2015

Brims Tidal Array

Seabirds Technical Report

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NATURAL RESEARCH PROJECTS LIMITED

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SUMMARY

- This Technical Report is concerned with the environmental studies undertaken to inform the EIA and HRA of seabirds for the proposed Brims Tidal Array, a tidal energy development being progressed by OpenHydro and SSE Renewables. The report presents baseline results collected during the two-year boat-based European Seabirds at Sea (ESAS) survey programme together with relevant context information on regularly occurring species.

- The Survey Area covers 112.9 km^2 and comprises the Agreement for Lease (AfL) area buffered to 4 km. This area is covered by 11 parallel transects spaced 1.4 km apart and with a total length of 79.5 km. Surveys of all 11 transects took a single day to complete, meaning that on each survey day, where weather permitted, the whole Survey Area was covered.

- The surveys were conducted following the ESAS method. This involves a team of two accredited surveyors on board a survey vessel collecting data on all birds and marine mammals seen in a 300 m wide survey corridor in a format that is suitable for distance sampling analysis. The study design was agreed on with Marine Scotland / SNH (letter, 16 April 2013).

- One day of survey effort (i.e. surveying each transect once) was scheduled at monthly intervals from March 2012 to March 2014. A total of 18 surveys were undertaken over the two years, 12 of which covered the Survey Area fully.

- Persistent unfavourable sea conditions prevented some scheduled surveys visits in the autumn and winter months. No surveys were possible in September-December 2012, January 2013, August 2013, or between November 2013 and January 2014. Difficult sea conditions were encountered during several other surveys, leading to incomplete survey coverage. When conditions allowed (one day in March 2013 and another in June 2013) additional surveys were undertaken to compensate for missed surveys in the previous month.

- The resulting data gap in autumn/winter was assessed for each species through comparison with alternative data sources. It is concluded that the current dataset is entirely fit for purpose and will form the basis of a robust impact assessment.

- A total of 17 seabird species were regularly recorded and the results for each of these are considered in detail. Nine other seabird species and several migrant non-seabird bird species were on occasion recorded in very small numbers.

- Survey results are presented as ‘raw’ numbers of seabird and marine mammal species recorded. For those seabird species with sufficient records, Distance Sampling statistical analysis has been undertaken to provide abundance estimates with confidence limits for the Survey Area (the AfL buffered to 4 km) and the AfL buffered to 1, 2 and 3 kilometres.

- Seasonal abundance estimates are put into context by comparison with regional population sizes. Additional context information covering likely origins, population trends, conservation status, behaviour, and vulnerability to impacts from tidal energy developments is also presented for key species. Information gaps relevant to the EIA of the Project are also identified.

- Site importance is expressed in four categories in relation to the regional population, ranging from negligible (<0.1%), low (0.1-<1%), medium (1-<5%) to high (>5%).

- Shag is the only species for which the Survey Area is considered to have high importance during the breeding season.

- The area supports numbers of medium importance for kittiwake (breeding), razorbill (breeding and chicks-on-sea period) and black guillemot (breeding, non-breeding).

- Estimates for all other species reached low or negligible importance for all seasons.

Abbreviations

The following abbreviations are used in this report:

- AIF - Anticipated Impact Footprint
- AfL - Agreement for Lease area
- AOB - Apparently occupied burrow
- AON – Apparently occupied nest
- AOS – Apparently occupied site
- AOT – Apparently occupied territory
- BDMPS - Biologically defined minimum population size
- BTA – Brims Tidal Array
- ESAS – European Seabirds at Sea
- HRA – Habitats Regulations Assessment
- JNCC - Joint Nature Conservation Committee
- LCL – Lower confidence limit
- MMFR - Mean maximum foraging range
- MPA – Marine Protected Area
- MS - Marine Scotland
- NRP – Natural Research (Projects) Ltd
- RP – Regional population
- SPA - Special Protection Area
- SNH - Scottish Natural Heritage
- SMP – Seabird Monitoring Programme
- UCL - Upper confidence limit
- AfL+'n'km –The Agreement for Lease area buffered to 'n' number of kilometres

INTRODUCTION

1. This Technical Report presents the results of visual boat-based European Seabird at Sea (ESAS) surveys in the Pentland Firth, off the southern coastline of the island of Hoy in Orkney over a two year period from March 2012 to March 2014. The surveys are part of the environmental studies to inform the EIA of seabirds and marine mammals for the proposed Brims Tidal Array, a tidal energy development being progressed by OpenHydro and SSE Renewables. The results of the survey programme and supporting contextual information together form the baseline characterisation of the ornithological interest to support the Marine Licence application for the Project.

2. The proposed Project is described in detail in the Environmental Statement (Chapter 4 Project Description). The ESAS survey design and methods are fully described in a method statement previously provided to stakeholders (NRP 2013).

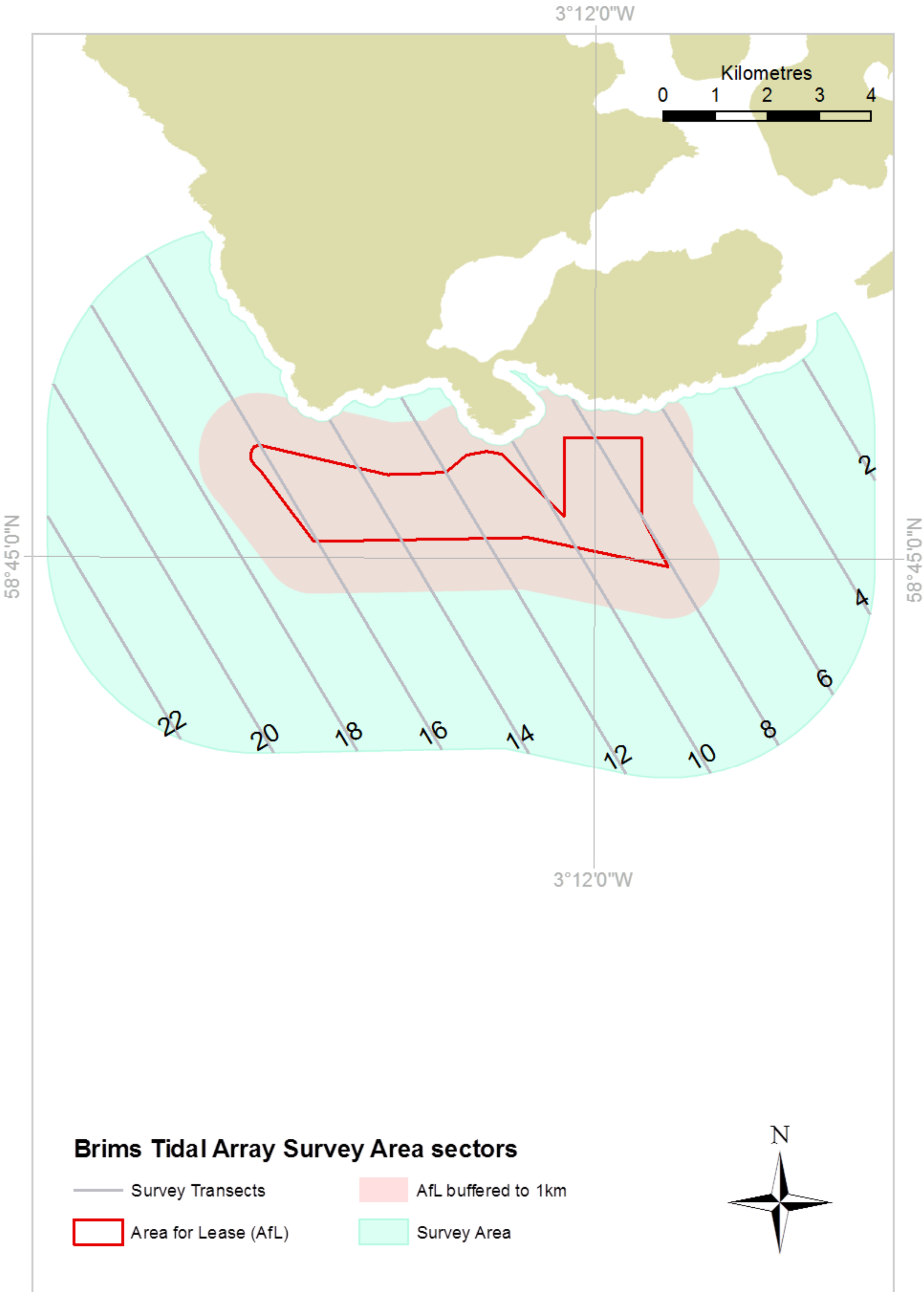
3. The ESAS survey programme was undertaken by Natural Research (Projects) Ltd (NRP) and is designed to provide baseline data on seabirds (and marine mammals) occurring in the Brims Tidal Array Area of Lease (AfL) and a surrounding 4km buffer, a total area of 112.9 km^2; this area is known as the Survey Area (). This information will help inform the assessment of potential impacts of the Project on seabirds and marine mammals that will be presented in the Environmental Statement (ES) and Habitats Regulation Appraisal (HRA) Report for the Project. The same survey data will provide pre-installation monitoring information to compare with later operational monitoring data. Survey work consists of visual boat-based seabird surveys undertaken at approximately monthly intervals. Agreement on methodology was reached with Marine Scotland (letter, 16 April 2014).

4. The aims of the report are as follows:

   - To provide an overview of the survey programme and its context;
   - To summarise the survey design and methods;
   - To summarise the survey effort each month;
   - To summarise the sea conditions at the time of surveys;
   - To present the survey results for each species in terms of density, abundance, distribution and behaviour (where data allow);
   - To summarise for regularly occurring species context information relevant to the assessment of impacts such as population size, conservation status, flight behaviour and geographical movements and vulnerability to tidal array impacts;
   - To evaluate the importance of the Survey Area and AfL+1km for each regularly occurring species and indicate the relevance to the Project;
   - To describe any problems encountered;
   - Identify any important information gaps; and
   - To draw comparisons with results from ESAS surveys undertaken in 2009-2011 in the Pentland Firth to address the possible autumn/winter data gap which arose due to unsuitable weather conditions during this time of year.

5. The ESAS method includes the collection of data on any marine mammal species seen during the surveys. In addition to ESAS surveys, dedicated marine mammals visual surveys, and on most survey trips passive acoustic monitoring surveys, were also conducted at the same time. The marine mammal survey programme and results (including data from the ESAS surveys) are reported in Chapter 15 Marine mammals.

