the data into a grid with each grid cell containing the sum of birds observed and the observation effort employed. As most transect sections were up to 6km long, no higher resolution could be achieved and the data were resolved into grid cells 6 x 6km in size.

2.1.4 Temporal extent and resolution

Data collected between 1980 - 2004 were extracted for analysis from the ESAS database. In order to allow for the best available data coverage, all years of data were combined. In order to link possible SPAs to key stages in the birds' annual cycle and to enhance the understanding of their potential ecological significance, data were split not only by species and region as described above but also by species specific seasons. Seasons were defined as breeding, summer or winter, although in a few cases additional seasons such as time of post-breeding moult were also described (Table 1).

For seabird assemblages two stages in the annual cycle (winter, summer) were defined by month (Table 1). By contrast, a third stage (breeding) was not defined by a time period, but data were pooled from single species during their individual breeding seasons. The breeding season of assemblages contains therefore data, which were not necessarily collected simultaneously.

2.1.5 Distribution of effort

Because ESAS data were collected on platforms of opportunity, the effort of data collection was not evenly distributed over the area of interest, neither in space nor in time. This might cause problems for the identification of suitable areas for SPA designation because of two reasons: (1) if too little or no data were collected in an area, large bird assemblages might have been missed and hotspots would not be identified; and (2) even where hotspots were identified, if data were collected over less than three years, they would not have been able to meet the criterion of regularity and would inevitably fail to meet our selection criteria.

If peaks in effort would always take place where seabird numbers are highest, too many possible SPAs would be identified; if high effort always coincides with seabird absences, too few possible SPAs would be identified. Although Garthe *et al* (unpublished data, EU project BECAUSE) suggest that trends for northern fulmar, black-legged kittiwakes and the large gulls differ between the northern and the southern part of the North Sea, there is currently too little information published to verify large scale changes in distribution patterns of seabirds. The impact of unevenly distributed effort in combination with changing seabird distribution patterns can therefore not be evaluated satisfactorily.

Effort fluctuated during 1980 - 1998 between 8286 km^2 and 2157 km^2. After 1998 effort steadily decreased until it reached a minimum of 13km^2 in 2006 (Figure 3).

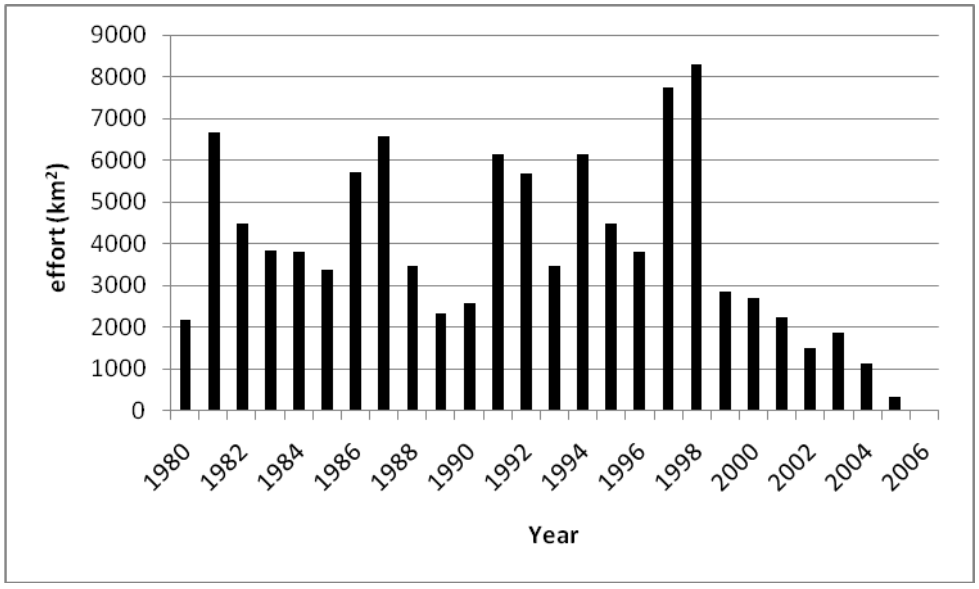


Figure 3. Data collection effort between 1980 and 2006.

Moreover, the months of the year were not equally covered, with most data collected during the summer months between May and September (Figure 4) .

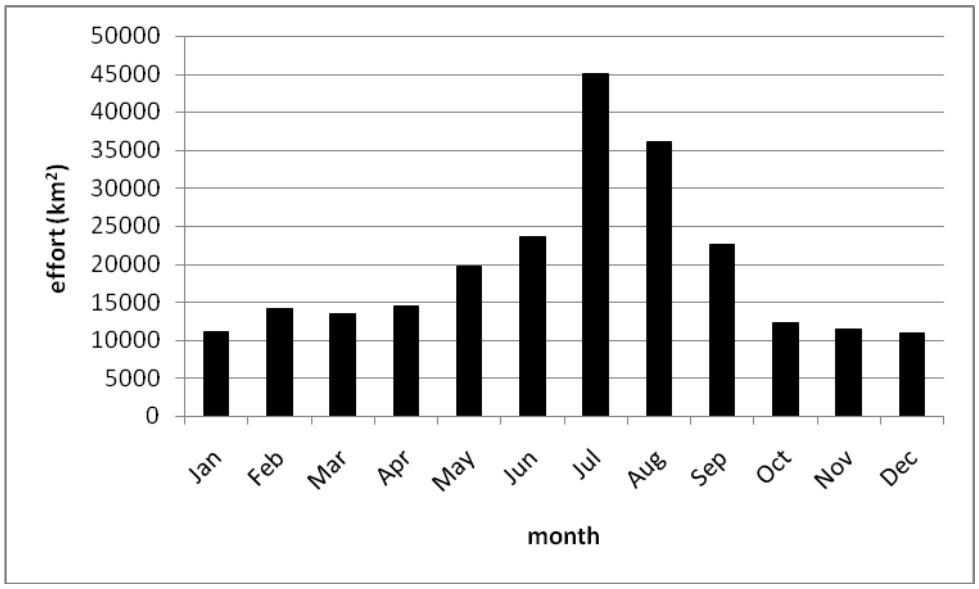


Figure 4. Data collection effort over the course of the year.

Simultaneously with the temporal fluctuations in effort the spatial distribution of effort varied. When effort is compared between seabird regions, most was achieved in the North Sea (SR2, Figure 2), which is partly due to the fact that it is the second largest seabird region in the area of interest. Ignoring the differences in absolute numbers, it becomes apparent that the overall pattern of effort, the peaks and troughs, differ between regions. The sampling of ESAS data can be roughly divided into three phases. During the first phase (1980-1985) the focus of data collection was on the North Sea (SR 2), with little effort in the other regions. Between 1986 - 1999, the second phase, data collection varies greatly between regions. During the first three years of this phase the emphasis was on seabird regions 1-4 (all around the UK, but the Channel and the Celtic sea), during the next eight years is concentrated on seabird regions 2 (North Sea) and 5 (Channel and Celtic Sea), and during

the last three years it reverted to seabird regions 1-4. Phase 3 was characterised by a general decrease in effort.

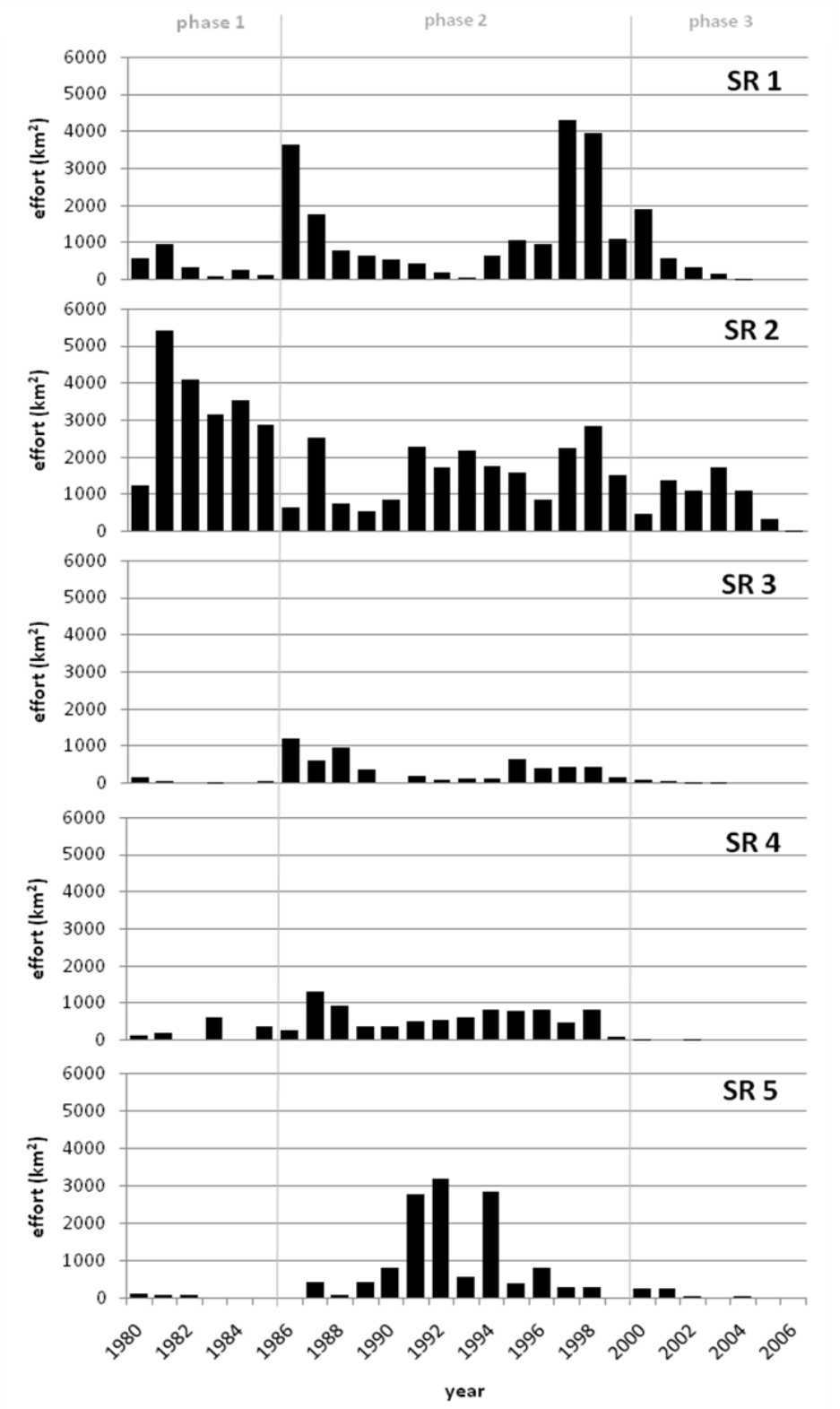


Figure 5. Data collection effort between 1980 and 2006 in the seabird regions 1-5.

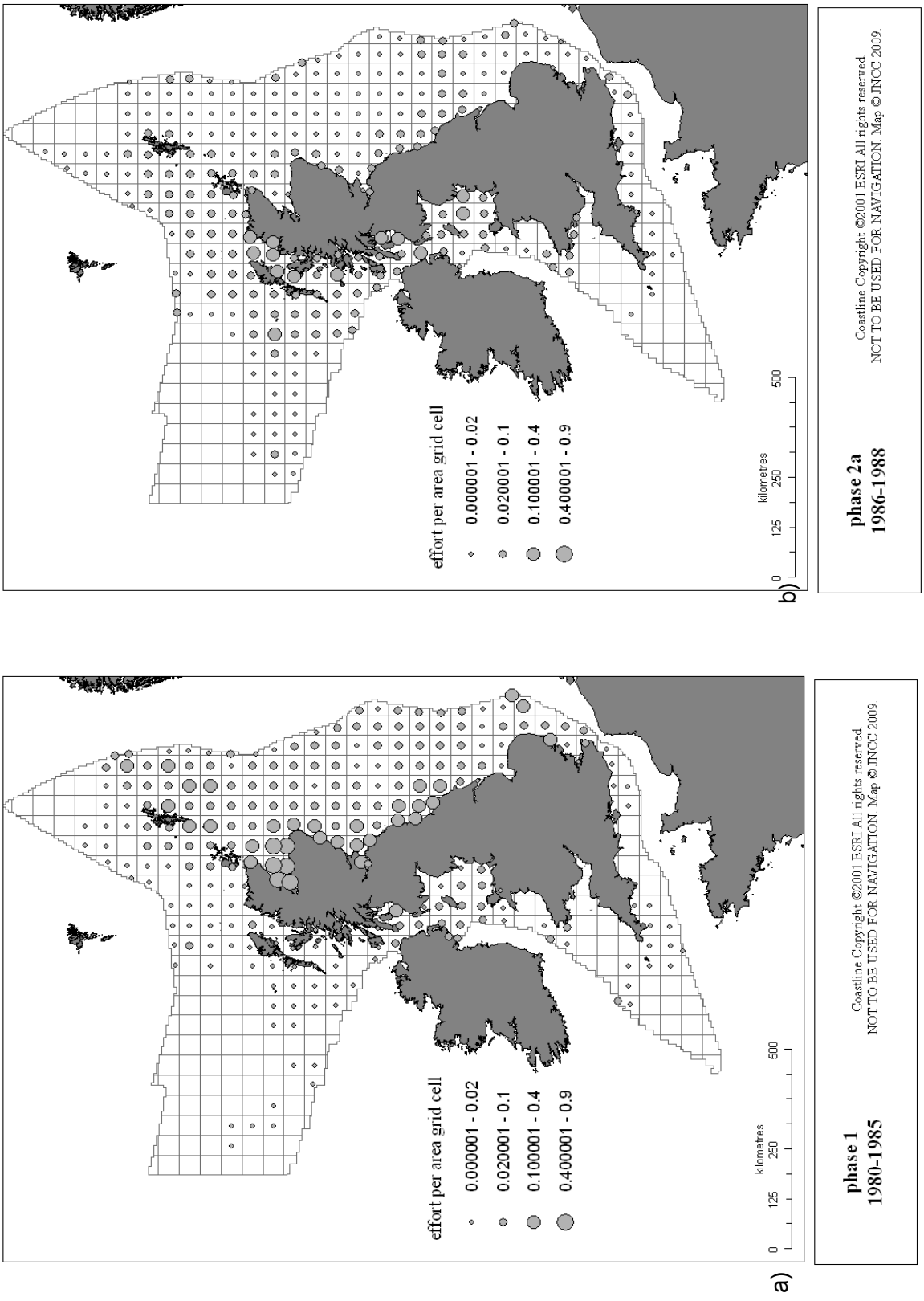


Figure 6. Maps of effort during phase 1 (1980-1985, a) and during phase 2a (1986-1988, b)

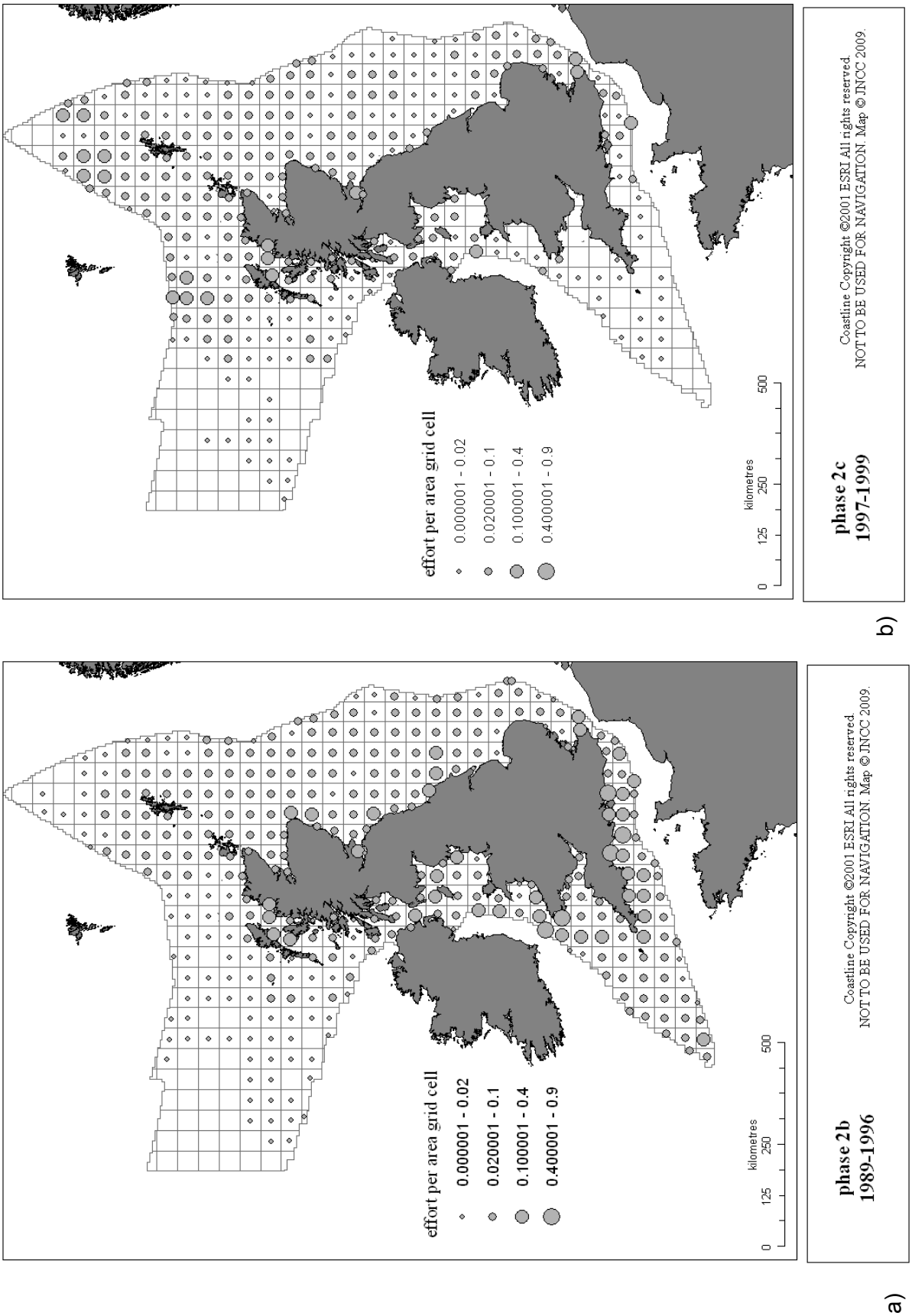


Figure 7. Maps of effort during phase 2b (1989-1996, a) and during phase 2c (1997-19999, b).

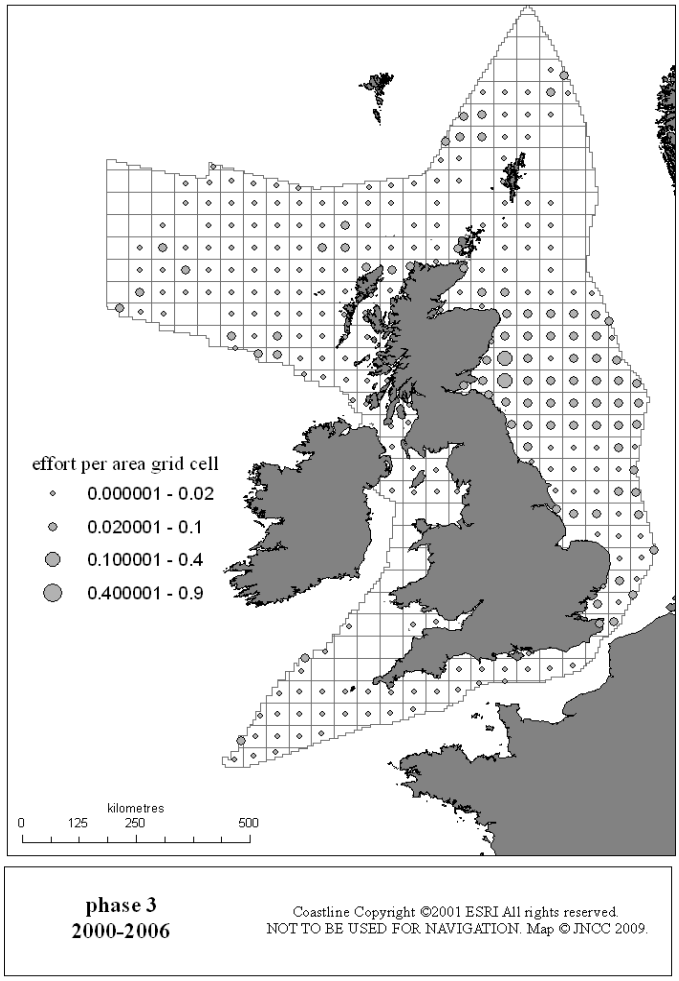


Figure 8. Maps of effort during phase 3 (2000-2006).

The graphs of Figure 5 and the maps of Figure 6 - Figure 8 demonstrate the differences in sampling effort over time at the different regions. It is difficult to say how much sampling effort is necessary to produce maps reliable enough for our purpose, however, zero sampling effort is definitely a problem and areas suitable for SPA designation might have been missed. Although the maps and graphs will look differently if different time periods or spatial scales are used, they give an indication of regions with zero sampling effort. Areas with no sampling effort are:

1. large parts of the north-west of the British Fishery Limit during all times;
2. the northern tip of the British Fishery Limit during all times;
3. the area to the west of the English Channel, before 1989 and after 1996;
4. Cardigan Bay and the area in and around Bristol Channel, before 1989 and after 1996;
5. Liverpool Bay after 1997;
6. varying parts of the English channel around Lyme Bay, before 1989 and between 1997-1999;
7. areas to the east and west of Shetland and to the north of the Orkney Islands, after 2000.

Because of their large size, areas 1-4 are of particular concern and special attention should be paid to these regions to determine if data from other sources might be helpful for hotspot detection, or additional sampling might be necessary to prevent suitable areas being missed in these locations.

Good sampling effort took place in the North Sea region, in the Irish Sea and along the West coast of Scotland during most times.

Figure 9 shows areas where data were collected over less than 3 years, so no hotspot in these areas would be able to meet the criterion of regularity. Most of them are far offshore, but there is also a large area at Cardigan Bay. In all these areas further sampling effort would be necessary to be able to identify possible SPAs.

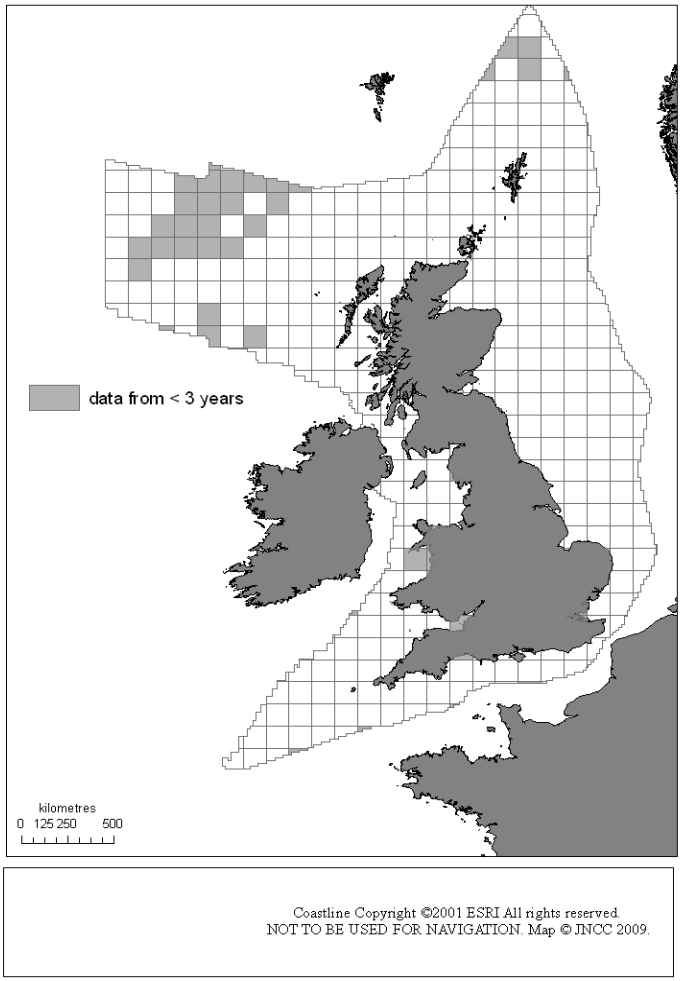


Figure 9. Map of areas with data from less than 3 years.

2.1.6 Data preparation

i Exclusion of data

Data collected during unfavourable weather conditions were excluded because data quality was potentially compromised. Unfavourable weather conditions were subjectively defined as any sea state greater than force 6 on the Beaufort Scale and as visibility less than 1km.

Some seabirds are often found to be associated with fishing vessels because they scavenge on the fisheries waste and discards thrown overboard during fishing activities (Hudson and Furness 1988a, Garthe 1993, Camphuysen *et al* 1995). Observations of birds that were recorded as being associated with the observation platform were omitted to avoid arbitrarily increased seabird numbers and double counts. In spite of this measure, numbers of species known as ship followers may be increased due to the presence of the observation platform as ship following individuals are not always unambiguously identifiable as such.

Besides this potential systematic error during the seabird counts, it may be asked if attraction to fishing vessels has the potential to govern seabird distribution on a larger scale. Currently, we cannot distinguish if seabirds accumulate within an area because there is an abundance of fish, or because there are many fishing vessels as a response to the abundance of fish. It is therefore impossible to determine if some of the seabird hotspots occur as a response to the fishing activities in a particular region.

ii Decline of detection probability of birds at increasing distances

When surveying seabirds along a transect line, distant birds sitting on the water are easier to overlook compared with birds sitting closer to the survey platform. Undetected individuals could lead to an underestimation of bird densities. To account for this bias, Buckland *et al* (2001) developed “Distance sampling” to achieve more accurate abundance estimates of populations. This technique, however, needs a distance specified for each observation. As about one third of the ESAS data used do not have this information, instead ‘detection-correction-factors’ were calculated for each species and applied to the raw data. Like Distance sampling they correct for undetected individuals in a distance, but they are calculated with help of data with distance information, and generically applied to data both with and without distance information.

For the calculation of these factors, all data for birds on the water of a particular species were summed, separately by distance band (A = 0-50m, B = 50-100m, C = 100-200m, D = 200-300m). It was assumed that all birds on the water in the first 100m were detected. The detecting-correction-factor is the factor by which the bird density on the water in the first 100m from the observer departs from the overall bird density on the water in the entire transect. The factors (y) were calculated for each species as follows:

$$y = \frac{(x(A) + x(B)) \bullet z}{(x(A) + x(B) + x(C) + x(D))}$$

where x(A) is the sum of birds recorded in distance band A. The factor z is the factor by which the area size of A+B departs from that of A+B+C+D. The total sum of birds on the water in the (entire) transect are multiplied by y (Stone *et al* 1995). Detection correction factors do not apply to flying individuals, only for those sitting on the water.

Both detection correction factors and Distance sampling assume that in the distance bands closest to the observer 100% of all individuals were detected. This might not be realistic for inconspicuous species, but to identify correct detection rates a double platform approach during data collection would have been needed, which was not supported by the available

data. Hence, the detection rate of 100% at band A and B was used in this analysis and we recognise that this would lead to a conservative population estimate for inconspicuous species, such as Atlantic puffins on the water.

Detection-correction-factors varied according to sea state, numbers of observers and the use of binoculars. Since sea state had the largest impact on the correction factors, they were calculated separately for sea state 0 (mirror calm); sea states 1 - 3 (sea with wavelets and few whitecaps); and sea states 4-5 (small to moderate waves with numerous whitecaps).

Factors for correcting detection were not calculated in all cases, either because there were not enough data for the calculation (too few observations), or the data did not show a decreasing detection with distance to observer (distant large flocks were more easily detected than those close to the observer). In these cases, no correction factor was applied, leading to a conservative population estimate for these species (Appendix 1, Table 11). In some cases the correction factors were higher for 200m transects than those calculated for 300m transects. This could be due to ship avoidance, which would be more pronounced in 200m transects.

In the case of seabird assemblages, numbers were the sum of all species, after they were corrected for detection.

2.2 Generation of continuous seabird density surface maps

In order to create continuous seabird density surface maps (a grid surface) from transect data (discrete data points), data were interpolated at locations where no data were collected. Out of a variety of different interpolation techniques, such as inverse distance weighting, kernel density estimation and kriging, kriging was the most suitable; while the other techniques use generically predetermined functions to interpolate values at unknown locations, kriging uses inherent information in the data itself for interpolation and takes therefore the nature of the data into account.

Kriging predicts the value of a variable at an unsampled location by interpolating between known values at neighbouring sampled locations, using the spatial information in the data. Data points in the immediate vicinity were given more weight than those further away, the degree of weighting being determined by the degree of spatial autocorrelations in the data. Kriging not only predicts abundance at unsampled locations, it provides a variance for the estimated values. As a stochastic method, it was therefore preferable to deterministic methods (Isaaks and Srivastava 1989).

2.2.1 Poisson kriging

Seabird data collected from platforms of opportunity are usually heterogeneously distributed and zero inflated (therefore not normally-distributed), which causes problems as one assumption of Ordinary kriging is normally distributed data. Moreover, the necessity to correct for effort, which is needed because survey effort is not evenly distributed, increases the asymmetry of the zero inflated data and increases the variance of the kriging estimates (Monestiez *et al* 2005). Strong asymmetry in the data decreases the detectability of spatial autocorrelation, leading to less precise and smoothed predicted distributions. Increased variances are a sign of an undesirable loss of precision. Poisson kriging is a special form of kriging that overcomes these problems by estimating the weights based on a Poisson distribution instead of a normal distribution. In Poisson kriging, the kriging calculation itself allows for the correction of effort and there is no need to do this correction as an additional step, as with the other kriging methods. As a result, the variance of the kriged values

becomes significantly smaller and the estimated data are more reliable (Monestiez *et al* 2005).

Poisson kriging was applied to data-sets for all target species, regions and seasons. For further details on the method refer to Zuur *et al* (2008). After continuous maps were created for these data-sets, all regions with data for the same species-season were re-amalgamated to create a continuous map covering the entire British Fishery Limit. Where duplicate grid values existed (e.g. where regional maps overlapped) a weighted average was calculated, the weight determined by the kriging variances (Zuur *et al* 2008).

A map was produced for every region and season where a species was seen on more than five occasions. Some of the maps did not cover the entire study area because some species were present in only parts of it.

2.2.2 Rescaling of maps to meet population estimates

Maps could show higher or lower seabird densities than feasible because of the way data were collected, including problems such as unequal sampling effort in time and space, and the possibility of ship-following individuals. To address this, maps were rescaled using data from Barrett *et al* (2006), who estimated total numbers of seabirds in different North Atlantic sea regions. This peer reviewed publication is currently considered as the only recent population estimate available on this scale. The regions most relevant for the rescaling were the International Council for the Exploration of the Sea (ICES) regions IV (a-c; North Sea), VII d-e (Channel) and VI (Western UK, Figure 10).

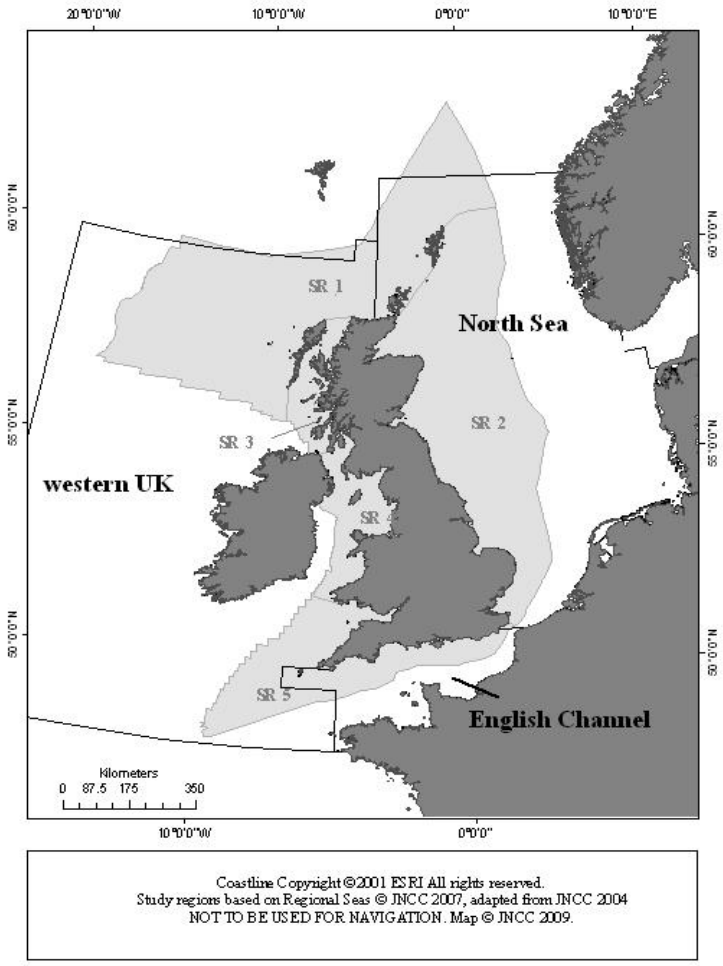


Figure 10. ICES regions used to rescale some of the seabird density surface maps in order to meet the ICES population estimates. The area of interest is shaded in light grey.

A few small parts of the study area at the north and the northwest were not covered by these regions and were within the much larger Nordic ICES areas. In order not to distort the data, these sections were ignored during the calculation of ICES-rescaling-factors, although the resulting factors were applied within the small parts.

To calculate a rescaling factor, population estimates from the ICES analysis were compared with those from the kriged maps. For this, the ICES estimates had to be adjusted proportionally to the different area size covered by the kriged maps, and had to be adjusted to the different time periods covered by the kriged maps. For this, weighted means were applied, e.g. if a "kriged-season" was composed of two summer and one autumn months of the ICES estimates, it was calculated as ((2 x summer estimate)+(1 x autumn estimate))/3). The rescaling factor was the ratio between the kriged population estimate and the adjusted ICES population estimate and could be used to modify the kriged population estimate to an assumed level of the ICES population estimate.

The ICES-rescaling-factors were calculated for each species-season maps and the assemblage maps during winter and summer (Appendix I, Table 12). For the assemblage map of the breeding season, the ICES-rescaled single-species maps of breeding species were added up. The rescaling factors were applied with five species: for northern fulmar, northern gannet, great skua and great black-backed gull during breeding and wintering

periods; and kittiwake during winter. These species were known to be attracted to ships and total numbers obtained from the kriged maps were typically larger than those estimated by Barrett *et al* (2006).

Barrett *et al* (2006) did not provide population estimates for all species of interest, such as many shearwater species, European storm-petrel, pomarine and Arctic skua Mediterranean gull, little gull, Iceland gull, glaucous gull and little auk. Population estimates other than ICES estimates were not available for at-sea populations, so these species could not be rescaled.

2.3 Identification and delineation of seabird concentrations

Several techniques for the delineation of seabird concentrations were considered. To identify the location of consistently high bird densities over a larger area, the use of the local Getis-Ord Gi* statistic was considered to be the most appropriate method, as it takes both into account, the number of birds at a locations and how clustered this value is. Gi* identifies therefore not only areas with high numbers, but areas with particularly aggregated high numbers.

2.3.1 Local Getis-Ord Gi*

Local Getis-Ord Gi* belongs to the group of local indicators of spatial association (LISAs, Anselin 1995). The local Getis-Ord Gi* statistic is a ratio between the values of a variable within a defined radius around a central location and the values of this variable in the entire study area, assigned to the central location. It is therefore a measure of how high and clustered values are. Local Getis-Ord Gi* is calculated for every data point on a map. The output is a map of Gi*s and describes the spatial distribution of areas with more or less high and clustered values.

The radius for the calculation was 60km since this agreed with the majority (48 out of 56 cases) of maximum radii of autocorrelations identified in the kriging analysis. Species and seasons where a different maximum distance for autocorrelation was identified were Cory's shearwater during summer (31,000km), great shearwater during summer (20,000km), sooty shearwater during summer (42,000km), Manx shearwater during their additional season (20,000km), Pomarine skua during their additional season 1 (20,000km), herring gull during winter (20,000km), Iceland gull during winter (20,000km) and Sandwich tern during winter (20,000km). With the exception of sooty shearwater during summer, in all these cases no model variogram could be fitted because the data showed no clear autocorrelation pattern. The application of a generic threshold is therefore feasible.

2.3.2 Thresholds

In order to delineate areas of high and clustered bird densities, the locations with the highest Getis-Ord Gi*values were chosen. Two threshold values were used and compared: the top 5% and the top 1% of all Getis-Ord Gi*on a map. Only those Getis-Ord Gi*s at locations with seabird densities >0 birds/km^2 were taken into consideration, thus the size of the area defined by the highest n% of Gi*s varies between density surface maps. It is important to notice that these thresholds represent only two options out of a large range of possible thresholds. They were chosen to indicate how possible SPAs might look if thresholds in this range are used, however, we don't want to imply that one or the other should be used. Because the choice of a threshold has a large effect on the number and size of seabird hotspots identified, two thresholds were chosen, compared and evaluated (see Discussion).

2.4 Application of the UK SPA selection guidelines

The seabird hotspots identified in the preceding analytical steps were assessed against the UK SPA selection guidelines (Stroud *et al* 2001). The guidelines advise that SPA selection should be determined in two stages.

Stage 1: (considered in this report) is intended to identify areas that are likely to qualify for SPA status on the basis of threshold populations, or other ecological considerations.
Stage 2: (not considered in this report) is intended to consider locations identified at Stage 1 as well as other potentially important areas to select the most suitable areas.

An area may be considered under any one of four components of Stage 1:

Stage 1.1 Numbers of species listed on Annex I of the EU Birds Directive (EEC 1979) should exceed 1% of the agreed Great Britain (GB) (or if relevant the all Ireland) population for the species on a regular basis.

Stage 1.2 For migratory species not listed on Annex I of the EU Birds Directive, numbers at a site should exceed 1% of the agreed biogeographic population for the species on a regular basis.

Stage 1.3 For waterbird species assemblages, more than 20,000 waterbirds (as defined by the Ramsar Committee), of at least two species, should occur regularly at a site.

Stage 1.4 Finally, where the application of stages 1.1-1.3 does not identify an adequate suite of areas, sites may be selected if they satisfy one or more of various ecological criteria listed under Stage 2 (e.g. by virtue of population size and density, by contributing to species range, etc).

Population estimates for assessment at stage 1.1 and 1.2 of the guidelines are determined by the Avian Population Estimates Panel (APEP). National population estimates were defined by Baker *et al* (2006). During the breeding season, the population was given as the numbers of pairs. These were converted into numbers of individuals by multiplying the numbers of breeding pairs by 1.5, the method applied by Wetlands International (2006). For Cory's shearwater and little gull no national population could be determined since these species do not breed in the UK. For these species a default minimum number of 50 individuals was applied.

Where possible population estimates for biogeographic populations were obtained from Waterbird Population Estimates (WPE, Wetlands International 2006). If numbers were not available then a draft of *Report on the Conservation Status of Migratory Waterbirds in the Agreement Area by Wetlands International* (RCS) was consulted (for long-tailed skua, great skua, razorbill, little auk and Atlantic puffin). In the cases of Manx shearwater and Arctic skua, numbers were obtained from Mitchell *et al* (2004) and numbers of pairs were converted into numbers of individuals by the method applied in Wetlands International (breeding individuals multiplied by 1.5, 2006). For northern gannet the population estimate given by Mitchell *et al* (2004) was used, with updated numbers for the UK (Wanless 2005) and for Norway (Barrett 2006). As RCS supplied a range for the biogeographic population of common guillemots, numbers were used from Mitchell *et al* (2004) with updated Norwegian numbers (Barrett 2006). For great shearwater population estimates, Rowland (2006) and Woods and Woods (1997) were consulted. Population estimates for pomarine skua were obtained from Furness (1996), with numbers of pairs converted into numbers of individuals by the method applied in Wetlands International (2006).

If ranges were reported rather than actual numbers, the arithmetical mean was used in assessment, though the use of a geometric mean would have not given any different result in terms of qualification of areas. In the case of population estimates for more than one subspecies, we used the larger one in agreement with the RAMSAR (1971) Policy. We set an upper limit of 20,000 individuals as the maximum 1% value in agreement with RAMSAR (1971). Thresholds were rounded according to the standards given in Ramsar Convention 6 (Wetlands International 2006).

2.4.1 Regularity

The definition of regularity for aggregations of birds is given by Stroud *et al* (2001), where "the requisite number of birds is known to have occurred in two thirds of the seasons for which adequate data are available". This definition is in accordance with the RAMSAR definition of regular occurrence. Since all data from 25 years were pooled to create one density surface map, it was not possible to assess population sizes within each hotspot in different years to apply the Ramsar definition. To overcome this problem we had to depart from the RAMSAR definition: raw data from each year were split into those data points within a particular area and data points outwith this or any other area. Every hotspot holding qualifying numbers was assessed for regularity. Whenever enough data points per subsample were available (4 data points), a two-tailed Mann-Whitney U test (Mann and Whitney 1947) was conducted. A significant result suggests that data points within an area were different from the data points outwith areas. If the median of subsamples within an area was significantly higher than the median of data outwith areas, this was interpreted as a hotspot being present in that year. If the median was significantly higher during (1) more than three years, and (2) at least two out of three seasons with sufficient data for the test, the hotspot was defined as a regularly occurring hotspot. Because we conducted repeated testing for significance for each area, a Bonferroni-correction of the α-level was applied (Holm 1979). As there is a minimum number of data points required for this test, areas with particularly low sampling effort might not be able to qualify at all because regular occurrence cannot be shown.

Of the hotspots based on top 1% of Getis-Ord Gi* which meet the criterion of minimum numbers, another three would have become possible SPAs if Bonferroni would not have been applied: one area for northern fulmar during the breeding season, one for Manx shearwater during the breeding season, and one for all species during breeding. Eight hotspots based on top 5% of Getis-Ord Gi* dropped out because of the application of the Bonferroni-correction: one area for northern fulmar during winter, one for lesser black-backed gull during winter, one for Atlantic puffin during breeding, one for northern gannet during breeding, two for common guillemot during winter, and one each for all species during summer and during breeding.

The use of a Bonferroni-correction can be regarded as a conservative approach to deal with repeated sampling, which means that fewer hotspots meet our criterion of regularity with the use of a Bonferroni-correction than without. On the other hand, no correction of the α-level would result in areas that erroneously meet the criterion of regularity. The conservative approach of the application of the Bonferroni-correction is therefore preferable.

2.4.2 Single species areas

Population thresholds applied to single species areas for assessment at stages 1.1 and 1.2 are given in (Appendix 1,Table 13). For each hotspot identified the total number of seabirds contained was calculated from the kriged density surfaces by summing the grid cells within each hotspot and comparing these with the thresholds.

2.4.3 Seabird assemblages

To assess the number of individuals contained in the hotspots identified on the assemblage density surface maps, numbers from single-species density surface maps were summed up. For winter and summer, these numbers had to be calculated as weighted means because seasons of single-species density surface maps did not necessarily correspond to those of the assemblage density surface maps (a similar calculation as in 2.2.2 for rescaling of the density surface maps was used). For the breeding season, all single-species density surface maps during breeding were summed up.

Significant concentrations of all seabird species that held more than 20,000 individuals, with at least two species present, were assessed for regularity using the procedure described above (section 2.4.1).

2.5 Survey effort and sufficiency of sightings

In order to assess the sufficiency of sampling effort, three features were considered: (1) to determine differences in observer effort within the entire British Fishery Limit a map was created, displaying the varying amounts of effort; (2) to determine how many seabird observations actually contributed to the identification of each possible SPA, the number of grid cells with seabird observations was counted for each hotspot qualifying at Stages 1.1 - 1.3 of the UK SPA selection guidelines, and the proportion between gridcells with observations and gridcells without observations was calculated; and (3) it was assessed how many hotspots failed to meet the UK SPA selection guidelines because there were insufficient data to establish regularity, as defined in this report.

3 Results

3.1 Seabird density surface maps

As spatial autocorrelation was detected in most of the species-season data-sets; it was therefore possible to use Poisson kriging as a spatial interpolation technique to generate continuous seabird density surface maps for 32 species and for seabird assemblages. For each species and assemblage, surface density maps for one or more seasons were prepared, resulting in a total of 57 density surface maps (Appendix 2, seabird density surface maps).

Poisson kriging produced low variances, with maximum standard errors of less than 1 bird/km^2. Highest variances were usually confined to the outer limits of the kriged maps, which were not used for further analyses. The precision of the maps was therefore good.

3.2 Hotspots and the application of the UK SPA selection guidelines

3.2.1 Hotspots and areas qualifying at Stages 1.1 - 1.3

All 57 maps held a number of hotspots, regardless if the 5% or the 1% threshold was chosen. Because the Getis-Ord statistic was calculated on the maps with a 100 km buffer, hotspots did not necessarily fall into the British Fishery Limit (e.g. little gull during winter).