Figure 1. The location of the ESAS Survey Area, survey transects, the Brims Tidal Array (AfL area) and its associated buffers.



METHODS

Survey Design and Methods

Aim of the Survey

6. The primary aim of the ESAS survey is to provide data that establish the distribution, abundance and behaviour of birds, within the defined Survey Area and how these change seasonally. The survey was designed so that the bird data would be suitable for Distance Sampling statistical analysis (Thomas *et al., 2*010), and thereby allow absolute measures of abundance with confidence limits to be estimated for all common seabird species present.

7. The survey design and survey method is described in detail in the *Cantick Head Tidal Array Project Surveys Methods for Birds, Marine Mammals & Basking Shark* (NRP 2013). This document, which was approved by MS (letter, 16 April 2013), describes in detail the layout of the survey design and the reasoning behind it. It also briefly describes the survey methods. The design has been driven by the theoretical requirements of Distance Sampling (Thomas *et al.,* 2010) and mediated by practical consideration of safe operation of the survey vessel and the desire to reduce potential disturbance of birds and marine mammals. The survey design and method are also informed by the COWRIE guidance for offshore windfarms (Camphuysen, 2004) and the draft SNH survey guidance for 'wet renewables' (Jackson and Whitfield, 2011). The guidance recommends the European Seabirds At Sea (ESAS) survey method (Camphuysen *et al*., 2004) to inform for offshore windfarm projects and thus this was the survey method chosen.

8. The Survey Area was defined as the Agreement for Lease area (AfL) buffered to 4 km.

9. The Survey Area has high exposure to wind and swell and these present a significant constraint to safely undertaking boat-based surveys, particularly during the winter months. ESAS surveys must be undertaken in conditions of Sea State 4 or below, and marine mammal surveys ideally require conditions to be below Sea State 3.

ESAS method

10. The salient points of the survey design and method are:

- A single Survey Area (the Survey Area) of 112.9 km^2 comprising the original Agreement for Lease area of 11.1 km^2 and a surrounding 4 km buffer (Figure 1) was surveyed..
- The Survey Area was covered by 11 parallel transect lines spaced 1.4 km apart, giving even coverage across the Survey Area (Figure 2). The total transect length was 79.5 km. Transects were numbered 2 to 22 (even numbers only) sequentially from east to west and were orientated northwest to southeast.
- At the target boat speed of 10 knots it took 6 to 8 hours to survey all 11 transects. Complete coverage of all transects was generally achieved within a single day.
- One survey visit (1 day) was scheduled to occur at approximately monthly intervals through the year however some flexibility in the timing of visits was required to allow surveys to be undertaken in sea conditions suitable for undertaking ESAS surveys.
- Surveying was undertaken by a team of two accredited and highly experienced ESAS surveyors. To prevent surveyor fatigue affecting data quality, surveyors had a rest break of 5 - 10 minutes between the end of surveying of one transect line and commencing surveying of the next transect line. These rest breaks amounted to approximately 15% of the surveyors' time during a survey.
- Recording was undertaken from one side of the vessel only, whichever side presented the best conditions for detecting birds at the time.
- Surveyors had a ranging stick to facilitate accurate determination of distance bands, and an angle board to determine bearings (only required for marine mammal records).

- All birds, marine mammals and basking shark seen were recorded. The species, number, plumage, activity, flight direction and distance from the boat were recorded, together with information on environmental conditions at the time of each sighting in terms of sea state, swell, wind force and direction and sun glare. Distance of birds sitting on the sea was recorded as one of five distance bands: 0-50m, 50-100m, 100-200m, 200-300m, and >300m. See Camphuysen (2004) for full details. Due to the potential for red-throated diver presence, surveyors kept a vigilant watch ahead of the vessel (beyond 300m) when feasible.
- In cases where an animal could not be identified to species level it was assigned to a higher taxonomic level appropriate to the level of certainty for example this might be a species pair where two similar species could not be distinguished (e.g. guillemot/razorbill) or a taxonomic family if there are several potential candidate species (e.g. 'auk species' and 'dolphin species').
- All but one survey was conducted from the MV Karin, with a single survey undertaken with the MV Scotia. Both vessels comply with ESAS recommendations regarding vessel type, size (both 24m long) and height of survey platforms (5m and 5.1m above sea level respectively).

Photo of MV Karin

Photo of MV Scotia

Vantage point surveys

11. A pilot study on the behaviour of diving seabirds was undertaken from the south coast of Hoy in 2012 and 2013 as part of the ornithological studies being undertaken for the environmental studies of the Brims Tidal Array.

12. The study was initiated after it became apparent (through the boat-based surveys) that moderate densities of common guillemot, razorbill and puffins were using the Survey Area to forage and aimed to increase understanding of the potential for collision risk. In that context it is important to know the relative importance of diving and loafing behaviour of birds that are using areas where tidal devices are proposed as only actively diving birds would be at potential risk of collision.

13. Results were considered useful for context as part of the collision risk modelling (Supporting Document: Collision risk to diving seabirds) and are not reported here. A report detailing the survey design and results was provided to SNH in November 2013.

Analyses - Seabirds

14. Statistical analyses of the seabird data were undertaken by Caloo Ecological Services, the results of which are provided as an Annex to this Technical Report (Caloo, 2015). Substantial detail on data analysis and results is provided in the Annex, the salient points of which presented throughout this Technical Report.

Distance sampling

15. Caloo (2015) presents distance sampling analyses of the seabird data collected during ESAS surveys on 18 survey dates between March 2012 and March 2014. Results are presented for the Area for Lease (AfL) buffered to a range of distances – with density and abundance estimates for the AfL buffered to 1 km, 2 km, 3km and 4km as well as for the whole Survey Area. Table 1 provides an overview of the different components of the Survey Area.

Table 1 The extent of the Survey Area and sub-areas used to report the results.

Description	Label (used in text)	Area (km^2)
Agreement for Lease area	AfL	11.02
1km wide buffer surrounding AfL	AfL 1 km buffer	21.03
3km wide buffer surrounding AfL	AfL 3 km buffer	80.85
AfL buffered to 4km	Survey Area	112.90

16. Density estimates are provided for both individual surveys and for seasons specific to each species. For a particular species, density estimates varied greatly between survey dates within a month. Therefore monthly estimates of abundance based upon one or two surveys would poorly reflect the true average abundance of birds present during that month, and thus provide an unreliable basis for impact assessment. Therefore, the approach adopted was to base characterisation of the survey area and sub-areas on seasonal rather than monthly abundance estimates. This avoids having to assume that surveys on different dates within a month are sampling the same statistical population. Also, as seasons usually encompass several months, seasonal estimates are usually based upon more surveys than are the corresponding monthly estimates. This means that the resulting estimates should be more reliable, and less prone to sampling error.

17. For birds on the water, the probability of detection was estimated using detection function modelling (Buckland *et al.* 2001, 2004), using all observations of in-transect birds on the water across all surveys from March 2012 to March 2014 inclusive. To estimate the probability of detection for the more commonly recorded species (those with 30 or more sightings) a single detection function was fitted across all species and surveys. Variation in the probability of detection between species is captured by including species as a covariate in the model, with sightings for all species with less than 30 observations combined into a single ‘other species’ category. The shape of the detection function is modelled as a half normal key function with no adjustment terms (Buckland *et al.* 2001). Cluster size, survey, sea state, wind force, swell height and observer were then considered as additional covariates and the best fitting model was used to estimate the probability of detection.

18. For species with less than 30 sightings, the standard approach (Maclean *et al*. 2009) to estimate the probability of detection is to use JNCC correction factors such as those provided in Stone *et al*. (1995). However an alternative approach was used that aims to provide more accurate estimates. As the starting point a detection function model with the same covariates as the model used to estimate the probability of detection for common species was used, and also the same underlying dataset of all sightings of birds on the water across all species and surveys. However to capture the variation between species in detectability the species covariate was replaced with a quantitative covariate, body length and a two-level factorial covariate describing behaviour (‘surface/aerial feeder’ or ‘surface diver’). The underlying assumption of this approach is that a rare species will have similar probabilities of detection to a common species with similar traits, thus allowing the probability of detection for rare as well as common species to be estimated. For the more commonly recorded species with 30 or more sightings the rare species model provides very similar estimates of the probability of detection as the common species model, increasing confidence in its predictions for rarer species. For these rarer species, the probability of detection based upon the rare species detection function model, which is site-specific and takes into account the effect of other covariates is likely to provide a more accurate estimate of the actual probability of detection than using generic JNCC correction factors.

19. For birds in flight, density estimates are based on snapshot counts, for which no distance data is recorded, and so it was assumed all flying birds within the snapshot box were detected.

20. For all abundance and density estimates, 95% one sided (90% double sided) confidence limits are provided. For birds on the water, these confidence limits take into account uncertainty in both the estimated probability of detection and in the encounter rate. For birds in flight, where it is assumed that all birds are detected, the confidence limits only take into account uncertainty in the encounter rate. Caloo (2015) also

describes the methods used to take into account observations not positively identified to species, in particular a minority of observations of auk species.

The size of Anticipated Impact Footprint (AIF)

21. Impact footprint is a term used to define the area over which a species may experience an impact arising from a project. An Anticipated Impact Footprint (AIF) is the predicted area, based on the best information available and where necessary expert judgement, within which a species is considered likely experience an impact from a project, and is a concept used in assessing ecological effects of a proposed project. The way impacts act on species vary and the distance from a project at which individuals of a species may experience an impact can also vary depending on its vulnerability. Thus the geographical extent of the AIF will vary between impacts and between species.

22. JNCC and SNH jointly advised (letter 9 July 2015)) that a 0.5km-1km buffer around the proposed tidal array is appropriate for informing the assessment of displacement and disturbance impacts for the range of seabird species that occur in the Survey Area (with the exception of divers and seaduck – 2km buffer). This is referred to as the AfL +1 km area and is used as the focal point to determine ornithological site importance.

Tables of seabird abundance

23. The ‘raw’ numbers of birds and marine mammals seen from transects on survey day are presented in Appendix 1, (Table A35 to Table A53).

24. Tables showing the estimated density and abundance of each regularly occurring seabird species for each survey month is summarised for each commonly occurring species for the whole Survey Area and for the AfL+1km, AfL+2km and AfL+3km in the individual species accounts.

25. ‘Off-effort’ records are presented in Appendix 1 (Table A35 to Table A53). These refer to any records that were not recorded from a transect line or were on the opposite side of the boat to that being recorded; they do not contribute to the estimated abundance. They mostly comprise records made incidentally by surveyors whist the boat was sailing the ‘tails’ between transects. During these periods surveyors took a short break but may have remained on deck or been looking out from a window and if they happened to see what they considered to be a ’notable’ species or aggregation this was noted as an off-effort record. These records represent incidental data as there is no measure of the effort associated with them and although they may add to the understanding of the wildlife importance of the Survey Area they cannot be used for statistical estimates of population abundance.

Species distribution maps

26. The results maps show the locations of species recorded ‘in transect’, either on water or flying, as dots. The dots are scaled in size according to the number of birds recorded. Birds that were sitting on the water (orange dots) are distinguished from birds that were in flight (blue dots). The transect lines indicated on the maps are the designed survey layout. The AfL+1km area is also shown on the maps to give an indication of the areas that might be affected by the Project.

27. The purpose of the maps is to illustrate the distribution pattern of a species across the Survey Area in each season. The amount of survey effort (i.e. number of survey visits) varies between the defined seasons for a species. For this reason between-season differences in the number of dots shown on the maps for a species should not be interpreted as a reliable indication of abundance differences between seasons.

28. The position of records for plotting on maps was calculated from the GPS position of the vessel at the time of the record and the distance and direction of the animal from the vessel. The accuracy of determining an animal’s position is approximately plus or minus 100m based on the size of recording bands, vessel speed and GPS accuracy.

Seabird seasons

29. To facilitate the reporting of results and the evaluation of the importance of the development site for each species the year is divided into periods based on the timing of a species' phenology of annual activity (Table 2). Such divisions inevitably end up being an approximation as the timing of activities such as breeding and migration can vary between individuals within a colony and years by up to several weeks. It is not unusual for a species' phenology to vary geographically within the UK by up to several weeks. Typically such geographical variation is broadly along a north-south gradient reflecting for example the timing of spring, but it e can also be along other gradients, for example it is reported that the timing of breeding of puffin differs by approximately three weeks between the east and west coast of Scotland. It is reasonable therefore that the definition of seasons should be site-specific.

30. The choice of months for each species' periods used in this report was informed by information on the timing of breeding and migration (Cramp and Simmons, 1977; Cramp and Simmons, 1982; Cramp, 1985; Forrester *et al*., 2007; Furness, 2014; Wernham *et al.*, 2002).

31. For all species that breed in the region a colony attendance period is defined that corresponds to the breeding season and when breeding adults are geographically constrained by the need to stay within foraging of their colony. In the case of common guillemot and razorbill a 'chicks-on-sea period' is also defined. This is the part of their breeding season that occurs after the colony-attendance period when male adults may have dependent young with them on the sea. In this period these species are no longer geographically constrained by having to be within foraging range of their colony. The term 'summering' is used for species that occur in the Survey Area during the breeding season but do not breed in the region. A passage period or winter period is used to cover the remaining parts of the year when a species is present and in many cases includes the autumn as well as the winter months.

32. Key terminology is summarised below.

    Breeding (colony attendance):

    - Establishment (territory establishment/nest building)
    - Egg laying and incubation
    - Chick rearing at colony

    Post-breeding/chicks-on-sea (guillemot and razorbill):

    - Left colony
    - Breeding birds and their offspring present in region but may have dispersed from vicinity of colony.

Table 2 Seasonal divisions of the year used to summarise survey results of regularly occurring seabird species in the Brims Tidal Array Survey Area.

Species	Season	Proposed definition	Comment
Red-throated diver	Breeding (attending breeding lochs)	April to September	Present in very low numbers, recorded on eight occasions. Three observations of single birds in breeding season (May, June, September) and five in non-breeding season.
	Non-breeding (passage and overwintering)	October to March	
Fulmar	Breeding (attending colony)	May to September	Large numbers present year-round, with very large numbers occurring prior to and early in the breeding season. Given inshore nature of development site and close proximity to colonies, likely that at all times the majority of birds present are from local colonies. Some birds are present at colonies year-round.
	Non-breeding	October to April	
Manx shearwater	Summering and passage	May to October	Recorded in small to moderate numbers between March-April and June-August. The former period overlaps with the species' spring passage to its colonies in Britain, Ireland, and northern Europe, whereas birds recorded during the latter possibly involve wandering non-breeding birds as well as birds on autumn migration.
Storm petrel	Breeding (attending colony and autumn passage)	May to October	Recorded in small numbers between June and October, in line with the species' breeding season.
Gannet	Breeding (attending colony)	Late March to September	Late March surveys show that numbers at this time are similar to average for April-May and it is therefore considered that these surveys are better categorised as part of the breeding season. Scottish gannets mainly return to colonies in March (Forrester and Andrews 2007).
	Non-breeding (passage and overwintering)	October to mid-March	
Shag	Breeding (attending colony)	March to August	Present in low to moderate numbers year-round with. Early breeding species (first eggs can be in March) but with protracted season (Forrester and Andrews 2007). Birds present in winter are likely to be predominantly from Orkney breeding colonies.
	Non-breeding (overwintering)	September to February	
Arctic skua	Breeding (present on breeding grounds)	April to August	Only recorded April to August, matching the timing of Orkney breeding season.
Great skua	Breeding (present on breeding grounds)	April to August	Commonly recorded April to August, matching the timing of Orkney breeding season. Outside this period only a single bird recorded in spring (March), likely involving an early arrival or a

Species	Season	Proposed definition	Comment
			migrant passing through. In September a total of 22 birds were recorded in the Study Area, which were likely to be late departing birds of the local breeding population.
Common gull	Breeding (attending colony)	April to July	Scarce during the breeding season, predominantly an inshore species.
	Non-breeding (passage and overwintering)	August to March	Scarce during the non-breeding season, predominantly an inshore species.
Herring gull	Breeding (attending colony)	April to August	Absent from the Survey Area during the breeding season, small numbers present mid-winter.
	Non-breeding (passage and overwintering)	September to March	
Great black-backed gull	Breeding, attending colony	April to August	Present in small numbers year-round. Likely that at all times the majority of birds present are from local colonies.
	Non-breeding (overwintering)	September to March	
Kittiwake	Breeding (attending colony)	Late-March to mid-August	Kittiwakes were typically present in moderate numbers during the colony-attendance period and in low to very low numbers at other times. Surveys conducted in late March show that numbers at this time were similar (with the exception of odd peaks) to April to July surveys and thus late March is better categorised as part of the breeding season.
	Non-breeding (passage and overwintering)	Mid-August to late-March	
Arctic tern	Breeding (attending colony)	May to mid-August	Only recorded May to July when present in small numbers. Orkney birds depart colonies in July and early August. The single August survey (22/08/2012, 0 birds) fell in the second half of the month by when Arctic terns will have departed their colonies, therefore this survey is not representative of the breeding period.
Common guillemot	Breeding (attending colony)	March to July	Common guillemots were typically present in moderate to large numbers from late March to July and in small to moderate numbers at other times. Surveys conducted in late March show that numbers at this time were similar to April to July surveys, and by mid- March the majority of breeding birds are likely to be back at breeding colonies (Forrester and Andrews 2007). Thus March is best categorised as part of the breeding season. The July surveys were all

Species	Season	Proposed definition	Comment
	Breeding (chicks-on-sea, and moulting)	August	undertaken mid-month (between 10th and 20th of July), although by this time it is likely that a large proportion of breeding individuals and chicks will have already departed colonies, as suggested by the drop in numbers in this month, others will still be attending colonies in mid-July. Therefore it is considered that the July surveys are best categorised as representing the colony-attendance part of the breeding season. By August all birds will have departed colonies but during this month chicks remain dependent on their father for food (thus it is still part of the breeding season). It is also the time when adults undergo wing moult and become temporarily flightless (which increases their vulnerability to disturbance). For these reasons August merits categorisation as a season in its own right. The single August survey (20/08/2012) undertaken found very low numbers of birds present in the Survey Area (and no dependent chicks), suggesting that at least in 2012 guillemots with chicks had abandoned the area by the third week of August.
	Non-breeding (passage and overwintering)	September to February	
Razorbill	Breeding (attending colony)	April to July	Razorbills were typically present in moderate to large numbers from April to July and were either present in small numbers at other times. Surveys conducted in late March show that numbers at this time were low and much lower than between April and July, reflecting the relatively late (e.g. *cf* common guillemot) return to colonies. Thus it is considered that March surveys are best categorised as representing the non-breeding season. July surveys are all mid-month (between 10th and 20th of July), although by this time it is likely that a large proportion of breeding individuals and chicks will have already departed colonies while others will still be attending colonies in mid-July. Therefore it is considered that July surveys are best categorised as representing the colony-attendance part of the breeding season. By August all birds will have departed colonies but during this month chicks remain dependent on their father for food (thus it is still part of the breeding season). It is also the time when adults undergo wing moult and become temporarily flightless (which increases their vulnerability to disturbance). For these reasons August merits categorisation as a season in its own right.
	Chicks-on-sea/moulting	August	
	Non-breeding (passage and overwintering)	September to March	
Black guillemot	Breeding (attending colony)	April to August	Present in small numbers year-round, birds return to colonies in mainly April (Forrester and Andrews 2007). Non-migratory, at all times of year the birds present are likely to be from local Orkney breeding colonies.
	Winter	September to March	

Species	Season	Proposed definition	Comment
Puffin	Breeding (attending colony)	April to mid-August	Surveys show that puffins were present in moderate from April to July (the breeding season) and absent or very scarce at other times. The single August survey (20/08/2012) fell in the second half of the month by when puffins have departed colonies (Furness, 2014), and thus the survey is best categorised as representing the non-breeding period; the numbers present in August were small. Between mid-August and February puffins were absent or very scarce. The results of the two late March surveys are contradictory, with moderate numbers (*ca* 566) present on 27/3/2012 but low numbers present on 27/3/2013 (*ca* 48). It is considered that these surveys are best treated as representing the non-breeding period as this will lead to precautionary interpretation of the site's value for this species as categorising March in this way leads to an increase in the mean seasonal density for both the breeding and non-breeding period. There is no value for this project in defining an August/September post-breeding period for puffins (e.g. August and September is so defined for some other Scottish development projects) as puffins were very scarce at this time of year (a single bird seen during August).
	Non-breeding (passage and overwintering)	Mid-August to March	

Literature Review - Seabirds

Regional population geographical limits

33. EIA requires that assessment is based on considering potential effects at appropriate spatial scales. For seabirds this is usually interpreted as a scale ranging from international, national, regional and district level (IEEM, 2010). Of these, it is likely that the regional level has most relevance to the Brims Tidal Array EIA. With the exception of district level, information on site importance in relation to above thresholds is presented in the individual species accounts.