In a two step process the UK SPA selection guidelines were applied to all hotspots, testing first if a hotspot held qualifying proportions of the population, and second if the hotspot was used on a regular basis. A large proportion of hotspots did not fulfil one or the other of our criteria and these were therefore not considered further. The number of hotspots for each species and season is presented in Table 2. In some cases potential hotspots failed to qualify only by a narrow margin; their potential interest 33.2.2(i) and 4.2.1).

Table 2. Total number of hotspots within the British Fishery Limit, based on the application of an upper 5% and 1% Getis-Ord Gi* threshold (see text). The table shows the numbers of hotspots for each seabird species after applying the minimum number criterion, and the number of hotspots qualifying after applying the minimum number criterion in combination with the criterion of regularity.

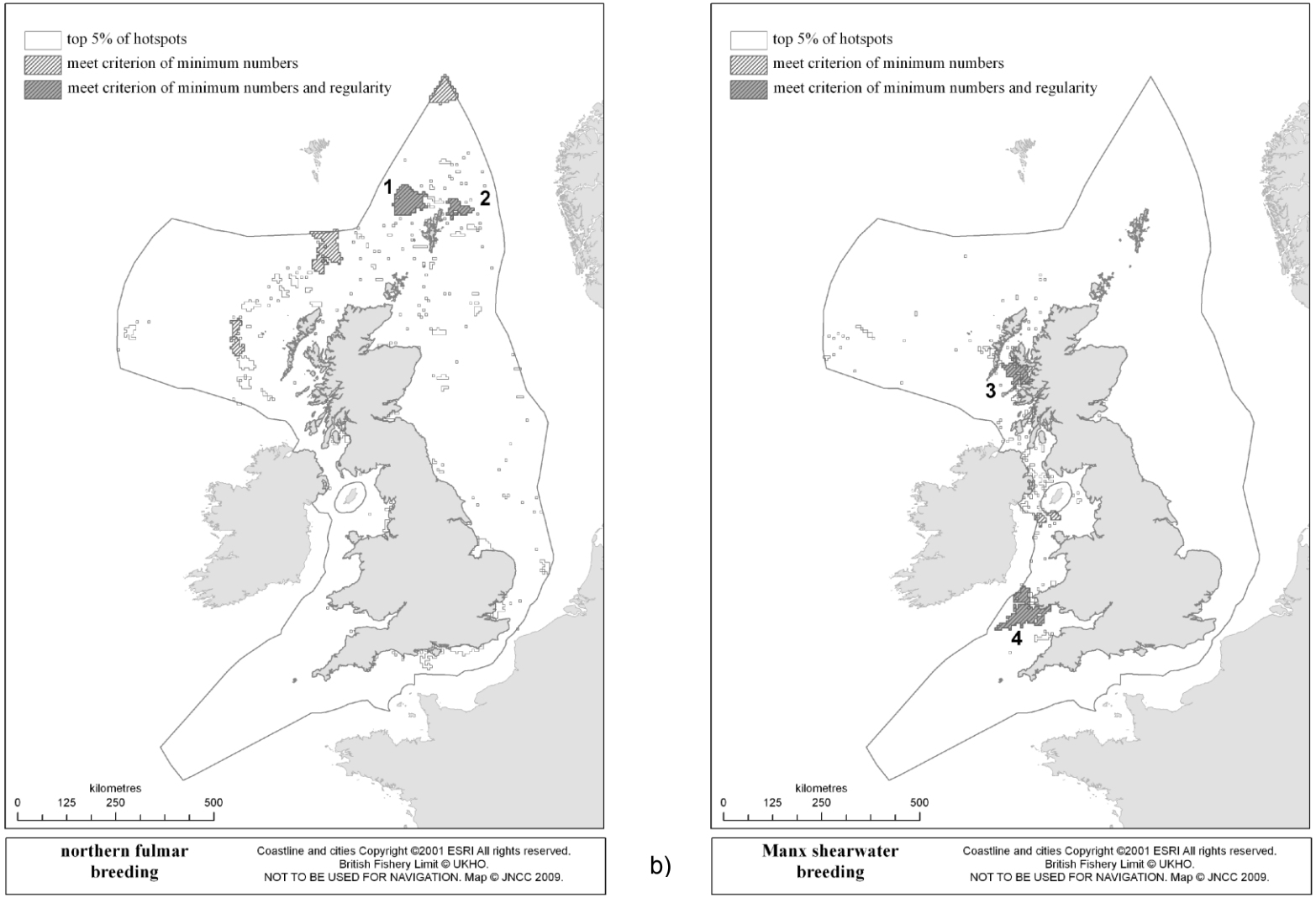
Species		Based on top 5% Getis-Ord Gi*					Based on top 1% Getis-Ord Gi*				
		Number of hotspots	hotspots qualifying by our minimum number criterion	hotspots qualifying by our minimum number criterion and our regularity criterion	hotspots not qualifying by our regularity criterion because of too few data	hotspots not qualifying by our regularity criterion because test result is not significant	Number of hotspots	hotspots qualifying by our minimum number criterion	hotspots qualifying by our minimum number criterion and our regularity criterion	hotspots not qualifying by our regularity criterion because of too few data	hotspots not qualifying by our regularity criterion because result is not significant
northern fulmar	breeding	151	5	2	1	2	64	3	-	1	2
	winter	162	6	-	1	5	64	3	-	1	2
Cory's shearwater	summer	17	1	-	1	-	8	-	-	-	-
great shearwater	summer	29	-	-	-	-	4	-	-	-	-
sooty shearwater	summer	116	-	-	-	-	23	-	-	-	-
Manx shearwater	breeding	131	4	2	1	1	49	3	2	-	1
	additional season	1	-	-	-	-	-	-	-	-	-
European storm-petrel	breeding	114	6	-	3	3	20	5	-	4	1
Leach's Storm-petrel	breeding	27	1	1	-	-	3	2	-	2	-
northern gannet	breeding	204	3	2	-	1	80	1	1	-	-
	winter	76	1	-	-	1	26	1	-	-	1
great cormorant	breeding	37	-	-	-	-	8	-	-	-	-
	winter	45	1	1	-	1	7	-	-	-	-
European shag	breeding	47	4	1	3	-	16	3	1	-	2
	winter	51	3	2	1	-	21	2	1	1	-
pomarine skua	additional season 1	52	-	-	-	-	18	-	-	-	-
	additional season 2	44	-	-	-	-	25	-	-	-	-
Arctic skua	breeding	253	-	-	-	-	58	-	-	-	-
	additional season	90	-	-	-	-	32	-	-	-	-
long-tailed skua	additional season 1	4	-	-	-	-	3	-	-	-	-
	additional season 2	2	-	-	-	-	1	-	-	-	-
great skua	breeding	84	3	2	-	1	38	1	1	-	-
	winter	269	1	-	-	1	89	1	-	1	-
black-legged kittiwake	breeding	329	2	2	-	-	130	-	-	-	-
	winter	212	2	-	-	2	97	1	-	-	1
black-headed gull	breeding	78	-	-	-	-	19	-	-	-	-
	winter	38	-	-	-	-	12	-	-	-	-
little gull	breeding	3	1	-	-	1	1	1	-	1	-
	winter	2	-	-	-	-	-	-	-	-	-
	additional season	20	11	-	6	5	8	8	-	7	1
great black-backed gull	breeding	42	1	-	-	1	9	-	-	-	-
	winter	149	1	-	-	1	49	1	-	-	1
Mediterranean gull	all year	2	-	-	-	-	-	-	-	-	-
common gull	breeding	132	-	-	-	-	40	-	-	-	-
	winter	72	-	-	-	-	32	-	-	-	-

Table 2 (cont). Total number of hotspots within the British Fishery Limit, based on the application of an upper 5% and 1% Getis-Ord Gi* threshold (see text). The table shows the numbers of hotspots of hotspots for each seabird species after applying the minimum number criterion, and the number of hotspots qualifying after applying the minimum number criterion in combination with the criterion of regularity.

Species		Based on top 5% Getis-Ord Gi*					Based on top 1% Getis-Ord Gi*				
		Number of hotspots	hotspots qualifying by our minimum number criterion	hotspots qualifying by our minimum number criterion and our regularity criterion	hotspots not qualifying by our regularity criterion because of too few data	hotspots not qualifying by our regularity criterion because test result is not significant	Number of hotspots	hotspots qualifying by our minimum number criterion	hotspots qualifying by our minimum number criterion and our regularity criterion	hotspots not qualifying by our regularity criterion because of too few data	hotspots not qualifying by our regularity criterion because result is not significant
lesser black-backed gull	breeding	164	3	-	3	-	54	-	-	-	-
	winter	56	5	1	1	3	33	2	-	1	1
herring gull	breeding	152	-	-	-	-	57	2	-	2	-
	winter	141	1	-	-	1	66	1	-	-	1
Iceland gull	winter	16	-	-	-	-	6	-	-	-	-
glaucous gull	winter	44	-	-	-	-	24	-	-	-	-
	additional season 2	2	-	-	-	-	1	-	-	-	-
Sandwich tern	breeding	21	-	-	-	-	6	-	-	-	-
	winter	3	-	-	-	-	-	-	-	-	-
common tern	breeding	42	-	-	-	-	7	-	-	-	-
Arctic tern	breeding	193	-	-	-	-	69	-	-	-	-
common guillemot	breeding	132	5	4	1	-	66	5	1	1	3
	additional season	181	8	1	-	7	63	1	-	-	1
	winter	189	3	1	-	2	93	-	-	-	-
razorbill	breeding	90	-	-	-	-	46	-	-	-	-
	additional season	75	-	-	-	-	30	-	-	-	-
	winter	133	-	-	-	-	34	-	-	-	-
little auk	winter	76	9	-	8	1	51	5	-	5	-
Atlantic puffin	breeding	104	4	3	-	1	43	1	1	-	-
	winter	88	1	1	-	-	32	-	-	-	-
All species	breeding	440	13	-	-	13	136	8	-	2	6
	summer	291	13	2	4	7	103	1	-	-	1
	winter	297	5	-	2	3	128	1	-	1	-
Total		6013	127	28			2201	63	8		

i Areas qualifying based on top 5% of Getis-Ord Gi*

Out of 6013 hotspots based on locations of top 5% Getis-Or Gi*, 28 areas meet the guidelines for SPA selection according to the analyses presented here. Qualifying areas for petrels and shearwaters are shown in Figure 11, for storm-petrels and gannets in Figure 12, for cormorants in Figure 13, for European shag in Figure 14, for skuas in Figures 16-18, for gulls in Figure 15, for auks in Figures 16-18, and for seabird assemblages in Figure 18. An overview of all qualifying areas based on the top 5% Getis-Ord Gi* is given in Figure 19. Each area is marked with a number on the following maps and the corresponding area characteristics are presented in Tables 14-41 shown in Appendix 3.



a) b)

Figure 11. Hotspots identified on density surface maps of a) northern fulmar during breeding (March – July) and b) Manx shearwater during breeding (May – September). All hotspots identified by top 5% Getis-Ord Gi* are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

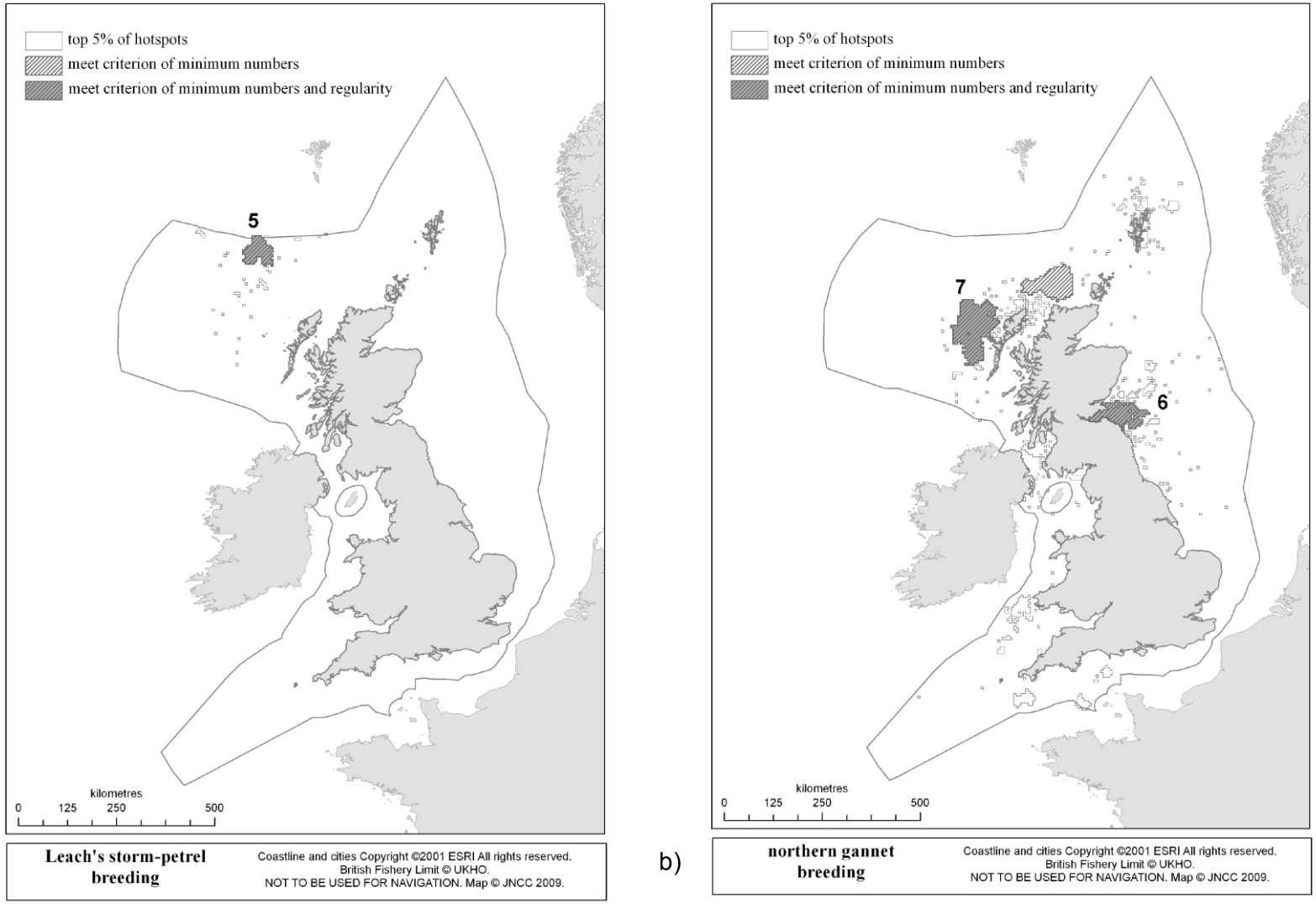


Figure 12. Hotspots identified on density surface maps of a) Leach's storm-petrel during breeding (June – October) and b) northern gannet during breeding (May – September). All hotspots identified by top 5% Getis-Ord Gi* are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

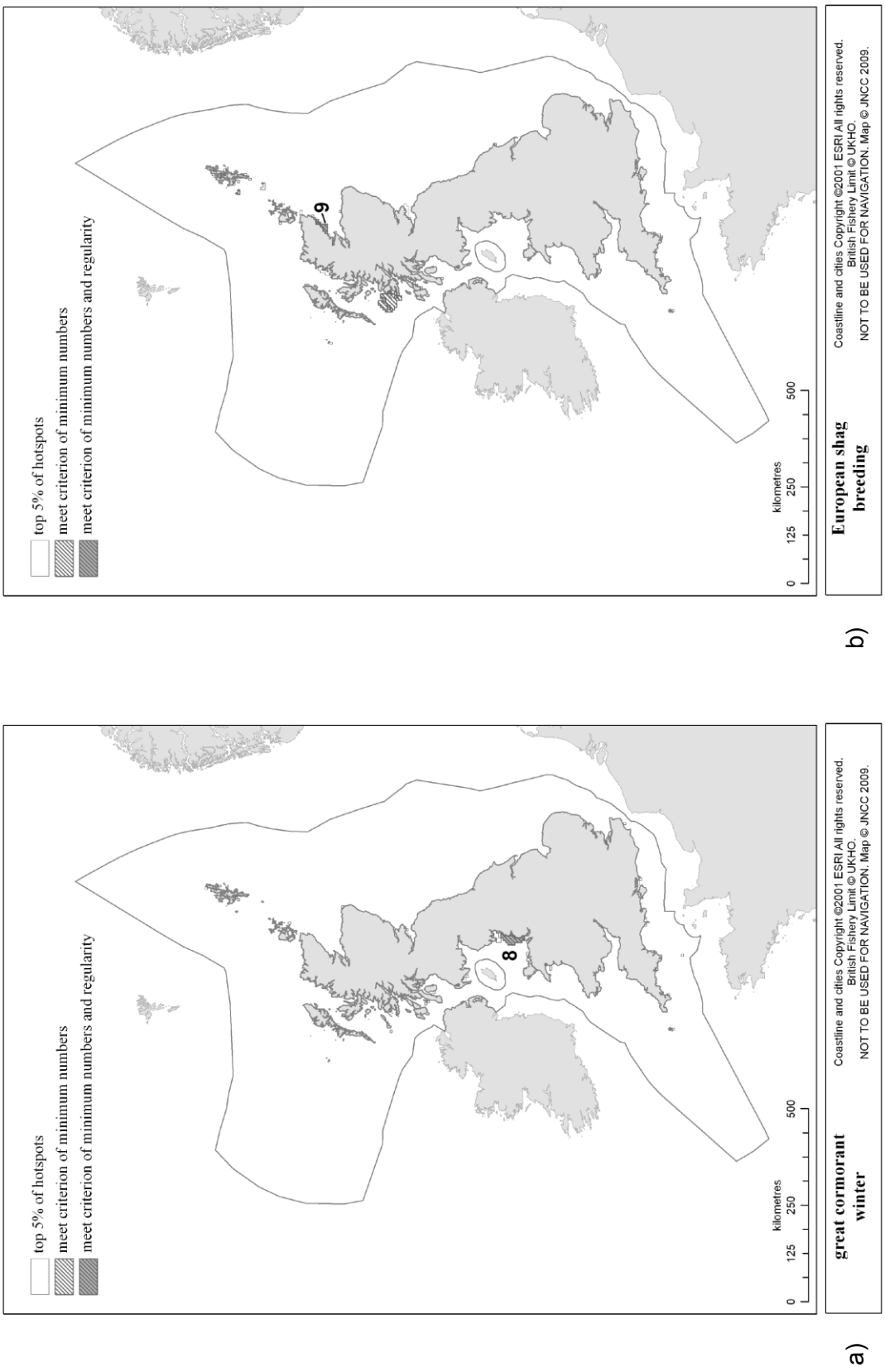


Figure 13. Hotspots identified on density surface maps of a) great cormorant during winter (September – March) and b) European shag during breeding (March – September). All hotspots identified by top 5% Getis-Ord Gi* are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

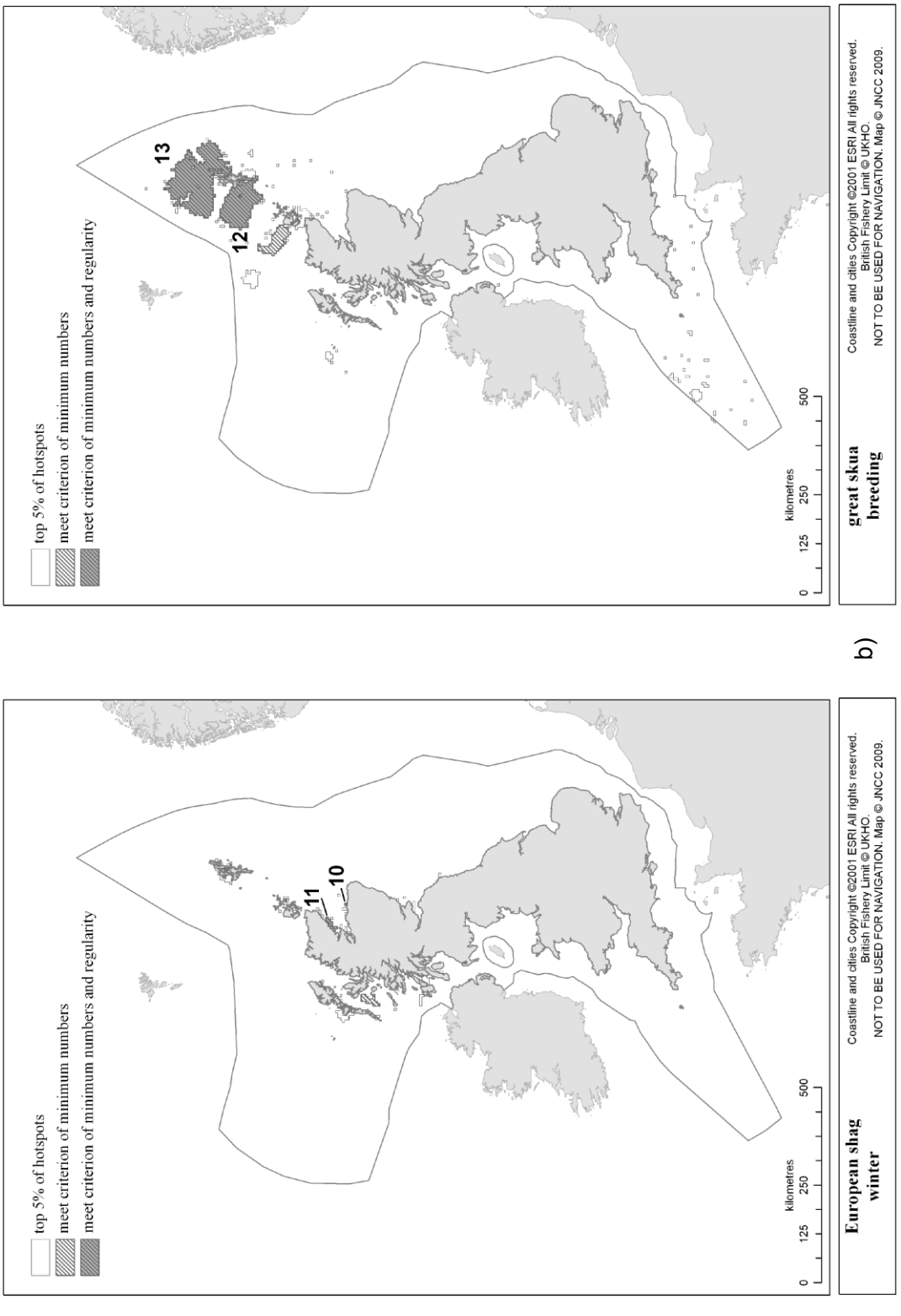


Figure 14. Hotspots identified on density surface maps of a) European shag during winter (October – February) and b) great skua during breeding (May – August). All hotspots identified by top 5% Getis-Ord Gi*are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

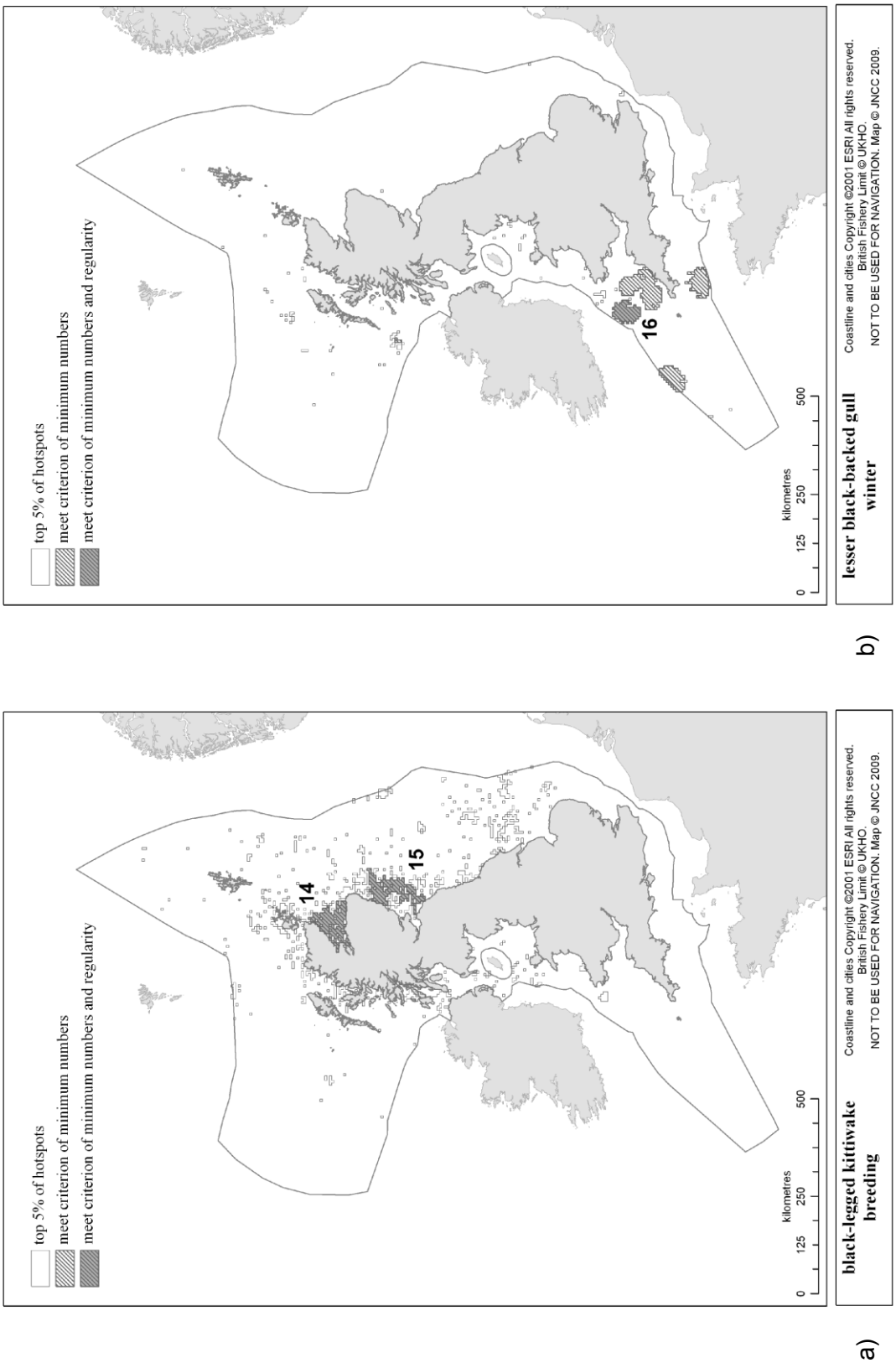


Figure 15. Hotspots identified on density surface maps of a) black-legged kittiwake during breeding (May - September) and b) lesser black-backed gull during winter (September - April). All hotspots identified by top 5% Getis-Ord Gi*are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

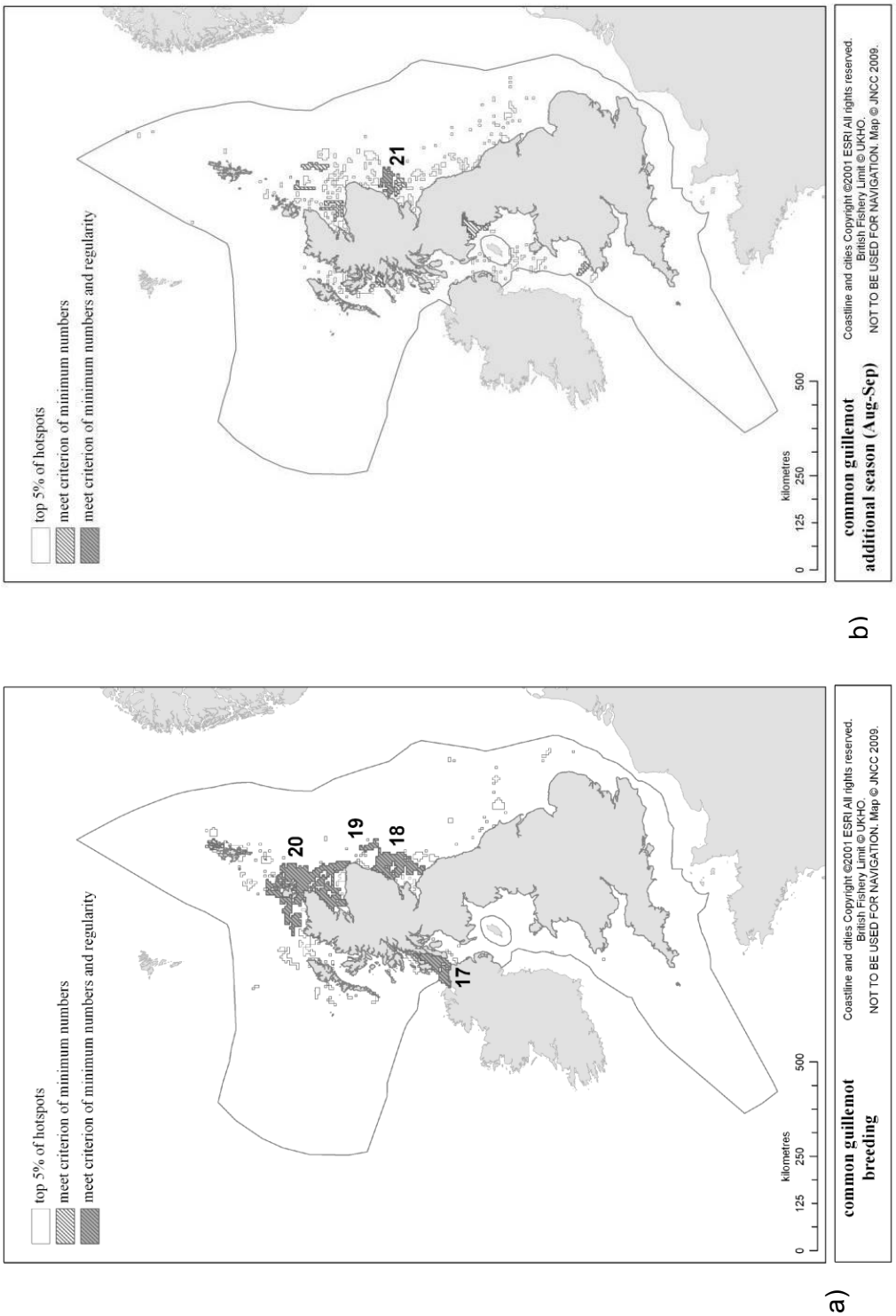


Figure 16. Hotspots identified on density surface maps of a) common guillemot during breeding (May - June) and b) common guillemot during an additional season (August - September). All hotspots identified by top 5% Getis-Ord Gi* are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

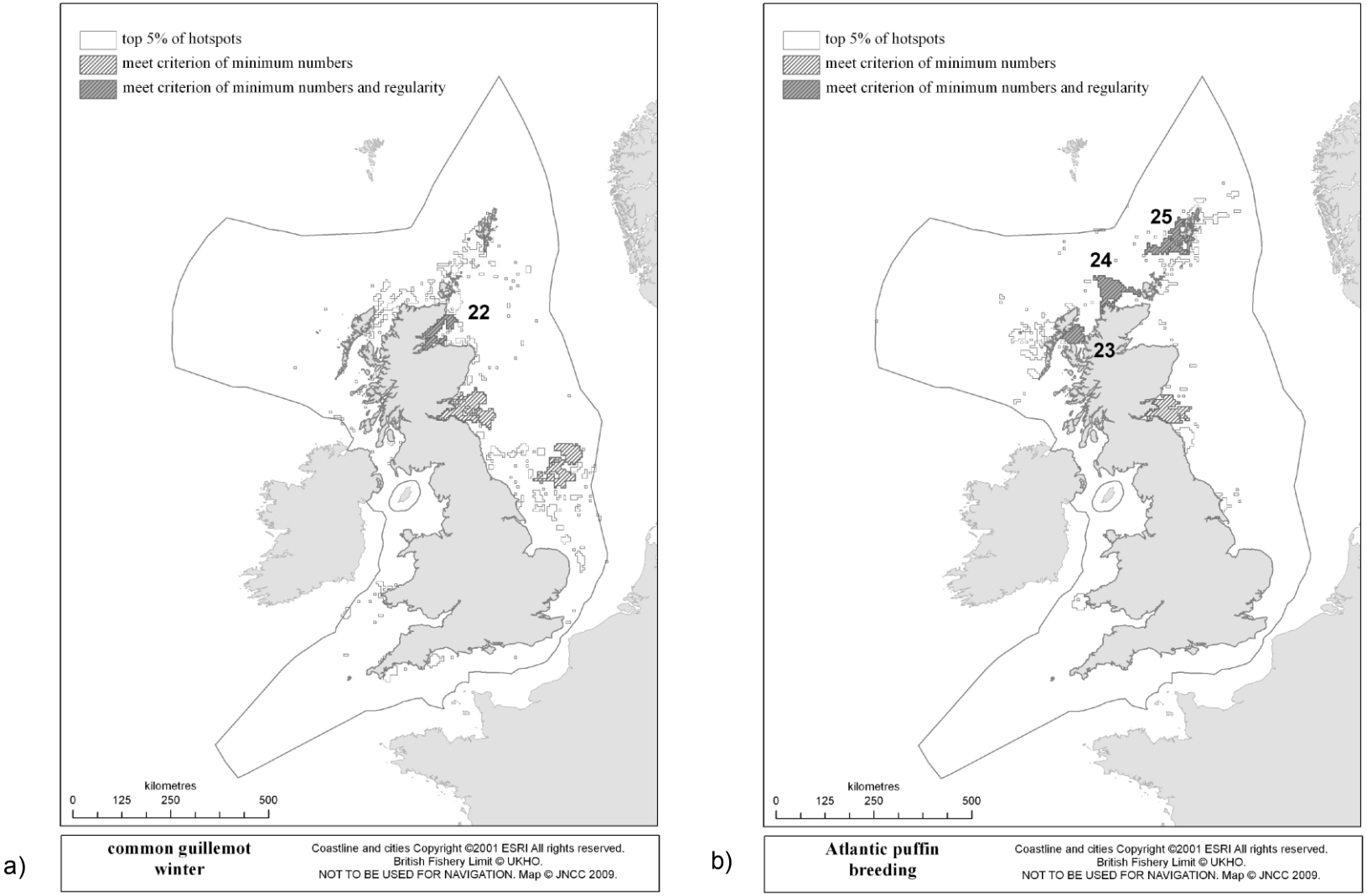


Figure 17. Hotspots identified on density surface maps of a) common guillemot during winter (October – April) and b) Atlantic puffin during breeding (April – June). All hotspots identified by top 5% Getis-Ord Gi* are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

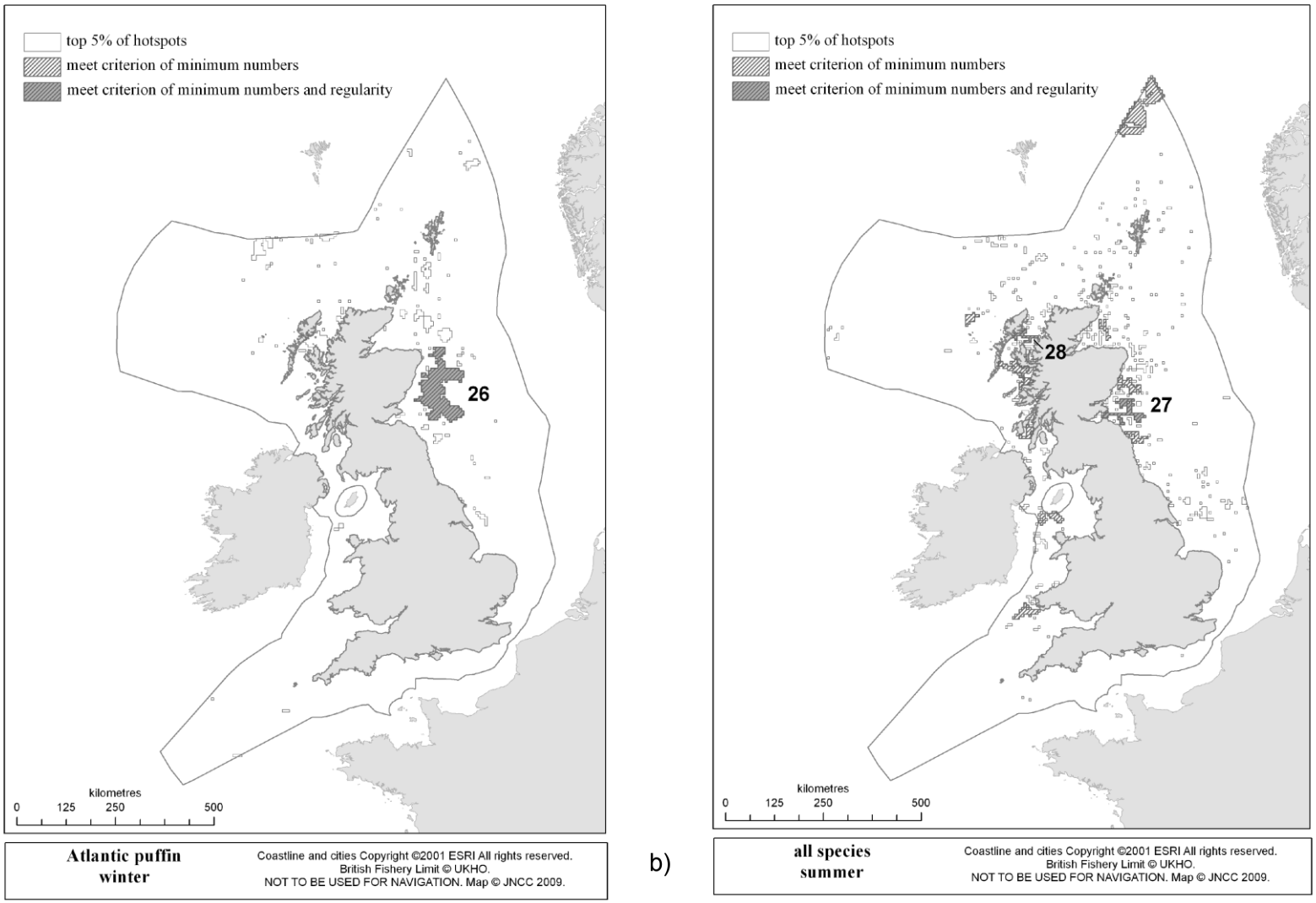


Figure 18. Hotspots identified on density surface maps of a) Atlantic puffin during winter (August – March) and b) all species during summer (July – August). All hotspots identified by top 5% Getis-Ord Gi*are shown. Of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked

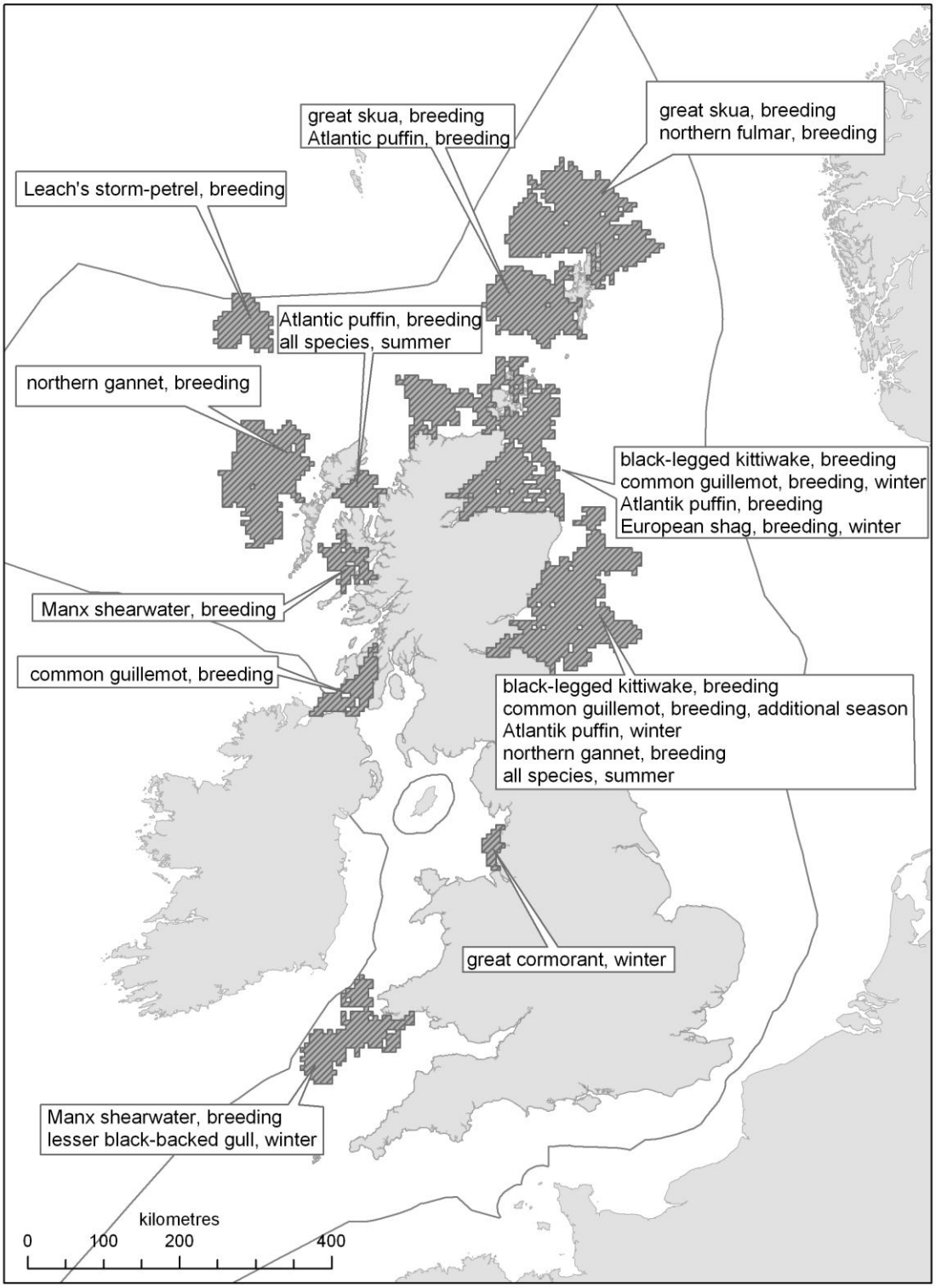


Figure 19. All areas qualifying based on top 5% Getis-Ord Gi.

ii Areas qualifying based on top 1% of Getis-Ord Gi*

Out of 2201 hotspots based on locations of top 1% Getis-Ord Gi*, eight areas meet the guidelines for SPA selection according to the analyses presented here. Qualifying areas for shearwaters and gannets are shown in Figure 20, for cormorants in Figure 21, for skuas in Figure 22, for auks in Figure 22 - Figure 23, and an overview in Figure 24. Each area is marked with a number and area characteristics are presented in Tables 42 - 49, shown in Appendix 3.