34. There is no agreed or officially endorsed definition of regional populations for seabirds around the UK. For most species there are no or few range discontinuities or major barriers that make for natural regional divisions. Furthermore, it is clear from tagging studies that individuals of most species range widely and intermix with individuals from other areas. Thus the notion of a regional population for most seabirds is to a large extent a construct for convenience and cannot fully represent the actual degree of spatial independence between areas. As a consequence of these factors, any division into regions will inevitably be arbitrary to some extent and the defined populations are unlikely to be self-contained, rather there will inevitably be significant mixing of individuals between adjacent regions. This does not mean that that the concept of a regional population is not useful for EIA, but it is important to recognise the limitations of what is meant by such a regional population and its largely artificial basis.

35. It is also important to bear in mind that the conclusions drawn from EIA are potentially sensitive to how a regional receptor population is defined. For example, other things being equal, the larger a region's geographic extent the more individuals of a species the defined population is likely to contain. This may have the effect of diluting the assessed magnitude of an impact from a project on the population being considered. Sensitivity to what may effectively be a semi-arbitrary decision (the boundary chosen) is clearly unsatisfactory and could lead to poor decision making.

36. The matter of where boundaries might be drawn for marine policy in general including nature conservation was the subject of a Marine Scotland consultation report (Marine Scotland, 2010). This presents a number of alternative regional divisions that have been and are being used for various aspects of marine policy. Information on seabird breeding season foraging ranges (Thaxter *et al.*, 2012) also provides useful information on the minimum geographic scale appropriate for defining breeding regions for a species.

37. Following advice from SNH/MS (letter, 2 November 2012) the agreed approach to defining regional breeding populations was through the use of a foraging range-driven definition. In line with recommendations regional breeding populations were thus defined according to the likely connectivity with the Survey Area, in turn based on species-specific foraging ranges. Although it is accepted that such regions do not necessarily represent closed ecological systems, and therefore potential development impacts could exceed beyond them, it is considered that the approach taken here is sufficiently focussed to both determine regional importance levels as well potential development impacts on a scale ecologically relevant to each receptor species.

38. Seabird foraging ranges are strongly linked to food resource availability. In the marine environment such resources tend to be patchily distributed, with often marked inter-annual variation in distribution. Thus, for the purpose of this assessment using mean or maximum ranges would likely substantially under- or overestimate average site-colony connectivity.

39. Instead spatial connectivity between the Survey Area and seabird colonies was calculated - for most seabird species - by using the mean maximum foraging range (Thaxter *et al.*, 2012). This is considered to be a reasonably robust indicator of connectivity for the key breeding seabird species involved.

40. Colonies within each species-specific foraging range from the Brims Survey Area (edge to edge) were selected for inclusion. For skuas, gulls (excluding kittiwake) and terns direct (over land) distances were used,

with by-sea distances used for all other species (adjusting for non-direct flight lines to reflect the presence of mainland features as these species do not cross land). Colonies which fell just outside a foraging range were considered for inclusion on a case by case basis. For example, for puffin a MMF range of 105km would just exclude the large colony at Fair Isle (40,000 AOB, SMP database) by about 20 km. However, given its location relative to the Survey Area, with no potential for a direct line of flight, the ample foraging habitat available around Fair Isle and north of Orkney and the effect inclusion would have on the regional population size (increasing the population by nearly 40%) connectivity was not considered reasonable.

41. Conversely, the large kittiwake colony at West Westray was included even though it lies about 15km beyond the MMFR of 61km, a distance short-fall which falls well within the standard deviation of 23km around the MMFR, values based on high quality empirical data (Thaxter *et al.*, 2012).

42. Due to a lack of available foraging range information for great black-backed gull (not included in Thaxter *et al.* 2012) a maximum range of 40 km was assumed based on estimates in Ratcliffe *et al.* (2000). For storm petrel an alternative range was used based on Leach's storm petrel, a closely related species.

43. A particularly difficult issue concerns the foraging range of black guillemot, with a wide range of estimates in the literature. It is largely considered a short range species, yet foraging distances range from: less than 5 km from the coast of Caithness during the breeding season, 2.4-3.9 km from colonies on Papa Westray, 1-7 km (Ireland), 13-15 km, most frequently to 5 km (eastern Canada), 0.5-4 km and up to 7 km (Canada, northern Europe) and even up to 55 km in NW Canada (BirdLife International 2000). There is no evidence that the species travels such long distances in the UK. However, setting the bar too low would result in a regional population of a handful of pairs, likely substantially affecting predicted impact magnitude in the EIA in an artificial manner. Similarly, using too large a distance would dilute potential impacts and lead to underestimating effects on the population.

44. Clearly, small regional populations of several tens of birds do not exist in isolation but are part of a much larger patchwork of spatially distinct sub-populations – a meta-population. It is known that black guillemot is strongly sedentary, moving very little from its natal area through its life span. Furness (2014) indicates that for the non-breeding season an impact zone of 20 km around a given development would probably capture most of the resident population during that time of year when birds are somewhat more mobile than during the breeding season.

45. A tentative foraging range of up to 15 km has been assumed to define the regional breeding population, a value balancing ranging capacity during the breeding season, yet falling short of dispersal movement capacity as prevalent during winter.

46. The above definition is inappropriate for the latter part of the breeding season of common guillemot and razorbill (chicks-on-sea). Although razorbill and guillemot typically vacate their breeding colonies in early to mid-July their breeding season continues for several more weeks, whilst dependent young are reared at sea. Thus the period between colony-departure to the end of August is part of these species' breeding season; it is also the period when adults undergo primary moult and are thus temporarily flightless. During the chicks-on-sea part of the breeding season, despite most individuals being flightless, birds may nevertheless travel relatively large distances (100s of km) by swimming (Wernham *et al.*, 2002), and by August the numbers off the east Scottish mainland south of the Moray Firth have increased markedly compared to numbers during the colony-attendance period (Skov *et al*., 1995). This increase coincides with a corresponding decrease in the numbers in the waters around Orkney and Shetland.

47. Because the post-colony departure dispersal is mainly by swimming, and thus relatively slow compared to flying, birds using the Project area in August are likely to mainly comprise birds from the relatively close colonies of the north coast mainland and Orkney birds, and that Shetland birds are likely to be relatively scarce. Thus balancing the desire for the regional context populations to be based on ecological reality yet factor in due caution to account for uncertainty it is considered that for EIA purposes the appropriate definition for regional populations of razorbill and guillemot in the chick-on-sea part of the breeding season (defined as August) is the same as the regional breeding population for the colony attendance period. This is likely to underestimate the population size, and therefore is a precautionary approach to assessment.

48. Biologically defined minimum population size (BDMPS) populations for the periods of the year when seabirds are not breeding have recently been defined through a process of extensive literature review by Furness (2014). This review concludes that relatively few 'regions' are appropriate for most species (typically two or three) and even then considerable movement between these regions is likely for some species. The definition of the 'regions' varies between species, the BDMPS non-breeding population for a species that includes the waters off northern Scotland is considered to be appropriate for definition of the non-breeding season regional population for EIA purposes.

49. An overview of the foraging ranges used for breeding seabird species and associated rationale is presented in Table 3.

Table 3 Species-specific foraging ranges derived from Thaxter *et al.* (2012) used to determine the extent of regional breeding populations

Species	Mean maximum foraging range	Maximum foraging range	Range threshold used	Rationale	Geographical extent
Red-throated diver	9	9	9	Best available information.	Regional population limited to Hoy due to short foraging range.
Fulmar	400 km	580km	400 km	Mean maximum range strikes reasonable balance between need for population definition (i.e. boundaries) and long-ranging capacity of species.	Regional population including Shetland, Orkney, Scottish east coast, northern England (Farne Isles), northern Scotland, Western isles, and Scottish west coast as far south as Colonsay (Argyll & Bute)
Manx shearwater	>330 km	>330 km	400 km	Threshold value used essentially arbitrary (although precautionary) in lieu of better available estimate.	Species does not breed in region in appreciable numbers. Very small colony (7 AON) present on Fetlar during SB2000 counts just within range used, though exceedingly unlikely that these birds would contribute to species' occurrence in the Brims Survey Area given the extent of foraging grounds around Shetland and the likely lack of density dependence in said colony.
Storm petrel	Not known	>65km	100 km	MMFR not known, and therefore value of 92km for Leach's storm petrel (a similar species) used as starting point (rounded up to 100km).	Regional population encompasses all of Orkney and NW Sutherland Coastal Islands.
Gannet	229.4 km	590	250 km	MMFR plus 10% strikes reasonable balance between need for population definition (i.e. boundaries) and long-ranging capacity of species without running risk of omitting important colonies	Using 250 km as a threshold, seven colonies make up the regional breeding population: Shetland - Fair Isle, Foula, Noss; Orkney – Sule Skerry and Sule Stack, West Westray; Western Isles – North Rona

Species	Mean maximum foraging range	Maximum foraging range	Range threshold used	Rationale	Geographical extent
				from regional population definition.	and Sula Sgeir; Banff & Buchan: Troup, Pennan and Lion's Head
Shag	14.5 km	17 km	20 km	MMFR +10% similar to maximum known range. Threshold value rounded up to 20km, though no colonies within that range beyond 16km.	Regional population includes Hoy, Switha, Flotta, South Ronaldsay and the Pentland Firth Islands in Orkney and (just) part of the North Caithness Cliffs.
Arctic skua	62.5 km	75 km	70 km	MMFR +10% to account for colonies on edge of range (rounded up to 70km).	Regional population encompassing Hoy, mainland Orkney, South Ronaldsay, Rousay, Stronsay and Shapinsay, north and east coast of Caithness (incl Stroma) and the NW coast of Sutherland
Great skua	86.4 km	219 km	100 km	MMFR +10% to account for colonies on edge of range (rounded up to 100km).	All of Orkney, except far northeast; north and east coasts of Caithness (incl. Stroma), NW coast of Sutherland
Common gull	50	50	50 km	Best available information, (Thaxter *et al.*, 2012)	Southern Orkney, Caithness coastline as well as inland colonies.
Herring gull	61.1 km	92 km	70 km	MMFR +10% to account for colonies on edge of range (rounded up to 70km).	On Orkney as far north as the south coast of Rousay and Stronsay; coastal Sutherland as far west as the Rabbit Islands; in Caithness as far south as the East Caithness Cliffs SPA
Great black-backed gull	Not known	40 km	40 km	Best available information (Ratcliffe *et al.*, 2000)	Regional population includes Orkney as far east as Copinsay, eastern Mainland and inland moors and all islands to the south. In Sutherland as far west as the North Caithness Cliffs SPA. In Caithness as far south as Freswick Bay
Kittiwake	60 km	120	75 km	MMFR +10% to account for colonies on edge of range, further increased to 75km as it is considered likely that relatively large colonies on Rousay and West Westray can reach the Survey Area.	Population extent includes mainland Orkney, Copinsay and all islands to the south. In Sutherland it extends as far west as the Sutherland Coastal Islands, and in Caithness as far south as the East Caithness Cliffs SPA.
Arctic tern	24.2 km	30 km	30 km	MMFR +10% approaches maximum range. Threshold value used 30km, though no	Using the species' maximum known foraging range the regional breeding population includes Hoy, Burray and South Ronaldsay on Orkney

Species	Mean maximum foraging range	Maximum foraging range	Range threshold used	Rationale	Geographical extent
				colonies within that range beyond 22km.	(and islands in Scapa Flow), Pentland Firth Islands and Stroma.
Guillemot	84.2 km	135 km	110 km	MMFR +10% adjusted to include large colonies along Sutherland coast which are expected to be able to reach the Survey Area.	Population extent includes most of Orkney, except far northeast, Sule Skerry and Sule Stack; on mainland Scotland as far west as Cape Wrath and as far south as the East Caithness Cliffs SPA
Razorbill	48.5 km	95 km	50 km	MMFR rounded up to 50km, reflecting relatively short range of this species.	Population extends from mainland Orkney and Copinsay to islands to the south, and from the North Caithness Cliffs SPA to Freswick Bay on the Scottish mainland.
Black guillemot	Not known	Not known	15 km	Threshold assumed on basis of a range of available estimates (see text above in section 'Regional population geographical limits'.	The species' short range leads to a small spatial population extent including Hoy, South Walls, South Ronaldsay, Pentland Firth Islands, Switha (Orkney), North Caithness Cliffs SPA, Stroma and Thurso Bay to Duncansby Head.
Puffin	105.4 km	200 km	115 km	MMFR +10%, rounded to 115km. Due to long range capacity it is considered there is some potential for birds from the very large colony on Fair Isle to reach the Survey Area (at 125 km just outside of threshold), though this colony was excluded to ensure regional definition remains suitably conservative.	Regional breeding population includes all of Orkney, and on mainland Scotland extends as far west as Droma and as far south as the East Caithness Cliffs SPA.

Regional population sizes

50. The number of adults breeding in the region is well quantified through the periodic national census of breeding colonies coordinated by JNCC, but only patchily by additional *ad hoc* counts undertaken at many colonies in the years in between (e.g. Mitchell *et al., 2*004; JNCC Seabird Monitoring Programme (SMP) database). The regional breeding population was determined by summing the number of adults breeding in the region based on the Seabird 2000 data. Where counts are expressed as pairs, apparently occupied nests etc. this was doubled to give the number of breeding adults. In the case of guillemot and razorbill JNCC colony counts are given as the number of birds present at the colony. This was converted to an estimated number of breeding adults using the x1.34 correction factor given by Mitchell *et al.* (2004).

51. A recent study into colony-attendance-rate correction factors for breeding common guillemot and razorbill indicated there is substantial variation in this factor between colonies depending on local conditions (Harris *et al.,* 2015, Harris *et al.,* in prep). Pending advice from JNCC/SNH on this matter the established correction factor has been used in this report.

52. Since the Seabird 2000 census, monitoring counts from a sample of breeding seabird colonies has shown there have been recent population changes. For most species the change in numbers since Seabird 2000 is either small or variable (SNH, 2012; reviewed in Furness, 2014) and thus the Seabird 2000 results provide a reasonable – or at least the most complete - estimate of the current breeding population size. However for kittiwake the recent monitoring shows that the number of breeding birds has undergone large and widespread decline since the Seabird 2000 census, so much so that the Seabird 2000 results no longer give a reasonable estimate of the population size. Therefore for this species the assumed breeding population size is estimated by multiplying the average decline observed at monitored colonies since the Seabird 2000 census by the Seabird 2000 estimate (SNH, 2012).

53. As a consequence of delayed maturity, most seabird species have substantial numbers of non-breeding immature birds in their population and these individuals may be intermixed with and in many cases indistinguishable from actively breeding adults in the breeding season. Therefore, the total numbers of a species present in the region during the breeding season may be substantially greater than the sum of breeding adult birds.

54. The size of regional non-breeding BDMPS estimated by Furness (2014) is used in the evaluation of importance of the evaluation of the Survey Area and AfL+1km area. In cases where Furness splits the non-breeding season into more than one period the smallest of the population sizes given is chosen as this provides the most cautious basis for evaluating importance.

55. An overview of the population estimates used for regional breeding and non-breeding seabird species is presented in Table 4.

Table 4 Species-specific regional breeding and non-breeding populations

Species	Season	Regional population		Source/comment
		Number	Units	
Red-throated diver	Colony attendance	111	Adults	Dillon *et al.* (2009): Hoy population
	Non-breeding	1,523	Birds	Furness (2014): NW North Sea
Fulmar	Colony attendance	965,822	Adults	AOS x 2; Seabird 2000
	Non-breeding	568,736	Birds	Furness (2014): UK North Sea
Manx shearwater	Summering	8,507	Birds	Furness (2014): UK North Sea
Storm petrel	Colony attendance	4,636	Adults	AOS x 2; Seabird 2000
Gannet	Colony attendance	75,870	Adults	AOS x 2; SMP (2015)
	Non-breeding	248,385	Birds	Furness (2014): UK North Sea & Channel
Shag	Colony attendance	754	Adults	AON x 2; Seabird 2000
	Non-breeding	41,503	Birds	Furness (2014): NW North Sea
Arctic skua	Colony attendance	930	Adults	AOT x 2; Seabird 2000
Great skua	Colony attendance	4,470	Adults	AOT x 2; Seabird 2000
Common gull	Colony attendance	5,930	Adults	AON x 2; Seabird 2000
	Non-breeding	6,000	Birds	Forrester *et al.* (2007): Orkney

Species	Season	Regional population		Source/comment
		Number	Units	
Herring gull	Colony attendance	5,294	Adults	AON x 2; Seabird 2000
	Non-breeding	466,511	Birds	Furness (2014): North Sea & Channel
Great black-backed gull	Colony attendance	5,156	Adults	AON x 2; Seabird 2000
	Non-breeding	91,399	Birds	Furness (2014): UK North Sea
Kittiwake	Colony attendance	62,792	Adults	AON x 2, adjusted for -45% decline since Seabird 2000; JNCC (2014)
	Non-breeding	627,816	Birds	Furness (2014): UK North Sea
Arctic tern	Colony attendance	1,724	Adults	AON x 2; Seabird 2000
Guillemot	Colony attendance	609,250	Adults	Individuals x 1.34; Seabird 2000
	Chicks on sea	609,250	Adults	Assumed same on basis of regional breeding population
	Non-breeding	1,617,306	Birds	Furness (2014): North Sea & Channel
Razorbill	Colony attendance	10,739	Adults	Individuals x 1.34; Seabird 2000
	Chicks on sea	10,739	Adults	Assumed on basis of breeding population
	Non-breeding	218,622	Birds	Furness (2014): North Sea & Channel
Black guillemot	Colony attendance	1,576	Adults	Individuals; Seabird 2000
	Non-breeding	3,656	Birds	Furness (2014): population within 20 km of a given site, using ratio of 1.32 immature birds for each adult
Puffin	Colony attendance	142,670	Adults	AOB x 2; Seabird 2000
	Non-breeding	231,957	Birds	Furness (2014): North Sea & Channel
AOS: Apparently Occupied Site; AON: Apparently Occupied Nest; AOT: Apparently Occupied Territory; AOB: Apparently Occupied Burrow				

Impacts of tidal energy developments on seabirds

There is a considerable amount of empirical evidence on how offshore windfarms affect seabirds, whereas understanding of impact pathways in relation to wave and tidal developments is still nascent. However, several review studies have been undertaken that have assessed the likely vulnerability of seabird species to the impacts of offshore windfarms and wave and tidal renewable developments (Garthe and Hüppop, 2004; Furness *et al.*, 2012, 2013) and the results of these are summarised in Table 5. Information on vulnerability is also incorporated in the species accounts.

Table 5 Species vulnerability to disturbance by vessels, vulnerability to displacement by structures, diving behaviour depth and overall impact potential of tidal turbine developments after Furness *et al.* (2012).