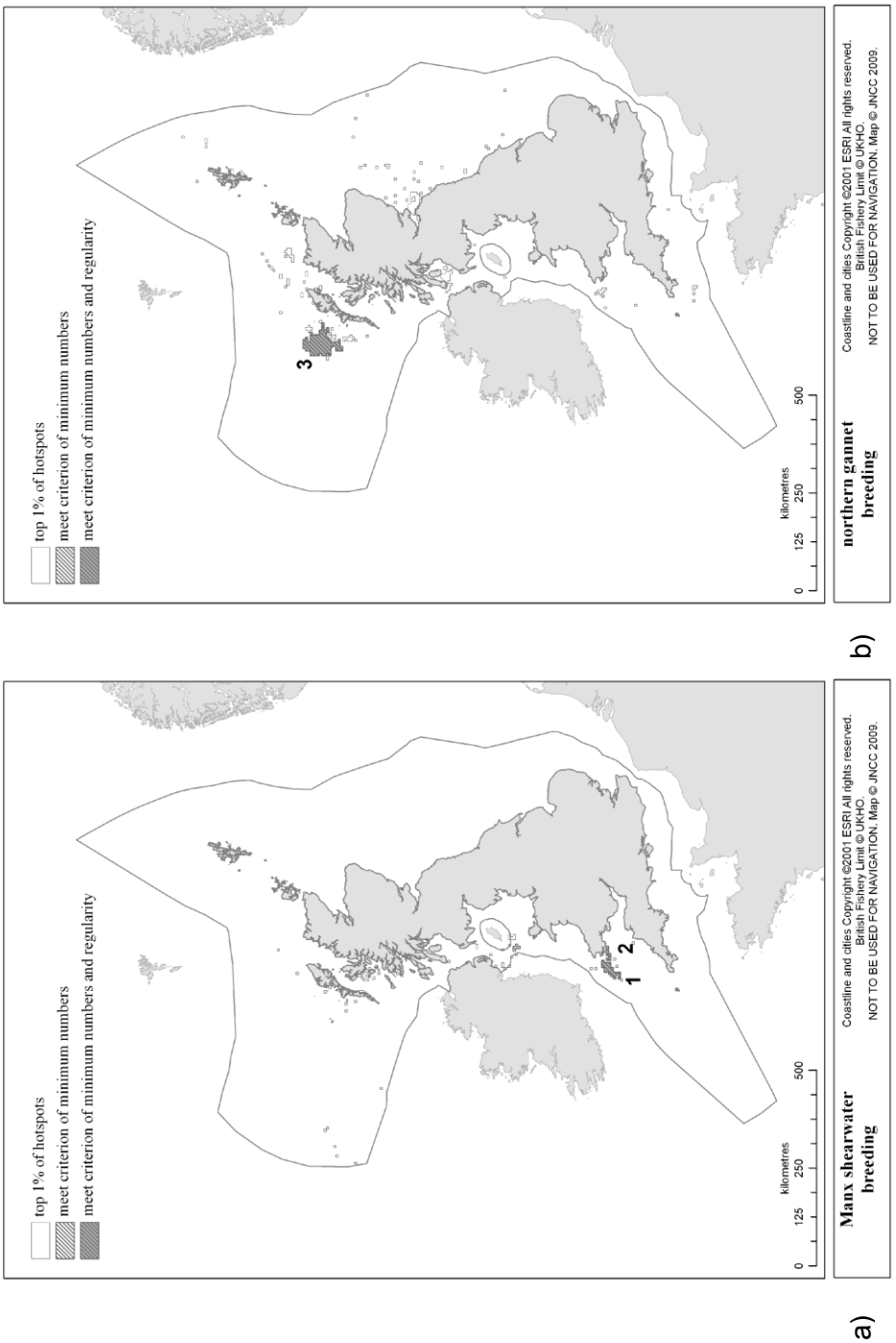


Figure 20. Hotspots identified on density surface maps of a) Manx shearwater during breeding (May – September) and b) northern gannet during breeding (May – September). Given are all hotspots identified by the top 1% of Getis-Ord Gi*; of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

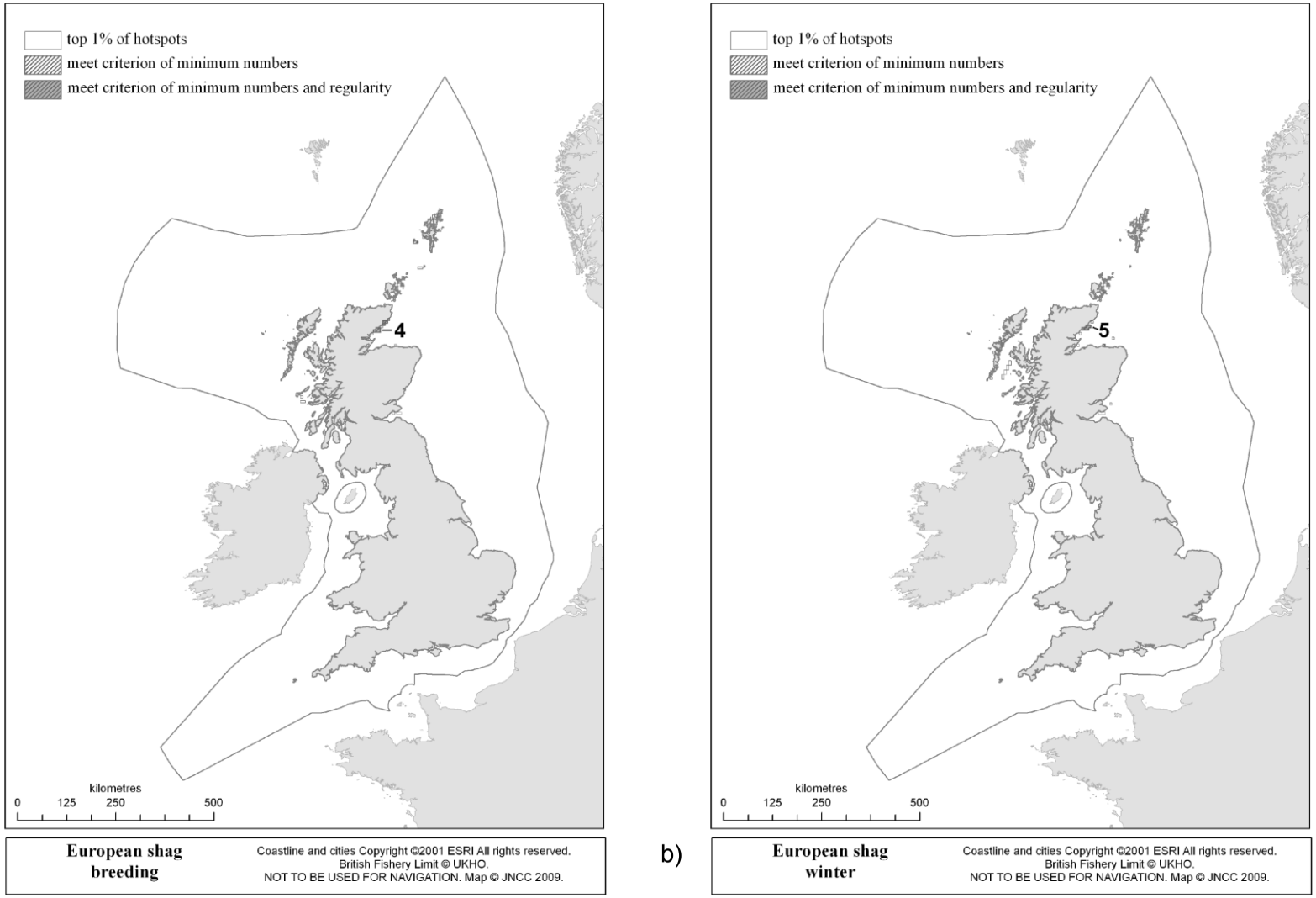


Figure 21. Hotspots identified on density surface maps of a) European shag during breeding (March - September) and b) European shag during winter (October - February). Given are all hotspots identified by the top 1% of Getis-Ord Gi*; of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

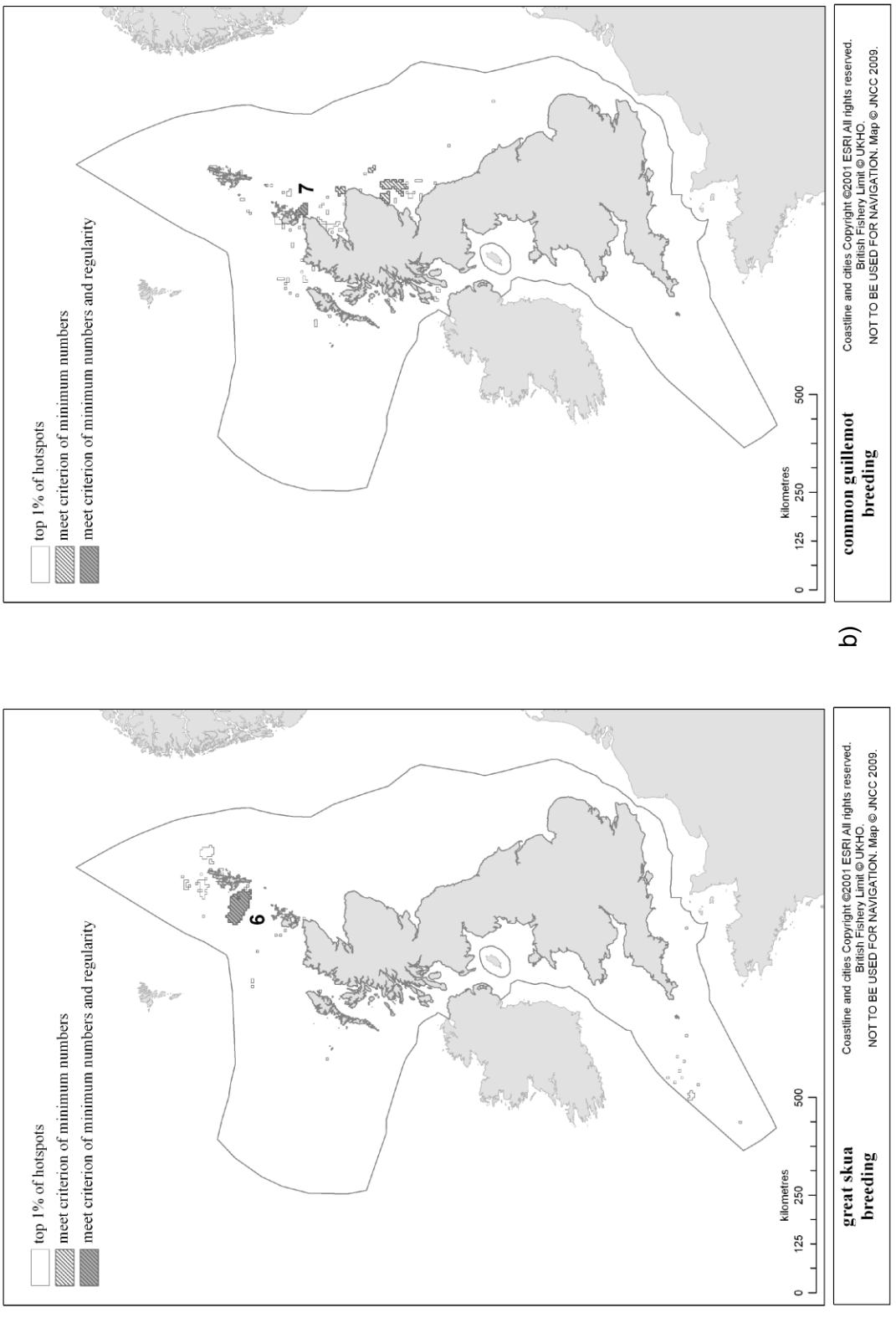


Figure 22. Hotspots identified on density surface maps of a) great skua during breeding (May – August) and b) common guillemot during breeding (May – June). Given are all hotspots identified by the top 1% of Getis-Ord Gi* of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

Figure 23. Hotspots identified on density surface maps of Atlantic puffin during breeding April - July). Given are All hotspots identified by top 1% Getis-Ord Gi*; of these all hotspots qualifying by our criterion of minimum numbers and all hotspots qualifying by minimum numbers and by regularity are marked.

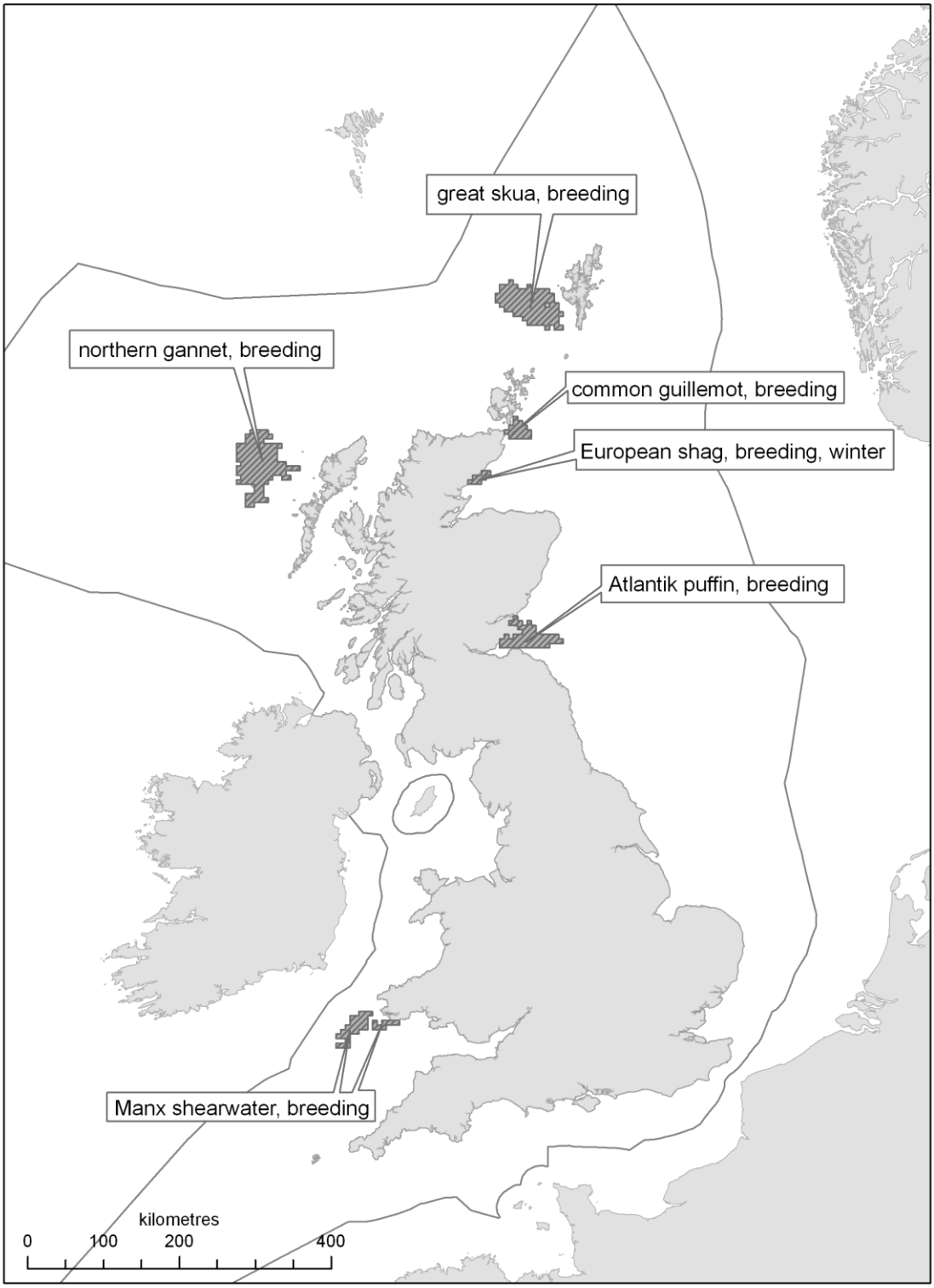


Figure 24. All areas qualifying based on top 1% Getis-Ord Gi*.

iii Summary of areas qualifying at Stages 1.1 - 1.3

Table 3 provides an overview of the number of qualifying areas identified based on top 5% and on top 1% of Getis-Ord Gi*; and it shows the sizes of the areas and the number of individuals contained within these areas.

Table 3. Characteristics of areas qualifying at Stages 1.1-1.3.

species		Based on top 5% Getis-Ord Gi*					Based on top 1% Getis-Ord Gi*				
		Number of qualifying areas	total area (km^2)	number of individuals included	% of population	individuals/km^2	Number of qualifying areas	total area (km^2)	number of individuals included	% of population	individuals/km^2
northern fulmar	breeding	2	6,444	125,690	1.2	19.5	-				
Manx shearwater	breeding	2	8,007	158,238	14.1	19.8	2	1,248	64,792	5.8	51.9
Leach's Storm-petrel	breeding	1	3,858	17,024	11.8	4.4	-				
northern gannet	breeding	2	17,763	87,895	7.6	4.9	1	4,207	51784.3	4.5	12.3
great cormorant	winter	1	918	1,378	1.2	1.5	-				
European shag	breeding	1	266	5,034	2.5	18.9	1	159.7	4605.5	2.3	28.8
	winter	2	401	6,886	3.4	17.2	1	164	3,179	1.6	19.4
great skua	breeding	2	24,575	7,156	17.5	0.3	1	3,455	1,620	4.0	0.5
black-legged kittiwake	breeding	2	10,826	112,959	1.3	10.4	-				
lesser black-backed gull	winter	1	2,952	12,665	2.3	4.3	-				
common guillemot	breeding	4	23,232	507,125	5.9	21.8	1	643	28,356	0.3	44.1
	additional season	1	1,656	62,525	0.7	37.8	-				
	winter	1	2,787	25,996	0.3	9.3	-				
Atlantic puffin	breeding	3	9,978	76,537	0.6	7.7	1	1,647	56,732	0.4	34.4
	winter	1	10,692	20,573	0.2	1.9	-				
all species	summer	2	2,947	123,982		42.1	-				
Total		**28**	**127,302**	**1,351,664**		**10.6**	**8**	**11,525**	**211,067**		**18.3**

While each area was identified for one species, meeting the SPA selection guidelines, several other species appear in many of these sites in qualifying numbers (although our criterion of regularity is not necessarily met). Table 4 - Table 10 give an overview of sites and species hosted in qualifying numbers.

Table 4. Presence of species in areas 1-15, identified based on top 5% Getis-Ord Gi*. Species present with qualifying numbers are marked with x, species for which the area was targeted are marked with⊗.

species present	season	areas														
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
northern fulmar	breeding	⊗	⊗											x		
	winter													x		
Cory's shearwater	summer															
great shearwater	summer															
sooty shearwater	summer															
Manx shearwater	breeding			⊗	⊗											
	additional season															
European storm-petrel	breeding	x				x		x					x	x		
Leach's storm-petrel	breeding					⊗										
northern gannet	breeding						⊗	⊗						x		
	winter							x						x		
great cormorant	breeding															
	winter								⊗							
European shag	breeding									⊗		x	x		x	
	winter									x	⊗	⊗			x	
pomarine skua	additional season 1															
	additional season 2															
Arctic skua	breeding															
	additional season															
long-tailed skua	additional season 1															
	additional season 2															
great skua	breeding	x	x										⊗	⊗		
	winter												x			
black-legged kittiwake	breeding						x								⊗	⊗
	winter															
black-headed gull	breeding															
	winter															
little gull	breeding						x									
	winter															
	additional season															
great black-backed gull	breeding													x		
	winter															
Mediterranean gull	all year															
common gull	breeding															
	winter															
lesser black-backed gull	breeding				x											
	winter				x											
herring gull	breeding															
	winter															
Iceland gull	winter															
glaucous gull	winter															
Sandwich tern	breeding															
	winter															
common tern	breeding															
Arctic tern	breeding															
common guillemot	breeding						x						x		x	x
	winter						x								x	x
	additional season			x			x								x	x
razorbill	breeding															
	winter															
	additional season														x	x
little auk	winter						x							x	x	x
Atlantic puffin	breeding						x	x					x			x
	winter															
all species	breeding	x	x	x	x	x	x	x					x	x	x	x
	winter	x	x		x		x	x					x	x	x	x
	summer	x	x	x	x	x	x	x					x	x	x	x
Total		**6**	**5**	**4**	**6**	**4**	**11**	**7**	**1**	**2**	**1**	**2**	**9**	**11**	**11**	**10**

Table 5. Presence of species in areas 16-28, identified based on top 5% Getis-Ord Gi*. Species present numbers are marked with x, species for which the area was targeted are marked with⊗.

species present	season	areas													total
		16	17	18	19	20	21	22	23	24	25	26	27	28	
northern fulmar	breeding														3
	winter					x									2
Cory's shearwater	summer														0
great shearwater	summer														0
sooty shearwater	summer														0
Manx shearwater	breeding														2
	additional season														0
European storm-petrel	breeding					x									6
Leach's storm-petrel	breeding														1
northern gannet	breeding														3
	winter														2
great cormorant	breeding														0
	winter														1
European shag	breeding					x		x			x				7
	winter					x		x							6
pomarine skua	additional season 1														0
	additional season 2														0
Arctic skua	breeding														0
	additional season														0
long-tailed skua	additional season 1														0
	additional season 2														0
great skua	breeding					x					x				6
	winter					x					x				3
black-legged kittiwake	breeding			x		x		x				x	x		8
	winter														0
black-headed gull	breeding														0
	winter														0
little gull	breeding														1
	winter														0
	additional season			x											1
great black-backed gull	breeding														1
	winter														0
Mediterranean gull	all year														0
common gull	breeding														0
	winter														0
lesser black-backed gull	breeding														1
	winter	⊗													2
herring gull	breeding														0
	winter		x												1
Iceland gull	winter														0
glaucous gull	winter														0
Sandwich tern	breeding														0
	winter														0
common tern	breeding		x												1
Arctic tern	breeding					x									1
common guillemot	breeding		⊗	⊗	⊗	⊗	x	x		x	x	x	x		14
	winter			x		x		⊗				x	x		8
	additional season		x	x		x	⊗	x				x	x		11
razorbill	breeding														0
	winter														0
	additional season			x		x						x			5
little auk	winter			x		x						x			7
Atlantic puffin	breeding			x		x			⊗	⊗	⊗		x		10
	winter											⊗			1
all species	breeding	x	x	x	x	x	x	x	x	x	x	x	x	x	24
	winter	x	x	x	x	x		x		x	x	x	x		20
	summer	x	x	x	x	x	x	x	x	x	x	x	⊗	⊗	24
total		**4**	**7**	**11**	**4**	**17**	**4**	**9**	**3**	**5**	**8**	**10**	**8**	**2**	

Table 6. Presence of species in areas based on top 1% Getis-Ord Gi*. Species present with qualifying numbers are marked with x, species for which the area was targeted was marked with ⊗.

species present	season	areas								total
		1	2	3	4	5	6	7	8	
northern fulmar	breeding									0
	winter									0
Cory's shearwater	summer									0
great shearwater	summer									0
sooty shearwater	summer									0
Manx shearwater	breeding	⊗	⊗							2
	additional season									0
European storm-petrel	breeding			x						1
Leach's storm-petrel	breeding									0
northern gannet	breeding			⊗						1
	winter									0
great cormorant	breeding									0
	winter									0
European shag	breeding				⊗	x	x			3
	winter					⊗				1
pomarine skua	additional season 1									0
	additional season 2									0
Arctic skua	breeding									0
	additional season									0
long-tailed skua	additional season 1									0
	additional season 2									0
great skua	breeding						⊗			1
	winter									0
black-legged kittiwake	breeding									0
	winter									0
black-headed gull	breeding									0
	winter									0
little gull	breeding									0
	winter								x	1
	additional season									0
great black-backed gull	breeding									0
	winter									0
Mediterranean gull	all year									0
common gull	breeding									0
	winter									0
lesser black-backed gull	breeding									0
	winter									0
herring gull	breeding									0
	winter									0
Iceland gull	winter									0
glaucous gull	winter									0
Sandwich tern	breeding									0
	winter									0

species present	season	areas								total
		1	2	3	4	5	6	7	8	
common tern	breeding									0
Arctic tern	breeding									0
common guillemot	breeding							⊗		1
	winter									0
	additional season									0
razorbill	breeding								x	1
	winter									0
	additional season									0
little auk	winter									0
Atlantic puffin	breeding								⊗	1
	winter									0
all species	breeding	x		x			x	x	x	5
	winter						x		x	2
	summer	x		x			x		x	4
Total		3	1	4	1	2	5	2	6	

To show if the areas were present during only a few years or during longer periods of time Tables 7 and 8 present the results of the Mann-Whitney U-tests conducted to prove regular occurrence.

Table 7. Results of Mann-Whitney U-tests conducted to investigate the presence of hotspots based on top 5% Getis-Ord Gi* between 1980 – 2004. The results are given by year and for every hotspot which met our SPA selection criteria, "+" indicates that the original data within a hotspot was significantly higher than outwith hotspots, "-" indicates that there was no difference, and no entry indicates that there was not enough data to conduct the test.

species	site	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
northern fulmar - breeding	1		-	+				+	-				+	+			+	+	+	-		+				
	2		+			-			+			+	+	+			+		-	-						
Manx shearwater - breeding	3							+		-	+						+	+		+						
	4				+				+			+	+	+	+	+	+	+	+	+						
Leach's storm petrel - breeding	5										+								+	+				-		
northern gannet - breeding	6	-	+			+	+	-	+		+		+		+	+	+	+	+	+	+	+	+	+	+	+
	7	+						+	+	+	+					+		+	+	+	-	+	+		+	
great cormorant - winter	8	-	-						+	+				+					+	+						
European shag - breeding	9		+	+	+											+										
European shag - winter	10			+	+															+						
	11		+	+	+																					
great skua - breeding	12		+	+		+		+	+	+		+	+	+		+	+	+	+	+					+	
	13	-	+	-		+		+	+	-		+	+	+		+	+	+	+	+	-	-				
black-legged kittiwake - breeding	14	+	-	+	+	+	+	+	-			+	+	+	-	-			+	+	+	-	+	+	-	+
	15	+	+			+	+		-	-			+	+	+	+	+	+	+	+	+		+	+	+	+
lesser black-backed gull - winter	16												+	+	+											
common guillemot - breeding	17						+			+								+	+							
	18		-				+	+	+							+		+							+	
	19															-		+							+	+
	20	+	+	+	+	+		+	+							+	+		+	+	+	+	+	+	+	+
common guillemot - additional season	21	+				+	+		-	+						+	+							+		
common guillemot - winter	22		+	+	+	+		+		-				-		+		+		+						
Atlantic puffin - breeding	23							+	+	+	+		+		+	+	+	+	+	+	+		+			
	24		+	+		+		+	+			-	+				+	-	-	+		+	+			
	25		+	+		+		+	+	+		+	+	+			+		+	+					+	
Atlantic puffin - winter	26	+	+	-		+	+		+	+		+	+	+	+	+	+			+				+		
all species - summer	27		-			-							+	+	+	+			+	+	+		+	+	+	+
	28	+						+		-						-	+			+	+					

Table 8. Results of Mann-Whitney U-tests conducted to investigate the presence of hotspots based on top 1% Getis-Ord Gi* between 1980 – 2004. The results are given by year and for every hotspot which met our SPA selection criteria, "+" indicates that the original data within a hotspot was significantly higher than outwith hotspots, "-" indicates that there was no difference, and no entry indicates that there was not enough data to conduct the test.

species	site	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Manx shearwater - breeding	1								+			+		+		+			-							
	2								+			+		+												
northern gannet - breeding	3	+						+	+	+	+					+		-	+	+		-	+		+	
European shag - breeding	4			+	+											+										
European shag - winter	5		+	+	+																					
great skua - breeding	6		+	+		+		+	+	+		+	+	+		+	+	+	+	+					+	
common guillemot - breeding	7					+			+								+			+			+	+		+
Atlantic puffin- breeding	8		-				+						+		+			+	+		+		+	+	+	+

3.2.2 Hotspots and areas to be considered at Stage 1.4

i Near-qualifying areas

Our criterion of regularity, as used in this analysis, was applied to ensure that the locations that might be suggested as possible SPAs are significant hotspots on a regular basis, and not just for a limited period of time. But the principle of the site holding significant numbers in at least two thirds of years when data were collected (based on a minimum of 3 years) is somewhat arbitrary and, perhaps in borderline cases should not be applied too strictly. Therefore, areas that meet our criterion of minimum numbers, but fail to meet our criterion of regularity by a narrow margin, were reviewed; hereafter these areas are termed near-qualifying areas.

In total, nine areas identified based on top 5% of Getis-Ord Gi* belong to the near-qualifying category. These areas were identified for the following species: northern gannet during breeding, common guillemot during winter and during an additional season, for Atlantic puffin during breeding, and for all species during breeding and during summer. Their locations are shown in Figure 25 and characteristics of each area are given in Tables 50 - 58 in Appendix 3. Three further areas, based on top 1% of Getis-Ord Gi*, are shown in Figure 26 and their characteristics are presented in Tables 59 - 61 in Appendix 3. These are areas for northern fulmar during breeding, for Manx shearwater during breeding, and for all species during breeding.

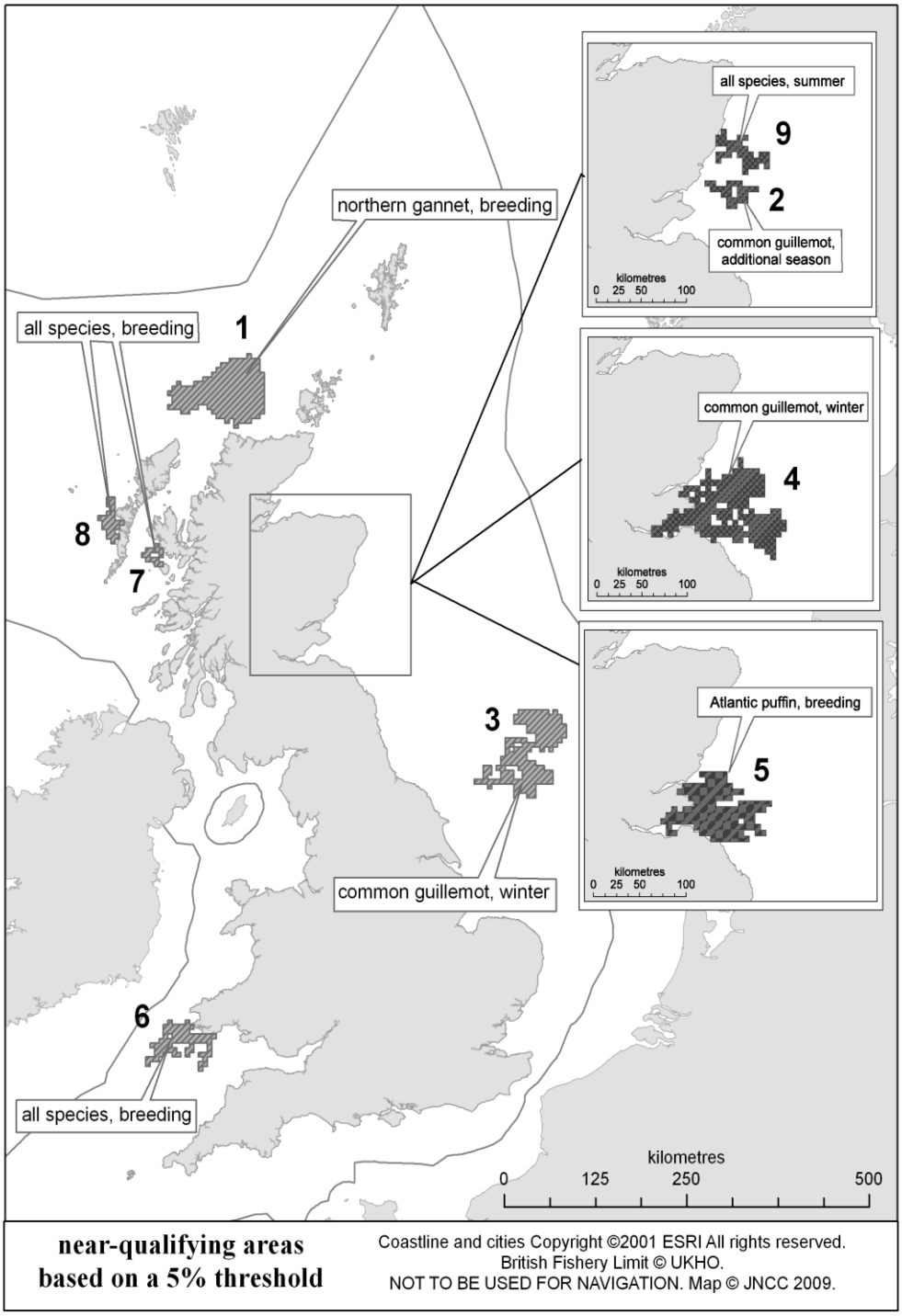


Figure 25. Near-qualifying areas, based on top 5% of Getis-Ord Gi*.

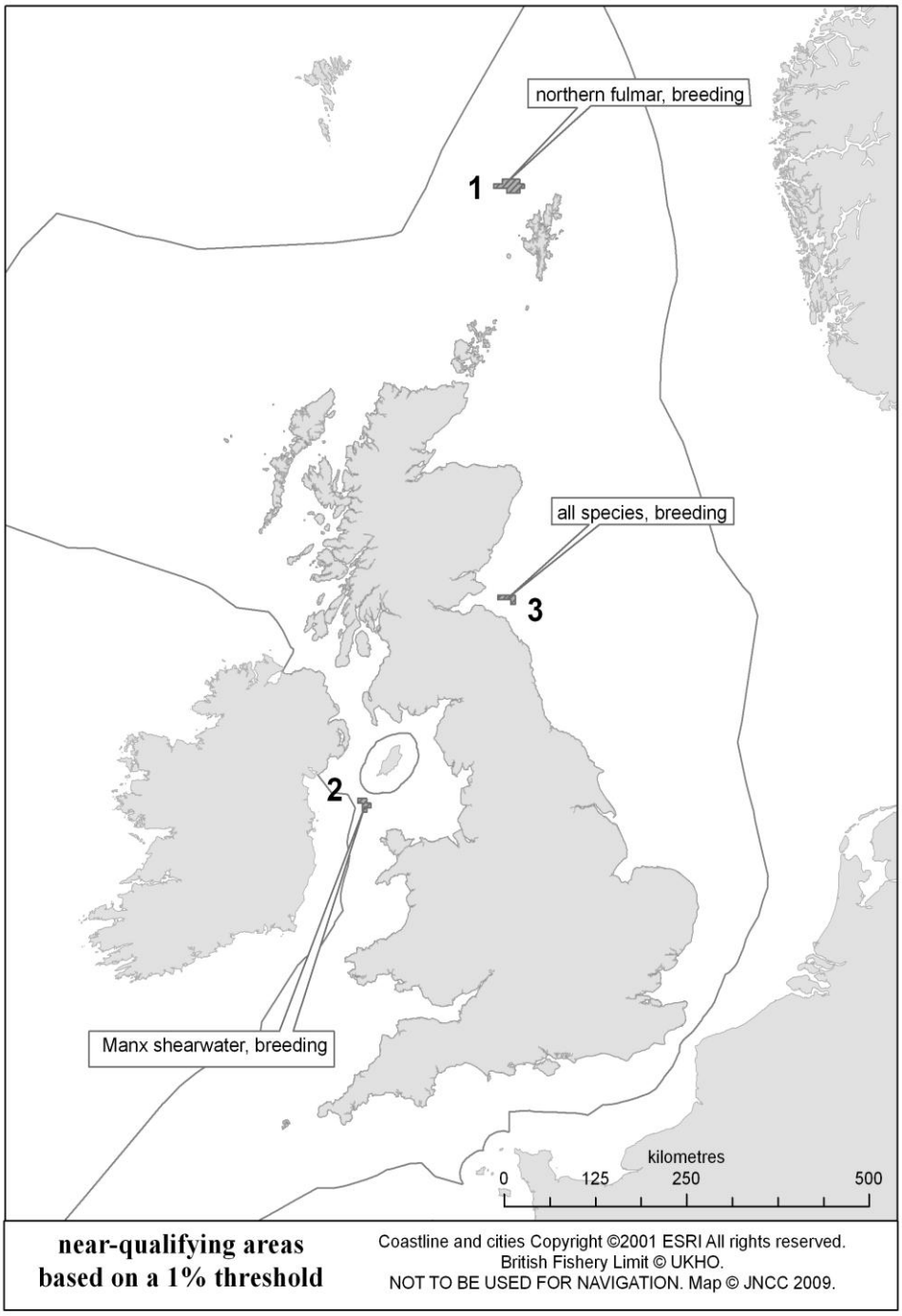


Figure 26. Near-qualifying areas, based on the top 1% of Getis-Ord Gi*.

ii Summary of near-qualifying areas to be considered at Stage 1.4

Table 9 provides an overview of the number of near-qualifying areas identified based on top 5% and on top 1% of Getis-Ord Gi*; and it gives the sizes of the areas and the number of individuals comprised by them.

Table 9. Summary of characteristics of near-qualifying areas to be considered at Stage 1.4.

species		Based on top 5% Getis-Ord Gi*					Based on top 1% Getis-Ord Gi*				
		Number of near-qualifying areas	size of areas (km^2)	number of individuals included	% of population	individuals/km^2	Number of near-qualifying areas	size of areas (km^2)	number of individuals included	% of population	individuals/km^2
northern fulmar	Breeding						1	504	40,755	0.4	80.9
Manx shearwater	Breeding						1	180	12,039	1.1	66.9
northern gannet	Breeding	1	7,380	16,793	1.5	2.3					
common guillemot	additional season	1	828	25,416	0.3	30.7					
	Winter	2	12,359	91,747	1.1	7.4					
Atlantic puffin	Breeding	1	4,486	71,964	0.5	16.0					
all species	Breeding	3	3,843	147,987		38.5	1	180	22,131		123.0
	Summer	1	1,176	68,496		58.3					
Total		**9**	**30,072**	**422,403**		**153**	**3**	**864**	**74,925**		**271**

For these areas, too, several other species could appear in these sites in qualifying numbers (although our criterion of regularity is not necessarily met). Table 10 gives an overview of sites and species held by them in qualifying numbers.

Table 10. Coverage of species by near-qualifying areas. Species present with qualifying numbers are marked with x; species for which the near-qualifying area was identified are marked with⊗.

	season	Areas (top 5%)										Areas (top 1%)			
		1	2	3	4	5	6	7	8	9	total	1	2	3	total
northern fulmar	breeding										0	⊗			1
	winter										0				0
Cory's shearwater	summer										0				0
great shearwater	summer										0				0
sooty shearwater	summer										0				0
Manx shearwater	breeding						x	x			2		⊗		1
	additional season										0				0
European storm-petrel	breeding	x									1				0
Leach's storm-petrel	breeding										0				0
northern gannet	breeding	⊗			x	x					3				0
	winter										0				0
great cormorant	breeding										0				0
	winter										0				0
European shag	breeding										0				0
	winter				x	x					2				0
pomarine skua	additional season 1										0				0
	additional season 2										0				0
Arctic skua	breeding										0				0
	additional season										0				0
long-tailed skua	additional season 1										0				0
	additional season 2										0				0
great skua	breeding	x									1				0
	winter										0				0
black-legged kittiwake	breeding				x	x					2				0
	winter										0				0
black-headed gull	breeding										0				0
	winter										0				0
little gull	breeding										0				0
	winter										0				0
	additional season			x							1				0
great black-backed gull	breeding										0				0
	winter										0				0
Mediterranean gull	all year										0				0
common gull	breeding										0				0
	winter										0				0
lesser black-backed gull	breeding										0				0
	winter										0				0
herring gull	breeding										0				0
	winter										0				0
Iceland gull	winter										0				0
glaucous gull	winter										0				0
Sandwich tern	breeding										0				0
	winter										0				0
common tern	breeding										0				0
Arctic tern	breeding										0				0
common guillemot	breeding	x	x		x	x				x	5				0
	winter			⊗	⊗	x					3				0
	additional season		⊗		x	x				x	4				0
razorbill	breeding										0				0
	winter										0				0
	additional season										0				0
little auk	winter			x	x	x					3				0
Atlantic puffin	breeding	x			x	⊗					3				0
	winter										0				0
all species	breeding	x	x	x	x	x	⊗	⊗	⊗	x	9	x		⊗	2
	winter	x		x	x	x					4				0
	summer	x	x	x	x	x	x	x		⊗	8	x			1
total		**8**	**4**	**6**	**11**	**11**	**3**	**3**	**1**	**4**		**3**	**1**	**1**	

iii Important regions

The identification of areas that qualify as possible offshore SPAs highlighted some regions of particular importance because they are repeatedly selected. Figure 27 shows how many qualifying areas are located at any location in the area of interest.

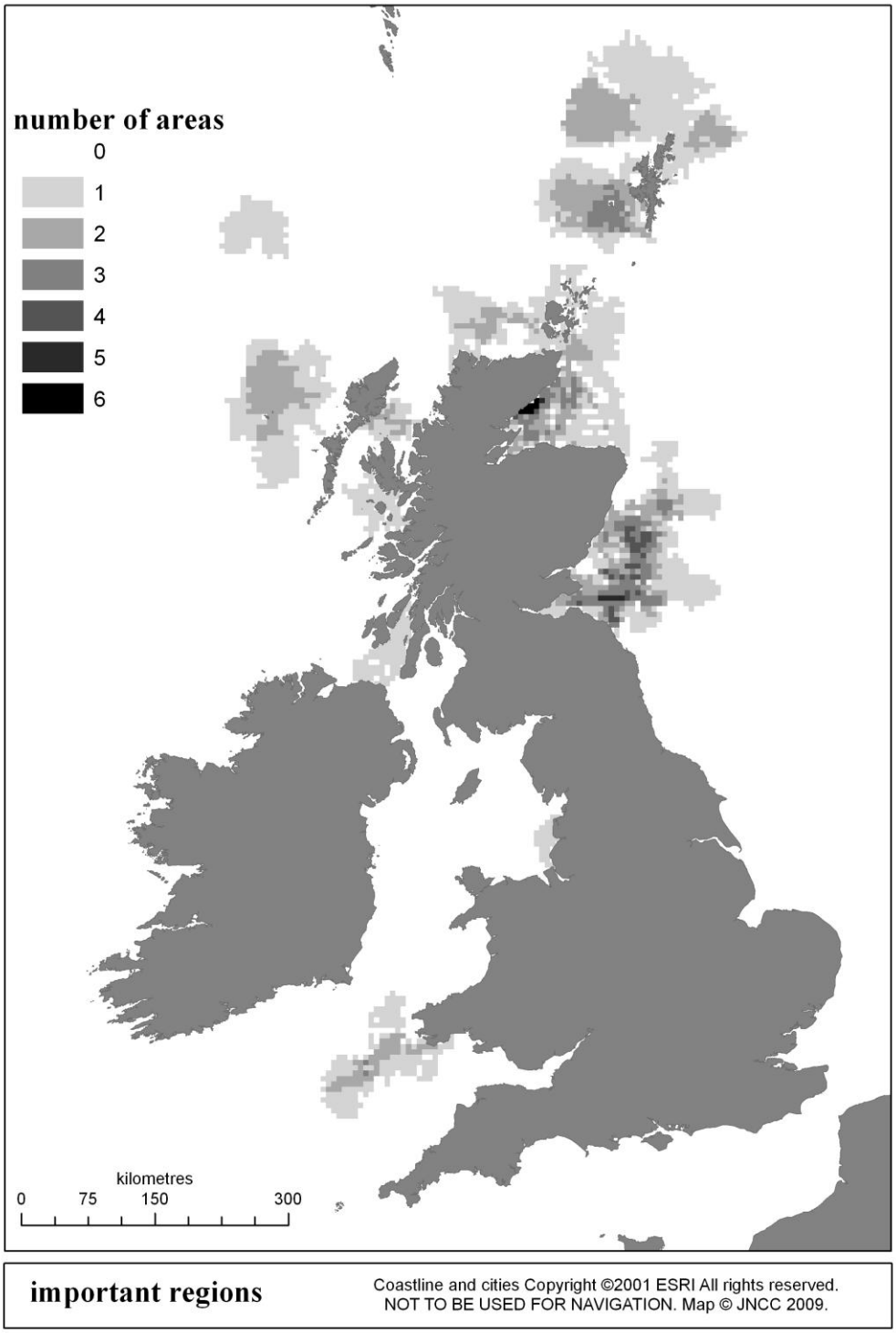


Figure 27. Important Regions. Given are the number of all areas qualifying at Stage 1.1 - 1.3, based on top 5% or top 1% of Getis-Ord Gi*, at any location in the area of interest.

Four regions are important for multiple seabird species:

i. Outer Firth of Forth/Wee Bankie/Marr Bank

In this region five qualifying areas occur:

- northern gannet breeding (5% threshold)
- black-legged kittiwake winter (5% threshold)
- common guillemot, breeding (5% threshold)
- all species, summer (5% threshold)
- Atlantic puffin, breeding (1% threshold)

Additionally, some near-qualifying areas appear in this region:

- common guillemot, winter (5% threshold)
- common guillemot, additional season (5% threshold)
- Atlantic puffin, breeding (5% threshold)
- all species, breeding (1% threshold)

ii. Inner Firth of Forth

In the inner Firth of Forth, there are three qualifying areas:

- northern gannet breeding (5% threshold)
- Atlantic puffin, winter (5% threshold)
- Atlantic puffin, breeding (1% threshold)

One further near-qualifying area was identified for, too:

- common guillemot, winter (5% threshold)

iii. Moray Firth

Two qualifying areas are associated with the coastal waters in the Moray Firth:

- Edges: shag breeding and winter (5% threshold, 1% threshold)
- Edges: common guillemot, winter (5% threshold)

Two further qualifying areas are associated with the entire area:

- Black-legged kittiwake, breeding (5% threshold)
- common guillemot breeding (5% threshold)

iv. North and West of Shetland Islands

North and West of Shetland, three qualifying areas are identified:

- northern fulmar, breeding (5% threshold)
- great skua, breeding (5% threshold, 1% threshold)
- West: Atlantic puffin, breeding (5% threshold)

One further near-qualifying area was identified, too:

- northern fulmar, breeding (1% threshold)

3.3 Survey effort and sufficiency of sightings

The overall ESAS survey effort varied considerably over the area of interest, ranging between 0-115km^2 surveyed per 6x6km grid cell. Survey effort was clearly concentrated along ferry routes in many areas, and in the Moray Firth (Figure 28). Least sampling effort was achieved at the northwestern, southwestern and the northern limits of the study area. Most qualifying areas occur at locations with moderate sampling effort; but some, such as the area for Leach's storm-petrel during the breeding season in the north-west, and the area for great cormorant during the winter in Liverpool Bay, contain substantial areas with no or low sampling effort (Figure 28).