Species	Vulnerability to disturbance by vessels Score out of 5 [1]	Vulnerability to displacement by structures Score out of 5 [1]	Diving behaviour depth Score out of 5 [1]	Overall Vulnerability Index to tidal turbine impacts	
				Risk score	Descriptor on 5-category scale
Red-throated diver	5	2	3	3.8	Moderate vulnerability
Black-throated diver	5	3	3	3.6	Moderate vulnerability
Great northern diver	5	3	3	4.1	Moderate vulnerability
Fulmar	1	1	1	0.5	Very low vulnerability
Manx shearwater	1	1	1	1.5	Low vulnerability
Storm petrel	1	1	1	0.5	Very low vulnerability
Gannet	2	2	3	1.4	Low vulnerability
Cormorant	4	2	3	7.0	High vulnerability
Shag	3	2	3	9.6	High vulnerability
Eider	3	1	3	1.5	Low vulnerability
Arctic skua	1	1	1	0.6	Very low vulnerability
Great skua	1	1	1	0.7	Very low vulnerability
Common gull	2	1	1	0.7	Very low vulnerability
Herring gull	2	1	1	0.8	Very low vulnerability
Great black-backed gull	2	1	1	1.0	Low vulnerability
Kittiwake	2	1	1	0.9	Very low vulnerability
Arctic tern	2	2	1	1.9	Low vulnerability
Common guillemot	3	1	5	9.0	High vulnerability
Razorbill	3	2	5	9.6	High vulnerability
Black guillemot	3	2	4	9.9	High vulnerability
Puffin	2	2	4	3.8	Moderate vulnerability

Species	Vulnerability to disturbance by vessels Score out of 5 [1]	Vulnerability to displacement by structures Score out of 5 [1]	Diving behaviour depth Score out of 5 [1]	Overall Vulnerability Index to tidal turbine impacts	
				Risk score	Descriptor on 5-category scale

[1] Score 1 is lowest vulnerability/shallowest diving behaviour.

[2] Score ranges from 0 (no risk) to >10 (highest vulnerability) and is derived from species-specific information on diving behaviour, habitat flexibility, use of tidal streams, vulnerability to disturbance and vulnerability to displacement.

Site Importance

56. The importance to regional receptor populations of the Survey Area, in particular the turbine deployment area buffered to 1 km (AfL+1km), is evaluated by comparing seasonal estimates of mean abundance (+95%UCL) with regional receptor population sizes. The importance of the AfL+1km to a receptor population was defined on the basis on the mean percentage of a population present, as follows:

- High importance, >5% of the population;
- Medium importance, 1 - 5% of the population;
- Low importance, 0.1 - <1% of the population; and,
- Negligible, <0.1% of the population.

RESULTS

Survey Effort and Sea Conditions

57. A total of 18 surveys visits (days) were undertaken between March 2012 and March 2014 (Table 6). On the majority of survey dates conditions were good or sufficient for survey work and well within ESAS guidelines for seabird surveys (up to sea state 4). However, on two of the winter survey visits conditions of sea state 5 were temporally experienced. Full details of sea state, wind direction, swell and survey times for each transect are presented in Appendix 1 (Table A34).

58. Eleven survey visits were made during between late March and mid-August, encompassing the entire breeding season for most seabird species. This is one visit more than was planned for at the start of the survey programme. Virtually all transects were surveyed in these months and sea conditions at the time of surveys were generally very good (predominantly sea state 1 to 3) in 2013 yet merely good (predominantly sea states 3 and 4, but never exceeding sea state 4) in 2012.

59. Eight autumn/winter survey visits were made in the months September to early March. Unsuitable sea conditions prevented any survey visits in November and January, whereas September and October were only sampled in 2013. Transect coverage was slightly below target, with sea conditions at the times of surveys were good to very good.

60. Despite the weather related problems, all of the winter survey effort was conducted in sea conditions that complied with ESAS guidance. The potential effect of lower survey coverage during autumn and winter on the baseline dataset is considered in Section 'Seabird Results'.

Table 6 Survey visit summary March 2012 to March 2014.

Survey	Date	Number of transects surveyed	Total transect length (km)	On-effort time (hh:mm)	Sea State (Douglas Scale)	
					Range	Mean
1	27/03/2012	11	78.9	06:01	0-5	1.5
2	18/04/2012	11	78.9	05:35	2-5	2.8
3	27/05/2012	11	78.9	05:10	2-4	2.7
4	30/06/2012	11	78.9	05:13	1-4	3.4
5	20/07/2012	11	78.9	06:10	1-4	2.0
6	20/08/2012	10	73.9	05:06	2-3	2.1
7	11/12/2012	7	50.8	03:14	1-4	2.3
8	17/02/2013	11	78.9	05:01	2-4	2.8
9a	04/03/2013	7	50.8	03:01	2-3	2.4
9b	05/03/2013	11	78.9	05:26	1-3	2.1
10	30/03/2013	11	78.9	05:16	2	2.0
11	16/05/2013	*1	5.2	0:21	4	4
12	03/06/2013	11	78.9	05:33	1-3	1.7
13	25/06/2013	11	78.9	05:28	1-3	1.7
14	10/07/2013	11	78.9	05:15	1-3	1.7
15	09/09/2013	11	78.9	06:02	1-3	1.7
16	23/10/2013	9	53.5	04:07	2-4	3.3
17a	17/02/2014	5	27.7	02:00	2-4	2.9
17b	19/02/2014	**3	18.9	01:16	2-4	2.8
18	12/03/2014	7	41.8	02:49	2	2

*Transect 14 part surveyed, **Transect 18 part surveyed. Full details of sea conditions are presented in Appendix 1, Table AX)

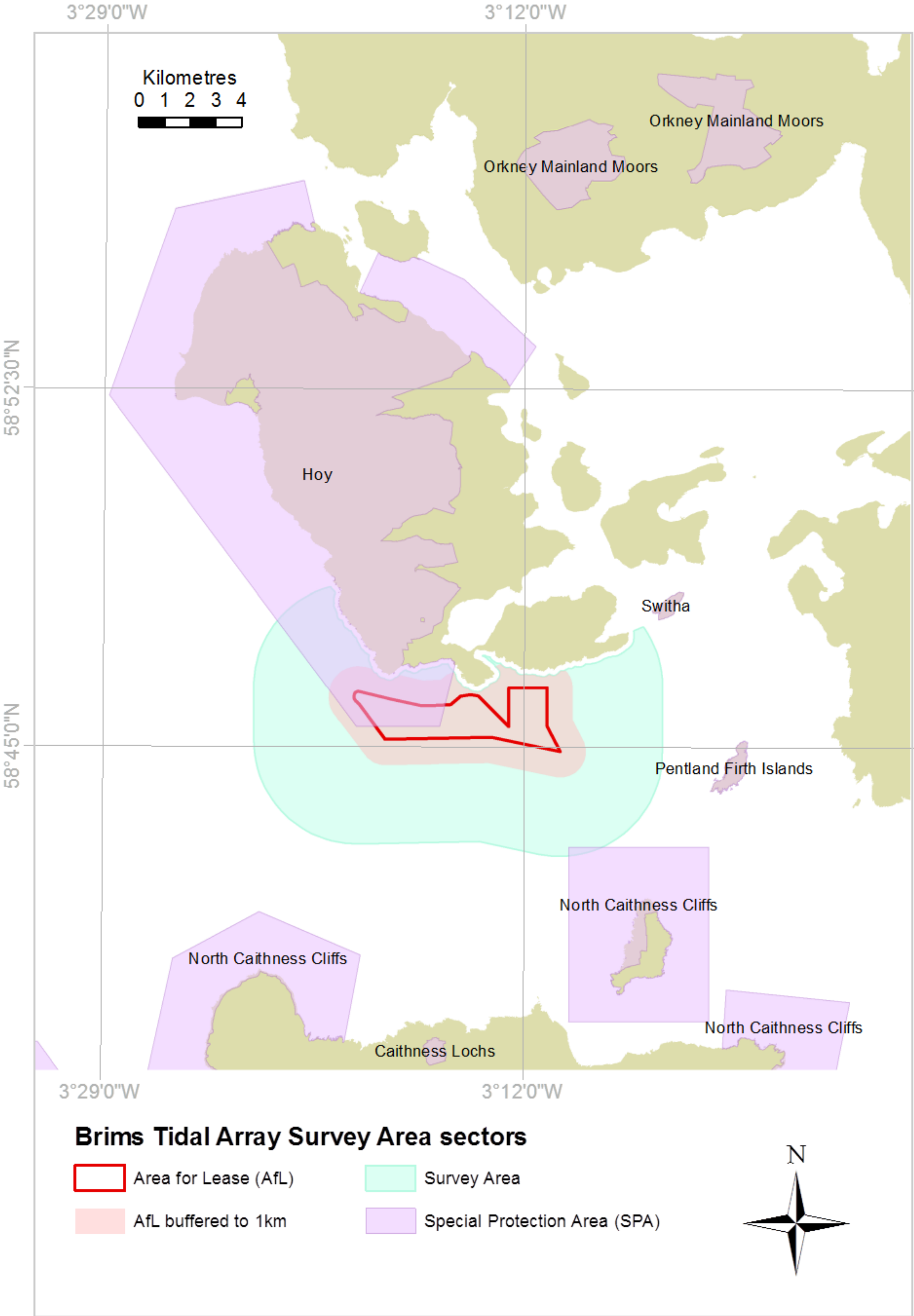
Seabird Results

Ornithological context in relation to designated sites

61. The Survey Area partly overlaps the marine component of Hoy SPA, a site designated for breeding seabirds.

62. The Survey Area is likely to be used for foraging and transiting through by several seabird species that are qualifying features of Hoy SPA and other designated sites in Pentland Firth and Orkney waters and north Caithness coast and in some cases further afield (Figure 2). The HRA Report outlines the designated site interests that could potentially be affected by the proposed Project. This document should be referred to for further information on this aspect.

Figure 2. The Brims Survey Area and adjacent Special Protection Areas (SPAs)



The autumn/winter data gap

63. The autumn/winter gap in the survey programme due to unsuitable weather was considered during consultation with SNH/MS. SNH (letter, 21 August 2014) recommended that a comparison with other data sources, including information from the nearby MeyGen tidal energy development could be used to show that the existing BTA dataset is of sufficient quality during this time of year to allow for a robust impact assessment.

64. Therefore an effort was made to compare data from the BTA Survey Area with alternative data sources. Sources considered were: older ESAS information (e.g. Stone *et al.,* 1995), APEM aerial survey data, MeyGen baseline survey data and more informal information (e.g. Forrester *et al.*, 2007).

65. Ultimately it was considered that the MeyGen data would provide the best benchmark for comparison. Firstly, the site is situated within the Pentland Firth at just 11km distance from the BTA Survey Area. ESAS boat-based surveys for this site were undertaken between 2009 and 2011. Although it is acknowledged that any comparison will be limited by inherent differences between usage patterns of tidal passes by diving birds across Scotland (e.g. Waggitt *et al.*, in prep) it is considered that the type of data available from the MeyGen surveys has several advantages compared to other available data sources:

- The proximity of the MeyGen survey area to the BTA Project survey area, maximising the likelihood for at least similar patterns to occur;

- Identical methods of data collection and survey effort (comparing like with like). ESAS boat-based surveys were deployed for both projects;

- No compatibility issues regarding species identification, Available digital aerial data from APEM is not considered to be of sufficient quality or scope to allow for a sensible comparison of (autumn/winter) datasets, in particular in relation to species identification and its inability to distinguish between different auk species in particular;

- Available MeyGen data is very recent (as opposed to older ESAS data); and,

- Spatial units, MeyGen project area and the BTA AfL+1km area are roughly the same size.