In each qualifying area it was analysed how many of its grid cells, and consequently how much of its spatial extend, contain observations of the relevant species in the raw ESAS data. In all areas identified based on the top 1% of Getis-Ord Gi*, observations of the relevant species were found in substantial proportions of their extent (average: 77%, range: 44-100%). Areas based on top 5% Getis-Ord Gi* had lower coverage (average: 63%, range: 15-100%). Particularly the areas for Leach's storm-petrel during breeding (18%), lesser black-backed gull during winter (22%), and one of the areas for common guillemot during breeding (15%), and the area for cormorant during winter (18%) had low coverage with less than one third of the area with observations of the corresponding species.

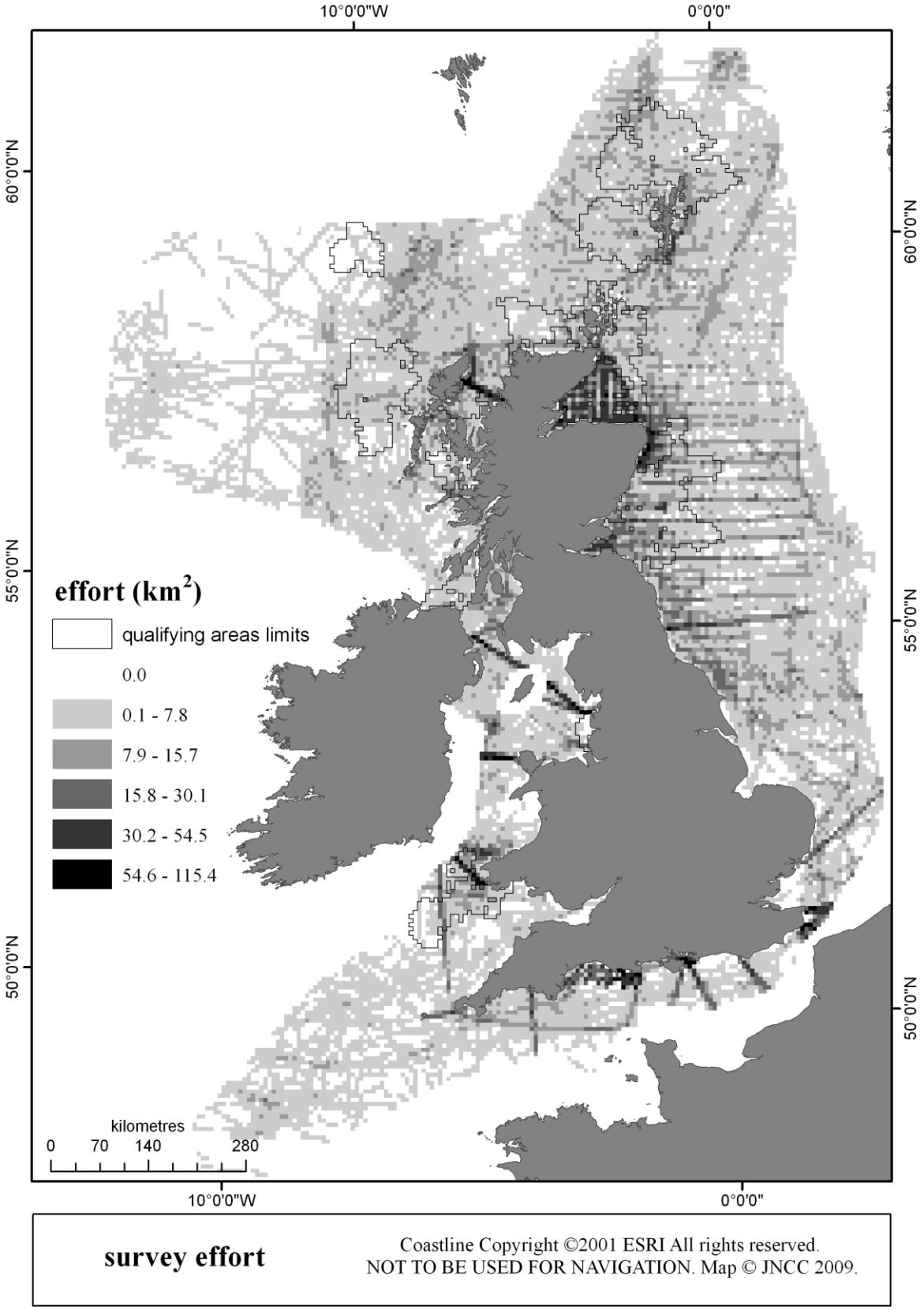


Figure 28. ESAS sampling effort in the British Fishery Limit with qualifying areas (based on both, the top 5% and 1% hotspots).

4 Discussion

This report demonstrates that there are several areas within the British Fishery Limit that host numbers of seabirds exceeding the thresholds defined in Stages 1.1 - 1.3 of the UK SPA selection guidelines (Table 2). Of these, many also meet the Ramsar definition of regularity, as defined in this report, and therefore qualify for SPA status.

4.1 Areas qualifying at Stages 1.1 - 1.3

4.1.1 Northern fulmar, breeding

Population estimate. The northern fulmar is a common seabird in Britain and Ireland with 538,000 individuals breeding here, most of them (90%) in Scotland (Mitchell *et al* 2004). The largest colonies occur on Shetland (188,500 apparently occupied sites, or AOS), Orkney (90,800 AOS) and Caithness (30,000 AOS).

Distribution at sea. During the early breeding season (March - April), highest densities of northern fulmar occur along the edge of the continental shelf to the north and west of Scotland, around Shetland, and to a lesser extent over Dogger Bank (Stone *et al* 1995, Pollock *et al* 2000). Later during the breeding season (May to July), numbers increase at the Outer Hebrides, around Orkney and across the northern North Sea (Stone *et al* 1995, Pollock *et al* 2000). The year-round importance of the edge of the continental shelf for northern fulmar has been recognized before (Reid *et al* 2001). Hotspots to the east and west of Shetland are not associated with the edge of the continental shelf, but with a particular high fishing activity, including whitefish trawling (east of Scotland : Greenstreet *et al* 1999, Greenstreet *et al* 2006). The northern fulmar is known to feed extensively on fish discarded from trawlers and it is described as the predominant consumer of offal produced by fishing vessels around Shetland (Hudson and Furness 1988a, Hudson and Furness 1988b, Furness *et al* 1992). It is therefore likely that the hotspots around Shetland are a result of the high fishing activity, producing a large supply of offal for foraging fulmars, although a similar association on the scale of the North Sea was not found (Camphuysen and Garthe 1997).

Foraging range. Foraging ranges of northern fulmar were never measured directly, but trip durations (6 - 24h at Foula, Furness and Todd 1984, Furness and Bryant 1996) suggest that fulmars can travel well over 100km away from their colony; Hamer *et al* suggest distances of 245km at St. Kilda, and 122km at Foula (Hamer *et al* 1997).

Status. The northern fulmar is a regularly occurring migratory species in the UK. Therefore, Stage 1.2 of the UK SPA site selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is either 1% of the relevant biogeographic population or 20,000 individuals, whichever number is lower. The latter applies for northern fulmar, because its biogeographic population consists of nearly 10 million individuals (Mitchell *et al* 2004).

Hotspots based on the top 5% of Getis-Ord Gi.* The two qualifying areas for northern fulmar are located to the west and to the east of Shetland's large colonies. Both were present during two years in the 1980's and during several years over the course of the 1990's. Data were only available, however, for the area west of Shetland to indicate its presence after the 1990's (for the year 2000), and during some of these years seabird numbers were not higher in these areas then elsewhere.

The qualifying areas are well within the foraging range of northern fulmars and could therefore be generated by foraging breeders.

Hotspots based on the top 1% of Getis-Ord Gi.* No areas qualified based on the top 1% hotspots.

Our analysis identified two significant areas for northern fulmar. They are close to the largest breeding site and qualify at Stage 1.2 of the UK SPA selection guidelines. It might be beneficial to collect more data in this region to verify that these areas currently contain high densities of northern fulmar, as most data suggesting this were collected before 2000. Additionally, the seabird assemblage exceeds qualifying numbers in both areas during breeding, winter and summer, and the areas hold qualifying numbers of one (east of Shetland, Table 15) or two other species (west of Shetland, Table 14).

4.1.2 Manx shearwater, breeding

Population estimate. A significant proportion (68-91%) of the world Manx shearwater population breeds in Britain and Ireland (Mitchell *et al* 2004), highlighting the UK's responsibility for the conservation of this species. The three largest colonies are on the islands of Rum in the Inner Hebrides (120,000 AOS), Skomer (101,800 AOS) and Skokholm (46,200 AOS), both off the western coast of Pembrokeshire (Mitchell *et al* 2004).

Distribution at sea. Stone *et al* (1995) show that high densities of Manx shearwater start to accumulate in waters around these large colonies in March and April. Between May and August high numbers spread into the Irish Sea, where birds predominantly concentrate in September and October. A Global Positioning System (GPS) monitoring programme on breeding and incubating Manx shearwater from Skomer also found individuals in June - August up to 50km west of Skomer, in Cardigan Bay, in the Irish Sea off Dundalk and at the Mull of Galloway (Guilford *et al* 2008). The area from Dundalk to the south-west of the Isle of Man is the location of the Irish Sea Front (Simpson and Hunter 1974); a highly productive area in the summer. The stratification in this area starts to build up in April and is well established between June and October (Simpson *et al* 1977). Begg and Reid (1997) illustrate an association of Manx shearwaters and other species with this area.

The density surface maps generated by Poisson kriging in this analysis correspond well with the distributions of Manx shearwaters described in the published literature. Hall *et al* (1987) have shown that Manx shearwater use the north and the western coastal areas of the North Sea. This is not reflected in the density surface maps of this analysis, which describe low densities across the whole of the North Sea. This may be a result of the difference in scale of densities between the west coast with its large colonies, and the east coast with much fewer individuals, giving concentrations in the North Sea less weight.

Foraging range. The study of Guilford *et al* (2008) suggests that these areas are primarily used for foraging. Manx shearwaters can feed well over 300km away from their colonies (Brooke 1990), so concentrations around these colonies and in the Irish Sea occur well within foraging range of the large colonies.

Status. The Manx shearwater is a regularly occurring migratory species in the UK and Stage 1.2 of the UK SPA site selection guidelines should be applied (Stroud *et al* 2001) when assessing areas for possible SPA classification. The threshold for such assessment is 1% of the relevant biogeographic population, which is corresponds to 11,300 individuals (Mitchell *et al* 2004).

Hotspots based on the top 5% of Getis-Ord Gi.* Most of the hotspots are present either around Rum, Skomer and Skokholm, or in the Irish Sea. The high density areas around the colonies are the only hotspots qualifying at Stage 1.2 of the UK SPA selection guidelines. They could be formed either by foraging individuals, resting birds after leaving the colony in

the early morning or before returning to the colonies during dawn, or they could be created by a high turnover of individuals passing through the area. The raw ESAS data show that the proportion of sitting individuals is higher within hotpots (89%) than outside hotspots (77%), which indicate that Manx shearwater might forage to a greater extent in these hotspots than in other areas.

The qualifying area around Rum overlaps with two potential SPA colony extensions. Out of the six years with sufficient data, five support the presence of this hotspot. Data were only sufficient for this test during the late 1980's and between 1995-1998, however. The seabird assemblage appears in qualifying numbers during two seasons and one additional species is held in qualifying numbers (Table 16).

The qualifying area to the west of Skomer and Skokholm overlaps with one potential SPA colony extension. Of the 11 years with sufficient data, all showed the presence of this area. This result suggests that this area is permanently present, although we have not enough data to test this after 1998. Seabird assemblages exceed qualifying numbers during breeding, winter and summer, and one additional species occurs in qualifying numbers during two seasons (Table 17).

Hotspots based on the top 1% of Getis-Ord Gi.* Hotspots based on top 1% of Getis-Ord Gi* were at the same locations as those based on top 5% of Getis-Ord Gi*, and the same suggested causes apply. The difference is that the areas covered are much smaller, which means that the hotspot at Rum does not qualify by our site selection guidelines. While four out of five years of data show the presence of the westerly area, all three years of suitable data support the presence of the easterly area. Although diminished in size, the two small hotspots meet our SPA selection guidelines. The seabird assemblage exceeds SPA qualifying numbers in the westerly area during breeding and in summer (Tables 42 and 43).

The analysis has identified the most important areas for breeding Manx shearwaters. These three areas qualify at Stage 1.2 of the UK SPA selection criteria and are located around the large colonies of Rum, Skomer and Skokholm. The area of the Irish Sea Front may also be important, although the latter did not meet our criterion of regularity. When a conservative site selection is applied, the area west of Skomer Island and Skokholm Island could be proposed as a possible SPA, as it meets Stage 1.2 of the SPA selection guidelines, and it holds important numbers of seabirds. A cautious approach would additionally consider the area around Rum and possibly the Irish Sea Front as possible SPAs (Stage 1.4 of the site selection guidelines). If areas based on the top 1% of Getis-Ord Gi* are considered, only very few years with suitable data are available to support their presence over a longer period of time. The collection of more data in these areas would be advisable to proof that they are also currently present.

Because Rum holds the largest colony of Manx shearwaters, it was expected that the area around it would have been identified more clearly (e.g. when the 1% threshold was applied) as an important area for these birds. The fact that the presence of the area was indicated five out of six times when tests could be conducted supports the view that this area might be suitable as a possible SPA. Further surveys at the area around Rum and possibly also in the Irish Sea area would be beneficial to further investigate their suitability.

During October and November no qualifying areas could be identified for Manx shearwater, presumably because they migrate to South America during this time of the year and few individuals are left within the boundaries of the British Fishery Limit (Cramp 1998).

4.1.3 Leach's storm-petrel, breeding

Population estimate. Leach's storm-petrel is a widespread pelagic species in both the Atlantic- and Pacific Oceans. Of the North Atlantic population of Leach's storm-petrel (4.5-9 million individuals, Stroud *et al* 2001), a small proportion (0.7-1.3%) breeds in Great Britain. Mitchell *et al* (2004) estimated the number of AOS at St Kilda as 45,433, at Flannan Isles west of Lewis as 1,425, and at North Rona as 1,132.

Distribution at sea. Pollock *et al* (2000) and Stone *et al* (1995) describe that, during breeding, Leach's storm-petrel is most concentrated over the shelf edge. It uses this area mostly during summer and prefers the deeper areas along the shelf edge (Reid *et al* 2001). This is generally in agreement with the density surfaces generated in this analysis. While Pollock *et al* (2000) describe highest densities around the Anton Dhorn Seamount and Rosemary Bank to the west of the Outer Hebrides, highest densities occurred further north, between Rosemary Bank and Ymir Ridge according to our analysis. The concentration over shelf edges are also described by Brown *et al* (1988) for individuals in Nova Scotia, who assume that upwelling systems create relatively high concentrations of prey for this surface feeding bird.

Status. Leach's storm petrel is listed on Annex I of the EU Birds Directive. Therefore, Stage 1.1 of the UK SPA selection guidelines should be applied in the initial assessment of whether a site might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant GB or all-Ireland wintering population, in this case 1,400 individuals (Stroud *et al* 2001, Baker *et al* 2006).

Hotspots based on the top 5% of Getis-Ord Gi.* Leach's storm-petrel is known to be mainly solitary at sea (Cramp 1998). Few hotspots were identified and just one is large enough to hold enough individuals to meet the qualifying threshold of the UK SPA selection guidelines. There are only data available for four years to test for the presence of this hotspot (1989, 1997-98 and 2002), and tests support this hotspot only during the first three of these (when it held significantly higher numbers than the surrounding areas). It holds also qualifying numbers of one more species and the seabird assemblage exceeds qualifying numbers during breeding and summer (Table 18). This area has not been surveyed extensively; observations of Leach's storm-petrel have been recorded in 18% of the hotspot area. Consequently, any further consideration of this area as a possible SPA needs to be tempered with this in mind.

Hotspots based on the top 1% of Getis-Ord Gi.* No qualifying areas were identified based on top 1% Getis-Ord Gi*.

Based on our analysis Leach's storm-petrel meet the requirements of Stage 1.1 of the UK SPA selection guidelines in only one area. However, data coverage and the number of observations of Leach's storm-petrel in this area do not support recommendation as a possible SPA in its current dimensions. Further surveys would be advisable if this area would be considered as a possible SPA.

4.1.4 Northern gannet, breeding

Population estimate. Most of the biogeographic population of northern gannets (more than 1.1 million individuals, updated from Mitchell *et al* 2004) breed in Great Britain, highlighting the responsibility of the UK for the conservation of this species. The world's largest colonies are at St Kilda (59,622 AOS), Bass Rock (48,065 AOS) and Grassholm (32,094 AOS, Wanless *et al* 2005). The population of northern gannets increased generally over the last four decades, although the rate of increase varied among colonies (Mitchell *et al* 2004).

Distribution at sea. In the early breeding season, gannets are still widespread over the entire area around Britain, with increasing densities around the colonies at St Kilda, Shetland and south-west Ireland (Stone *et al* 1995). Later in the breeding season, individuals concentrate in the vicinity of the major colonies at St Kilda, Ailsa Craig, Grassholm, Bass Rock and off south-west of Ireland. This distribution, particularly the high densities around the colonies, is similar to the one described by our analysis. Only the area at Solan Bank to the north of Scotland seems to have slightly higher concentrations on the maps generated in his study, than described by Stone *et al* (1995).

Foraging range. Northern gannets feed opportunistically on a variety of prey and their foraging ranges during the breeding season vary accordingly among colonies and times. While Tasker *et al* (1985) report that foraging trips of gannets rarely exceed 150km and that most of these are less than 50km, more recent satellite telemetry data show a mean foraging distance of 232km from the colony at Bass Rock, with a maximum range well over 400km (Hamer *et al* 2007) or even 540km (Hamer *et al* 2000). Gannets of the latter study were often associated with features such as Buchan Deep and Halibut Bank to the north-east of the colony, and Farne Deep, Dogger Bank and Outer Silver Pit to the south-east of the colony (Hamer *et al* 2000). These locations are not confirmed by the distribution maps resulting from our analysis herein.

Status. The northern gannet is a regularly occurring migratory species in the UK. Therefore, stage 1.2 of the UK SPA site selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant biogeographic wintering population, in this case 11,600 individuals (Mitchell *et al* 2004 with updated figures).

Hotspots based on top 5% Getis-Ord Gi.* When hotspots were identified based on top 5% Getis-Ord Gi*, three important areas held enough individuals to meet our criterion of minimum numbers: the areas around St Kilda, to the east of Bass Rock, and north of the Scottish coast at Solan Bank, all near large gannet colonies (St Kilda, Bass Rock, Sula Sgeir and Sule Stack, respectively). Only the areas associated with the largest colonies, St Kilda and Bass Rock, qualify on regularity of occurrence. In both cases this is based on a large number of years (13 and 20) of data which are spread over the entire period of data collection, strongly suggesting that these hotspots are permanently present at their location. Both of these hotspots lie within the foraging range as previously documented (see above), but they do not indicate particularly significant foraging sites, such as sandbanks, perhaps with the exception of the Wee Bankie off the Firth of Forth. The area at Bass Rock overlaps with two potential SPA colony extensions, and it borders on two existing SPAs. The seabird assemblage exceeds qualifying numbers during breeding, winter and summer, and six additional species occur in qualifying numbers during at least one season (Table 19). The qualifying area around St Kilda overlaps with two potential SPA colony extensions. The seabird assemblages during breeding, winter and summer attain qualifying numbers, and two other species are present in qualifying numbers during at least one season (Table 20).

Hotspots based on top 1% Getis-Ord Gi.* The only area that qualifies as an SPA based on top 1% Getis-Ord Gi* is a slightly smaller area around St Kilda than that based on the 5% threshold. Ten out of 12 years of suitable data, collected between 1980 and 2003, suggest a lasting presence of this hotspot. It overlaps with one potential SPA colony extension and holds qualifying numbers of European storm-petrel and numbers of the seabird assemblage exceed qualifying numbers during breeding and summer (Table 44).

This analysis identified four areas that meet Stage 1.2 of the UK SPA selection guidelines for northern gannet. These areas indicate the importance of areas around the large breeding colonies. The area around the colony at St Kilda is important as it also appears as a hotspot based on top 1% of Getis-Ord Gi*. The area around Bass Rock is significant as it is

important for six other species and the seabird assemblage as a whole. Bass Rock forms part of a very important region, its significance for so many species offers a strong case for consideration as a possible SPA. The strong data basis suggests the permanent nature of the hotspots at St. Kilda and Bass Rock and gives further evidence for their suitability as a protected area.

4.1.5 Great cormorant, winter

Population estimate. The biogeographic population of the great cormorant is estimated at 117,900 individuals (Wetlands International 2006). In Britain and Ireland, 11,600 apparently occupied nests were counted between 1998 and 2002, located along the entire coastline as well as inland, where they breed on trees (Mitchell *et al* 2004).

Distribution at sea. At sea, cormorants are mostly restricted to inshore waters, preferring waters less than 10m water deep for foraging (Skov *et al* 1995). During the winter, high densities occur in Liverpool Bay, moderately high densities in the Firth of Clyde and low densities in the inshore areas of the Moray Firth (Stone *et al* 1995). The surface density maps generated by our analysis highlighted similar areas.

Status. The great cormorant is a regularly occurring migratory species in the UK. Therefore, stage 1.2 of the UK SPA site selection guidelines should be applied in the initial assessment of whether the site might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant biogeographic wintering population, in this case 1,200 individuals (Wetlands International 2006).

Hotspots based on top 5% Getis-Ord Gi.* One area qualified according to the SPA selection guidelines, which abuts on two existing SPAs (Table 21). But the map of survey effort showed that this area was poorly covered by surveys and cormorants were observed in only in 18% of the area. Enough data was available to conduct the Mann-Whitney U-tests during only seven years (during early and late 1980's, and early and late 1990's), and the site was shown to be present in only five of these.

Hotspots based on the top 1% of Getis-Ord Gi.* No qualifying areas were identified based on top 1% Getis-Ord Gi*.

The one area identified for great cormorant during breeding which qualifies at Stage 1.2 of the SPA selection guidelines is nevertheless not suitable for classification at the current stage because of the low survey effort achieved there. More surveys would be required to investigate if this area represents an important hotspot in the distribution of great cormorants.

Although hotspots were identified for Great cormorants during breeding close to the shores of the Moray Firth, Luce Bay, Liverpool Bay, East and South of Anglesey, Caernarvon Bay and in the western part of the English Channel, none of them held Great cormorants in qualifying numbers. It is possible that this species shows different foraging patterns during breeding compared to their winter feeding habits, but this remains to be tested.

4.1.6 European shag, breeding

Population estimate. The distribution of the biogeographic population of the European shag (201,800 individuals, Wetlands International 2006) is restricted to the north-east Atlantic. The population of Britain and Ireland is estimated at 32,300 apparently occupied nests (AON), most of them occur on the north and the west coasts of Britain (Mitchell *et al* 2004). The largest colonies occur at Foula (2,300 AON), the Farne Islands (1,300 AON) and Lambay Island (1,100 AON, Mitchell *et al* 2004).

Distribution at sea. The European shag is almost entirely an inshore species. During the breeding season, highest densities occur around the colonies of Orkney, Shetland, the Moray Firth, the Firth of Forth, and the west coast of Scotland (Stone *et al* 1995). The density surface maps generated in this study showed the same distribution.

Foraging range. Radio-tagged individuals from the Isle of May have shown that shags forage no further than 17 km away from their colony (Wanless *et al* 1991). A recent study suggested that shags are primarily benthic feeders with a flexible foraging strategy, depending on habitat and prey (they forage solitary for bottom-living fish in rocky habitats, but with other shags at sandy habitats for sandeel, Watanuki *et al* 2008).

Status. As the European shag is a regularly occurring migratory species in the UK, stage 1.2 of the UK SPA site selection guidelines should be applied to judge whether the site might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant biogeographic wintering population, in this case 2,000 individuals (Wetlands International 2006).

Hotspots based on top 5% Getis-Ord Gi.* The qualifying area is located south-west of a series of colonies at the northern coast of the Moray Firth. Most of the area is within 2km of the colonies, and does not extend further than 18 km off the coast. Although the data basis for this site is not very strong, all four years for which data is available (1981-1983 and 1994) support the presence of the site.

Hotspots based on top 1% Getis-Ord Gi.* The same area was selected when using the top 1% Getis-Ord Gi*. Again, most of the area is within 2km of the colonies and it does not extend further than 18km off the coast. Only during the years 1982, 1983 and 1994 enough data was available to test for the presence of this area.

The analysis identified two areas at a location previously described by other publications (see above). Both areas qualify at Stage 1.2 of the SPA selection guidelines. Their location close to a series of large European Shag colonies suggests that this is a genuinely important area for this species in that region. The selection of this location with the application of both thresholds provides further evidence of its importance. As the data basis is rather weak, further data collection would be necessary to demonstrate that this site is currently present.

4.1.7 European shag, winter

Distribution at sea. Outside the breeding season, shags remain in coastal waters, but may disperse further along the coast (Skov *et al* 1995). Many birds may roost at the deserted colony during winter (Cramp 1998), explaining why the inshore areas at Caithness remain occupied with the highest densities of shags throughout the year (Stone *et al* 1995). This is also reflected by the map generated in our study.

Hotspots based on top 5% Getis-Ord Gi.* The qualifying area for wintering European shags is almost identical to the one identified for breeding shags (Table 24). In addition, a smaller area at the south coast of the Moray Firth qualifies, again located near an area of shag colonies (Table 23). The data basis for the area is very weak with data collected during only 3 years.

Hotspots based on top 1% Getis-Ord Gi.* If the identification of areas is based on top 1% Getis-Ord Gi*, again the same area in the northern part of the Moray Firth is identified, as for that species during the breeding season and the same features apply (Table 46). The data which were tested for the repeated occurrence of the area were collected during the years 1981-1983; hence, the data basis is weak.

Our analysis identified two areas for the European shag during winters that qualify at Stage 1.2 of the UK SPA selection guidelines. The fact that all analyses on shags during breeding and winter determine the area at the northern coast of Moray Firth as significant location provides a strong case for this area to be considered as a potential SPA. Further surveys are recommended to investigate if these are permanent and currently important areas for European shag.

4.1.8 Great skua, breeding

Population estimate. The biogeographic population of the great skua is comparatively small, with 40,800 individuals worldwide (Delany *et al* 2008). The population has been increasing since 1990, with highest numbers nest in Shetland, Orkney and Iceland (Mitchell *et al* 2004). In the UK, the largest colonies occur on Foula (Shetland Islands, 2,293 individuals), on Hoy (Orkney Islands, 1,973 individuals), and on Unst (Shetland Islands, 1,385 individuals).

Distribution at sea. At sea, Pollock *et al* (2000), Bloor *et al* (1996) and Stone *et al* (1995) describe the highest densities of great skua during the breeding season as present around the breeding colonies at Orkney and Shetland. Moderate densities occur along the edge of the shelf, in the northern Minches and south to the Wash on the east coast of Britain (Stone *et al* 1995). The distribution maps generated in this analysis show a similar pattern.

Foraging range. Great skua diet varies according to stage of breeding season and age of the bird. Early and late in the breeding season, they feed to a great extent on whitefish discarded from trawlers. During June and July, they feed mostly on sandeels, obtained by kleptoparasitism in multi-species flocks (Furness and Hislop 1981). Foraging ranges could vary accordingly with type of food (RSPB 2000). Highest densities in this area are likely to be close to the largest breeding colonies.

Status. The great skua is a regularly occurring migratory species in the UK. Therefore, stage 1.2 of the UK SPA selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant biogeographic wintering population, in this case 400 individuals (Delany *et al* 2008).

Hotspots based on the top 5% of Getis-Ord Gi.* Two large qualifying areas to the south-west and the north-east of Shetland were identified. Both qualify at Stage 1.2 of the UK SPA selection guidelines. The area south-west of Shetland overlaps with one potential SPA colony extension. It holds qualifying numbers of four other species and overall seabird numbers exceed qualifying numbers during breeding, winter and summer (Table 25). Its presence at this location could be tested with data from fifteen years, spread between 1981 and 2003, and during all of them numbers of great skuas were higher than outwith sites. A permanent presence of this site is therefore well supported by the data.

The area north-east of Shetland overlaps with two potential SPA colony extensions, and another six species occur in qualifying number. Also, the seabird assemblage exceeds qualifying numbers during breeding, winter and summer (Table 26). At this area, data from 17 years were available, of which 12 showed that great skua numbers were higher inside than outside hotspots. Because few of these data are recent more surveys would be required to determine if it is still present. Hotspots are within the foraging range of the largest colonies at Shetland, where a range of more than 100km is deemed as possible.

Hotspots based on the top 1% of Getis-Ord Gi.* When the top 1% Getis-Ord Gi* were used to identify hotspots, the same locations as with the 5% threshold are identified, but only one smaller area qualifies under the SPA selection guidelines. Data collected in 15 years between 1981 and 2003 suggest that the location of this area is permanent. This area

overlaps with one potential SPA colony extension and the seabird assemblage exceeds qualifying numbers in all three seasons (Table 47). The same reasons as for the identification of the 5% threshold areas apply.

The analysis identified significant areas that correspond with earlier descriptions of great skua distributions during breeding (see above). All three areas qualify at Stage 1.2 of the UK SPA selection guidelines. The choice of a 5% or a 1% threshold reflects a more precautionary or conservative approach in site selection, respectively. All areas hold generally high numbers of seabirds and (in case of the areas based on top 5% of Getis-Ord Gi*) are occupied by many species exceeding qualifying numbers. Hence, there are sound reasons for recommending an SPA south-west of Shetland, and possibly north-east of Shetland, although further data collection there would be required to determine if it is still present.

4.1.9 Black-legged kittiwake, breeding

Population estimate. The black-legged kittiwake is one of the most abundant seabirds worldwide, with a biogeographic population of 8.4 million individuals (Wetlands International 2006). In Great Britain and Ireland, a total of 416,000 breeding individuals was recorded (Mitchell *et al* 2004). The largest kittiwake colonies occur on rocky sea cliffs along the North Sea coasts of north-east England (Humberside, 42,000 individuals), Scotland (Caithness: 49,500 individuals), and Orkney (57,700 individuals). Particular attention has been given recently to kittiwakes, because there is evidence from various colonies that breeding populations (Heubeck 2000, Thompson and Walsh 2000) and adult survival rates are declining (Harris *et al* 2000).

Distribution at sea. During the breeding season kittiwakes occur in highest densities along the coasts of Scotland and north-east England, over Dogger Bank and around Orkney (Stone *et al* 1995, Skov *et al* 1995). The Wee Bankie off the Firth of Forth has also been noted as a significant area for kittiwakes breeding at the Isle of May (Wanless *et al* 1998).

Foraging range. Daunt *et al* (2002) describe the foraging range of kittiwakes as 73km for individuals from the Isle of May and Humphreys *et al* (2006) measured a maximum foraging distance of 83km at the same location, which means that the Wee Bankie is well within the range of black-legged kittiwakes from the Isle of May. Camphuysen *et al* (2006) describe a close association between surface feeding kittiwakes and diving guillemots - the former taking advantage of concentrations of prey near the surface by the latter - in the area of the Wee Bankie. The density surface maps generated by Poisson kriging in this analysis closely resembled the distributions described by these studies.

Status. The black-legged kittiwake is a regularly occurring migratory species in the UK. Therefore, Stage 1.2 of the UK SPA site selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is either 1% of the relevant biogeographic population or 20,000 individuals, whichever number is lower. As the biogeographic population of black-legged kittiwake consists of 8.4 million individuals (Wetlands International 2006), the threshold of 20,000 individuals applies.

Hotspots based on the top 5% of Getis-Ord Gi.* Two large top 5% hotspots meet the SPA selection guidelines: one in the Moray Firth and one in the Firth of Forth. Both occur mostly within the foraging range of black-legged kittiwake colonies (70km, Camphuysen *et al* 2006), and could be caused by foraging breeding birds. The qualifying area in the Moray Firth overlaps with two potential SPA colony extensions, and it borders on three existing SPAs. Four other species occur here in qualifying numbers, some of them during several seasons, and the seabird assemblage exceeds qualifying numbers during breeding, winter and

summer (Table 27). For both areas data were available from a large number of years (21 and 19 years, respectively). They indicate the presence of both hotspots during most times between 1980 and 2004, so a permanent presence of these areas can be assumed. The qualifying area in and around the Firth of Forth includes the Wee Bankie and Aberdeen Bank. It shares large sections with the qualifying areas of common guillemot during breeding and during moult. The area overlaps with two SPAs. The seabird assemblage exceeds qualifying numbers in all three seasons and three other species occur in qualifying numbers (Table 28).

Hotspots based on the top 5% of Getis-Ord Gi.* None of the top 1% hotspots qualify using the site selection guidelines.

The two main locations identified in this analysis occur at places which are described as significant kittiwake foraging areas by other studies (see above). They both qualify at Stage 1.2 of the site selection guidelines and overlap in parts with SPAs. The significance of the area for a large number of other species and the seabird community as a whole provides a strong case for the consideration of the area at the Firth of Forth and the Moray Firth as possible SPAs; both form part of important seabird regions (see 4.2.2).

During the winter, black-legged kittiwakes disperse over a large area of the continental shelf and identified hotspots are too scattered to hold qualifying numbers, particularly considering the threshold of 20,000 individuals which need to be reached. Consequently, no qualifying area could be identified for black-legged kittiwakes during winter.

4.1.10 Lesser black-backed gull, winter

Population estimate. The population of the lesser black-backed gulls has increased throughout the 20th century; the latest estimates of the biogeographic population indicate 550,000 individuals of the subspecies that occur in Britain (*Larus fuscus graellsii*, Wetlands International 2006). A large proportion of this population breeds in Britain and Ireland. Mitchell *et al* (2004) list 91,300 apparently occupied nests at coastal colonies, plus 116,700 apparently occupied nests inland. The United Kingdom therefore has a high responsibility for the conservation of this species.

Distribution at sea. During winter, this species is widespread along the coasts of the North Sea, with exception of the Norwegian coast, but more scattered, in the Irish Sea. A few dispersed locations with high densities are present in the Celtic Sea and at the South-west Approaches (Stone *et al* 1995). Lesser black-backed gulls have a varied diet, including earthworms and rubbish obtained inland (Stone *et al* 1992a). At sea, particularly during winter, they are often associated with fishing vessels and feed on discarded fish (Furness *et al* 1992, Stone *et al* 1992a). The density surface maps of this analysis shows similar irregular locations of high densities of individuals in the Celtic Sea (Stone *et al* 1995).

Status. As the lesser black-backed gull is a regularly occurring migratory species in the UK, Stage 1.2 of the UK SPA selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is 1% of the relevant biogeographic population or 20,000 individuals, in this case 5,500 individuals (Wetlands International 2006).

Hotspots based on the top 5% of Getis-Ord Gi.* One area in the Celtic Sea qualifies by the SPA selection guidelines from the analysis based on top 5% Getis-Ord Gi*. The seabird assemblage exceeds its qualifying numbers in this area during all three seasons (Table 29). Other areas qualify numerically but they do not meet our criterion of regularity. The survey effort in the qualifying area is rather poor and lesser black-backed gulls were observed in

only 22% of its extent. Also, the test for regular occurrence was based on only three years of data, collected during 1991-1993.

Hotspots based on the top 1% of Getis-Ord Gi.* No qualifying areas were identified based on the 1% Getis-Ord Gi* threshold, suggesting that individuals are less aggregated during the post-fledging time.

Based on our analysis for lesser black-backed gull in winter, one area qualified at Stage 1.2 of the UK SPA selection guidelines. It is uncertain, however, why the hotspot in the Celtic Sea occurs. Lesser black-backed gulls are frequently with ships, so these hotspots could result from the presence of fishing vessels in the area. This uncertainty, combined with the insufficient survey coverage of the area does not provide a good case for recommending this area for consideration as a possible SPA for this species. Further data collection would be necessary to investigate the suitability of this area as a possible SPA.

4.1.11 Common guillemot, breeding

Population estimate. The common guillemot is one of the most abundant seabird species at higher latitudes of the northern hemisphere, with an estimated biogeographic population of 8.5 million individuals in the North Atlantic (Mitchell *et al* 2004). Nearly a quarter of these breed in Britain and Ireland (2 million individuals, Baker *et al* 2006), indicating a high responsibility for the UK for the conservation of this species.

Common guillemots breed all around Britain and Ireland at suitable cliff habitat. The largest colonies in the UK are at Handa (112,700 individuals, north-west Sutherland), Rathlin Island (95,100 individuals) and the mainland cliffs at Berriedale (79,100 individuals, east Caithness) (Mitchell *et al* 2004).

Distribution at sea. During breeding and chick-rearing (May - June), Stone *et al* (1995) and Skov *et al* (1995) describe highest densities of guillemots around the main breeding areas of the Moray Firth, Orkney, Shetland and the Firth of Forth; and high densities around colonies at north-west Scotland, Flamborough Head and on the islands off Pembrokeshire.

Foraging range. Most of these locations are within the estimated foraging range of 60km to the colonies (Harris and Wanless 1985, Wanless *et al* 1998), and it is likely that they are formed by foraging individuals breeding at these sites. Camphuysen *et al* (2006) recorded that guillemots from the Isle of May dominated the feeding grounds at the Wee Bankie, whereas individuals from the Farne Island and St. Abb's foraged at the Marr Bank. The density surface maps generated in this analysis resemble these descriptions of guillemot distributions.

Status. The common guillemot is a regularly occurring migratory species in the UK. Therefore, Stage 1.2 of the UK SPA site selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is either 1% of the relevant biogeographic population or 20,000 individuals, whichever number is lower. The latter applies for common guillemot (Mitchell *et al* 2004).

Hotspots based on the top 5% of Getis-Ord Gi.* The hotspots are all within the foraging range of common guillemot colonies (excluding a small area 70km east of Aberdeen). The large qualifying area at the Moray Firth is well in range of the colonies at Caithness and Orkney; in its westernmost extension it is in range of Handa, in its southernmost extension it is close to the colonies between Rosehearty and the Bay of Cullen. It overlaps with six potential SPA colony extensions, and it abuts on one designated SPA. The seabird assemblage exceeds qualifying numbers, and seven other species reach qualifying numbers

in the area (Table 33). Tests for its regular occurrence were carried out on data collected in 17 years, and the results are indicating that this is a permanent hotspot for common guillemot.

The qualifying areas in the Firth of Forth are in range of the colonies between Crawton and Fowlsheugh, the Isle of May, St. Abb's Head and the Farne Islands. The larger of the two areas includes the Wee Bankie and Marr Bank. Data from only seven years of collection were available to test for its presence (well spread between 1981 and 2003), but six out of seven of these showed significantly higher numbers of common guillemots in this area than outside it. Both sandbanks are known to have a high presence of sandeels and they are important feeding areas for guillemots and other seabirds breeding in the area (Wanless *et al* 1998). It is part of an important region (see 4.2.2), and it overlaps with two potential SPA colony extensions. The seabird assemblage exceeds the qualifying number during breeding, winter and summer, and four additional species occur in qualifying numbers during at least one season (Table 31). The smaller area also hosts important seabird numbers during breeding and summer (Table 32). However, data for the test of its presence were available from no more than four years.

The qualifying area on the west coast, in the North Channel and the Firth of Clyde, is close to the largest guillemot colony, Rathlin Island. It overlaps one potential SPA colony extension and it borders on two existing SPAs. The seabird assemblage exceeds qualifying numbers during breeding, winter and summer, and the herring gull (winter) occurs in qualifying numbers (Table 30). It is worth mentioning that the herring gull is not covered by any other qualifying area elsewhere. Common guillemots were seen in only 15% of this area, however, and data were only available from four years to test for its regular occurrence (1985, 1988, and 1996-97).

Hotspots based on the top 1% of Getis-Ord Gi.* Most hotspots based on the top 1% of Getis-Ord Gi* were on the east coast of Scotland. The only qualifying area is located in range of the colonies at Orkney and Caithness, but it is much smaller than the corresponding area based on top 5% of Getis-Ord Gi*. Data collected during seven years (between 1984 and 2004) suggest a permanent occurrence at this location. It overlaps with one potential SPA colony extension and the seabird assemblage exceeds qualifying numbers during breeding (Table 48). Around the Firth of Forth, a hotspot at Marr Bank comprises the required number of individuals, but not on a regular basis. Like the west coast area of Rathlin Island, it does not qualify for selection as a possible SPA.

Based on our analysis, three main locations of interest were identified for common guillemots during breeding: one area close to the colonies of Caithness and Orkney, one area over the sandbanks of the Firth of Forth and north of it, and one area at Rathlin Island. While the area at Caithness and Orkney qualifies at Stage 1.2 of the UK SPA selection guidelines regardless of which Getis-Ord threshold is applied, the areas at Rathlin Island and at the Firth of Forth qualify only based on top 5% Getis-Ord Gi*. Based on the frequency of occurrence of qualifying hotspots and the overlap with other protected sites, the area at Caithness and Orkney makes the strongest case for consideration as a possible SPA, the area at the Firth of Forth is of moderate importance, and the area at Rathlin Island makes the weakest case to be recommended for consideration. For the latter two further surveys would be recommended to strengthen their case.

4.1.12 Common guillemot, additional season

Distribution at sea. By late June and July common guillemot chicks are fledging and they leave the colonies accompanied by the male parent. Because adult guillemots moult into their winter plumage after breeding, both juveniles and parents are flightless. Camphuysen (2002) illustrates how they disperse from the colonies on the east coast of Scotland rapidly

eastwards during the post-fledging period. Instead of heading towards the feeding areas used during breeding, they fan out towards areas further away from the coast (Camphuysen 2002). Stone *et al* (1995) also describe a movement resulting into high densities around the colonies, and moderate to high densities across the northern North Sea and Dogger Bank in the east, and at the Irish Sea Front and St. George's Channel in the west. High densities in the northern North Sea are also described by Skov *et al* (1995).

The kriged seabird density surface map of guillemots during their post-breeding season reflects some of these references; however, densities in the northern North Sea and over Dogger Bank are not higher than during the breeding season, whereas high densities occur in the Solway Firth.

Hotspots based on the top 5% of Getis-Ord Gi.* One area based on the top 5% threshold of Getis-Ord Gi* qualified according to the UK SPA selection guidelines. It is situated at the same location as one of the qualifying areas during the breeding season and therefore does not represent an exclusive post-fledging area. The seabird community exceeds qualifying numbers during breeding and during summer in this area (Table 34). Seven out of eight years of data showed the presence of this area, and, as they were well spread over the 1980's, the 1990's and the current decade, they suggest a permanent presence of this area.

Hotspots based on the top 1% of Getis-Ord Gi.* No qualifying areas were identified based on the 1% Getis-Ord Gi* threshold, suggesting that individuals are less aggregated during the post-fledging time compared to the breeding season.

Based on our analysis, one area qualifies at Stage 1.2 of the UK SPA selection guidelines. This analysis does not provide a strong case for consideration of a possible SPA specifically for common guillemots in the post-fledging period; however, it may be feasible to recommend a combined breeding and post-fledging area for common guillemots to be considered as a possible SPA.

4.1.13 Common guillemot, winter

Distribution at sea. During the early winter season, common guillemot densities remain high on the north-east coasts of Scotland and England, in the Minches, close to the Irish Sea Front and over Dogger Bank (Stone *et al* 1995). As winter progresses, common guillemots disperse further over the southern North Sea, into the Kattegat and Skagerrak and off southern Ireland. High densities are still recorded in the inner regions of the Moray Firth and the Firth of Forth Bank (Stone *et al* 1995). Skov *et al* (1995) describe larger areas hosting high densities in the Moray Firth as well as at the Firth of Forth and over Dogger Bank. The kriged density surface maps of our analysis support these findings.

Hotspots based on the top 5% of Getis-Ord Gi.* One area in the inner Moray Firth, based on the top 5% hotspots, qualifies according to the UK SPA selection guidelines. It abuts on three designated SPAs, and it overlaps with one potential SPA colony extension. It is also part of an important region (4.2.2). The seabird assemblage exceeds qualifying numbers in the area during all three seasons, and three further species reach qualifying numbers (Table 35). From the ten years with suitable data, eight show the presence of the site in the first half of the 1980's and in the middle of the 1990's.

Hotspots based on the top 1% of Getis-Ord Gi.* No hotspots qualify when based on the top 1% of Getis-Ord Gi*.

This analysis identified one area qualifying at Stage 1.2 of the UK SPA selection guidelines, that should be recommended for consideration as a possible SPA, as it delineates a location previously identified as an important area during winter for common guillemots by other

publications (Skov *et al* 1995, Stone *et al* 1995). Further surveys to investigate if the area is currently present would be welcome. Two other areas, the Firth of Forth and Dogger Bank, would qualify numerically, but not on a regular basis; so currently these areas cannot be considered as a possible SPAs under stage 1.2.

4.1.14 Atlantic puffin, breeding

Population estimate. The Atlantic puffin is one of the most abundant species in the North Atlantic, its biogeographic population is estimated at 13.5 million individuals (Wetlands International 2006). Of these, 600,700 individuals breed in Britain and Ireland, many at the largest colonies at St Kilda (142,300 apparently occupied burrows, or AOB), Sule Skerry (59,500 AOB) and the Farne Islands (55,700 AOB, Mitchell *et al* 2004).

Distribution at sea. During the breeding season they are present in high densities close to their breeding colonies at Shetland, Orkney, the Faeroes, the Outer Hebrides, St Kilda, the Firth of Forth and Skomer (Stone *et al* 1995, Bloor *et al* 1996, Pollock *et al* 2000). The density surface maps of this study indicate an additional area with high densities at Solan Bank north of Scotland.

Foraging range. Trip durations measured at various colonies around the Britain suggest a foraging range between c. 35 - 100km from the colonies (Bradstreet and Brown 1985). Although in Norway even greater distances were recorded (137km, Anker-Nilssen 1990), it can be assumed that most Puffins feed close to the colony (Corkhill 1973, Wanless *et al* 1990). Stone *et al* (1992b) describe that foraging trips of puffins extended to 40km from Skomer and Skokholm, with a tendency to decrease later during the day.

Status. The Atlantic puffin is a regularly occurring migratory species in the UK. Therefore, Stage 1.2 of the UK SPA selection guidelines should be applied in the initial assessment of whether an area might be suitable for classification as an SPA for the species (Stroud *et al* 2001). The threshold for such assessment is either 1% of the relevant biogeographic population or 20,000 individuals, whichever number is lower. The qualifying number of Atlantic puffin is therefore 20,000 individuals (Mitchell *et al* 2004).

Hotspots based on the top 5% of Getis-Ord Gi.* Three areas where identified, which qualify by the UK SPA selection guidelines. One area is located west of Shetland, one at Solan Bank north of Scotland, and one at the North Minch. All three areas are close to medium or large colonies (Foula for the Shetland area, Sule Skerry for the area north of Handa, and Shiant Isles at the North Minch). The qualifying areas are within the foraging range of the colonies.

The area in the Minches overlaps with one potential SPA colony extension and hosts qualifying numbers for the seabird assemblage during the breeding season and the summer (Tale 36). The area at Shetland overlaps with one potential SPA colony extension. The seabird assemblage exceeds qualifying numbers in all three seasons, and three other species occur in qualifying numbers (Table 38). The area north of Handa overlaps with three potential SPA colony extensions. The seabird assemblage and one extra species occur in qualifying numbers (Table 37). In all three areas data from thirteen years were available to test for their presence, and nearly all of the tests were significant, suggesting a rather permanent presence of these areas.

Hotspots based on the top 1% of Getis-Ord Gi.* One area qualified at Stage 1.2 of the UK SPA selection guidelines. The area is located in the Firth of Forth, east of the area identified for Atlantic puffin during winter based on top 5% of Getis-Ord Gi*. It overlaps with one potential SPA colony extension, and it borders on two existing SPAs. As 10 out of 11 years of data collection show its presence, suggesting that this area is permanently present.

Based on this analysis, four areas were identified that qualify at Stage 1.2 of the UK SPA selection guidelines (Table 49). The unusual situation arises that a qualifying area based on top 1% of Getis-Ord Gi* is identified at a location which is not qualifying based on top 5% of Getis-Ord Gi*. This is due to the differences in shape between the areas identified based on the two threshold values and numbers of data points enclosed, which leads to different outcomes when the criterion of regularity is assessed.

Although the qualifying areas appear at locations which can be expected by the distribution maps, they did not necessarily occur around the largest colonies. A reason might be the way the prey is aggregate around some colonies. This is speculative, however, so the recommendation of the area north of Handa as a possible SPA might be possibly based on the presence of a large colony, whereas the area at the Minches currently lacks sufficient support for further consideration as a possible SPA at Stage 1.2. The area west of Shetland and in the Firth of Forth are part of an important regions (4.2.2) and host qualifying numbers of a variety of other species and the seabird assemblage, which supports their consideration as a possible SPAs.

4.1.15 Atlantic puffin, winter

Distribution at sea. After the breeding season, when puffins leave their colonies, they move offshore within the western North Sea (Skov *et al* 1995, Stone *et al* 1995). To the north and west of Scotland they move into deeper waters and moderate densities are recorded south and west of the Faroes, at Shetland, Orkney and in the Minches (Pollock *et al* 2000). These movements correspond with the density surface map generated by Poisson kriging for Atlantic puffin in winter.

Hotspots based on the top 5% of Getis-Ord Gi.* A qualifying area for Atlantic puffin in winter occurs a short distance off the east coast of Great Britain. In this area, the seabird assemblage occurs in large numbers that exceed the qualifying threshold; another three other species occur in qualifying numbers. Little is known about the distribution of Atlantic puffin during the winter and no explanation can be offered for the location of the hotspot. The fact that nearly all of 15 years of data collection show the presence of this hotspot suggests that it might be permanently present at this location.

Hotspots based on the top 1% of Getis-Ord Gi.* Our analysis showed that no hotspots were identified based on the top 1% Getis-Ord Gi* statistic.

Although high densities are described by Stone *et al* (1995) at this location, providing further support that the qualifying area might be a significant area for puffins in the winter, there is no ecological explanation we could currently offer for its presence at this location. A conservative approach of site selection might therefore not consider this area as a possible SPA at Stage 1.2 of the selection guidelines, whereas a more cautious approach could support a recommendation.

4.1.16 All species, summer

Great Britain and Ireland host a breeding seabird assemblage of outstanding international importance (Mitchell *et al* 2004). While seabirds are restricted in their movements during breeding, they can usually disperse over large parts of the UK Fishery limit within a short period of time after the young fledged. The summer, here defined as July - August, covers for the UK breeding species usually a period of chick fledging and dispersal.

Hotspots based on the top 5% of Getis-Ord Gi.* Two qualifying areas for the seabird assemblage were identified, one at the Firth of Forth and one in the Minches. The area at

the Firth of Forth overlaps with one potential SPA colony extension, and it hosts qualifying numbers of three additional species (Table 40). Twelve out of 13 years of data collected between 1980 and 2002 show the presence of this area and suggest a permanent occurrence at this location. The area in the Minches overlaps with one potential SPA colony extension (Table 41). Merely five out of seven years of suitable data support the presence of this area (Table 41), thus further data collection is advisable to strengthen the case of this latter area.

Hotspots based on the top 1% of Getis-Ord Gi.* No qualifying areas based on top 1% of Getis-Ord Gi* were identified.

The location of qualifying areas for seabird assemblages is difficult to interpret because no single species with species-specific ecology can be addressed. Complementary to this section, which identifies areas with particularly high numbers of individuals in seabird assemblages, section 4.2.2 is dealing with identifying regions which hold a high number of qualifying areas of individual species. The identification of the Firth of Forth, particularly at the area of the Wee Bankie, by both this section and section 4.2.2 highlights the importance of this area for the seabird assemblage as a whole during the summer, and provides a strong case for its consideration as a possible SPA. The qualifying area in the Minches is less significant according to section 4.2.2, but could nevertheless be recommended for consideration as a possible SPA if a cautious approach is chosen.

4.1.17 Other species

For a number of species and seasons, no qualifying area could be identified, though some of these species at least appeared in qualifying numbers in areas identified for other species and seasons. 19 species did not reach qualifying numbers in any area, although hotspots were usually identified for these species.

Those species-seasons for which hotspots did not emerge from the analyses include most species of shearwater (Cory's shearwater, great shearwater, sooty shearwater, and Manx shearwater during winter), great cormorant during breeding, most species of skua during all seasons (pomarine skua, Arctic skua and long-tailed skua, but not great skua), some gull species during all seasons (black-headed gull, Mediterranean gull, common gull, Iceland gull, glaucous gull), and some gull species only during winter (black-legged kittiwake, little gull, great black-backed gull). For herring gull no suitable area was found during their breeding season, but they appear in qualifying number in one area identified for common guillemot during winter. Sandwich tern is the only tern species excluded, and Razorbill is the only auk species where no areas were identified.

The reasons for the failure to identify areas which hold these species in qualifying numbers differ between species. A variety of species show such low densities over the entire range of their seabird density surface maps that they never reach qualifying numbers, either in hotspots identified on their distribution maps, or in any other qualifying area. Species belonging to this category are Cory's shearwater; Manx shearwater (winter); pomarine and Arctic skua; Mediterranean, Iceland, glaucous, black-headed and common gull (the latter during breeding); and Sandwich tern. While the low densities of pomarine and Arctic skua are most likely a result of their small populations and solitary lifestyle, all other gulls have larger populations and their low densities are a result of dispersal.

Most of the excluded species show higher densities, but these are restricted to such small areas that the effective densities of these species are too low to reach qualifying numbers in any area. Relevant species-seasons here include great cormorant (breeding), long-tailed skua (summer), great black-backed gull (winter) and little gull (winter). This is also the case for another group of species, but additionally these have to exceed high thresholds to qualify,

a result of their large biogeographic populations: great and sooty shearwater (summer), black-legged kittiwake (winter), common gull, black-headed gull, herring gull (breeding) and razorbill.

4.2 Areas to be considered under Stage 1.4

4.2.1 Areas failing to meet our criterion of regularity by a narrow margin

If Stages 1.1-1.3 of the UK SPA selection guidelines do not identify an adequate suite of suitable sites for the conservation of seabirds in British waters, areas which meet one or more of the requirements of the Stage 2 guidelines can be proposed as additional possible SPAs. Requirements of Stage 2 provide for consideration of SPAs based on population size and density, species range, breeding success, history of occupancy, multi-species areas, naturalness and severe weather refuges (Stroud *et al* 2001). Any area with outstanding value in one or more of these requirements should be considered.

In order to identify further areas with high bird concentrations (referring to the guideline of population size and density), a selection of areas which held qualifying numbers of seabirds, but which failed to meet the SPA selection criterion of regularity by a narrow margin were investigated in more detail. A total of nine "near-qualifying areas" were identified for northern gannet during breeding, common guillemot during the additional season and during winter, Atlantic puffin during breeding, and for seabird assemblages during breeding and during summer.

Hotspots based on the top 5% of Getis-Ord Gi.* Qualifying areas for northern gannet during breeding were identified based on both top 1% and top 5% of Getis-Ord Gi*. These areas are at St Kilda and at the Firth of Forth, whereas the location of the near-qualifying area (based on top 5% of Getis-Ord Gi*) is off the north coast of Scotland. The near-qualifying area does not add range to the already identified areas, but it covers an area not addressed previously. Also four other species and the seabird assemblages during all three seasons occur in this site with qualifying numbers (Table 50). Although the site is of less importance for northern gannets, it appears to be significant for the seabird community.

For common guillemot three near-qualifying areas were identified, that could be considered at Stage 1.4: one area at Marr Bank during the additional season of moult, one area over Dogger Bank during winter, and one area at the Firth of Forth during winter (all based on top 5% Getis-Ord Gi*). The area at Marr Bank is south of the qualifying area identified for this species and season (Table 34, based on top 5% of Getis-Ord Gi*), hence it does not add value to the already identified qualifying areas. The opposite is true for the near-qualifying area over Dogger Bank. A qualifying area covering common guillemots during winter was identified before (Table 35, based on top 5% of Getis-Ord Gi*), but that area is a long distance north of Dogger Bank at the Moray Firth. Hence, the near-qualifying Dogger Bank area is supported by our criterion of range, and moreover, it holds qualifying numbers of little gull (additional season), common guillemot (winter), little auk (winter), and of seabird assemblages (breeding, winter and summer) (Table 52). Of these, particularly little gull is important since it is one of the species hardly covered by other areas. The third near-qualifying area for wintering common guillemots at the Firth of Forth could also be suggested for consideration as possible SPA based on our criterion of range, although this case is less robust than that for Dogger Bank. As this third near-qualifying area is part of the Firth of Forth, one of the most important regions for seabirds (see below 4.2.2), and as this area overlaps with two potential SPA colony extensions and borders on two existing SPAs, it could be recommended for consideration as possible SPA for guillemots and other species in this region (Table 53).

One near-qualifying area for Atlantic puffin during breeding is identified at the outer Firth of Forth, based on 5% of Getis-Ord Gi*. This area is further south than the other qualifying areas identified for this species and season, which are at the Minches, north of Handa and at Shetland (Tables 36, 37 and 38). It overlaps with two potential SPA colony extensions and it abuts on two existing SPAs (Table 54). This site is therefore beneficial in terms of range, but particularly the overall significance of the Firth of Forth for seabirds and the overlap with other protection sites should be taken into account when considering this area as a possible SPA (see 4.2.2).

For assemblages of breeding seabirds, there were three near-qualifying areas identified that could be considered at Stage 1.4: one area to the west of North and South Uist, one area at Canna, and one area at Skomer and Skokholm (all based on top 5% of Getis-Ord Gi*). The areas at Skomer and Skokholm and at Canna are primarily a result of the large number of breeding Manx shearwater (Tables 55-56), and they are at the same locations as the qualifying Manx shearwater areas based on top 5% of Getis-Ord Gi* (Tables 16 and 17). Hence these areas do not provide additional value to the already identified possible SPAs. The near-qualifying area west of North and South Uist is not covered by other already identified areas, but it borders on two existing SPAs. But without further evidence if this area consists over a longer period of time and why this location is important, there is no strong case for this area to be considered as possible SPA.

For assemblages of seabirds during the summer, one near-qualifying area was identified based on top 5% of Getis-Ord Gi*. Fowlsheugh east of Stonehaven is within a region which has to be considered as generally important for seabirds (see 4.2.2), and it coincides with qualifying areas identified for black-legged kittiwake (Table 28), common guillemot during breeding (Table 31) and the additional season of moult (Table 34), and for Atlantic puffin during winter (Table 39). The general importance of that region provides a strong case to recommend this area for consideration as a possible SPA.

Hotspots based on the top 1% of Getis-Ord Gi.* Based on top 1% of Getis-Ord, only three near-qualifying areas could be considered at Stage 1.4.: one area for northern fulmar during breeding west of Shetland, one for Manx shearwater during breeding in the vicinity of the Irish Sea Front, and one for the seabird assemblage during breeding at the Wee Bankie.

The area for northern fulmar during breeding is close to the already identified qualifying area for this species and season at Shetland (Table 14, based on top 5% of Getis-Ord Gi*). Apart from northern fulmar, seabird assemblages occur in this area in qualifying numbers during breeding and during the summer (Table 59), and it does not add much value to the already identified areas.

By contrast, the area for Manx shearwater in the vicinity of the Irish Sea Front is a well known foraging site of this species (Begg and Reid 1997) and currently no qualifying area exists at this location. If a cautious approach for the protection of Manx shearwater is desired, this area should be considered as additional possible SPA. No other species occurs in this area in qualifying numbers, probably due to its small size.

The near-qualifying area for the assemblage of breeding seabirds at the Wee Bankie is at a location which is already identified by qualifying areas for a selection of seabirds based on top 5% of Getis-Ord Gi*, such as northern gannet during breeding (Table 19), black-legged kittiwake during breeding (Table 28), common guillemot during breeding (Table 31), and for the seabird assemblage during the summer (Table 40). Based on top 1% of Getis-Ord Gi*, another qualifying area was identified for Atlantic puffin during breeding (Table 49). The overall importance of this region for seabirds in British waters is high and it is recommended to be considered as a possible SPA for the seabird assemblage.

4.2.2 Important regions

Over the course of the analysis it became evident that there are at least four very important multi species regions: the outer Firth of Forth with the Wee Bankie and Marr Bank, the inner Firth of Forth, the Moray Firth and the north and west of the Shetland Islands. These regions hold several areas that qualify for a variety of species or seabird assemblages. It may prove possible to identify one or more suitable areas in these regions to suggest as possible SPAs and to include many significant species of these regions in qualifying numbers.

A few regions, such as the ones off the north coast of Scotland, around St Kilda or to the west of Skomer and Skokholm, are important for a lower number of species. Their importance might not be as high as for the multi-species regions described above, but their value for individual species could be significant.

4.3 Possible SPAs and environmental data

The possible SPAs described in this report were identified based solely on the appearance of bird aggregations; no environmental data was used as an explanatory variable in this process. The reason for this was that early on in the process of generating seabird density surface maps we recognized that the environmental data available to us could not explain a great amount of the variability of the seabird distribution data; hence we discarded the possibility of modelling the seabird density surfaces with the help of GAMs or other appropriate modelling methods and decided to generate them by interpolation.

After identification of seabird hotspots, we conducted a series of simple analyses (correlations between environmental data and seabird data, Mann-Whitney U-test between data within and data outwith hotspots, simple habitat models) to investigate if the location of hotspots could be linked to environmental variables and habitats. None of these analyses revealed strong relationships between the environmental variables available to us and the location of hotspots, and the location of broad habitat categories, such as sandbanks, did not correspond to hotspots of species which are known to forage in association with sandbanks (e.g. black-legged kittiwakes).

Although it is desirable to define possible SPAs based not only on the location of bird assemblages but also on the location of important habitat conditions for seabirds, our attempts to link bird density surfaces and hotspots to environmental variables reveals that we are not yet able to build models with considerable predictive ability on the scale needed. Reasons for the failure might be due to the quality of the environmental data, the resolution of environmental and seabird density surface data, the variable nature of the marine environment and the lack of crucial data such as the location of prey organisms. We concluded that at the current stage, we are not able to build models to be able to predict and explain the location of seabird hotspots at the scale required for this analysis.

5 References

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Appendix 1 - Additional information

Table 11. Factors for detection correction. If possible, factors were calculated for all three categories of seastate. If the available data did not allow for a calculation by seastate, only one factor was calculated for all seastates combined and given in the centre column. [1)] refers to cases where not enough data were available to calculate a factor, [2)] refers to cases where no factor was calculated because detection did not decrease with distance.

		Transect width: 300m			Transect width: 200m		
species	**Seastate**	**0**	**1,2,3**	**4,5**	**0**	**1,2,3**	**4,5**
northern fulmar		1.14	1.22	1.31	1[1]	1.37	1.21
Cory's shearwater			1[1]			1[1]	
great shearwater			1[1]			1[1]	
sooty shearwater			1[1]			1.78	
Manx shearwater		1[2]	1.15	1.33		1[2]	
Balearic shearwater			1[1]			1[1]	
European storm-petrel		1[2]	1.33	1.4		1[2]	
Leach's storm-petrel		1.32	1.4	1.68		1[1]	
northern gannet		1[2]	1.09	1.12	1[1]	1.21	1.17
great cormorant			1[1]			1[1]	
European shag		1[2]	1.26	1.1		1[1]	
pomarine skua		1.38	1.38	1.38		1[1]	
Arctic skua		1[2]	1.51	1.29		1[1]	
long-tailed skua		1.95	1.95	1.95		1[1]	
great skua		1[2]	1.2	1.53		1.45	
Sabine's gull		1.67	1.67	1.67		1[1]	
black-legged kittiwake		1[2]	1.24	1.26	1[1]	1.49	1.44
black-headed gull		1.76	1.58	1.93		1[1]	
little gull			1[1]		1[1]	1.42	1.09
Mediterranean gull			1[1]			1[1]	
great black-backed gull		1.22	1.15	1.26	1[1]	1.77	1.25
common gull		1.29	1.32	1.67	1[1]	1.74	1.9
eastern common gull			1[1]			1[1]	
lesser black-backed gull			1[1]		1[1]	1.96	1[2]
herring gull			1[1]		1[1]	1.84	1.06
Iceland gull			1.5			1[1]	
glaucous gull			1.5			1[1]	
little tern			1[1]			1[1]	
Sandwich tern			1[1]			1[1]	
common tern		1[1]	1.01	1.8	1[1]	1.01	1.8
roseate tern			1[1]			1[1]	
Arctic tern		1.21	1.8	2.24		1.37	
common guillemot		1.24	1.35	1.49	1[2]	1.28	1.31
razorbill		1.37	1.35	1.5	1[1]	1.01	1.3
little auk		1.82	1.82	1.82	1[1]	1.49	1.24
Atlantic puffin		1.36	1.52	1.66	1[1]	1.43	1.23
Groups of species							
small gull			1[1]				
herring/lesser black-backed gull			1[1]				
large gull			1[1]				
black-backed gull			1[1]				
gull			1[1]				
common/Arctic tern			1[1]				
tern			1[1]				
guillemot/razorbill			1[1]			1[2]	
auk		1[2]	1.09	1.44			

Table 12. ICES-rescaling factors. Factors printed bold were used for rescaling.

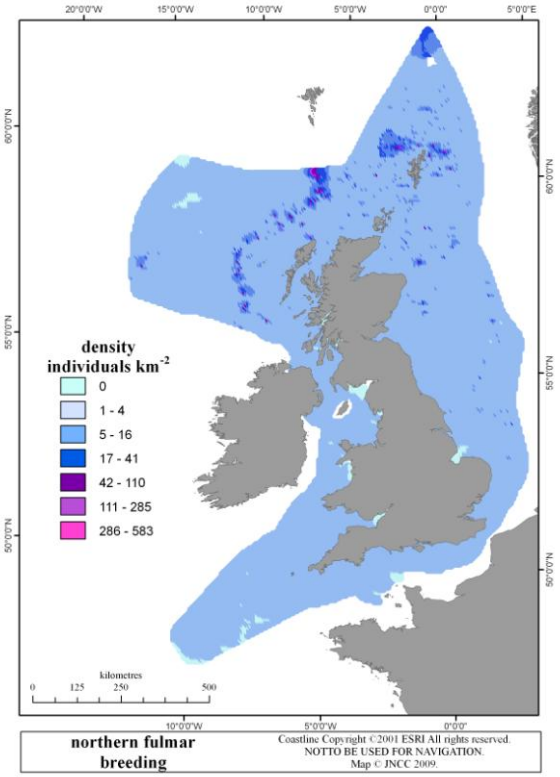
Common Name	Scientific Name	Season		
		Breeding	Wintering	Other seasons
northern fulmar	*Fulmarus glacialis*	**0.37**	**0.45**	
Manx shearwater	*Puffinus puffinus*	1.06		128.35
European storm-petrel	*Hydrobates pelagicus*	1.98		
Leach's storm-petrel	*Oceanodroma leucorhoa*	2.16		
northern gannet	*Morus bassanus*	**0.86**	**0.73**	
great cormorant	*Phalacrocorax carbo*	23.27	12.00	
European shag	*Phalacrocorax aristotelis*	1.16	1.34	
Arctic skua	*Stercorarius parasiticus*	0.44		0.51
great skua	*Stercorarius skua*	**0.64**	**0.81**	
black-legged kittiwake	*Rissa tridactyla*	1.25	**0.66**	
black-headed gull	*Larus ridibundus*	84.10	16.01	
great black-backed gull	*Larus marinus*	**0.72**	**0.21**	
Mediterranean gull	*Larus melanocephalus*			
common gull	*Larus canus*	47.80	5.40	
lesser black-backed gull	*Larus fuscus*	2.09	1.60	
herring gull	*Larus argentatus*	7.55	1.87	
Sandwich tern	*Sterna sandvicensis*	63.95	555.27	
common tern	*Sterna hirundo*	33.86		
Arctic tern	*Sterna paradisaea*	3.70		
common guillemot	*Uria aalge*	1.21	2.73	1.11
razorbill	*Alca torda*	1.37	1.42	0.66
Atlantic puffin	*Fratercula arctica*	1.98	6.94	
all species			1.29	1.05

Table 13. Qualifying population thresholds for single species areas. For thresholds below 50 individuals a minimum default threshold of 50 individuals applies. For thresholds above 20,000 individuals a maximum default threshold of 20,000 individuals is used in agreement with the Ramsar guidelines. If population estimates were given as ranges, an arithmetic mean was chosen over a geometric mean, however, there was no case in which the outcome of the analysis would have been different when using a geometric mean.

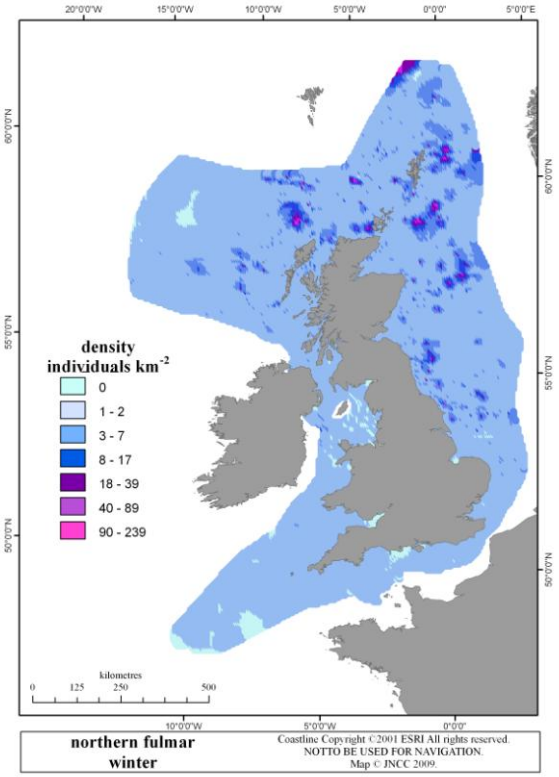
Common Name	Scientific Name	1% thresholds - rounded	
		National	Biogeographic
northern fulmar	*Fulmarus glacialis*		20,000
Cory's shearwater	*Calonectris*	50	
great shearwater	*Puffinus gravis*		20,000
sooty shearwater	*Puffinus griseus*		20,000
Manx shearwater	*Puffinus puffinus*		11,300
European storm-petrel	*Hydrobates*	770	
Leach's storm-petrel	*Oceanodroma*	1,400	
northern gannet	*Morus bassanus*		11,600
great cormorant	*Phalacrocorax carbo*		1,200
European shag	*Phalacrocorax*		2,000
pomarine skua	*Stercorarius*		300
Arctic skua	*Stercorarius*		750
long-tailed skua	*Stercorarius*		5,100
great skua	*Stercorarius skua*		400
black-legged kittiwake	*Rissa tridactyla*		20,000
black-headed gull	*Larus ridibundus*		20,000
little gull	*Larus minutus*	50	
great black-backed gull	*Larus marinus*		4,400
Mediterranean gull	*Larus*	50	
common gull	*Larus canus*		17,300
lesser black-backed gull	*Larus fuscus*		5,500
herring gull	*Larus argentatus*		20,000
Iceland gull	*Larus glaucoides*		2,000
glaucous gull	*Larus hyperboreus*		2,500
Sandwich tern	*Sterna sandvicensis*	380	
common tern	*Sterna hirundo*	360	
Arctic tern	*Sterna paradisaea*	1,600	
common guillemot	*Uria aalge*		20,000
razorbill	*Alca torda*		19,500
little auk	*Alle alle*		380
Atlantic puffin	*Fratercula arctica*		20,000

Appendix 2 Seabird density surface maps

Density surface maps for petrels can be found in Figure 29, for shearwaters in Figures 30-31, for storm-petrels in Figure 31, for gannets in Figures 31-32, for cormorants in Figures 32-33, for skuas in Figures 33-35, for gulls in Figures 35-39, for terns in Figures 39-40, for auks in Figures 40-42, and for all species as an assemblage in Figure 43. The densities given are densities after rescaling according to the ICES publication (Baker *et al* 2006).

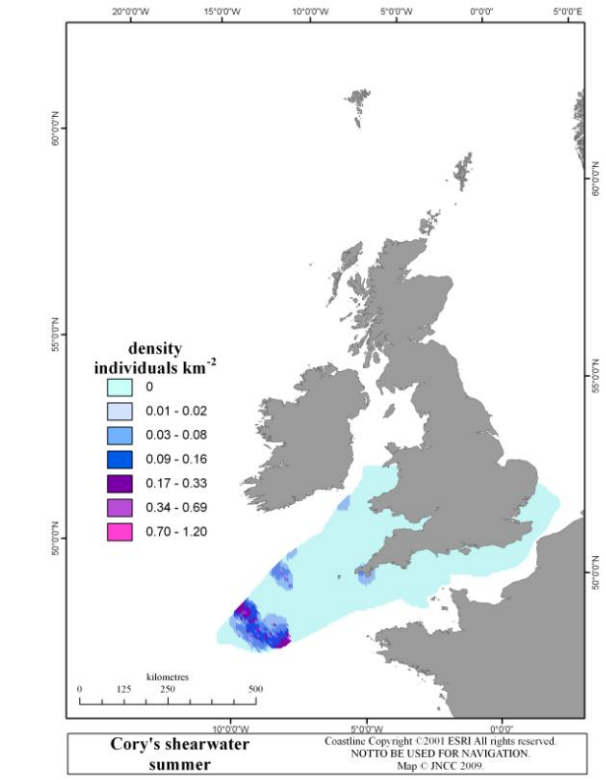


a)

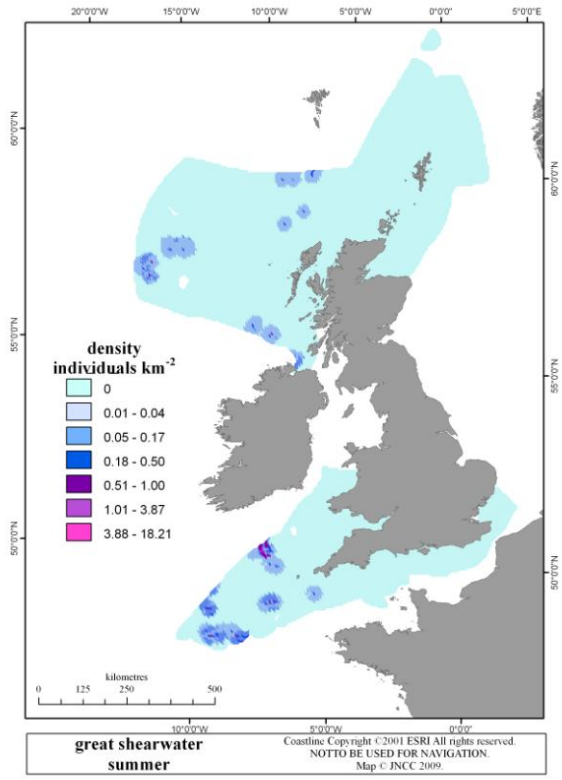


b)

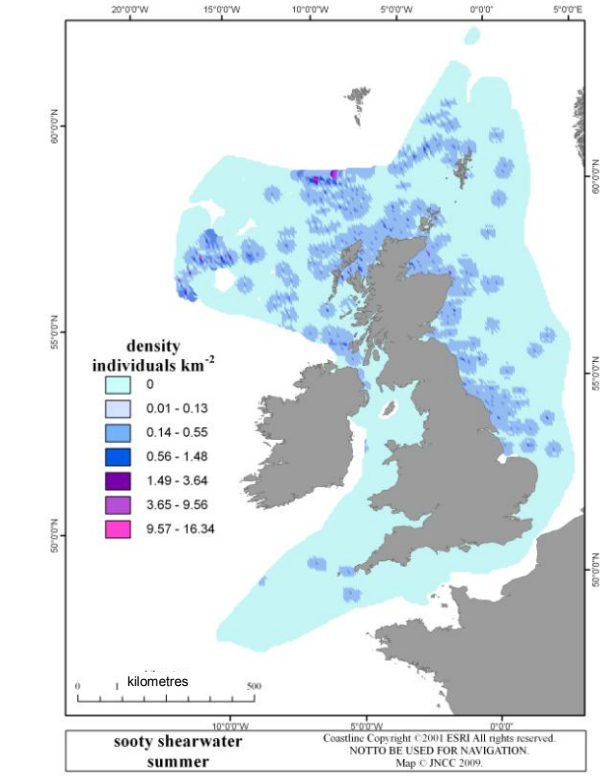
Figure 29. Predicted density surface maps from Poisson kriging of a) northern fulmar during breeding (March - July); and b) northern fulmar during winter (August - February).



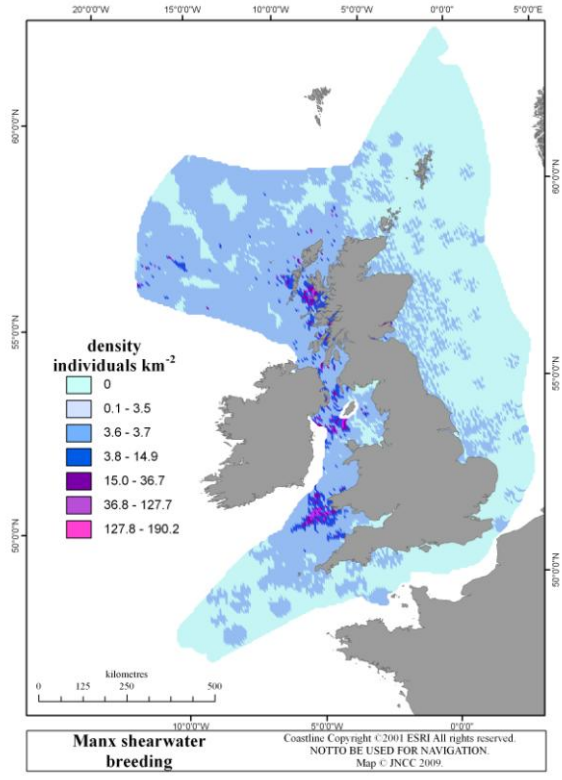
a)



b)

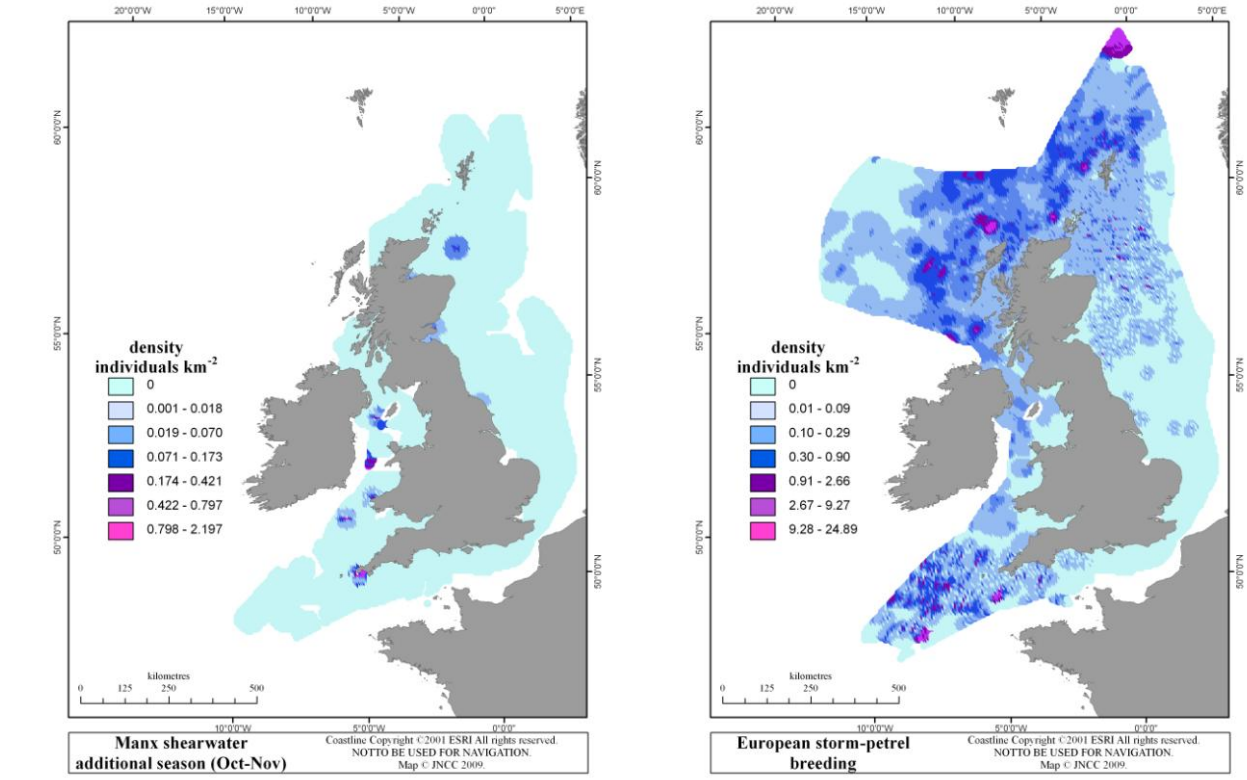


c)



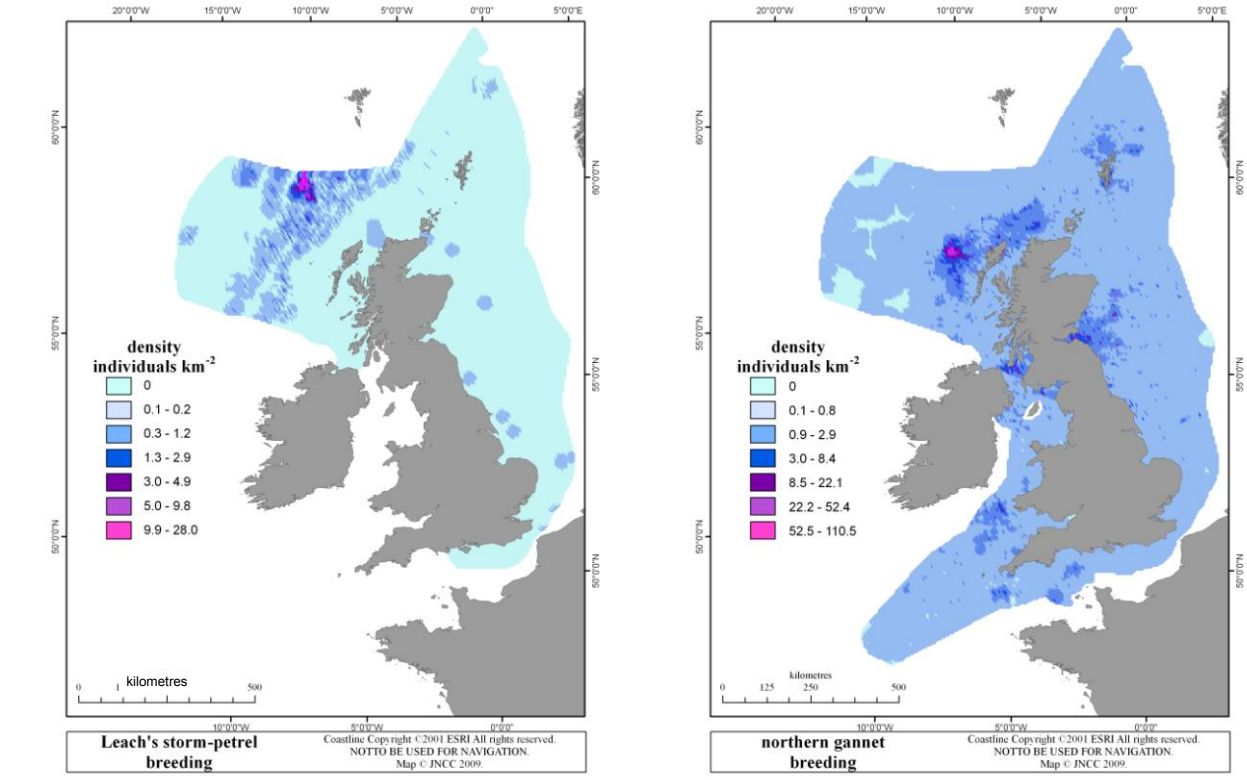
d)

Figure 30. Predicted density surface maps from Poisson kriging of a) Cory's shearwater during summer (July - October); b) great shearwater during summer (July - October); c) sooty shearwater during summer (July - November); and d) Manx shearwater during breeding (May - September).



a)

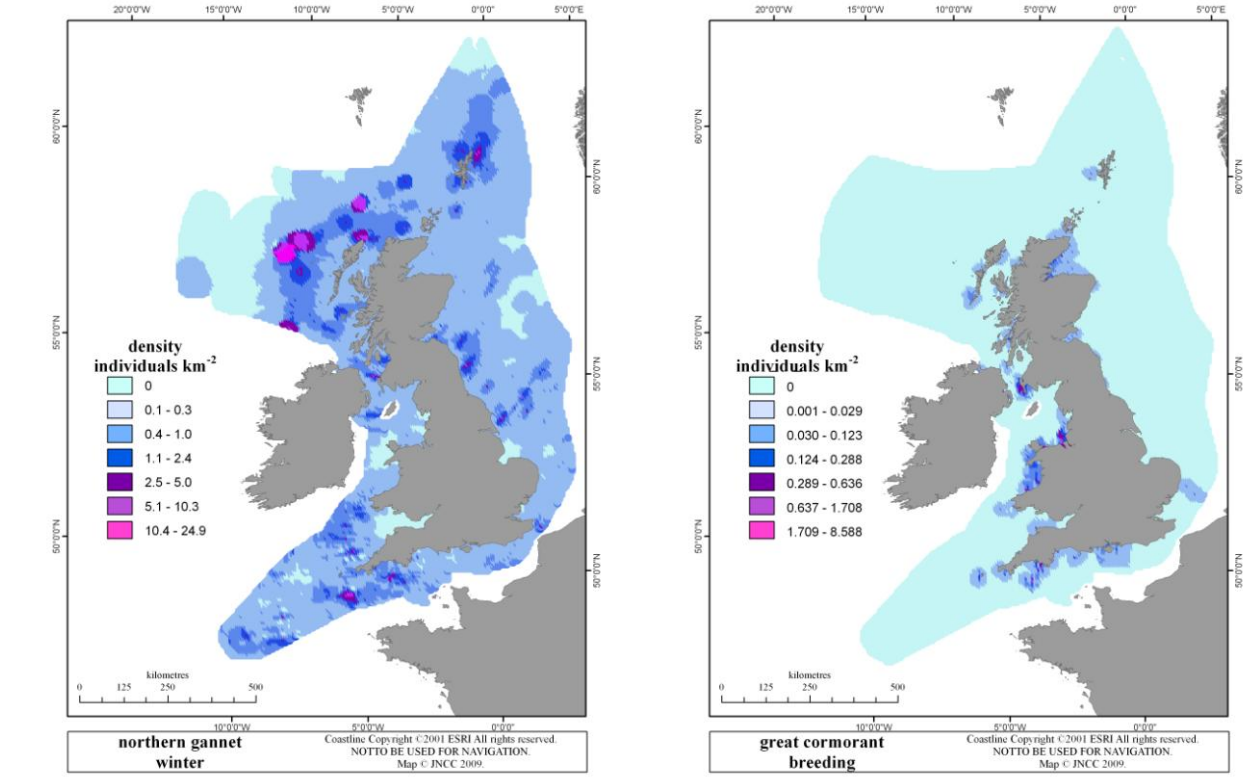
b)



c)

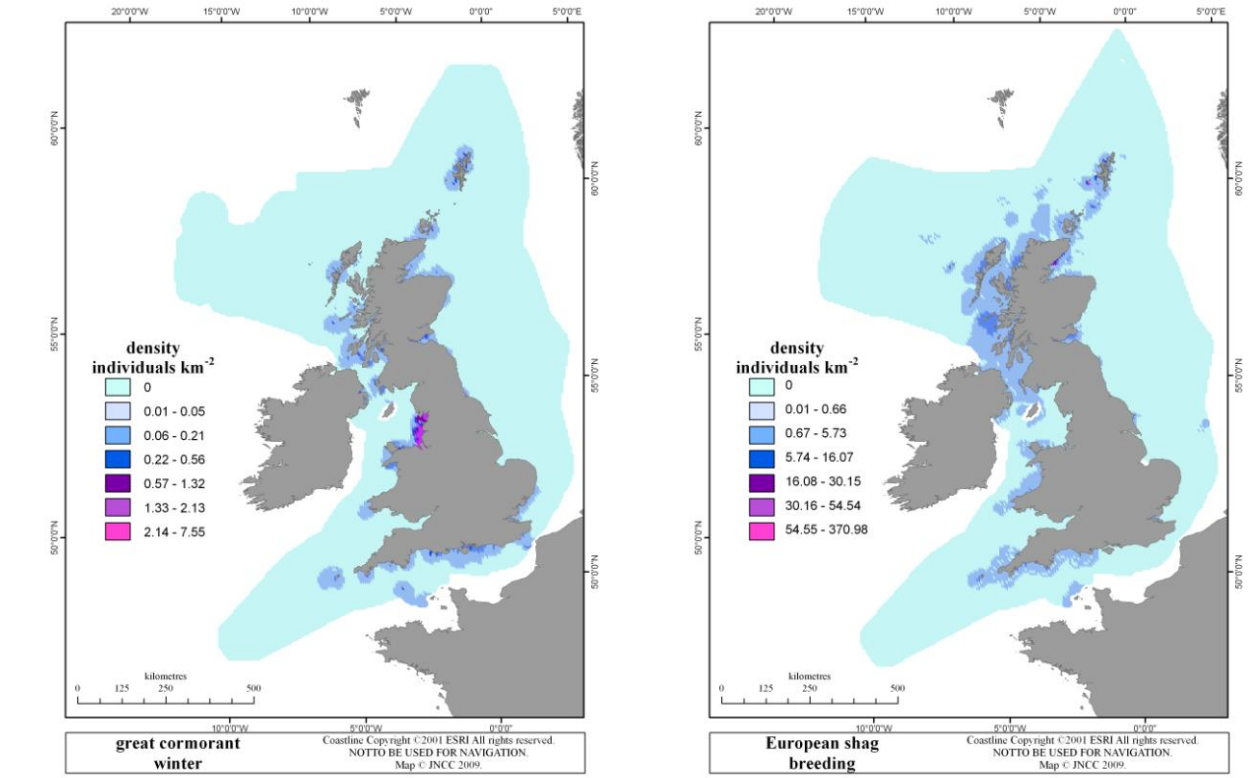
d)

Figure 31. Predicted density surface maps from Poisson kriging of a) Manx shearwater during an additional season (October - November); b) European storm-petrel during breeding (June - October); c) Leach's storm-petrel during breeding (June - October); and d) northern gannet during breeding (May - September).



a)

b)



c)

d)

Figure 32. Predicted density surface maps from Poisson kriging of a) northern gannet during winter (October - April); b) great cormorant during breeding (April - August); c) great cormorant during winter (September - March); and d) European shag during breeding (March - September).