66. Therefore, in each species account a quantitative comparison is made of average monthly densities of birds on the sea surface (the reported unit in the MeyGen Ornithological Chapter) for the AfL+1km and the MeyGen project area. For BTA the overall density (birds on the sea surface and in flight) is also presented for context purposes. For each species an assessment is made whether the existing BTA dataset is fit for purpose in relation to the autumn/winter period.

67. In summary, given the strong similarities between both sites in terms of seasonal patterns and estimated densities for all species, including during the autumn / winter period, as well as the clear reasons for those species where consistent differences do exist, it is concluded that the existing BTA survey dataset is entirely fit for purpose and forms the basis for a robust impact assessment.

Overview

68. The species accounts in this section present and discuss the results for the 17 regularly (more than three records, more than 5 individuals per observation) encountered seabird species. These are the species considered to have relevance to the Project. A summary of the abundance estimates and importance of the Survey Area and AfL+1km in each season for these species is presented in Table 9. Estimates combine birds on the sea surface and those in flight. Maps showing the distributions of records across the Survey Area for these species are also presented for each species (showing only in-transect observations). Although the minimum number of observations required for inclusion is an arbitrary threshold, it is considered that species with so few observations are clearly so scarce that the Survey Area holds no tangible importance and that therefore no further consideration is required.

69. Table 9 provides an overview of the site importance of the AfL+1km to regional breeding and non-breeding population of key seabird receptors. Details are provided on regional population size, abundance within the AfL+1km (mean and 95% confidence intervals) and site importance.

70. In addition nine other seabird species and four migrant non-seabird species were encountered on three or fewer occasions and in small numbers only during the surveys (Table 7, Table 8). Migrant waders and songbirds recorded during each survey are listed in Appendix 1 only. It is clear that the Survey Area has very low importance for all of these species at all times of the year and therefore they are not discussed further.

71. All survey count data are presented in Appendix 1 (Table A35 to Table A53).

Table 7 Summary of rarely encountered seabird species (including divers and seaduck) seen on-effort in the Survey Area seen during ESAS surveys March 2012 – March 2014.

Species	Date	Number	Behaviour	Position
Black-throated diver	12-Mar-14	1	on water	AfL 2-4km buffer
Great northern diver	25-Jun-13	1	on water	AfL 2-4km buffer
	23-Oct-13	2	flying, not in transect	AfL and AfL 1km buffer
Sooty shearwater	09-Sep-13	1	flying, in transect	AfL 2-4km buffer
Cormorant	27-May-12	1	flying, not in transect	AfL 2-4km buffer
	05-Mar-13	3	flying, not in transect	AfL 2-4km buffer
	23-Oct-13	2	on water	AfL 1km buffer
Eider	18-Apr-12	4	on water and flying, not in transect	AfL and AfL 1km buffer
	17-Feb-13	3	flying, not in transect	AfL 1km buffer
	04-Mar-13	2	flying, not in transect	AfL 2-4km buffer
Pomarine skua	09-Sep-13	1	flying, not in transect	AfL 2-4km buffer
Black-headed gull	25-Jun-13	1	flying, in transect	AfL 2-4km buffer
Common tern	03-Jun-13	1	flying, not in transect	AfL 2-4km buffer
	25-Jun-13	5	3 flying, not in transect, 2 in transect	AfL 1km and 2-4km buffers
Little Auk	05-Mar-13	1	on water	AfL 1km buffer
	17-Feb-14	1	flying, in transect	AfL 2-4km buffer
	19-Feb-14	1	on water	AfL 2-4km buffer

Table 8 Summary of non-seabird migrant bird species seen on-effort in the Survey Area during ESAS surveys March 2012 – March 2014.

Species	Date	No.	Behaviour	Position
Grey heron	09-Sep-13	1	flying, not in transect	AfL 2-4km buffer
Pink-footed goose	04-Mar-13	44	flying, not in transect	AfL 2-4km buffer
	05-Mar-13	5	flying, not in transect	AfL 2-4km buffer
Greylag goose	18-Apr-12	1	flying, not in transect	AfL
	27-May-12	12	flying, not in transect	AfL 2-4km buffer
	11-Dec-12	122	all flying,100, in transect, 22 not in transect	AfL 1km and AfL 2-4km buffer
	17-Feb-13	2	flying, not in transect	AfL 2-4km buffer
	05-Mar-13	2	flying, not in transect	AfL 2-4km buffer

Species	Date	No.	Behaviour	Position
	03-Jun-13	3	on water	AfL 2-4km buffer
Goose sp.	11-Dec-12	1	flying, not in transect	AfL 1km buffer
	23-Oct-13	3	flying, not in transect	AfL 2-4km buffer

Table 9 Summary of the importance of the AfL+1km to regional receptor populations of seabirds. Estimates reflect combined abundance of birds on the sea surface and birds in flight.

Species	Season	Regional population (RP)		Estimated mean in AfL+1km area (on sea and in flight)		Est. 95%UCL of mean in AfL+1km area (on sea and in flight)		Importance of AfL+1km to RP
		Number	Units	Number (all ages)	% of RP	Number (all ages)	% of RP	
Red-throated diver (no estimate available, maximum survey count given)	Colony attendance	111	Adults	Max 1 bird / survey, 3 observations	0.4%	n/a	n/a	Low
	Winter	1,532	Birds	Max 2 birds / survey, 4 observations	0.1%	n/a	n/a	Low
Fulmar	Colony attendance	965,822	adults	421	<0.1%	733	0.1%	Negligible/Low
	Winter	568,736	birds	410	0.1%	773	0.1%	Low
Manx shearwater	Summer (non-breeding)	8,507	birds	4	0%	17	0.2%	Negligible/Low
European storm-petrel	Colony attendance	4,636	birds	2	<0.1%	6	0.1%	Negligible/Low
Gannet	Colony attendance	75,870	adults	29	<0.1%	63	0.1%	Negligible/Low
	Winter	248,385	birds	8	<0.1%	25	0%	Negligible
Shag	Colony attendance	754	adults	48	6.4%	165	21.9%	**High**
	Winter	39,468	birds	47	0.1%	132	0.3%	Low
Arctic skua	Colony attendance	930	birds	1	0.1%	3	0.3%	Low
Great skua	Colony attendance	4,470	birds	21	0.5%	39	0.9%	Low
Herring gull	Colony attendance	5,294	adults	0	0%	0	0%	Negligible
	Winter	466,511	birds	1	<0.1%	10	<0.1%	Negligible
Great black-backed gull	Colony attendance	5,156	adults	1	<0.1%	5	0.1%	Negligible/Low
	Winter	91,399	birds	3	<0.1%	13	<0.1%	Negligible
Common gull	Colony attendance	5,930	adults	1	<0.1%	4	0.1%	Negligible/Low
	Winter	710,000	birds	1	<0.1%	7	<0.1%	Negligible
Kittiwake	Colony attendance	62,792	adults	161	0.3%	690	1.1%	Low/**Medium**
	Winter	627,816	birds	8	<0.1%	34	<0.1%	Negligible

Species	**Season**	**Regional population (RP)**		**Estimated mean in AfL+1km area (on sea and in flight)**		**Est. 95%UCL of mean in AfL+1km area (on sea and in flight)**		**Importance of AfL+1km to RP**
		Number	**Units**	**Number (all ages)**	**% of RP**	**Number (all ages)**	**% of RP**	
Arctic tern	Colony attendance	1,724	adults	2	0.1%	9	0.5%	Low
Common guillemot	Colony attendance	609,250	adults	446	<0.1%	825	0.1%	Negligible/Low
	Chicks on sea	609,250	adults	0	0%	0	0%	Negligible
	Winter	1,617,306	birds	80	<0.1%	253	<0.1%	Negligible
Razorbill	Colony attendance	10,739	adults	223	**2.1%**	433	**4%**	**Medium**
	Chicks on sea	10,739	adults	119	1.1%	369	3.4%	**Medium**
	Winter	218,622	birds	6	<0.1%	44	<0.1%	Negligible
Black guillemot	Colony attendance	1,576	adults	8	0.5%	48	3%	Low/**Medium**
	Winter	3,656	birds	10	0.3%	46	1.3%	Low/**Medium**
Puffin	Colony attendance	142,670	adults	202	0.1%	339	0.2%	Low
	Winter	231,957	birds	2	<0.1%	7	<0.1%	Negligible

Note, the population sizes shown are expressed to the same precision as given in the source data. Rows highlighted in grey indicate seasons for which a species showed medium or high site importance levels.

Species accounts

72. The following species accounts are set out in a consistent manner for all species. Each species account features tabulated season-specific density and abundance estimates for the Survey Area and the AfL area plus buffers ranging from 1-4km. Information on sample size, mean and maximum estimates and associated 95% confidence intervals are presented. In addition, for the most abundant species a four panel chart lays out seasonal patterns for the Study Area and the AfL+1km for the entire two year survey programme, seasonal site importance as well as comparison of average monthly densities between the BTA Survey Area and the MeyGen project area (the latter to consider the autumn/winter survey gap in some detail). For each season this information is discussed in light of site importance, statistical analysis findings and confidence in estimates.

73. Behavioural information is provided in relation to spatial distribution – accompanied by seasonal maps, analytical findings, foraging and flight directions recorded on site and key information on diving behaviour from the literature.

74. Subsequently, the likely origins of the bird populations in the Survey Area are discussed in relation to season, specific colonies and passage or winter populations. A section on status and protection provides information on national and Scottish population trends as well as – where available – at colonies within the Pentland Firth region.

75. Lastly, each account summarises known vulnerability levels in relation to tidal array developments, the relevance of a species to the project, any information gaps and the implications of the data comparison with the MeyGen data.