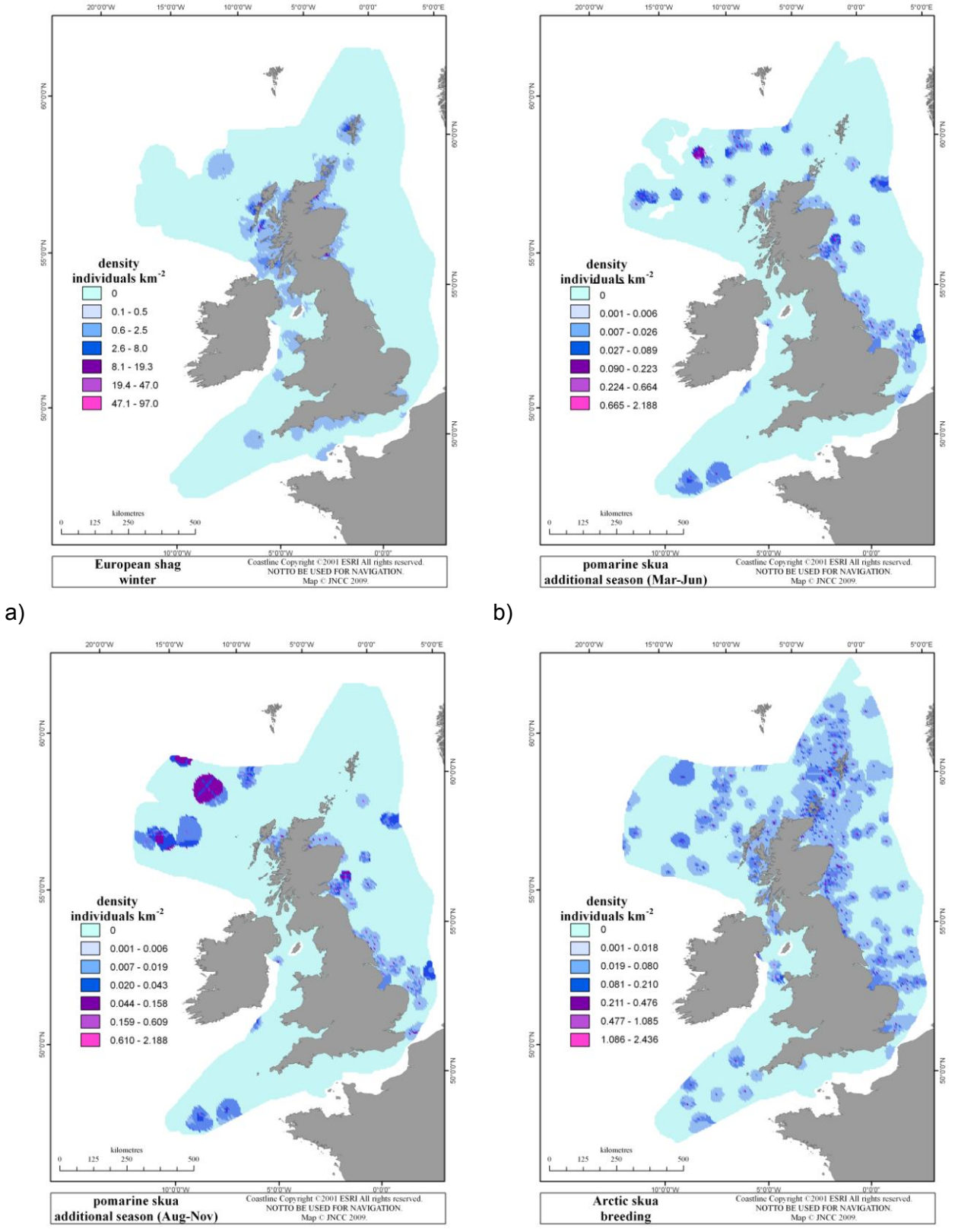
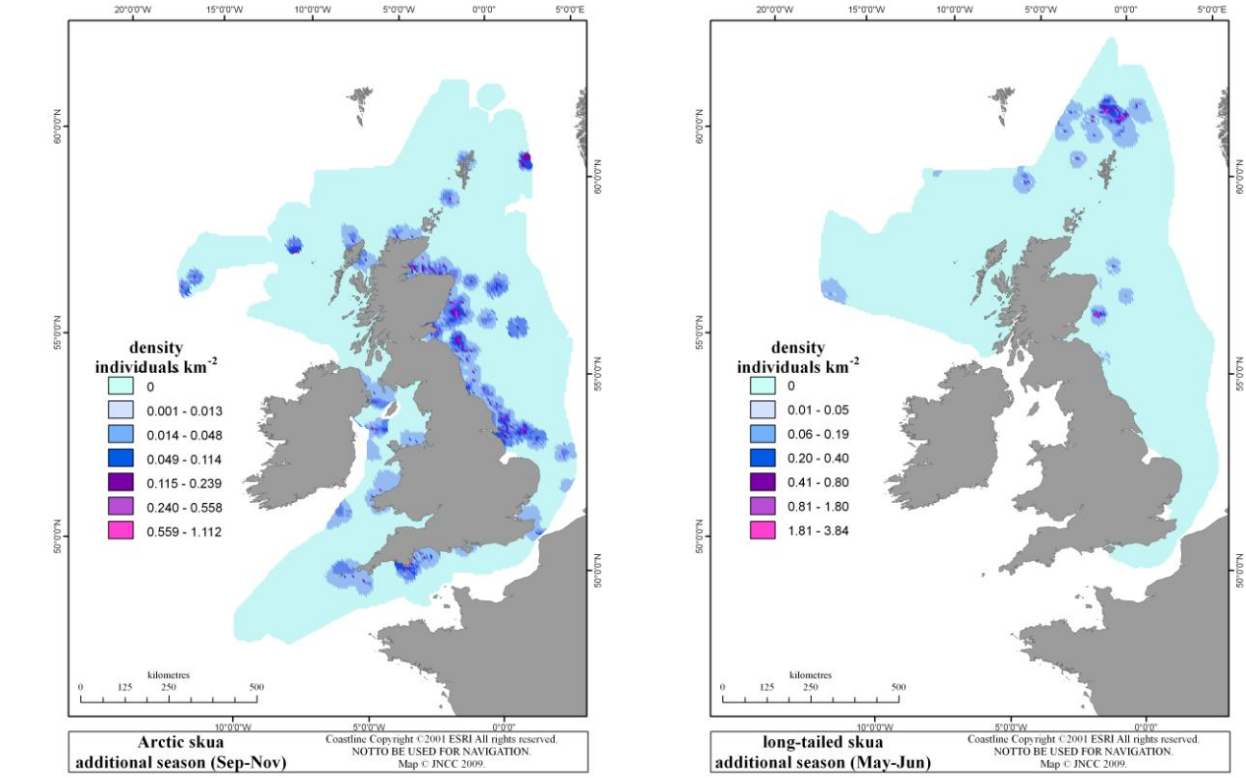
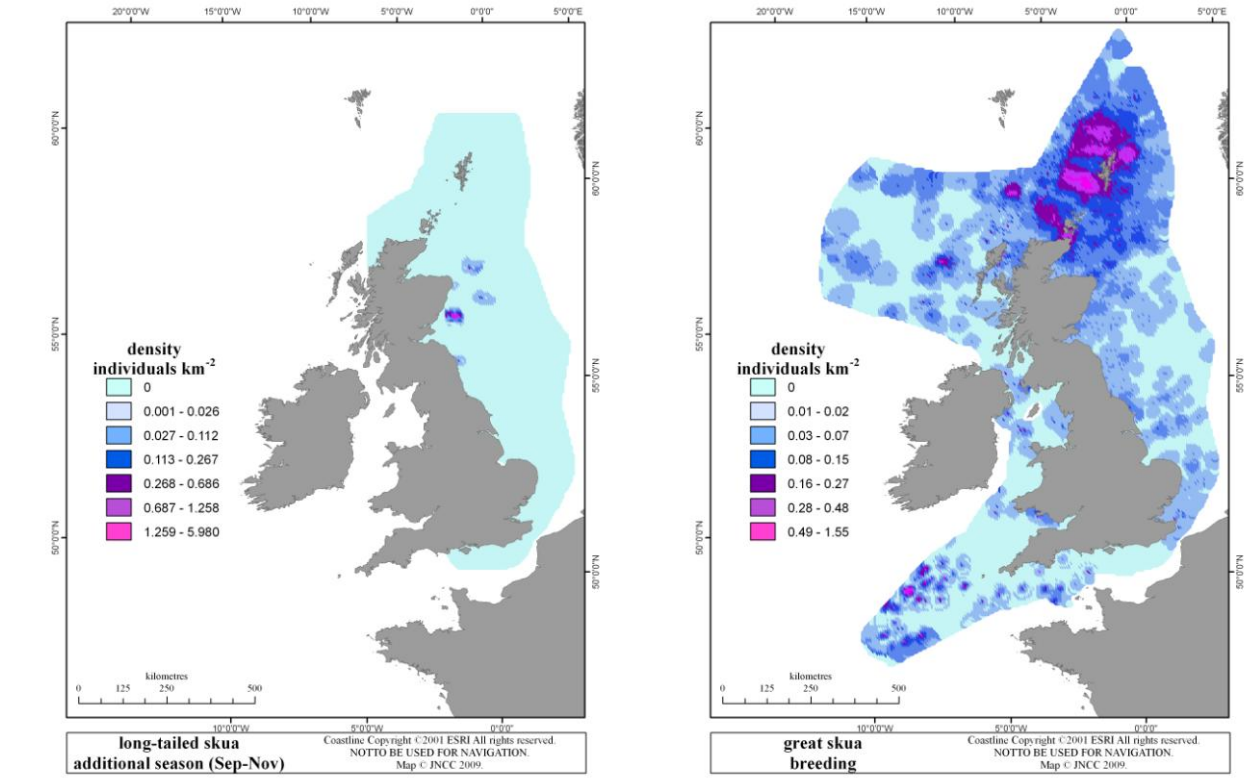


Figure 33. Predicted density surface maps from Poisson kriging of a) European shag during winter (October - February); b) pomarine skua during an additional season (March - June); c) pomarine skua during another additional season (August - November); and d) Arctic skua during breeding (May - August).



a)

b)



c)

d)

Figure 34. Predicted density surface maps from Poisson kriging of a) Arctic skua during an additional season (September - November); b) long-tailed skua during an additional season (March - June); c) long-tailed skua during another additional season (September - November); and d) great skua during breeding (May - August).

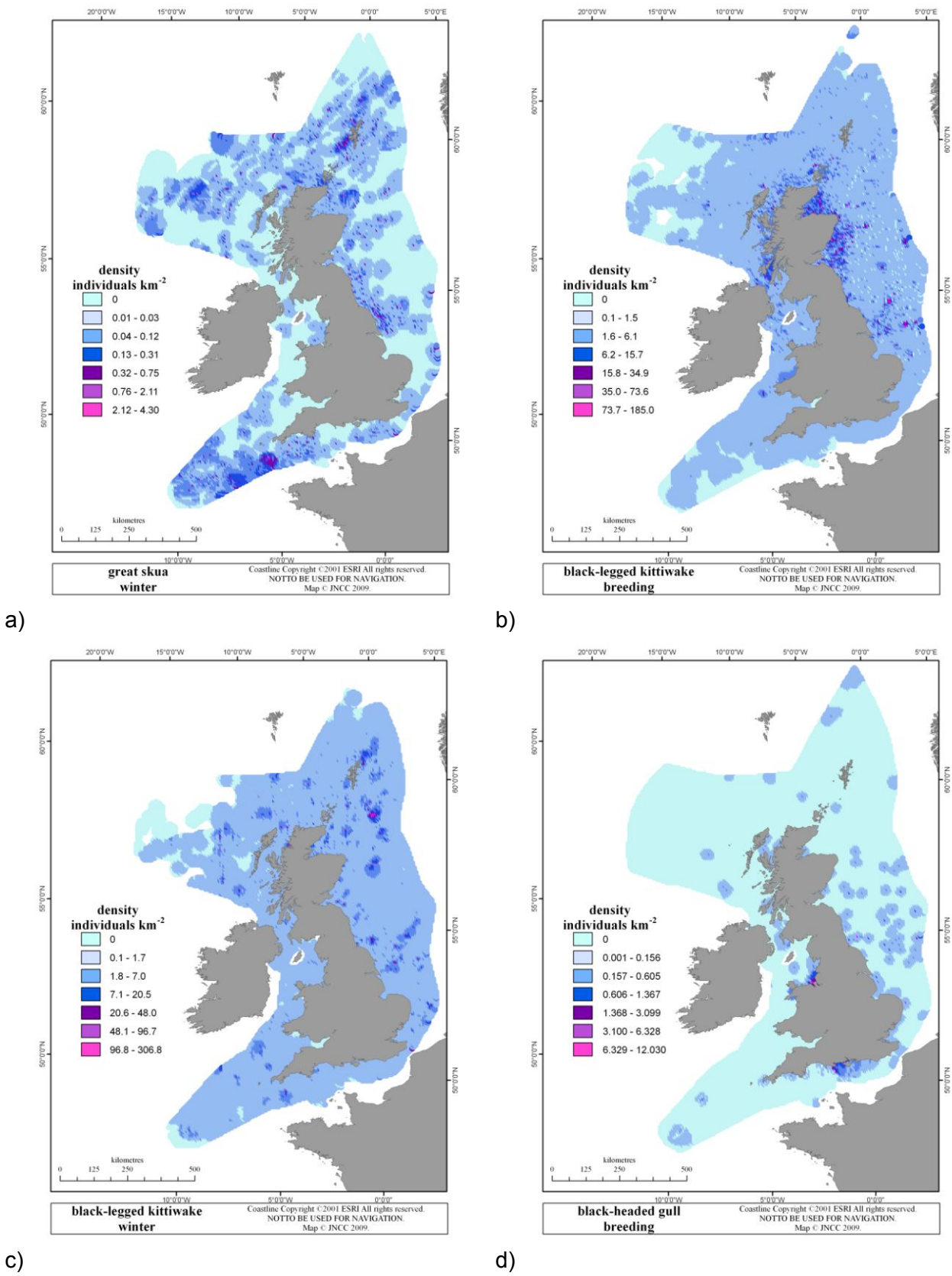


Figure 35. Predicted density surface maps from Poisson kriging of a) great skua during winter (September - April); b) black-legged kittiwake during breeding (May - September); c) black-legged kittiwake during winter (October - April); and d) black-headed gull during breeding (April - August).

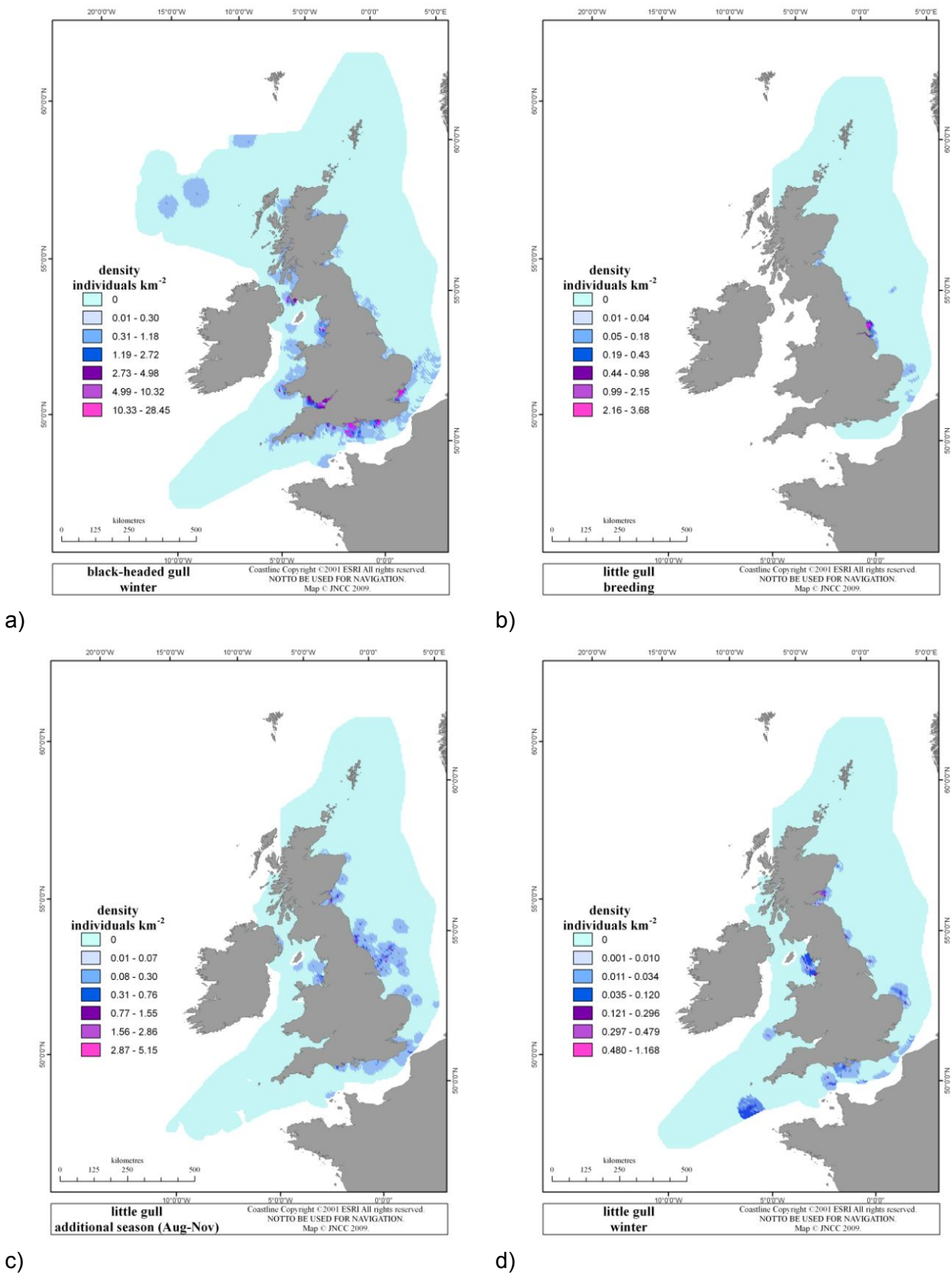
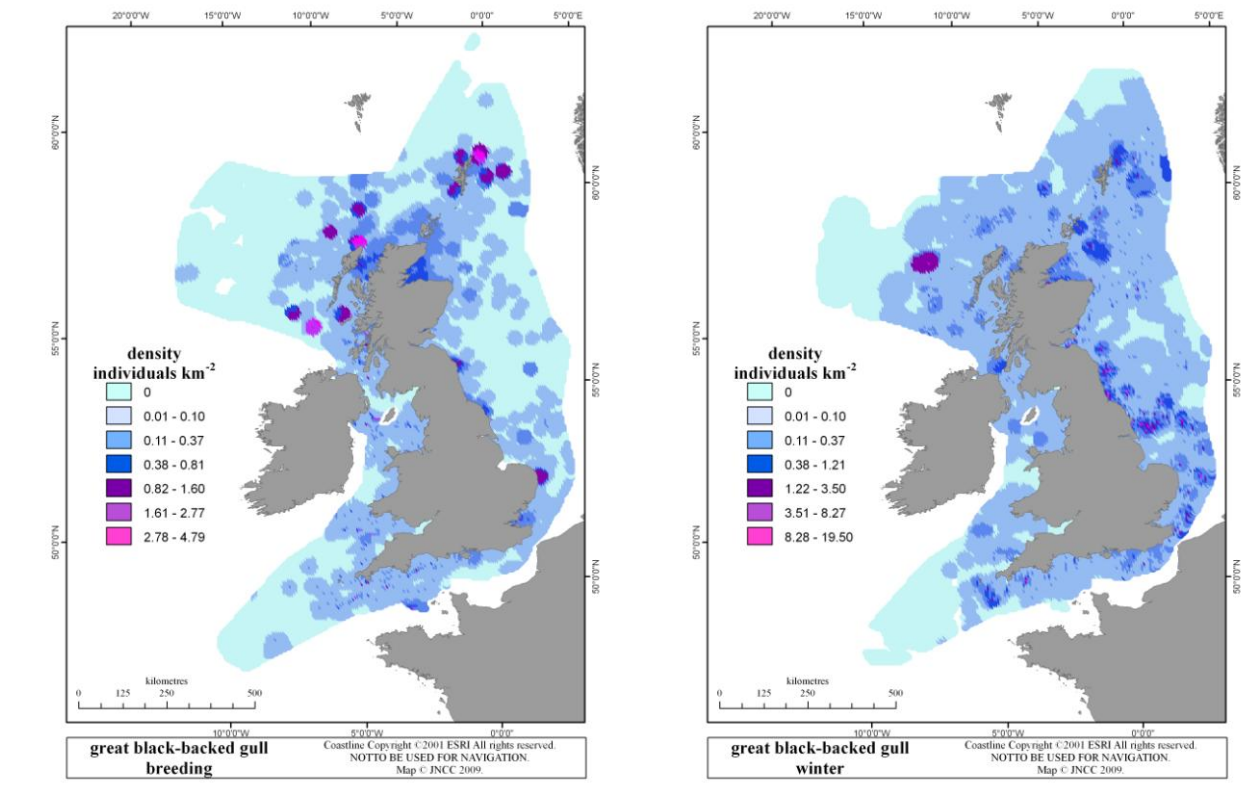
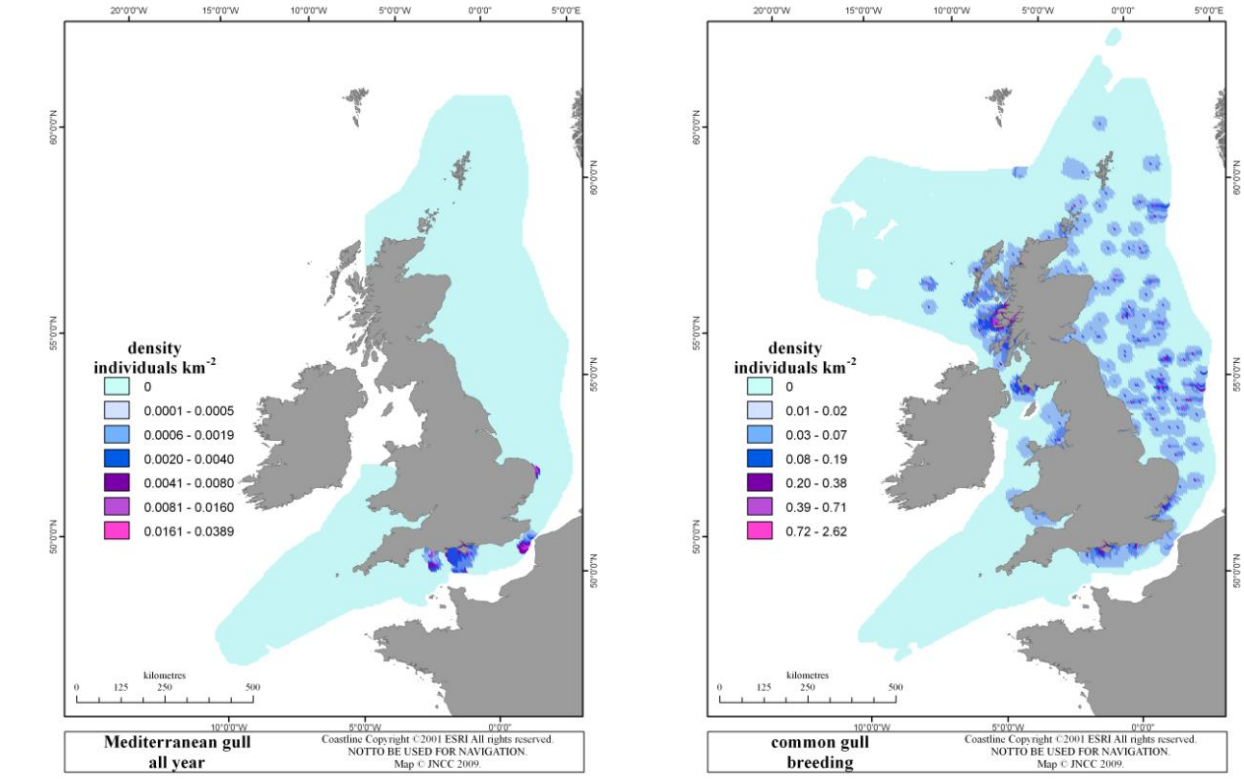


Figure 36. Predicted density surface maps from Poisson kriging of a) black-headed gull during winter (September - March); b) little gull during breeding (May - July); c) little gull during an additional season (August - November); and d) little gull during winter (December - April).



a)

b)



c)

d)

Figure 37. Predicted density surface maps from Poisson kriging of a) great black-backed gull during breeding (April - August); b) great black-backed gull during winter (September - March); c) Mediterranean gull all year; and d) common gull during breeding (May - August).

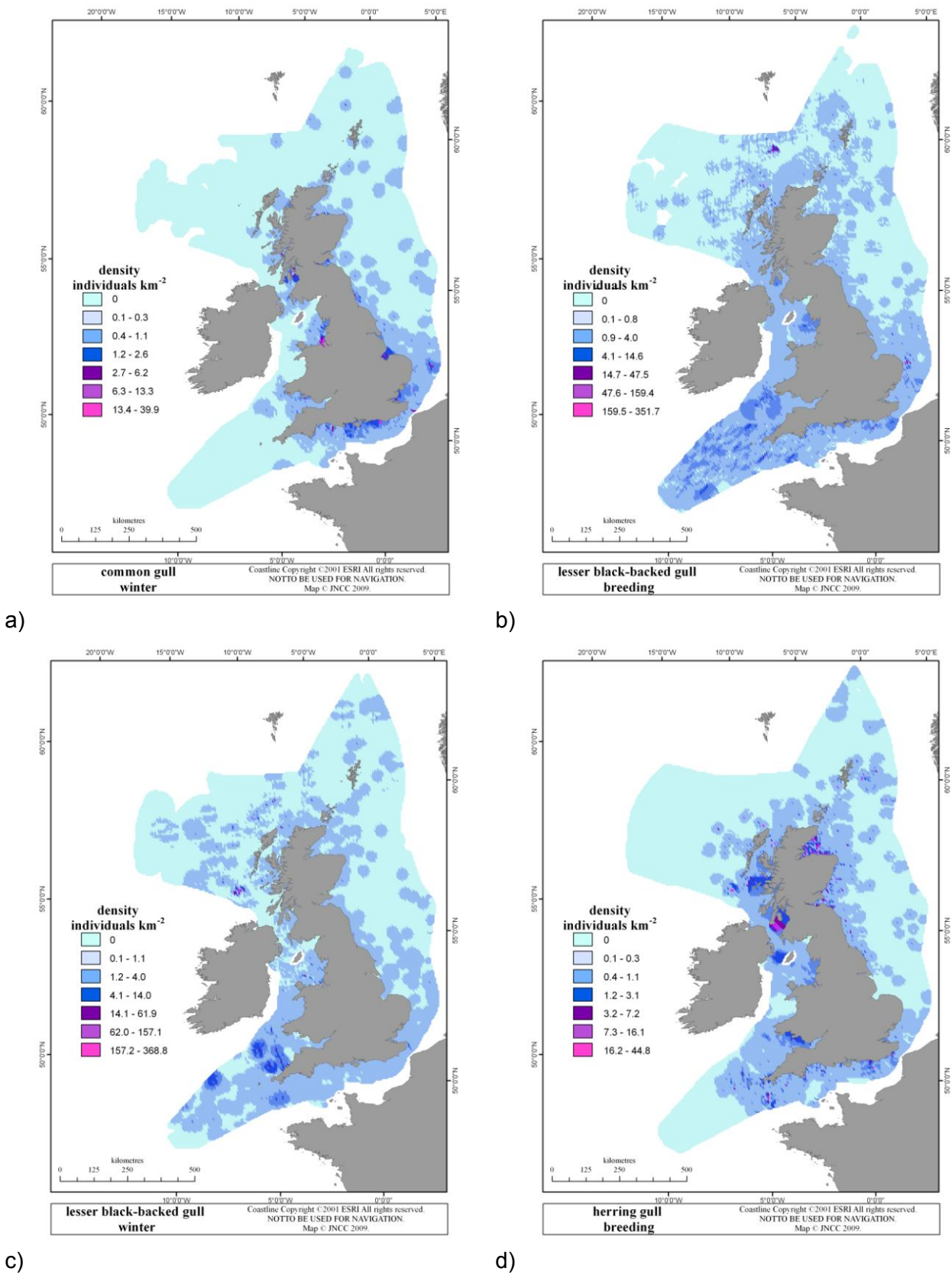
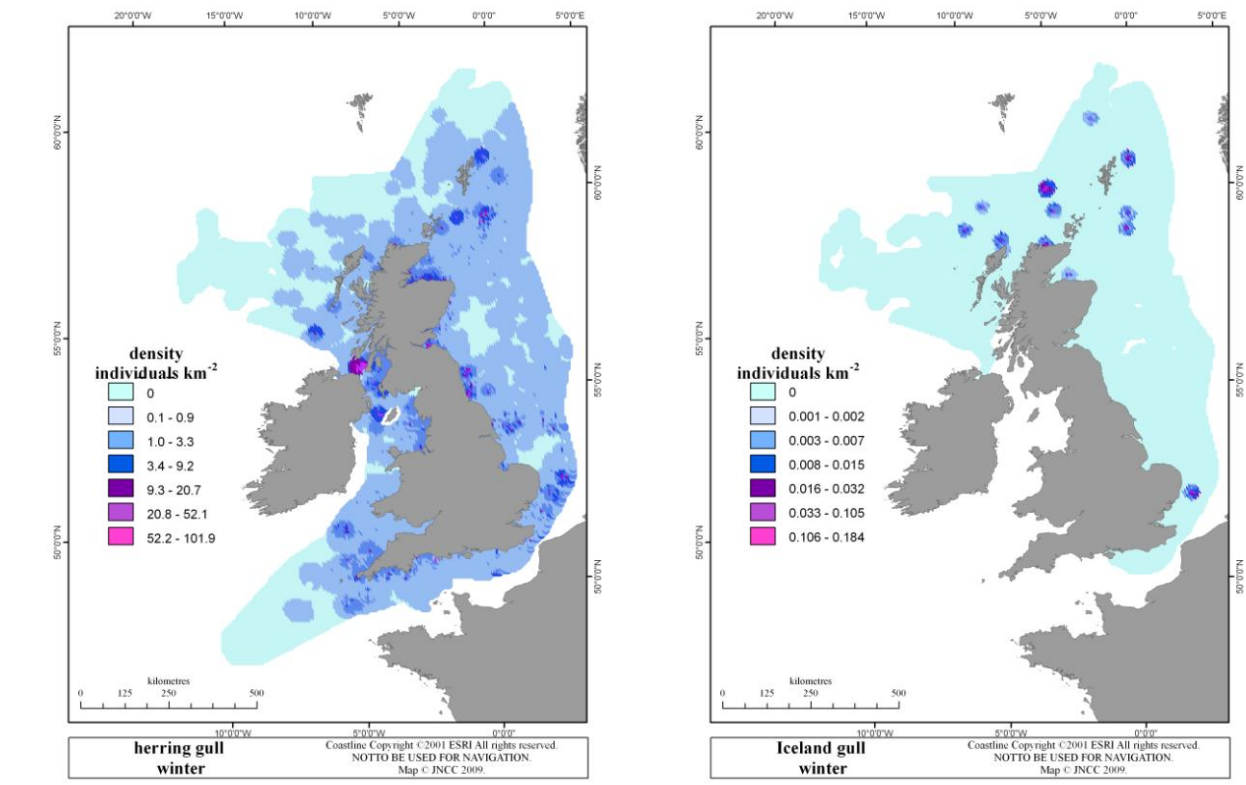
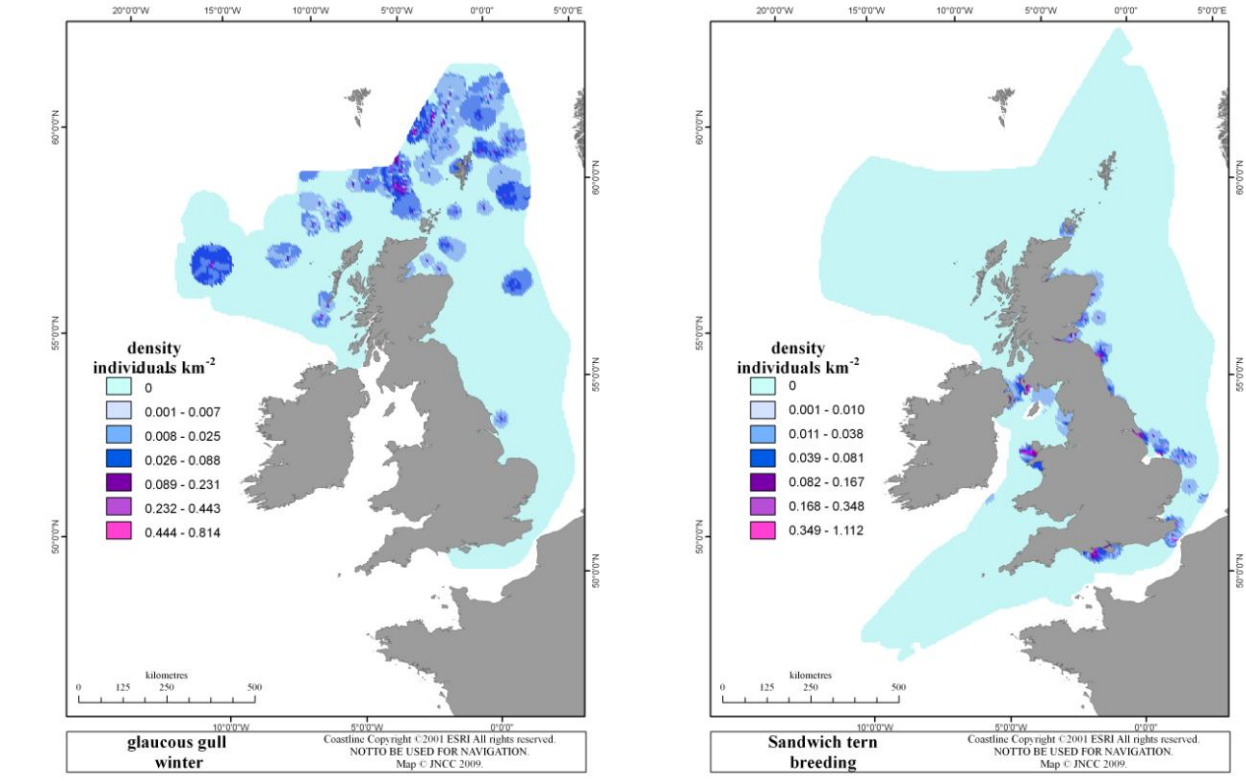


Figure 38. Predicted density surface maps from Poisson kriging of a) common gull during winter (September - April); b) lesser black-backed gull during breeding (May - August); c) lesser black-backed gull during winter (September - April); and d) herring gull during breeding (April - August).



a)

b)



c)

d)

Figure 39. Predicted density surface maps from Poisson kriging of a) herring gull during winter (September - March); b) Iceland gull during winter (November - April); c) glaucous gull during winter (October - March); and d) Sandwich tern during breeding (May - August).

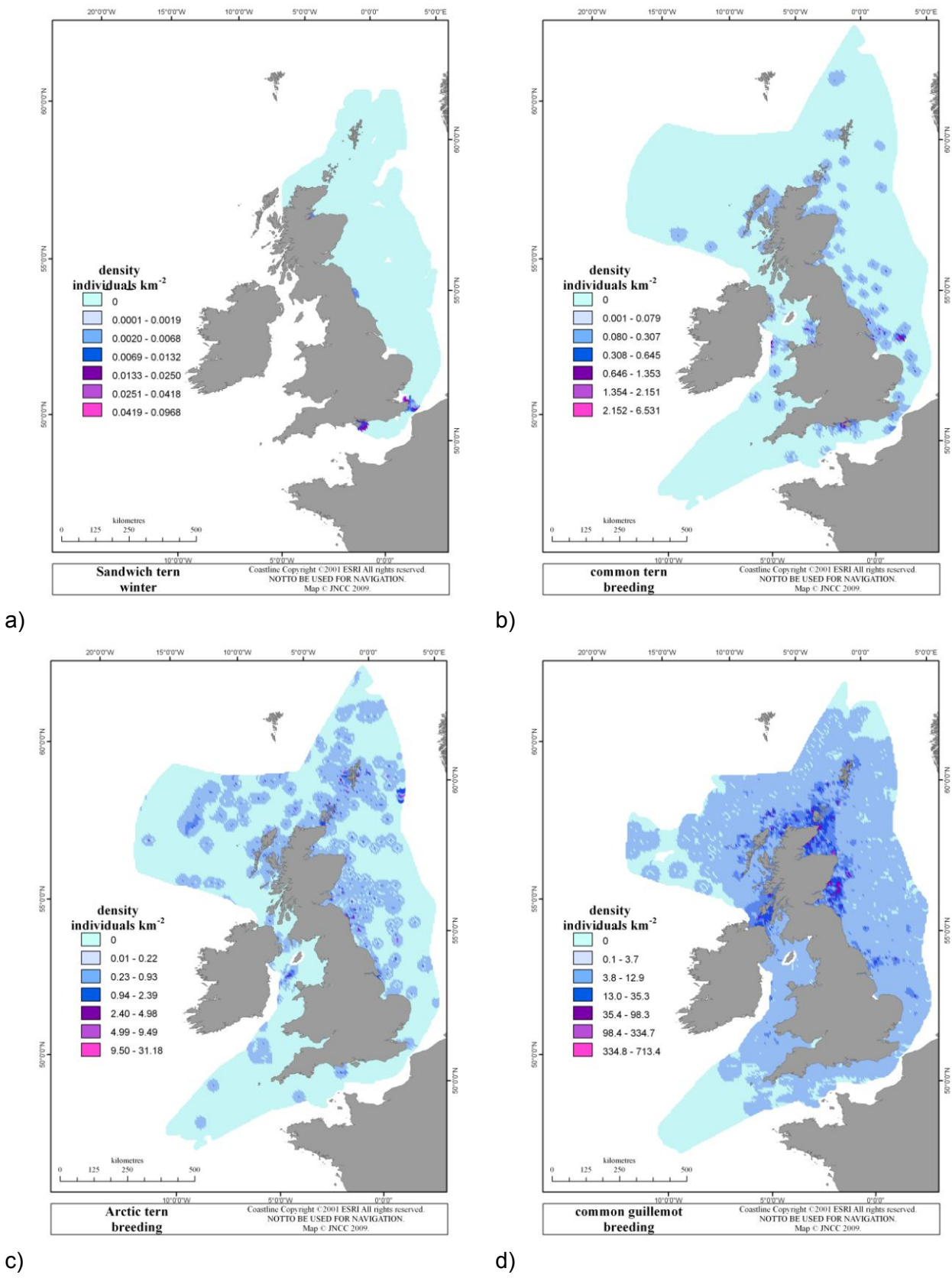
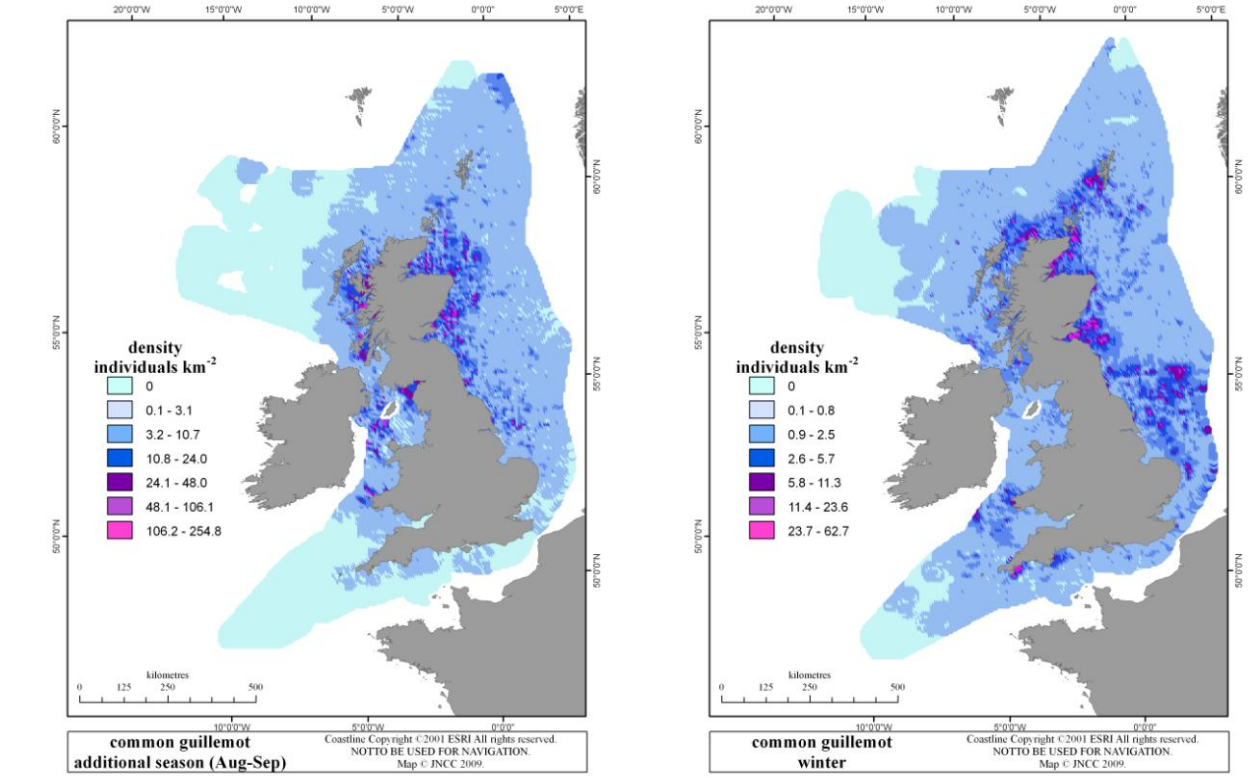
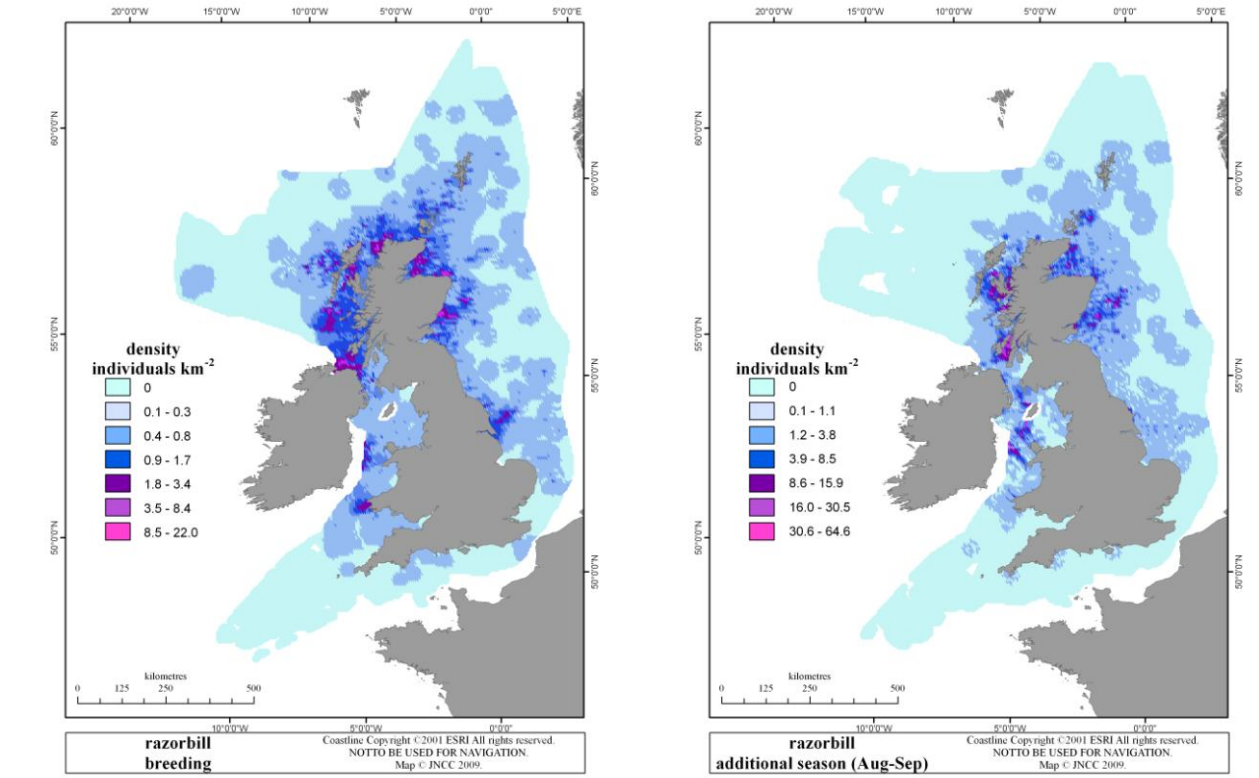


Figure 40. Predicted density surface maps from Poisson kriging of a) Sandwich tern during winter (September - October); b) common tern during breeding (May - September); c) Arctic tern during breeding (May - August); and d) common guillemot during breeding (May - June).



a)

b)



c)

d)

Figure 41. Predicted density surface maps from Poisson kriging of a) common guillemot during an additional season (August - September); b) common guillemot during winter (October - April); c) razorbill during breeding (May - June); and d) razorbill during an additional season (August - September).

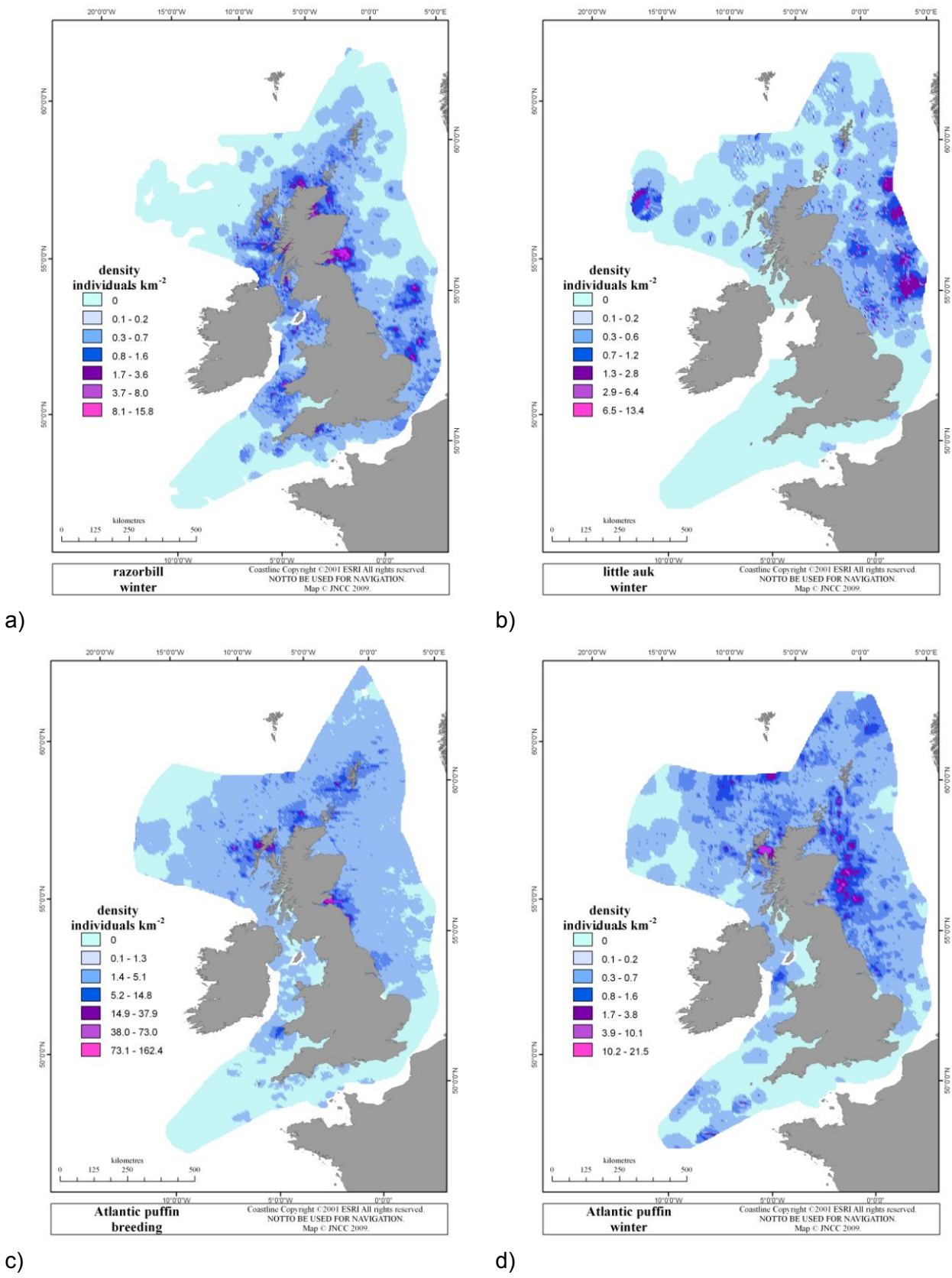
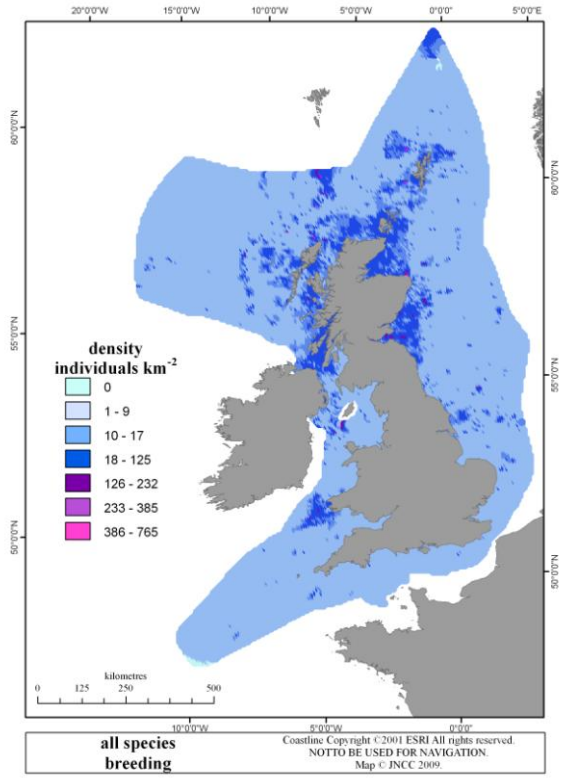
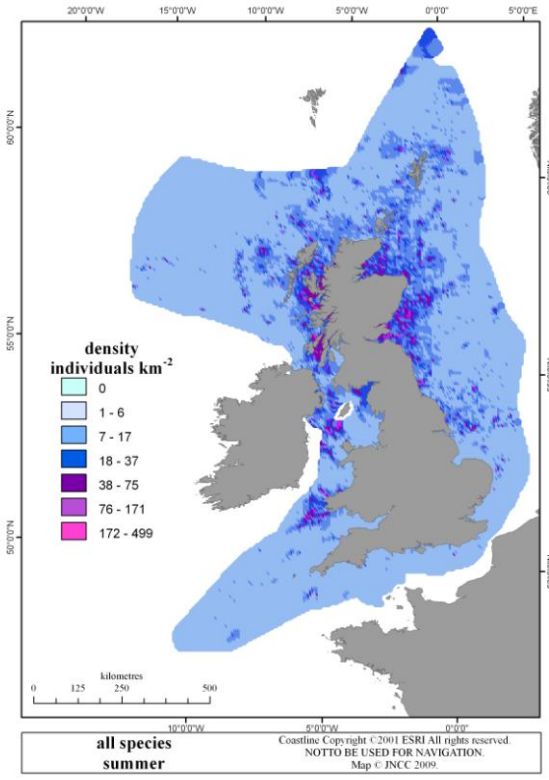


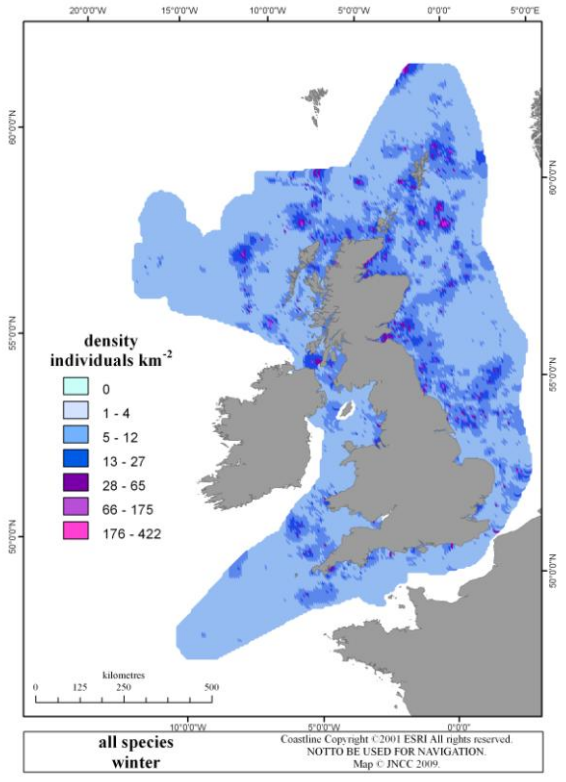
Figure 42. Predicted density surface maps from Poisson kriging of a) razorbill during winter (October - April); b) little auk during winter (November - March); c) Atlantic puffin during breeding (April - July); and d) Atlantic puffin during winter (August - March).



a)



b)



c)

Figure 43. Predicted density surface maps from Poisson kriging of a) all species during breeding (combination of all maps of breeding species); b) all species during summer (July - August); and c) all species during winter (November - March).

Appendix 3 - Characteristics of areas

The following tables contain characteristics of each area qualifying by the UK SPA selection guidelines. They include information about the species and season the area was identified for, the size of the area and numbers of additional species during their seasons. Although the additional species might occur in qualifying numbers in these areas, there is no proof that they do this on a regular basis, or that the area is a hotspot (defined by Getis-Ord Gi*) for these species.

8.1 Qualifying areas based on top 5% of Getis-Ord Gi*

Table 14. Characteristics of area 1, northern fulmar during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Northern fulmar, breeding **area 1 (west of Shetland)**
Size: 4,608km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	**breeding**	**95,187**	**0.93**
	winter	5,130	0.03
sooty shearwater	summer	166	<0.01
Manx shearwater	breeding	29	<0.01
European storm-petrel	**breeding**	**1,306**	**1.70**
northern gannet	breeding	3,388	0.29
	winter	1,200	0.10
Arctic skua	breeding	54	0.07
long-tailed skua	additional season 1	10	<0.01
great skua	**breeding**	**1,129**	**2.77**
	winter	74	0.18
black-legged kittiwake	breeding	1,207	0.01
	winter	1,727	0.02
great black-backed gull	breeding	46	0.01
	winter	85	0.02
common gull	winter	5	<0.01
lesser black-backed gull	breeding	78	0.01
	winter	1	<0.01
herring gull	breeding	0	<0.01
	winter	317	0.01
glaucous gull	winter	39	0.02
Arctic tern	breeding	20	0.01
common guillemot	breeding	343	<0.01
	winter	1,005	0.01
	additional season	656	0.01
razorbill	breeding	23	<0.01
	winter	42	<0.01
little auk	winter	46	0.12
Atlantic puffin	breeding	1,352	0.01
	winter	1,371	0.01
all species	**breeding**	**104,329**	
	winter	**29,145**	
	summer	**59,600**	

Table 15. Characteristics of area 2, northern fulmar during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Northern fulmar, breeding — **area 2 (east of Shetland)**

Size: 1,836km2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	**breeding**	**30,503**	**0.30**
	winter	15,438	0.09
sooty shearwater	summer	1	<0.01
European storm-petrel	breeding	599	0.78
northern gannet	breeding	2,144	0.18
	winter	3,122	0.27
European shag	winter	3	<0.01
Arctic skua	breeding	2	<0.01
long-tailed skua	additional season 1	4	<0.01
great skua	**breeding**	**549**	**1.35**
	winter	55	0.14
black-legged kittiwake	breeding	217	<0.01
	winter	12,413	0.15
great black-backed gull	breeding	2,947	0.70
	winter	1,101	0.26
lesser black-backed gull	breeding	2	<0.01
herring gull	breeding	123	<0.01
	winter	6,648	0.25
Iceland gull	winter	17	0.01
glaucous gull	winter	88	0.04
Arctic tern	breeding	3	<0.01
common guillemot	breeding	5,844	0.07
	winter	456	0.01
	additional season	2,847	0.03
razorbill	breeding	184	0.01
	winter	99	0.01
	additional season	27	<0.01
little auk	winter	66	0.18
Atlantic puffin	breeding	2,402	0.02
	winter	195	<0.01
all species	**breeding**	**45,521**	
	winter	**42,659**	
	summer	**33,730**	

Table 16. Characteristics of area 3, Manx shearwater during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Manx shearwater, breeding **area 3 (Rum)**

Size: 2,363km^2

Overlap with other protected sites:

- potential 1km colony extension at Canna & Sanday (for common guillemot and Atlantic puffin)
- potential 4km colony extension at Rum (for common guillemot and Manx shearwater)

species present	season	number of individuals	% of population
northern fulmar	breeding	217	<0.01
	winter	322	<0.01
sooty shearwater	summer	5	<0.01
Manx shearwater	**breeding**	**43,692**	**3.88**
European storm-petrel	breeding	50	0.07
northern gannet	breeding	930	0.08
	winter	541	0.05
great cormorant	winter	7	0.01
European shag	breeding	394	0.20
	winter	1,876	0.93
Arctic skua	breeding	75	0.10
great skua	breeding	4	0.01
	winter	1	<0.01
black-legged kittiwake	breeding	4,271	0.05
	winter	466	0.01
great black-backed gull	breeding	557	0.13
	winter	39	0.01
common gull	breeding	107	0.01
	winter	9	<0.01
lesser black-backed gull	breeding	148	0.03
	winter	173	0.03
herring gull	breeding	1,425	0.05
	winter	380	0.01
Arctic tern	breeding	79	0.05
common guillemot	breeding	6,823	0.08
	winter	3,032	0.04
	additional season	**43,302**	**0.51**
razorbill	breeding	2,137	0.11
	winter	1,805	0.09
	additional season	15,369	0.79
little auk	winter	27	0.07
Atlantic puffin	breeding	760	0.01
	winter	722	0.01
all species	**breeding**	**61,673**	
	winter	9,087	
	summer	**111,418**	

Table 17. Characteristics of area 4, Manx shearwater during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Manx shearwater, breeding — **area 4 (Skomer and Skokholm)**

Size: 5,644km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Grassholm (northern gannet)

species present	season	number of individuals	% of population
northern fulmar	breeding	742	0.01
	winter	1,741	0.01
Manx shearwater	**breeding**	**114,546**	**10.18**
	additional season	29	<0.01
European storm-petrel	breeding	275	0.36
northern gannet	breeding	6,858	0.59
	winter	2,897	0.25
great cormorant	breeding	5	<0.01
European shag	breeding	5	<0.01
	winter	0	<0.01
Arctic skua	additional season	3	<0.01
great skua	breeding	12	0.03
	winter	22	0.05
black-legged kittiwake	breeding	3,816	0.05
	winter	3,782	0.05
black-headed gull	winter	12	<0.01
little gull	winter	4	
great black-backed gull	breeding	213	0.05
	winter	221	0.05
common gull	winter	113	0.01
lesser black-backed gull	**breeding**	**8,198**	**1.49**
	winter	**6,676**	**1.21**
herring gull	breeding	777	0.03
	winter	4,166	0.16
common tern	breeding	2	0.01
Arctic tern	breeding	41	0.03
common guillemot	breeding	9,423	0.11
	winter	5,831	0.07
	additional season	6,880	0.08
razorbill	breeding	1,706	0.09
	winter	2,376	0.12
	additional season	76	<0.01
Atlantic puffin	breeding	5,368	0.04
	winter	57	<0.01
all species	**breeding**	**151,988**	
	winter	**27,709**	
	summer	**145,659**	

Table 18. Characteristics of area 5, Leach's storm-petrel during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Leach's storm-petrel, breeding **area 5**
Size: 3,858km²

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	1,255	0.01
	winter	2,009	0.01
sooty shearwater	summer	143	<0.01
Manx shearwater	breeding	428	0.04
European storm-petrel	**breeding**	**1,289**	**1.68**
Leach's storm-petrel	**breeding**	**17,024**	**11.81**
northern gannet	breeding	429	0.04
	winter	262	0.02
pomarine skua	additional season 1	9	0.03
	additional season 2	13	0.04
Arctic skua	breeding	77	0.10
great skua	breeding	36	0.09
	winter	97	0.24
black-legged kittiwake	breeding	743	0.01
	winter	145	<0.01
black-headed gull	breeding	1	<0.01
	winter	5	<0.01
great black-backed gull	breeding	26	0.01
	winter	14	<0.01
lesser black-backed gull	breeding	4	<0.01
glaucous gull	winter	7	<0.01
Arctic tern	breeding	185	0.12
common guillemot	breeding	298	<0.01
	winter	858	0.01
	additional season	106	<0.01
razorbill	winter	1	<0.01
little auk	winter	171	0.46
Atlantic puffin	breeding	199	<0.01
	winter	3,530	0.03
all species	**breeding**	**22,137**	
	winter	7,007	
	summer	**24,000**	

Table 19. Characteristics of area 6, northern gannet during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Northern gannet, breeding **area 6 (Firth of Forth)**
Size: 5,528km^2

Overlap with other protected sites:
- Potential SPA colony extension of 2km for Forth Islands (common guillemot, northern gannet, razorbill)
- Potential SPA colony extension of 2km for St Abb's Head to Fast Castle (Atlantic puffin, common guillemot, northern fulmar and razorbill)

Bordering other protected sites:
- SPA Firth of Tay & Eden Estuary
- SPA Firth of Forth

species present	season	number of individuals	% of population
northern fulmar	breeding	694	0.01
	winter	2,757	0.02
sooty shearwater	summer	44	<0.01
Manx shearwater	breeding	3,787	0.34
	additional season	27	<0.01
European storm-petrel	breeding	79	0.10
northern gannet	**breeding**	**17,317**	**1.49**
	winter	3,180	0.27
great cormorant	breeding	16	0.01
	winter	71	0.06
European shag	breeding	937	0.46
	winter	**2,411**	**1.19**
pomarine skua	additional season 1	82	0.27
	additional season 2	83	0.28
Arctic skua	breeding	94	0.12
	additional season	242	0.32
great skua	breeding	42	0.10
	winter	74	0.18
black-legged kittiwake	**breeding**	**31,073**	**0.37**
	winter	6,889	0.08
black-headed gull	breeding	2	<0.01
	winter	267	0.01
little gull	breeding	12	
	winter	**89**	
	additional season	213	
great black-backed gull	breeding	83	0.02
	winter	1,153	0.27
common gull	breeding	53	<0.01
	winter	728	0.04
lesser black-backed gull	breeding	533	0.10
	winter	83	0.02
herring gull	breeding	3,426	0.13
	winter	7,448	0.28
Sandwich tern	breeding	40	0.11
common tern	breeding	39	0.11
Arctic tern	breeding	468	0.29
common guillemot	**breeding**	**63,443**	**0.74**
	winter	**41,283**	**0.48**
	additional season	**61,626**	**0.72**
razorbill	breeding	3,181	0.16
	winter	9,409	0.48
	additional season	7,032	0.36
little auk	**winter**	**745**	**1.99**
Atlantic puffin	**breeding**	**70,995**	**0.53**
	winter	3,251	0.02
all species	**breeding**	**196,358**	
	winter	**79,475**	
	summer	**165,734**	

Table 20. Characteristics of area 7, northern gannet during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Northern gannet, breeding **area 7 (St Kilda)**

Size: 12,235 km^2

Overlap with other protected sites:

- Potential SPA colony extension of 4km for St Kilda (Atlantic puffin, common guillemot, Manx shearwater, northern fulmar, northern gannet, razorbill)
- Potential SPA colony extension of 2km for Flannan Isles (Atlantic puffin, common guillemot, northern fulmar, razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	12,473	0.12
	winter	11,812	0.07
sooty shearwater	summer	54	<0.01
Manx shearwater	breeding	5,594	0.50
European storm-petrel	**breeding**	**3,270**	**4.25**
Leach's storm-petrel	breeding	276	0.19
northern gannet	**breeding**	**70,578**	**6.09**
	winter	**16,695**	**1.44**
great cormorant	winter	4	<0.01
European shag	breeding	70	0.03
	winter	201	0.10
pomarine skua	additional season 1	3	0.01
Arctic skua	breeding	57	0.08
	additional season	4	<0.01
great skua	breeding	368	0.90
	winter	104	0.25
black-legged kittiwake	breeding	2,559	0.03
	winter	4,056	0.05
great black-backed gull	breeding	296	0.07
	winter	496	0.12
lesser black-backed gull	breeding	341	0.06
	winter	751	0.14
herring gull	breeding	73	<0.01
	winter	217	0.01
glaucous gull	winter	3	<0.01
Arctic tern	breeding	61	0.04
common guillemot	breeding	17,712	0.21
	winter	2,816	0.03
	additional season	215	<0.01
razorbill	breeding	3,655	0.19
	winter	23	<0.01
	additional season	71	<0.01
little auk	winter	34	0.09
Atlantic puffin	**breeding**	**27,156**	**0.20**
	winter	2,689	0.02
all species	**breeding**	**144,594**	
	winter	**39,962**	
	summer	**110,948**	

Table 21. Characteristics of area 8, great cormorant during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Great cormorant, winter — **area 8 (Liverpool Bay)**

Size: 918km^2

Overlap with other protected sites:

Bordering other protected sites:

- SPA Morecambe Bay
- SPA Ribble & Alt Estuaries

species present	season	number of individuals	% of population
northern fulmar	breeding	6	<0.01
	winter	5	<0.01
Manx shearwater	breeding	1	<0.01
northern gannet	breeding	80	0.01
	winter	8	<0.01
great cormorant	breeding	226	0.19
	winter	**1,378**	**1.17**
Arctic skua	additional season	1	<0.01
great skua	breeding	11	0.03
	winter	13	0.03
black-legged kittiwake	breeding	387	<0.01
	winter	87	<0.01
black-headed gull	breeding	673	0.02
	winter	601	0.01
	winter	23	
	additional season	142	
great black-backed gull	breeding	40	0.01
	winter	51	0.01
common gull	breeding	28	<0.01
	winter	2,434	0.14
lesser black-backed gull	breeding	563	0.10
	winter	652	0.12
herring gull	breeding	301	0.01
	winter	2,172	0.08
Sandwich tern	breeding	4	0.01
	winter	0	<0.01
common tern	breeding	65	0.18
common guillemot	breeding	29	<0.01
	winter	536	0.01
	additional season	657	0.01
razorbill	breeding	31	<0.01
	winter	129	0.01
	additional season	52	<0.01
all species	breeding	2,444	
	winter	8,101	
	summer	3,235	

Table 22. Characteristics of area 9, European shag during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

European shag, breeding — **area 9 (Moray Firth)**

Size: 266km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	148	<0.01
	winter	526	<0.01
sooty shearwater	summer	6	<0.01
Manx shearwater	breeding	1	<0.01
northern gannet	breeding	39	<0.01
	winter	36	<0.01
great cormorant	breeding	27	0.02
	winter	3	<0.01
European shag	**breeding**	**5,034**	**2.49**
	winter	**3,116**	**1.54**
Arctic skua	breeding	32	0.04
	additional season	3	<0.01
great skua	breeding	10	0.02
black-legged kittiwake	breeding	1,076	0.01
	winter	717	0.01
great black-backed gull	breeding	109	0.03
	winter	95	0.02
common gull	winter	10	<0.01
lesser black-backed gull	breeding	4	<0.01
	winter	6	<0.01
herring gull	breeding	216	0.01
	winter	424	0.02
common guillemot	breeding	7,391	0.09
	winter	3,166	0.04
	additional season	6,668	0.08
razorbill	breeding	354	0.02
	winter	461	0.02
	additional season	312	0.02
little auk	winter	32	0.08
Atlantic puffin	breeding	148	<0.01
	winter	85	<0.01
all species	breeding	14,596	
	winter	8,993	
	summer	13,988	

Table 23. Characteristics of area 10, European shag during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

European shag, winter — **area 10 (Moray Firth, south)**

Size: 34km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	3	<0.01
	winter	7	<0.01
northern gannet	breeding	11	<0.01
	winter	3	<0.01
European shag	**winter**	**3,267**	**1.62**
Arctic skua	additional season	19	0.03
great skua	breeding	1	<0.01
black-legged kittiwake	breeding	258	<0.01
	winter	12	<0.01
great black-backed gull	breeding	8	<0.01
	winter	8	<0.01
	winter	17	<0.01
lesser black-backed gull	breeding	1	<0.01
herring gull	breeding	101	<0.01
	winter	142	0.01
Arctic tern	breeding	1	<0.01
common guillemot	breeding	104	<0.01
	winter	550	0.01
	additional season	440	0.01
razorbill	breeding	34	<0.01
	winter	16	<0.01
	additional season	362	0.02
Atlantic puffin	breeding	7	<0.01
	winter	4	<0.01
all species	breeding	530	
	winter	3,392	
	summer	1,196	

Table 24. Characteristics of area 11, European shag during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

European shag, winter — **area 11 (Moray Firth, north)**

Size: 367km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	167	<0.01
	winter	619	<0.01
sooty shearwater	summer	7	<0.01
Manx shearwater	breeding	9	<0.01
northern gannet	breeding	53	<0.01
	winter	48	<0.01
great cormorant	breeding	37	0.03
	winter	4	<0.01
European shag	**breeding**	**5,279**	**2.62**
	winter	**3,619**	**1.79**
Arctic skua	breeding	33	0.04
	additional season	11	0.02
great skua	breeding	12	0.03
	winter	3	0.01
black-legged kittiwake	breeding	1,528	0.02
	winter	1,501	0.02
great black-backed gull	breeding	160	0.04
	winter	138	0.03
common gull	winter	32	<0.01
lesser black-backed gull	breeding	8	<0.01
	winter	6	<0.01
herring gull	breeding	1,003	0.04
	winter	887	0.03
Arctic tern	breeding	8	0.01
common guillemot	breeding	7,744	0.09
	winter	5,358	0.06
	additional season	9,062	0.11
razorbill	breeding	465	0.02
	winter	841	0.04
	additional season	888	0.05
little auk	winter	52	0.14
Atlantic puffin	breeding	204	<0.01
	winter	166	<0.01
all species	breeding	16,716	
	winter	13,531	
	summer	18,665	

Table 25. Characteristics of area 12, great skua during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Great skua, breeding — **area 12 (Shetland Islands, south-west)**

Size: 8,120km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Foula (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	17,158	0.17
	winter	12,672	0.07
Manx shearwater	breeding	13	<0.01
European storm-petrel	**breeding**	**1,645**	**2.14**
northern gannet	breeding	2,265	0.20
	winter	1,946	0.17
great cormorant	breeding	4	<0.01
	winter	32	0.03
European shag	**breeding**	**14,597**	**7.23**
	winter	95	0.05
Arctic skua	breeding	370	0.49
	additional season	9	0.01
long-tailed skua	additional season 1	5	<0.01
great skua	**breeding**	**2,752**	**6.74**
	winter	**570**	**1.40**
black-legged kittiwake	breeding	2,246	0.03
	winter	5,298	0.06
great black-backed gull	breeding	966	0.23
	winter	183	0.04
common gull	breeding	14	<0.01
	winter	1	<0.01
lesser black-backed gull	breeding	168	0.03
herring gull	breeding	422	0.02
	winter	164	0.01
glaucous gull	winter	7	<0.01
common tern	breeding	8	0.02
Arctic tern	breeding	1,102	0.69
common guillemot	**breeding**	**24,286**	**0.28**
	winter	16,628	0.19
	additional season	4,086	0.05
razorbill	breeding	1,337	0.07
	winter	1,204	0.06
	additional season	244	0.01
little auk	winter	256	0.68
Atlantic puffin	**breeding**	**29,969**	**0.22**
	winter	1,080	0.01
all species	**breeding**	**99,322**	
	winter	**43,371**	
	summer	**61,341**	

Table 26. Characteristics of area 13, great skua during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Great skua, breeding — **area 13 (Shetland Islands, north-east)**

Size: 16,456km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Hermaness, Saxa Vord and Valla Field (Atlantic puffin, common guillemot, northern fulmar and northern gannet)
- Potential SPA colony extension of 2km for Fetlar (northern fulmar)

species present	season	number of individuals	% of population
northern fulmar	**breeding**	**142,044**	**1.39**
	winter	**28,662**	**0.16**
sooty shearwater	summer	284	<0.01
Manx shearwater	breeding	50	<0.01
European storm-petrel	**breeding**	**4,866**	**6.32**
northern gannet	**breeding**	**13,973**	**1.21**
	winter	**11,776**	**1.02**
great cormorant	winter	93	0.08
European shag	breeding	296	0.15
	winter	1,170	0.58
Arctic skua	breeding	366	0.49
	additional season	10	0.01
long-tailed skua	additional season 1	181	0.04
great skua	**breeding**	**4,404**	**10.79**
	winter	**578**	**1.42**
black-legged kittiwake	breeding	2,804	0.03
	winter	18,311	0.22
great black-backed gull	**breeding**	**4,853**	**1.15**
	winter	1,768	0.42
common gull	breeding	11	<0.01
	winter	79	<0.01
lesser black-backed gull	breeding	289	0.05
	winter	193	0.04
herring gull	breeding	145	0.01
	winter	8,386	0.32
Iceland gull	winter	21	0.01
glaucous gull	winter	167	0.07
Arctic tern	breeding	575	0.36
common guillemot	**breeding**	**35,782**	**0.42**
	winter	3,798	0.04
	additional season	7,985	0.09
razorbill	breeding	649	0.03
	winter	476	0.02
	additional season	128	0.01
little auk	**winter**	**388**	**1.04**
Atlantic puffin	breeding	16,229	0.12
	winter	2,360	0.02
all species	**breeding**	**227,619**	
	winter	**100,445**	
	summer	**135,676**	

Table 27. Characteristics of area 14, black-legged kittiwake during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Black-legged kittiwake, breeding **area 14 (Moray Firth)**
Size: 5,130km^2

Overlap with other protected sites:
- Potential SPA colony extension of 2km for East Caithness Cliffs (Atlantic puffin, common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for Troup, Pennan & Lions Heads (common guillemot, northern fulmar and razorbill)

Bordering other protected sites:
- SPA Dornoch Firth and Loch Fleet
- SPA Inner Moray Firth
- SPA Moray & Nairn Coast

species present	season	number of individuals	% of population
northern fulmar	breeding	3,479	0.03
	winter	4,781	0.03
sooty shearwater	summer	664	<0.01
Manx shearwater	breeding	248	0.02
	additional season	5	<0.01
European storm-petrel	breeding	50	0.06
northern gannet	breeding	1,090	0.09
	winter	609	0.05
great cormorant	breeding	132	0.11
	winter	34	0.03
European shag	**breeding**	**6,401**	**3.17**
	winter	**6,657**	**3.30**
pomarine skua	additional season 1	10	0.03
	additional season 2	24	0.08
Arctic skua	breeding	118	0.16
	additional season	186	0.25
great skua	breeding	266	0.65
	winter	129	0.32
black-legged kittiwake	**breeding**	**47,874**	**0.57**
	winter	8,053	0.10
black-headed gull	breeding	3	<0.01
	winter	63	<0.01
great black-backed gull	breeding	1,799	0.43
	winter	1,551	0.37
common gull	breeding	15	<0.01
	winter	508	0.03
lesser black-backed gull	breeding	151	0.03
	winter	33	0.01
herring gull	breeding	13,577	0.51
	winter	14,138	0.53
Iceland gull	winter	3	<0.01
glaucous gull	winter	14	0.01
Sandwich tern	breeding	3	0.01
	winter	1	<0.01
common tern	breeding	30	0.09
Arctic tern	breeding	209	0.13
common guillemot	**breeding**	**66,103**	**0.77**
	winter	**29,115**	**0.34**
	additional season	**73,871**	**0.86**
razorbill	breeding	7,934	0.41
	winter	6,313	0.32
	additional season	**27,063**	**1.39**
little auk	**winter**	**451**	**1.20**
Atlantic puffin	breeding	2,849	0.02
	winter	1,097	0.01
all species	**breeding**	**152,997**	
	winter	**73,981**	
	summer	**179,694**	

Table 28. Characteristics of area 15, black-legged kittiwake during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Black-legged kittiwake, breeding **area 15 (Firth of Forth)**
Size: 5,696km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Fowlsheugh (common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for Forth Islands (Atlantic puffin, common guillemot, northern gannet, razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	2,649	0.03
	winter	4,421	0.02
sooty shearwater	summer	67	<0.01
Manx shearwater	breeding	196	0.02
	additional season	1	<0.01
European storm-petrel	breeding	46	0.06
northern gannet	breeding	9,133	0.79
	winter	1,097	0.09
great cormorant	breeding	1	<0.01
	winter	1	<0.01
	winter	21	0.01
pomarine skua	additional season 1	172	0.57
	additional season 2	174	0.58
Arctic skua	breeding	228	0.30
	additional season	258	0.34
long-tailed skua	additional season 1	264	0.05
	additional season 2	752	0.15
great skua	breeding	99	0.24
	winter	180	0.44
black-legged kittiwake	**breeding**	**65,085**	**0.77**
	winter	6,380	0.08
black-headed gull	breeding	14	<0.01
	winter	1	<0.01
little gull	additional season	29	
great black-backed gull	breeding	38	0.01
	winter	209	0.05
common gull	breeding	12	<0.01
	winter	98	0.01
lesser black-backed gull	breeding	225	0.04
	winter	252	0.05
herring gull	breeding	2,345	0.09
	winter	2,616	0.10
Sandwich tern	breeding	13	0.03
common tern	breeding	3	0.01
Arctic tern	breeding	146	0.09
common guillemot	**breeding**	**125,870**	**1.47**
	winter	**23,621**	**0.28**
	additional season	**89,663**	**1.05**
razorbill	breeding	7,649	0.39
	winter	5,967	0.31
	additional season	**20,641**	**1.06**
little auk	**winter**	**380**	**1.01**
Atlantic puffin	**breeding**	**26,067**	**0.19**
	winter	8,527	0.06
all species	**breeding**	**239,885**	
	winter	**54,490**	
	summer	**208,976**	

Table 29. Characteristics of area 16, lesser black-backed gull during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Lesser black-backed gull, winter — **area 16 (St. Georges Channel)**
Size: 2,952km^2

Overlap with other protected sites:-

species present	season	number of individuals	% of population
northern fulmar	breeding	750	0.01
	winter	1,753	0.01
Manx shearwater	breeding	11,256	1.00
	additional season	34	<0.01
European storm-petrel	breeding	25	0.03
northern gannet	breeding	2,590	0.22
	winter	2,453	0.21
Arctic skua	additional season	3	<0.01
great skua	winter	33	0.08
black-legged kittiwake	breeding	593	0.01
	winter	7,746	0.09
great black-backed gull	breeding	69	0.02
	winter	302	0.07
common gull	winter	61	<0.01
lesser black-backed gull	breeding	4,218	0.77
	winter	**12,665**	**2.30**
herring gull	breeding	31	<0.01
	winter	5,631	0.21
common tern	breeding	1	<0.01
Arctic tern	breeding	66	0.04
common guillemot	breeding	748	0.01
	winter	3,301	0.04
razorbill	breeding	212	0.01
	winter	456	0.02
Atlantic puffin	breeding	560	<0.01
	winter	8	<0.01
all species	**breeding**	**21,117**	
	winter	**34,212**	
	summer	**20,384**	

Table 30. Characteristics of area 17, common guillemot during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, breeding **area 17 (Rathlin Island)**

Size: 2,974km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Rathlin Island (Atlantic puffin, common guillemot, northern fulmar, razorbill)

Bordering other protected sites:

- SPA Rathlin Island
- SPA Lough Foyle

species present	season	number of individuals	% of population
	breeding	319	<0.01
	winter	1,098	0.01
great shearwater	summer	14	<0.01
sooty shearwater	summer	34	<0.01
Manx shearwater	breeding	6,497	0.58
European storm-petrel	breeding	102	0.13
northern gannet	breeding	1,671	0.14
	winter	904	0.08
great cormorant	breeding	13	0.01
	winter	43	0.04
European shag	breeding	571	0.28
	winter	894	0.44
Arctic skua	breeding	26	0.03
great skua	breeding	5	0.01
	winter	3	0.01
black-legged kittiwake	breeding	13,525	0.16
	winter	408	<0.01
black-headed gull	breeding	8	<0.01
	winter	16	<0.01
great black-backed gull	breeding	175	0.04
	winter	654	0.15
common gull	breeding	94	0.01
	winter	0	<0.01
lesser black-backed gull	breeding	198	0.04
	winter	4	<0.01
herring gull	breeding	698	0.03
	winter	**30,523**	**1.15**
Arctic tern	breeding	101	0.06
common guillemot	**breeding**	**43,704**	**0.51**
	winter	1,752	0.02
	additional season	**25,498**	**0.30**
razorbill	breeding	6,223	0.32
	winter	1,218	0.06
	additional season	19,024	0.98
Atlantic puffin	breeding	1,116	0.01
	winter	256	<0.01
all species	**breeding**	**75,094**	
	winter	**37,584**	
	summer	**69,649**	

Table 31. Characteristics of area 18, common guillemot during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, breeding — **area 18 (Firth of Forth, larger area)**

Size: 5,435km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for St Abb's Head to Fast Castle (Atlantic puffin, common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for Fowlsheugh (common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	1,134	0.01
	winter	3,912	0.02
sooty shearwater	summer	100	<0.01
Manx shearwater	breeding	303	0.03
	additional season	4	<0.01
European storm-petrel	breeding	25	0.03
northern gannet	breeding	8,856	0.76
	winter	1,053	0.09
great cormorant	breeding	0	<0.01
	winter	1	<0.01
European shag	breeding	1	<0.01
	winter	27	0.01
pomarine skua	additional season 1	197	0.66
	additional season 2	199	0.66
Arctic skua	breeding	299	0.40
	additional season	227	0.30
long-tailed skua	additional season 1	294	0.06
	additional season 2	772	0.15
great skua	breeding	98	0.24
	winter	167	0.41
black-legged kittiwake	**breeding**	**47,656**	**0.57**
	winter	7,434	0.09
black-headed gull	breeding	3	<0.01
	winter	9	<0.01
little gull	winter	2	
	additional season	**51**	
great black-backed gull	breeding	73	0.02
	winter	355	0.08
common gull	breeding	10	<0.01
	winter	98	0.01
lesser black-backed gull	breeding	203	0.04
	winter	248	0.05
herring gull	breeding	2,780	0.10
	winter	3,415	0.13
Sandwich tern	breeding	59	0.16
common tern	breeding	5	0.02
Arctic tern	breeding	265	0.17
common guillemot	**breeding**	**149,281**	**1.75**
	winter	**27,519**	**0.32**
	additional season	**106,591**	**1.25**
razorbill	breeding	8,672	0.44
	winter	10,747	0.55
	additional season	**21,120**	**1.08**
little auk	**winter**	**433**	**1.15**
Atlantic puffin	**breeding**	**27,393**	**0.20**
	winter	6,167	0.05
all species	**breeding**	**247,216**	
	winter	**62,170**	
	summer	**207,975**	

Table 32. Characteristics of area 19, common guillemot during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, breeding — **area 19 (Firth of Forth, smaller area)**

Size: 756km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	3,019	0.03
	winter	865	<0.01
sooty shearwater	summer	6	<0.01
Manx shearwater	breeding	26	<0.01
European storm-petrel	breeding	2	<0.01
northern gannet	breeding	485	0.04
	winter	66	0.01
Arctic skua	breeding	24	0.03
	additional season	3	<0.01
great skua	breeding	12	0.03
	winter	13	0.03
black-legged kittiwake	breeding	6,362	0.08
	winter	209	<0.01
great black-backed gull	breeding	25	0.01
	winter	13	<0.01
lesser black-backed gull	breeding	7	<0.01
herring gull	breeding	34	<0.01
	winter	17	<0.01
Arctic tern	breeding	1	<0.01
common guillemot	**breeding**	**29,158**	**0.34**
	winter	849	0.01
	additional season	6,927	0.08
razorbill	breeding	1,574	0.08
	winter	117	0.01
	additional season	5,766	0.30
little auk	winter	114	0.30
Atlantic puffin	breeding	767	0.01
	winter	1,900	0.01
all species	**breeding**	**41,503**	
	winter	4,588	
	summer	**22,952**	

Table 33. Characteristics of area 20, common guillemot during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, breeding **area 20 (Moray Firth)**

Size: 14,066km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Calf of Eday (common guillemot and northern fulmar)
- Potential SPA colony extension of 2km for Rousay (common guillemot, northern fulmar)
- Potential SPA colony extension of 2km for Sule Skerry and Sule Stack (Atlantic puffin, common guillemot and northern gannet)
- Potential SPA colony extension of 2km for Hoy (Atlantic puffin, common guillemot and northern fulmar)
- Potential SPA colony extension of 2km for North Caithness Cliffs (Atlantic puffin, common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for East Caithness Cliffs (Atlantic puffin, common guillemot, northern fulmar and razorbill)

Bordering other protected sites:

- SPA East Sanday Coast

species present	season	number of individuals	% of population
northern fulmar	breeding	11,227	0.11
	winter	**20,679**	**0.12**
sooty shearwater	summer	856	<0.01
Manx shearwater	breeding	240	0.02
	additional season	13	<0.01
European storm-petrel	**breeding**	**828**	**1.08**
Leach's storm-petrel	breeding	7	<0.01
northern gannet	breeding	5,953	0.51
	winter	3,027	0.26
great cormorant	breeding	112	0.10
	winter	41	0.04
European shag	**breeding**	**8,713**	**4.32**
	winter	**5,404**	**2.68**
pomarine skua	additional season 1	9	0.03
	additional season 2	9	0.03
Arctic skua	breeding	568	0.76
	additional season	138	0.18
great skua	**breeding**	**1,287**	**3.15**
	winter	**432**	**1.06**
black-legged kittiwake	**breeding**	**57,988**	**0.69**
	winter	14,336	0.17
black-headed gull	breeding	1	<0.01
	winter	45	<0.01
great black-backed gull	breeding	2,653	0.63
	winter	2,326	0.55
common gull	breeding	54	<0.01
	winter	382	0.02
lesser black-backed gull	breeding	505	0.09
	winter	204	0.04
herring gull	breeding	8,845	0.33
	winter	11,315	0.43
Iceland gull	winter	4	<0.01
glaucous gull	winter	19	0.01
Sandwich tern	breeding	8	0.02
common tern	breeding	74	0.21
Arctic tern	**breeding**	**2,164**	**1.35**
common guillemot	**breeding**	**284,982**	**3.33**
	winter	**55,237**	**0.65**
	additional season	**114,462**	**1.34**
razorbill	breeding	16,242	0.83
	winter	8,803	0.45
	additional season	**28,269**	**1.45**
little auk	**winter**	**677**	**1.81**
Atlantic puffin	**breeding**	**27,727**	**0.21**
	winter	4,533	0.03
all species	**breeding**	**431,034**	
	winter	**126,819**	
	summer	**265,678**	

Table 34. Characteristics of area 21, common guillemot during an additional season (August - September), based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, additional season (August - September) **area 21 (Moray Firth)**
Size: 1656km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	514	0.01
	winter	1,694	0.01
sooty shearwater	summer	72	<0.01
Manx shearwater	breeding	149	0.01
European storm-petrel	breeding	5	0.01
northern gannet	breeding	1,465	0.13
	winter	142	0.01
European shag	breeding	1	<0.01
	winter	15	0.01
pomarine skua	additional season 1	127	0.42
	additional season 2	129	0.43
Arctic skua	breeding	75	0.10
	additional season	145	0.19
long-tailed skua	additional season 1	290	0.06
	additional season 2	758	0.15
great skua	breeding	34	0.08
	winter	119	0.29
black-legged kittiwake	breeding	14,802	0.18
	winter	787	0.01
black-headed gull	breeding	1	<0.01
little gull	additional season	2	
great black-backed gull	breeding	13	<0.01
	winter	104	0.02
common gull	winter	1	<0.01
lesser black-backed gull	breeding	25	<0.01
	winter	103	0.02
herring gull	breeding	397	0.01
	winter	659	0.02
Sandwich tern	breeding	14	0.04
common tern	breeding	1	<0.01
Arctic tern	breeding	105	0.07
common guillemot	**breeding**	**49,621**	**0.58**
	winter	2,110	0.02
	additional season	**62,525**	**0.73**
razorbill	breeding	3,758	0.19
	winter	606	0.03
	additional season	11,721	0.60
little auk	winter	24	0.07
Atlantic puffin	breeding	2,099	0.02
	winter	3,190	0.02
all species	**breeding**	**73,152**	
	winter	10,301	
	summer	**95,284**	

Table 35. Characteristics of area 22, common guillemot during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, winter **area 22 (Moray Firth)**
Size: 2,787km^2

Overlap with other protected sites:
- Potential SPA colony extension of 2km for East Caithness Cliffs (Atlantic puffin, common guillemot, northern fulmar and razorbill)

Bordering other protected sites:
- SPA Dornoch Firth and Loch Fleet
- SPA Inner Moray Firth

SPA Moray & Nairn Coast

species present	season	number of individuals	% of population
northern fulmar	breeding	1,417	0.01
	winter	2,876	0.02
sooty shearwater	summer	632	<0.01
Manx shearwater	breeding	189	0.02
	additional season	6	<0.01
European storm-petrel	breeding	5	0.01
northern gannet	breeding	404	0.03
	winter	353	0.03
great cormorant	breeding	143	0.12
	winter	29	0.02
European shag	**breeding**	**8,397**	**4.16**
	winter	**5,327**	**2.64**
pomarine skua	additional season 1	7	0.02
	additional season 2	16	0.05
Arctic skua	breeding	72	0.10
	additional season	78	0.10
great skua	breeding	140	0.34
	winter	70	0.17
black-legged kittiwake	**breeding**	**23,330**	**0.28**
	winter	7,474	0.09
black-headed gull	breeding	5	<0.01
	winter	19	<0.01
great black-backed gull	breeding	1,119	0.27
	winter	1,055	0.25
common gull	breeding	6	<0.01
	winter	176	0.01
lesser black-backed gull	breeding	85	0.02
	winter	18	<0.01
herring gull	breeding	8,361	0.32
	winter	7,073	0.27
Iceland gull	winter	1	<0.01
glaucous gull	winter	1	<0.01
Sandwich tern	breeding	2	0.01
	winter	1	<0.01
common tern	breeding	21	0.06
Arctic tern	breeding	83	0.05
common guillemot	**breeding**	**45,516**	**0.53**
	winter	**25,996**	**0.30**
	additional season	**41,819**	**0.49**
razorbill	breeding	4,447	0.23
	winter	5,085	0.26
	additional season	10,405	0.53
little auk	winter	232	0.62
Atlantic puffin	breeding	1,361	0.01
	winter	719	0.01
all species	**breeding**	**95,736**	
	winter	**57,484**	
	summer	**98,421**	

Table 36. Characteristics of area 23, Atlantic puffin during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Atlantic puffin, breeding **area 23 (Minches)**
Size: 1,845km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Shiant Isles (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	1,328	0.01
	winter	2,785	0.02
sooty shearwater	summer	527	<0.01
Manx shearwater	breeding	735	0.07
European storm-petrel	breeding	328	0.43
northern gannet	breeding	828	0.07
	winter	74	0.01
great cormorant	breeding	2	<0.01
	winter	1	<0.01
European shag	breeding	372	0.18
	winter	90	0.04
pomarine skua	additional season 1	7	0.02
	additional season 2	18	0.06
Arctic skua	breeding	34	0.05
	additional season	23	0.03
great skua	breeding	54	0.13
	winter	1	<0.01
black-legged kittiwake	breeding	4,166	0.05
	winter	1,049	0.01
black-headed gull	breeding	13	<0.01
great black-backed gull	breeding	644	0.15
	winter	82	0.02
common gull	breeding	1	<0.01
	winter	7	<0.01
lesser black-backed gull	breeding	276	0.05
	winter	49	0.01
herring gull	breeding	119	<0.01
	winter	379	0.01
common tern	breeding	9	0.02
Arctic tern	breeding	79	0.05
common guillemot	breeding	7,107	0.08
	winter	3,196	0.04
	additional season	11,875	0.14
razorbill	breeding	3,255	0.17
	winter	536	0.03
	additional season	7,081	0.36
little auk	winter	11	0.03
Atlantic puffin	**breeding**	**22,497**	**0.17**
	winter	8,965	0.07
all species	**breeding**	**42,373**	
	winter	17,551	
	summer	**44,948**	

Table 37. Characteristics of area 24, Atlantic puffin during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Atlantic puffin, breeding **area 24 (Handa)**

Size: 4,177km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Handa (common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for Cape Wrath (Atlantic puffin, common guillemot, northern fulmar and razorbill)
- Potential SPA colony extension of 2km for Sule Skerry and Sule Stack (Atlantic puffin, common guillemot and northern gannet)

species present	season	number of individuals	% of population
northern fulmar	breeding	4,950	0.05
	winter	13,448	0.07
sooty shearwater	summer	211	<0.01
Manx shearwater	breeding	516	0.05
European storm-petrel	breeding	697	0.91
Leach's storm-petrel	breeding	2	<0.01
northern gannet	breeding	8,739	0.75
	winter	3,019	0.26
European shag	breeding	217	0.11
Arctic skua	breeding	25	0.03
	additional season	12	0.02
great skua	breeding	214	0.52
	winter	214	0.53
black-legged kittiwake	breeding	7,146	0.09
	winter	3,226	0.04
great black-backed gull	breeding	425	0.10
	winter	145	0.03
lesser black-backed gull	breeding	67	0.01
	winter	149	0.03
herring gull	breeding	46	<0.01
	winter	1,212	0.05
common tern	breeding	11	0.03
Arctic tern	breeding	417	0.26
common guillemot	**breeding**	**33,077**	**0.39**
	winter	13,338	0.16
	additional season	1,608	0.02
razorbill	breeding	4,591	0.24
	winter	3,579	0.18
	additional season	858	0.04
little auk	winter	162	0.43
Atlantic puffin	**breeding**	**27,578**	**0.20**
	winter	1,346	0.01
all species	**breeding**	**88,929**	
	winter	**38,190**	
	summer	**44,859**	

Table 38. Characteristics of area 25, Atlantic puffin during breeding, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Atlantic puffin, breeding **area 25 (Shetland)**
Size: 3,956km^2

Overlap with other protected sites:
- Potential SPA colony extension of 2km for Foula (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	7,831	0.08
	winter	8,537	0.05
sooty shearwater	summer	6	<0.01
Manx shearwater	breeding	2	<0.01
European storm-petrel	breeding	269	0.35
northern gannet	breeding	1,843	0.16
	winter	1,346	0.12
great cormorant	breeding	4	<0.01
	winter	26	0.02
European shag	**breeding**	**14,542**	**7.21**
	winter	630	0.31
Arctic skua	breeding	254	0.34
	additional season	1	<0.01
great skua	**breeding**	**1,228**	**3.01**
	winter	**482**	**1.18**
black-legged kittiwake	breeding	2,319	0.03
	winter	2,593	0.03
great black-backed gull	breeding	733	0.17
	winter	154	0.04
common gull	breeding	1	<0.01
	winter	2	<0.01
lesser black-backed gull	breeding	165	0.03
herring gull	breeding	54	<0.01
	winter	159	0.01
glaucous gull	winter	6	<0.01
common tern	breeding	2	0.01
Arctic tern	breeding	1,344	0.84
common guillemot	**breeding**	**20,749**	**0.24**
	winter	13,732	0.16
	additional season	3,167	0.04
razorbill	breeding	1,014	0.05
	winter	790	0.04
	additional season	131	0.01
little auk	winter	239	0.64
Atlantic puffin	**breeding**	**26,463**	**0.20**
	winter	671	<0.01
all species	**breeding**	**78,824**	
	winter	**31,533**	
	summer	**47,816**	

Table 39. Characteristics of area 26, Atlantic puffin during winter, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Atlantic puffin, winter — **area 26 (Wee Bankie/Marr Bank)**

Size: 10,692km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	9,047	0.09
	winter	11,592	0.06
sooty shearwater	summer	86	<0.01
Manx shearwater	breeding	130	0.01
European storm-petrel	breeding	246	0.32
Leach's storm-petrel	breeding	6	<0.01
northern gannet	breeding	9,784	0.84
	winter	1,704	0.15
European shag	winter	1	<0.01
pomarine skua	additional season 1	153	0.51
	additional season 2	155	0.52
Arctic skua	breeding	224	0.30
	additional season	302	0.40
long-tailed skua	additional season 1	297	0.06
	additional season 2	802	0.16
great skua	breeding	173	0.42
	winter	251	0.62
black-legged kittiwake	**breeding**	**52,742**	**0.63**
	winter	7,080	0.08
black-headed gull	breeding	75	<0.01
great black-backed gull	breeding	133	0.03
	winter	266	0.06
common gull	breeding	21	<0.01
	winter	45	<0.01
lesser black-backed gull	breeding	106	0.02
	winter	61	0.01
herring gull	breeding	1,309	0.05
	winter	517	0.02
Sandwich tern	breeding	8	0.02
common tern	breeding	11	0.03
Arctic tern	breeding	353	0.22
common guillemot	**breeding**	**104,838**	**1.23**
	winter	**20,389**	**0.24**
	additional season	**115,361**	**1.35**
razorbill	breeding	6,784	0.35
	winter	4,344	0.22
	additional season	**33,470**	**1.72**
little auk	**winter**	**2,355**	**6.28**
Atlantic puffin	breeding	7,910	0.06
	winter	**20,573**	**0.15**
all species	**breeding**	**193,988**	
	winter	**69,763**	
	summer	**238,958**	

Table 40. Characteristics of area 27, all species during summer, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

All species, summer **area 27 (Firth of Forth)**
Size: 2,230km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Forth Islands (Atlantic puffin, common guillemot, northern gannet, razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	263	<0.01
	winter	1,847	0.01
sooty shearwater	summer	23	<0.01
Manx shearwater	breeding	209	0.02
	additional season	6	<0.01
European storm-petrel	breeding	44	0.06
northern gannet	breeding	7,497	0.65
	winter	1,353	0.12
great cormorant	breeding	4	<0.01
	winter	3	<0.01
European shag	breeding	440	0.22
	winter	606	0.30
pomarine skua	additional season 1	38	0.13
	additional season 2	37	0.12
Arctic skua	breeding	91	0.12
	additional season	96	0.13
long-tailed skua	additional season 1	2	<0.01
great skua	breeding	18	0.04
	winter	18	0.04
black-legged kittiwake	**breeding**	**22,487**	**0.27**
	winter	3,857	0.05
	winter	1	<0.01
little gull	breeding	3	
	winter	17	
	additional season	86	
great black-backed gull	breeding	26	0.01
	winter	674	0.16
Mediterranean gull	all year	0	<0.01
common gull	breeding	22	<0.01
	winter	171	0.01
lesser black-backed gull	breeding	281	0.05
	winter	22	<0.01
herring gull	breeding	1,706	0.06
	winter	3,021	0.11
Sandwich tern	breeding	8	0.02
common tern	breeding	5	0.01
Arctic tern	breeding	308	0.19
common guillemot	**breeding**	**38,515**	**0.45**
	winter	**26,280**	**0.31**
	additional season	**41,782**	**0.49**
razorbill	breeding	1,316	0.07
	winter	7,430	0.38
	additional season	5,092	0.26
little auk	winter	342	0.91
Atlantic puffin	**breeding**	**40,268**	**0.30**
	winter	1,735	0.01
all species	**breeding**	**113,533**	
	winter	**47,186**	
	summer	**102,182**	

Table 41. Characteristics of area 28, all species during summer, based on top 5% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

All species, summer **area 28 (Minches)**
Size: 717km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Shiant Isles (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	654	0.01
	winter	1,415	0.01
sooty shearwater	summer	63	<0.01
Manx shearwater	breeding	167	0.01
European storm-petrel	breeding	148	0.19
northern gannet	breeding	352	0.03
	winter	27	<0.01
European shag	breeding	156	0.08
	winter	22	0.01
pomarine skua	additional season 1	2	0.01
	additional season 2	6	0.02
Arctic skua	breeding	15	0.02
	additional season	6	0.01
great skua	breeding	26	0.06
black-legged kittiwake	breeding	2,748	0.03
	winter	448	0.01
black-headed gull	breeding	3	<0.01
great black-backed gull	breeding	234	0.06
	winter	39	0.01
common gull	breeding	1	<0.01
	winter	2	<0.01
lesser black-backed gull	breeding	188	0.03
	winter	27	<0.01
herring gull	breeding	14	<0.01
	winter	185	0.01
common tern	breeding	6	0.02
Arctic tern	breeding	12	0.01
common guillemot	breeding	3,345	0.04
	winter	1,252	0.01
	additional season	5,816	0.07
razorbill	breeding	1,267	0.06
	winter	226	0.01
	additional season	1,973	0.10
little auk	winter	4	0.01
Atlantic puffin	breeding	12,916	0.10
	winter	4,762	0.04
all species	**breeding**	**22,314**	
	winter	8,358	
	summer	**21,801**	

8.2 Qualifying areas based on top 1% of Getis-Ord Gi*

Table 42. Characteristics of area 1, Manx shearwater during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Manx shearwater, breeding — **area 1 (Skomer and Skokholm, westerly area)**
Size: 972km2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	116	<0.01
	winter	293	<0.01
Manx shearwater	**breeding**	**51,792**	**4.60**
	additional season	10	<0.01
European storm-petrel	breeding	24	0.03
northern gannet	breeding	2,393	0.21
	winter	789	0.07
great cormorant	breeding	5	<0.01
European shag	breeding	1	<0.01
Arctic skua	additional season	1	<0.01
great skua	breeding	3	0.01
	winter	3	0.01
black-legged kittiwake	breeding	1,428	0.02
	winter	328	<0.01
little gull	winter	2	
great black-backed gull	breeding	16	<0.01
	winter	39	0.01
lesser black-backed gull	breeding	2,710	0.49
	winter	669	0.12
herring gull	breeding	264	0.01
	winter	655	0.02
Arctic tern	breeding	2	<0.01
common guillemot	breeding	1,848	0.02
	winter	915	0.01
	additional season	50	<0.01
razorbill	breeding	390	0.02
	winter	568	0.03
Atlantic puffin	breeding	1,674	0.01
	winter	10	<0.01
all species	**breeding**	**62,667**	
	winter	4,244	
	summer	**59,735**	

Table 43. Characteristics of area 2, Manx shearwater during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Manx shearwater, breeding — **area 2 (Skomer and Skokholm, easterly area)**

Size: 276km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	18	<0.01
	winter	26	<0.01
Manx shearwater	**breeding**	**12,999**	**1.16**
European storm-petrel	breeding	7	0.01
northern gannet	breeding	243	0.02
	winter	112	0.01
great skua	winter	1	<0.01
black-legged kittiwake	breeding	41	<0.01
	winter	23	<0.01
little gull	winter	1	
great black-backed gull	breeding	15	<0.01
	winter	5	<0.01
common gull	winter	2	<0.01
lesser black-backed gull	breeding	590	0.11
	winter	102	0.02
herring gull	breeding	62	<0.01
	winter	58	<0.01
common guillemot	breeding	681	0.01
	winter	235	<0.01
	additional season	132	<0.01
razorbill	breeding	24	<0.01
	winter	150	0.01
	additional season	5	<0.01
Atlantic puffin	breeding	505	<0.01
	winter	8	<0.01
all species	breeding	15,184	
	winter	721	
	summer	14,372	

Table 44. Characteristics of area 3, northern gannet during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Northern gannet, breeding **area 3 (St Kilda)**
Size: 4,207km^2

Overlap with other protected sites:

- Potential SPA colony extension of 4km for St Kilda (Atlantic puffin, common guillemot, Manx shearwater, northern fulmar, northern gannet, razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	3,474	0.03
	winter	4,967	0.03
sooty shearwater	summer	30	<0.01
Manx shearwater	breeding	739	0.07
European storm-petrel	**breeding**	**985**	**1.28**
Leach's storm-petrel	breeding	74	0.05
northern gannet	**breeding**	**51,784**	**4.47**
	winter	7,214	0.62
European shag	breeding	10	<0.01
pomarine skua	additional season 1	1	<0.01
Arctic skua	breeding	19	0.03
	additional season	1	<0.01
great skua	breeding	167	0.41
	winter	40	0.10
black-legged kittiwake	breeding	1,067	0.01
	winter	2,569	0.03
great black-backed gull	breeding	96	0.02
	winter	28	0.01
lesser black-backed gull	breeding	57	0.01
	winter	179	0.03
herring gull	breeding	49	<0.01
	winter	116	<0.01
glaucous gull	winter	1	<0.01
Arctic tern	breeding	1	<0.01
common guillemot	breeding	3,554	0.04
	winter	1,095	0.01
	additional season	39	<0.01
razorbill	breeding	1,338	0.07
	additional season	3	<0.01
little auk	winter	6	0.02
Atlantic puffin	breeding	7,728	0.06
	winter	875	0.01
all species	**breeding**	**71,172**	
	winter	16,785	
	summer	**63,643**	

Table 45. Characteristics of area 4, European shag during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

European shag, breeding **area 4 (Moray Firth)**
Size: 160km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	55	<0.01
	winter	171	<0.01
northern gannet	breeding	15	<0.01
	winter	26	<0.01
great cormorant	breeding	23	0.02
	winter	3	<0.01
European shag	**breeding**	**4,606**	**2.28**
	winter	1,968	0.98
Arctic skua	breeding	29	0.04
	additional season	2	<0.01
great skua	breeding	4	0.01
black-legged kittiwake	breeding	633	0.01
	winter	655	0.01
great black-backed gull	breeding	62	0.01
	winter	80	0.02
	winter	10	<0.01
lesser black-backed gull	breeding	2	<0.01
	winter	3	<0.01
herring gull	breeding	130	<0.01
	winter	340	0.01
common guillemot	breeding	4,227	0.05
	winter	2,076	0.02
	additional season	6,457	0.08
razorbill	breeding	168	0.01
	winter	280	0.01
	additional season	143	0.01
little auk	winter	31	0.08
Atlantic puffin	breeding	74	<0.01
	winter	44	<0.01
all species	breeding	10,029	
	winter	6,196	
	summer	12,278	

Table 46. Characteristics of area 5, European shag during winter, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

European shag, winter **area 5 (Moray Firth)**
Size: 164km2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	119	<0.01
	winter	517	<0.01
sooty shearwater	summer	3	<0.01
Manx shearwater	breeding	1	<0.01
northern gannet	breeding	33	<0.01
	winter	14	<0.01
great cormorant	breeding	15	0.01
European shag	**breeding**	**2,488**	**1.23**
	winter	**3,179**	**1.58**
Arctic skua	breeding	3	<0.01
	additional season	1	<0.01
great skua	breeding	8	0.02
black-legged kittiwake	breeding	467	0.01
	winter	119	<0.01
great black-backed gull	breeding	76	0.02
	winter	30	0.01
lesser black-backed gull	breeding	2	<0.01
	winter	3	<0.01
herring gull	breeding	144	0.01
	winter	181	0.01
common guillemot	breeding	5,344	0.06
	winter	2,057	0.02
	additional season	416	<0.01
razorbill	breeding	322	0.02
	winter	173	0.01
	additional season	179	0.01
little auk	winter	23	0.06
Atlantic puffin	breeding	132	<0.01
	winter	125	<0.01
all species	breeding	9,159	
	winter	6,208	
	summer	4,281	

Table 47. Characteristics of area 6, great skua during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Great skua, breeding — **area 6 (Shetland Islands)**

Size: 3,455km²

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Foula (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	8,468	0.08
	winter	5,991	0.03
Manx shearwater	breeding	10	<0.01
European storm-petrel	breeding	263	0.34
northern gannet	breeding	821	0.07
	winter	644	0.06
great cormorant	breeding	1	<0.01
	winter	3	<0.01
European shag	**breeding**	**13,969**	**6.92**
	winter	12	0.01
Arctic skua	breeding	221	0.30
great skua	**breeding**	**1,620**	**3.97**
	winter	324	0.80
black-legged kittiwake	breeding	639	0.01
	winter	1,306	0.02
great black-backed gull	breeding	241	0.06
	winter	50	0.01
common gull	breeding	2	<0.01
lesser black-backed gull	breeding	130	0.02
herring gull	breeding	10	<0.01
	winter	41	<0.01
glaucous gull	winter	4	<0.01
common tern	breeding	1	<0.01
Arctic tern	breeding	575	0.36
common guillemot	breeding	11,292	0.13
	winter	9,018	0.11
	additional season	1,695	0.02
razorbill	breeding	534	0.03
	winter	505	0.03
	additional season	73	<0.01
little auk	winter	30	0.08
Atlantic puffin	breeding	15,726	0.12
	winter	412	<0.01
all species	**breeding**	**54,524**	
	winter	**21,304**	
	summer	**35,569**	

Table 48. Characteristics of area 7, common guillemot during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Common guillemot, breeding **area 7 (Orkney)**

Size: 643km²

Overlap with other protected sites:

- Potential SPA colony extension of 2km for North Caithness Cliffs (Atlantic puffin, common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	564	0.01
	winter	511	<0.01
Manx shearwater	breeding	2	<0.01
European storm-petrel	breeding	2	<0.01
Leach's storm-petrel	breeding	5	<0.01
northern gannet	breeding	167	0.01
	winter	72	0.01
great cormorant	breeding	1	<0.01
	winter	4	<0.01
European shag	breeding	118	0.06
	winter	70	0.03
Arctic skua	breeding	52	0.07
great skua	breeding	137	0.34
	winter	18	0.04
black-legged kittiwake	breeding	1,095	0.01
	winter	1,278	0.02
great black-backed gull	breeding	134	0.03
	winter	37	0.01
common gull	breeding	5	<0.01
	winter	1	<0.01
lesser black-backed gull	breeding	12	<0.01
	winter	3	<0.01
herring gull	breeding	7	<0.01
	winter	132	<0.01
common tern	breeding	2	0.01
Arctic tern	breeding	251	0.16
common guillemot	**breeding**	**28,356**	**0.33**
	winter	8,085	0.09
	additional season	2,751	0.03
razorbill	breeding	904	0.05
	winter	380	0.02
	additional season	603	0.03
little auk	winter	20	0.05
Atlantic puffin	breeding	755	0.01
	winter	460	<0.01
all species	**breeding**	**32,569**	
	winter	11,074	
	summer	6,489	

Table 49. Characteristics of area 8, Atlantic puffin during breeding, based on top 1% Getis-Ord Gi*. The estimated numbers of all species present are indicated, along with their season of occurrence. Species present in qualifying numbers are in bold (refer to Table 13 for qualifying thresholds).

Atlantic puffin, breeding **area 8 (Firth of Forth)**
Size: 1,647km²

Overlap with other protected sites:
- Potential SPA colony extension of 2km for Forth Islands (Atlantic puffin, common guillemot, northern gannet, razorbill)

Bordering other protected sites:
- SPA Firth of Tay & Eden estuary
- SPA Firth of Forth

species present	season	number of individuals	% of population
northern fulmar	breeding	136	<0.01
	winter	232	<0.01
sooty shearwater	summer	21	<0.01
Manx shearwater	breeding	3,386	0.30
	additional season	17	<0.01
northern gannet	breeding	7,398	0.64
	winter	675	0.06
great cormorant	breeding	11	0.01
	winter	46	0.04
European shag	breeding	872	0.43
	winter	2,341	1.16
pomarine skua	additional season 1	41	0.14
	additional season 2	41	0.14
Arctic skua	breeding	43	0.06
	additional season	89	0.12
great skua	breeding	22	0.05
	winter	11	0.03
black-legged	breeding	9,035	0.11
	winter	2,617	0.03
black-headed gull	breeding	23	<0.01
	winter	6	<0.01
little gull	breeding	11	
	winter	**96**	
	additional season	176	
great black-backed	breeding	30	0.01
	winter	461	0.11
common gull	breeding	22	<0.01
	winter	398	0.02
lesser black-backed	breeding	289	0.05
	winter	19	<0.01
herring gull	breeding	1,820	0.07
	winter	4,487	0.17
Sandwich tern	breeding	13	0.03
common tern	breeding	6	0.02
Arctic tern	breeding	240	0.15
common guillemot	breeding	16,833	0.20
	winter	16,563	0.19
	additional season	**23,203**	**0.27**
razorbill	breeding	1,333	0.07
	winter	3,885	0.20
	additional season	3,083	0.16
little auk	winter	211	0.56
Atlantic puffin	**breeding**	**56,732**	**0.42**
	winter	740	0.01
all species	**breeding**	**98,276**	
	winter	**32,647**	
	summer	**78,572**	

8.3 Near-qualifying areas based on top 5% of Getis-Ord Gi*

Table 50. Characteristics of near-qualifying area 1, northern gannet during breeding, based on top 5% Getis-Ord Gi*. Species present with qualifying number are in bold.

Northern gannet, breeding — **near-qualifying area 1 (Solan Bank)**
Size: 7,380km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for North Rona and Sula Skeir (Atlantic puffin, common guillemot, northern fulmar, northern gannet, razorbill)
- Potential SPA colony extension of 2km for Sule Skerry and Sule Stack (Atlantic puffin, common guillemot and northern gannet

species present	season	number of individuals	% of population
northern fulmar	breeding	8,060	0.08
	winter	7,341	0.04
sooty shearwater	summer	254	<0.01
Manx shearwater	breeding	2,216	0.20
European storm-petrel	**breeding**	**1,498**	**1.95**
Leach's storm-petrel	breeding	6	<0.01
northern gannet	**breeding**	**16,793**	**1.45**
	winter	4,194	0.36
European shag	breeding	268	0.13
Arctic skua	breeding	20	0.03
	additional season	8	0.01
great skua	**breeding**	**425**	**1.04**
	winter	248	0.61
black-legged kittiwake	breeding	6,802	0.08
	winter	4,251	0.05
great black-backed gull	breeding	688	0.16
	winter	220	0.05
lesser black-backed gull	breeding	190	0.03
	winter	273	0.05
herring gull	breeding	56	<0.01
	winter	631	0.02
Iceland gull	winter	1	<0.01
glaucous gull	winter	12	<0.01
Sandwich tern	breeding	0	<0.01
Arctic tern	breeding	443	0.28
common guillemot	**breeding**	**46,368**	**0.54**
	winter	14,663	0.17
	additional season	2,509	0.03
razorbill	breeding	4,432	0.23
	winter	3,165	0.16
	additional season	709	0.04
little auk	winter	233	0.62
Atlantic puffin	**breeding**	**29,103**	**0.22**
	winter	2,711	0.02
all species	**breeding**	**117,623**	
	winter	**38,154**	
	summer	**56,486**	

Table 51. Characteristics of near-qualifying area 2, common guillemot during an additional season (August - September), based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Common guillemot, additional season (August - September) **near-qualifying area 2 (Marr Bank)**
Size: 828km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	87	<0.01
	winter	936	0.01
sooty shearwater	summer	1	<0.01
Manx shearwater	breeding	15	<0.01
	additional season	1	<0.01
European storm-petrel	breeding	14	0.02
northern gannet	breeding	1,136	0.10
	winter	139	0.01
	winter	12	0.01
pomarine skua	additional season 1	16	0.05
	additional season 2	16	0.05
Arctic skua	breeding	94	0.13
	additional season	31	0.04
long-tailed skua	additional season 1	2	<0.01
great skua	breeding	14	0.03
	winter	14	0.04
black-legged kittiwake	breeding	6,998	0.08
	winter	1,575	0.02
black-headed gull	winter	8	<0.01
little gull	additional season	12	
great black-backed gull	breeding	24	0.01
	winter	114	0.03
common gull	breeding	2	<0.01
	winter	21	<0.01
lesser black-backed gull	breeding	9	<0.01
	winter	1	<0.01
herring gull	breeding	478	0.02
	winter	1,048	0.04
Sandwich tern	breeding	2	0.01
Arctic tern	breeding	47	0.03
common guillemot	**breeding**	**23,328**	**0.27**
	winter	9,597	0.11
	additional season	**25,416**	**0.30**
razorbill	breeding	682	0.03
	winter	4,258	0.22
	additional season	3,810	0.20
little auk	winter	38	0.10
Atlantic puffin	breeding	2,849	0.02
	winter	816	0.01
all species	**breeding**	**35,780**	
	winter	18,442	
	summer	**40,427**	

Table 52. Characteristics of near-qualifying area 3, common guillemot during winter, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Common guillemot, winter — **near-qualifying area 3 (Dogger Bank)**

Size: 6,012km^2

Overlap with other protected sites:

species present	season	number of individuals	% of population
northern fulmar	breeding	3,805	0.04
	winter	8,443	0.05
sooty shearwater	summer	12	<0.01
Manx shearwater	breeding	5	<0.01
northern gannet	breeding	1,019	0.09
	winter	2,582	0.22
Arctic skua	breeding	32	0.04
great skua	breeding	38	0.09
	winter	122	0.30
black-legged kittiwake	breeding	19,455	0.23
	winter	15,668	0.19
black-headed gull	breeding	56	<0.01
little gull	**additional season**	**98**	
great black-backed gull	breeding	78	0.02
	winter	881	0.21
common gull	breeding	239	0.01
	winter	5	<0.01
lesser black-backed gull	breeding	7	<0.01
	winter	128	0.02
herring gull	breeding	12	<0.01
	winter	724	0.03
common tern	breeding	21	0.06
Arctic tern	breeding	661	0.41
common guillemot	breeding	5,852	0.07
	winter	**35,869**	**0.42**
	additional season	9,288	0.11
razorbill	breeding	413	0.02
	winter	4,793	0.25
	additional season	101	0.01
little auk	**winter**	**3,950**	**10.53**
Atlantic puffin	breeding	578	<0.01
	winter	977	0.01
all species	**breeding**	**32,283**	
	winter	**73,123**	
	summer	**37,974**	

Table 53. Characteristics of near-qualifying area 4, common guillemot during winter, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Common guillemot, winter — **near-qualifying area 4 (Firth of Forth)**

Size: 6,347km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Forth Islands (common guillemot, northern gannet, razorbill)
- Potential SPA colony extension of 2km for St Abb's Head to Fast Castle (Atlantic puffin, common guillemot, northern fulmar and razorbill)

Bordering other protected sites:

- SPA Firth of Tay & Eden Estuary
- SPA Firth of Forth

species present	season	number of individuals	% of population
northern fulmar	breeding	793	0.01
	winter	4,932	0.03
sooty shearwater	summer	48	<0.01
Manx shearwater	breeding	3,941	0.35
	additional season	30	<0.01
European storm-petrel	breeding	64	0.08
northern gannet	**breeding**	**16,713**	**1.44**
	winter	3,219	0.28
great cormorant	breeding	14	0.01
	winter	69	0.06
European shag	breeding	922	0.46
	winter	**2,408**	**1.19**
pomarine skua	additional season 1	103	0.34
	additional season 2	103	0.34
Arctic skua	breeding	205	0.27
	additional season	310	0.41
long-tailed skua	additional season 1	23	<0.01
	additional season 2	26	<0.01
great skua	breeding	64	0.16
	winter	91	0.22
black-legged kittiwake	**breeding**	**34,868**	**0.42**
	winter	8,572	0.10
black-headed gull	breeding	25	<0.01
	winter	245	0.01
little gull	breeding	11	
	winter	153	
	additional season	349	
great black-backed gull	breeding	115	0.03
	winter	1,359	0.32
Mediterranean gull	all year	0	<0.01
common gull	breeding	50	<0.01
	winter	687	0.04
lesser black-backed gull	breeding	504	0.09
	winter	60	0.01
herring gull	breeding	3,802	0.14
	winter	8,390	0.32
Sandwich tern	breeding	77	0.21
common tern	breeding	23	0.06
Arctic tern	breeding	789	0.49
common guillemot	**breeding**	**90,685**	**1.06**
	winter	**55,878**	**0.65**
	additional season	**89,808**	**1.05**
razorbill	breeding	3,933	0.20
	winter	16,129	0.83
	additional season	13,257	0.68
little auk	**winter**	**740**	**1.97**
Atlantic puffin	**breeding**	**67,446**	**0.50**
	winter	4,956	0.04
all species	**breeding**	**225,091**	
	winter	**107,230**	
	summer	**204,635**	

Table 54. Characteristics of near-qualifying area 5, Atlantic puffin during breeding, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Atlantic puffin, breeding **near-qualifying area 5 (Firth of Forth)**
Size: 4,486km^2

Overlap with other protected sites:
- Potential SPA colony extension of 2km for Forth Islands (common guillemot, northern gannet, razorbill)
- Potential SPA colony extension of 2km for St Abb's Head to Fast Castle (Atlantic puffin, common guillemot, northern fulmar and razorbill)

Bordering other protected sites:
- SPA Firth of Tay & Eden Estuary
- SPA Firth of Forth

species present	season	number of individuals	% of population
northern fulmar	breeding	499	<0.01
	winter	1,346	0.01
sooty shearwater	summer	33	<0.01
Manx shearwater	breeding	3,681	0.33
	additional season	33	<0.01
European storm-petrel	breeding	27	0.03
northern gannet	**breeding**	**14,470**	**1.25**
	winter	1,914	0.17
great cormorant	breeding	13	0.01
	winter	62	0.05
European shag	breeding	933	0.46
	winter	**2,380**	**1.18**
pomarine skua	additional season 1	70	0.23
	additional season 2	71	0.24
Arctic skua	breeding	141	0.19
	additional season	201	0.27
great skua	breeding	51	0.12
	winter	33	0.08
black-legged kittiwake	**breeding**	**26,489**	**0.32**
	winter	5,545	0.07
black-headed gull	breeding	33	<0.01
	winter	28	<0.01
little gull	breeding	14	
	winter	160	
	additional season	347	
great black-backed gull	breeding	102	0.02
	winter	746	0.18
common gull	breeding	42	<0.01
	winter	570	0.03
lesser black-backed gull	breeding	429	0.08
	winter	62	0.01
herring gull	breeding	3,177	0.12
	winter	7,828	0.30
Sandwich tern	breeding	24	0.06
common tern	breeding	11	0.03
Arctic tern	breeding	370	0.23
common guillemot	**breeding**	**61,046**	**0.71**
	winter	**34,291**	**0.40**
	additional season	**59,927**	**0.70**
razorbill	breeding	3,301	0.17
	winter	10,774	0.55
	additional season	8,737	0.45
little auk	**winter**	**633**	**1.69**
Atlantic puffin	**breeding**	**71,964**	**0.53**
	winter	2,085	0.02
all species	**breeding**	**186,850**	
	winter	**68,342**	
	summer	**156,888**	

Table 55. Characteristics of near-qualifying area 6, all species during breeding, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

All species, breeding
Size: 2,472km^2

near-qualifying area 6 (Skomer and Skokholm)

Overlap with other protected sites:

- Potential SPA colony extension of 4km for Skomer and Skokholm (Atlantic puffin, common guillemot, Manx shearwater and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	298	<0.01
	winter	615	<0.01
Manx shearwater	**breeding**	**80,209**	**7.13**
	additional season	23	<0.01
European storm-petrel	breeding	79	0.10
northern gannet	breeding	4,081	0.35
	winter	1,509	0.13
great cormorant	breeding	5	<0.01
European shag	breeding	1	<0.01
Arctic skua	additional season	1	<0.01
great skua	breeding	3	0.01
	winter	9	0.02
black-legged kittiwake	breeding	2,994	0.04
	winter	776	0.01
black-headed gull	winter	1	<0.01
little gull	winter	19	
great black-backed gull	breeding	134	0.03
	winter	72	0.02
common gull	winter	11	<0.01
lesser black-backed gull	breeding	5,604	1.02
	winter	1,642	0.30
herring gull	breeding	513	0.02
	winter	1,415	0.05
Arctic tern	breeding	9	0.01
common guillemot	breeding	5,702	0.07
	winter	2,606	0.03
	additional season	417	<0.01
razorbill	breeding	891	0.05
	winter	1,287	0.07
	additional season	52	<0.01
Atlantic puffin	breeding	4,505	0.03
	winter	23	<0.01
all species	**breeding**	**105,026**	
	winter	9,933	
	summer	**96,819**	

Table 56. Characteristics of near-qualifying area 7, all species during breeding, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

All species, breeding **near-qualifying area 7 (Canna)**

Size: 451km^2

Overlap with other protected sites:

- potential 1km colony extension at Canna & Sanday (for common guillemot and Atlantic puffin)
- potential 4km colony extension at Rum (for common guillemot and Manx shearwater)

species present	season	number of individuals	% of population
northern fulmar	breeding	77	<0.01
	winter	139	<0.01
Manx shearwater	**breeding**	**17,333**	**1.54**
European storm-petrel	breeding	18	0.02
northern gannet	breeding	216	0.02
	winter	24	<0.01
European shag	breeding	67	0.03
	winter	753	0.37
Arctic skua	breeding	30	0.04
black-legged kittiwake	breeding	1,338	0.02
	winter	21	<0.01
great black-backed gull	breeding	10	<0.01
	winter	3	<0.01
common gull	breeding	35	<0.01
lesser black-backed gull	breeding	10	<0.01
	winter	6	<0.01
herring gull	breeding	113	<0.01
	winter	24	<0.01
Arctic tern	breeding	39	0.02
common guillemot	breeding	1,211	0.01
	winter	249	<0.01
	additional season	7,868	0.09
razorbill	breeding	364	0.02
	winter	288	0.01
	additional season	4,578	0.23
little auk	winter	3	0.01
Atlantic puffin	breeding	184	<0.01
	winter	319	<0.01
all species	**breeding**	**21,044**	
	winter	1,679	
	summer	**32,013**	

Table 57. Characteristics of near-qualifying area 8, all species during breeding, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

All species, breeding — **near-qualifying area 8 (North and South Uist)**

Size: 920km^2

Overlap with other protected sites:

Bordering other protected sites:

- SPA North Uist Machair and Islands
- SPA South Uist Machair and Lochs

species present	season	number of individuals	% of population
northern fulmar	breeding	174	<0.01
	winter	451	<0.01
sooty shearwater	summer	4	<0.01
Manx shearwater	breeding	9,376	0.83
European storm-petrel	breeding	186	0.24
northern gannet	breeding	677	0.06
	winter	195	0.02
	winter	8	0.01
European shag	breeding	62	0.03
	winter	875	0.43
Arctic skua	breeding	7	0.01
great skua	breeding	4	0.01
	winter	1	<0.01
black-legged kittiwake	breeding	227	<0.01
	winter	38	<0.01
great black-backed gull	breeding	7	<0.01
	winter	7	<0.01
lesser black-backed gull	breeding	1	<0.01
	winter	6	<0.01
herring gull	breeding	2	<0.01
	winter	29	<0.01
Arctic tern	breeding	5	<0.01
common guillemot	breeding	4,346	0.05
	winter	430	0.01
	additional season	519	0.01
razorbill	breeding	642	0.03
	winter	93	<0.01
	additional season	121	0.01
little auk	winter	0	<0.01
Atlantic puffin	breeding	6,195	0.05
	winter	274	<0.01
all species	**breeding**	**21,917**	
	winter	2,192	
	summer	14,747	

Table 58. Characteristics of near-qualifying area 9, all species during summer, based on top 5% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

All species, summer — **near-qualifying area 9 (east of Stonehaven)**

Size: 1,176km^2

Overlap with other protected sites:

- Potential SPA colony extension of 2km for Fowlsheug (common guillemot, northern fulmar and razorbill)

species present	season	number of individuals	% of population
northern fulmar	breeding	431	<0.01
	winter	773	<0.01
sooty shearwater	summer	68	<0.01
Manx shearwater	breeding	7	<0.01
European storm-petrel	breeding	1	<0.01
northern gannet	breeding	894	0.08
	winter	121	0.01
pomarine skua	additional season 1	107	0.36
	additional season 2	109	0.36
Arctic skua	breeding	66	0.09
	additional season	116	0.15
long-tailed skua	additional season 1	244	0.05
	additional season 2	645	0.13
great skua	breeding	35	0.08
	winter	106	0.26
black-legged kittiwake	breeding	15,608	0.19
	winter	1,015	0.01
black-headed gull	breeding	2	<0.01
little gull	additional season	6	
great black-backed gull	breeding	5	<0.01
	winter	50	0.01
common gull	breeding	1	<0.01
	winter	6	<0.01
lesser black-backed gull	breeding	10	<0.01
	winter	153	0.03
herring gull	breeding	555	0.02
	winter	614	0.02
Sandwich tern	breeding	4	0.01
Arctic tern	breeding	22	0.01
common guillemot	**breeding**	**39,303**	**0.46**
	winter	2,400	0.03
	additional season	**40,659**	**0.48**
razorbill	breeding	2,873	0.15
	winter	329	0.02
	additional season	7,967	0.41
little auk	winter	20	0.05
Atlantic puffin	breeding	1,468	0.01
	winter	2,288	0.02
all species	**breeding**	**61,354**	
	winter	8,639	
	summer	**68,496**	

8.4 Near-qualifying areas based on top 1% of Getis-Ord Gi*

Table 59. Characteristics of near-qualifying area 1, northern fulmar during breeding, based on 1% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Northern fulmar, breeding
Size: 504km^2

near-qualifying area 1 (north-west of Shetland Islands)

Overlap with other protected sites:-

species present	season	number of individuals	% of population
northern fulmar	**breeding**	**40,755**	**0.40**
	winter	621	<0.01
sooty shearwater	summer	4	<0.01
European storm-petrel	breeding	243	0.32
northern gannet	breeding	616	0.05
	winter	208	0.02
Arctic skua	breeding	10	0.01
great skua	breeding	188	0.46
	winter	2	0.01
black-legged kittiwake	breeding	453	0.01
	winter	267	<0.01
great black-backed gull	breeding	5	<0.01
	winter	10	<0.01
herring gull	winter	58	<0.01
glaucous gull	winter	3	<0.01
Arctic tern	breeding	6	<0.01
common guillemot	breeding	53	<0.01
	winter	106	<0.01
	additional season	58	<0.01
razorbill	winter	4	<0.01
little auk	winter	1	<0.01
Atlantic puffin	breeding	113	<0.01
	winter	122	<0.01
all species	**breeding**	**42,446**	
	winter	9,431	
	summer	**22,388**	

Table 60. Characteristics of near-qualifying area 2, Manx shearwater during breeding, based on 1% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

Manx shearwater, breeding — **near-qualifying area 2 (Irish Sea Front)**

Size: 180km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	34	<0.01
	winter	418	<0.01
Manx shearwater	**breeding**	**12,039**	**1.07**
European storm-petrel	breeding	12	0.02
northern gannet	breeding	159	0.01
	winter	81	0.01
Arctic skua	breeding	32	0.04
	additional season	6	s0.01
great skua	breeding	3	0.01
	winter	3	0.01
black-legged kittiwake	breeding	408	<0.01
	winter	99	<0.01
great black-backed gull	breeding	27	0.01
	winter	8	<0.01
lesser black-backed gull	breeding	22	<0.01
	winter	21	<0.01
herring gull	breeding	10	<0.01
	winter	161	0.01
Arctic tern	breeding	40	0.03
common guillemot	breeding	190	<0.01
	winter	27	<0.01
	additional season	4,084	0.05
razorbill	breeding	34	<0.01
	winter	61	<0.01
	additional season	997	0.05
Atlantic puffin	breeding	3	<0.01
	winter	139	<0.01
all species	breeding	13,013	
	winter	942	
	summer	18,130	

Table 61. Characteristics of near-qualifying area 3, all species during breeding, based on 1% Getis-Ord Gi*. Species present in qualifying numbers are in bold.

All species, breeding — **near-qualifying area 3 (Wee Bankie)**

Size: 180km^2

Overlap with other protected sites: -

species present	season	number of individuals	% of population
northern fulmar	breeding	35	<0.01
	winter	57	<0.01
Manx shearwater	breeding	48	<0.01
Leach's storm-petrel	breeding	0	<0.01
northern gannet	breeding	1,366	0.12
	winter	50	<0.01
pomarine skua	additional season 1	3	0.01
	additional season 2	4	0.01
Arctic skua	breeding	12	0.02
	winter	2	<0.01
black-legged kittiwake	breeding	3,962	0.05
	winter	1,250	0.01
little gull	additional season	3	
great black-backed gull	winter	11	<0.01
common gull	breeding	4	<0.01
	winter	2	<0.01
lesser black-backed gull	breeding	77	0.01
	winter	3	<0.01
herring gull	breeding	196	0.01
	winter	38	<0.01
common guillemot	breeding	5,143	0.06
	winter	787	0.01
	additional season	2,513	0.03
razorbill	breeding	128	0.01
	winter	133	0.01
	additional season	129	0.01
little auk	winter	15	0.04
Atlantic puffin	breeding	11,162	0.08
	winter	40	<0.01
all species	**breeding**	**22,131**	
	winter	2,386	
	summer	13,958	