Red-throated diver

Overview

76. Red-throated divers were very scarce in the Survey Area throughout the year, and was only recorded on eight occasions during the entire survey programme (totalling 8 individuals), a single one of which was seen on the water. The species has a very short foraging range of up to 9km, foraging in near-shore waters before returning to its upland breeding lochs (Thaxter *et al.* 2012).

Colony-attendance period

77. The colony-attendance period for red-throated diver is defined as the months of April to September as this covers the period from nest establishment through to young fledging for the great majority of breeding birds.

78. A total of three individuals (in flight) were seen in the 1km buffer around the AfL during the breeding season (May and June 2012, September 2013). None of these observations were 'in transect' (i.e. on the sea surface or in flight in a snapshot within 300m from the vessel) and therefore no reliable density estimates could be calculated. The peak survey count of one bird is therefore used to assess site importance.

Winter period

79. During the winter period a total of five individuals were seen (March and December 2012, February and March 2014). A single bird on the sea surface was flushed by the survey vessel at a distance of 100m. Too few observations were available to reliably calculate density estimates for the non-breeding season.

Behaviour

80. With very few records, distribution for red-throated diver has no obvious pattern (Figure 3, note map only shows in-transect observations).

Likely origins

81. The few birds seen in the Survey Area during the breeding season are likely to be exclusively from the Hoy breeding population of 111 adults (Dillon *et al.* 2009). During the winter period birds from outside the UK join the population (Wernham *et al.*, 2002). The NW North Sea population is estimated at 1,523 birds (Furness, 2014).

Status and protection

82. The entire UK breeding population of 4,146 adult birds occurs within Scotland, where numbers increased by approximately 34% between 1994 and 2006 (Dillon *et al.*, 2009).

83. No recent information is available for (SPA) populations around the Pentland Firth (MacArthur Green, 2013).

Vulnerability to tidal device impacts

84. Red-throated divers are considered to have very high vulnerability to vessel disturbance, low vulnerability to displacement by structures and moderate vulnerability in relation to tidal energy developments in general (Table 5).

Relevance to Project

85. Concerns are likely to be low as this species is very scarce in the Survey Area.

Information gaps

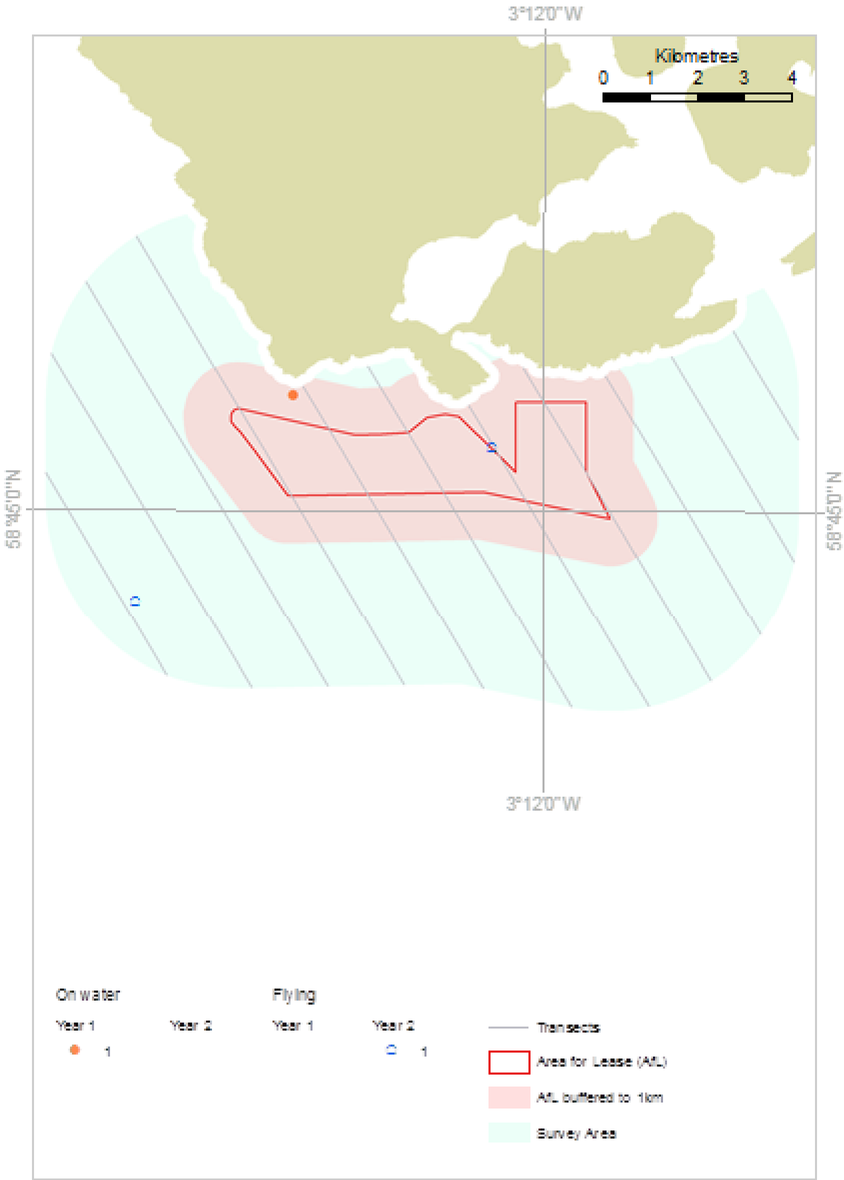
86. None of importance.

Comparison with MeyGen surveys

87. As density estimates could not reliably be calculated it is not possible to compare the AfL+1km area's average monthly densities with surveys undertaken for the nearby MeyGen project between 2009 and 2011. On the latter site red-throated divers were recorded between November and April on the boat surveys, with a peak in late winter (March) of 0.3 per km^2. This equated to a peak abundance in the boat survey area of four birds. No birds were recorded at the MeyGen site during the breeding season.

88. Clearly both the BTA Survey Area and the MeyGen project have very low densities present during any time of year. Given what is known of red-throated diver distribution on Orkney, with the vast majority of birds during the non-breeding season residing in and around Scapa Flow (Dawson *et al.*, 2009, Lawson *et al.*, 2015), and very small numbers along exposed coastlines elsewhere, it is unlikely that the autumn/winter survey gap is cause for concern. For red-throated diver the current dataset is therefore considered fit for purpose.

Figure 3. Distribution and abundance of red-throated divers recorded during ESAS surveys between March 2012 and March 2014 for a) the non-breeding period (9 survey days). No in-transect records for the breeding season.



a) Non-breeding period

Fulmar

Overview

89. Fulmars were common in the Survey Area throughout the year, with a high proportion of birds seen on the water. Fulmars range very widely away from breeding colonies to forage when they are breeding (mean maximum range: 400km, Thaxter *et al.,* 2012) and at other times of year when they make more extensive movements. The birds seen in the Survey Area are likely to be mainly from breeding areas across northern and eastern Scotland. This species habitually spends a lot of time in flight, dives to very shallow depths and has low sensitivity to human disturbance.

Colony-attendance period

90. The colony-attendance period for fulmar is defined as the months of May to September as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

91. Based on the MMFR the breeding population in the defined breeding region is 965,822 adults based on the Seabird 2000 census results (Mitchell *et al.,* 2004). The actual number of fulmars present in the region during the breeding season is likely to be substantially greater than this figure because of the presence of immature birds. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 62% of fulmar populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

92. Fulmar were present in the Study Area year-round, with densities in most months between 5-15 birds/km^2, with overall (slightly) higher densities in the months prior to the start of the breeding season, likely reflecting birds returning from their wintering areas to gather in the vicinity of their breeding colonies (Figure 4a). Substantial peaks occurred in March and May 2012, with 35 and 58 birds/km^2 respectively, indicating that during this time of year the area has the potential to attract large numbers of birds. Note however the large 95% confidence intervals around the May estimate in particular.

93. As one might expect, the seasonal pattern for the AfL+1km is very similar to that for the Study Area, and shows similar densities as well, indicating fulmar to be present across the entire Study Area without any particular preference for sub sections thereof (Figure 4b).

94. Statistical analysis revealed no clear consistent temporal difference between the breeding season and winter season across both years for fulmar. Not only was there no clear consistent difference between the seasons across years, but abundance/density appeared to be relatively constant (compared to other species) during the year. Fulmars will attend their colonies throughout most of the year (Wernham *et al.,* 2002), and the relative stability of the numbers of this species throughout the year might also reflect the presence of locally breeding birds outside the breeding season.

Table 10 Fulmar seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	8	347	574	13.13	421	262	733	35.27	1,131	2,330
Winter	7	160	397	12.78	410	255	773	27.21	873	2,263
AfL + 2 km										
Colony attendance	8	570	1342	17.38	919	458	2,084	73.42	3,882	8,317
Winter	7	218	505	9.84	520	335	953	19.21	1,016	2,482
AfL + 3 km										
Colony attendance	8	761	1697	15.17	1,170	549	2,566	65.08	5,022	11,133
Winter	7	281	742	8.94	690	440	1,150	15.97	1,233	2,360
Survey Area										
Colony attendance	8	1004	2235	13.66	1,543	739	3,161	58.56	6,613	11,899
Winter	7	343	1023	8.48	957	605	1,643	16.59	1,873	4,034
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

95. The mean estimated number of fulmars present in the Survey Area during the colony-attendance period was 1,543 birds (95%UCL: 3,161; Table 10, Figure 4d). These estimates represent 0.2% and 0.3% respectively of the assumed regional breeding population.

96. The estimated mean number of fulmars in the AfL+1km was 421 individuals (95%UCL: 733 individuals, Table 10, Figure 4d). These numbers represent <0.1%-0.1% of the regional breeding population respectively and thus the AfL+1km area is considered to have **negligible** to **low** importance as a foraging area for the population.

Winter period

97. The mean number of fulmars present in the Survey Area during the winter period (October to April) was 957 birds (95%UCL: 1,643 birds; Table 10, Figure 4d). This represents 0.2-0.3% of the estimated minimum non-breeding period population of 568,736 birds for the North Sea BDMPS region (Furness, 2014).

98. In the winter period the estimated mean number of fulmars in the AfL+1km was 410 individuals (95%UCL: 773 individuals, Table 10, Figure 4d). These estimates represent 0.1% of the assumed regional winter period population and thus the AfL+1km area is considered to have **low** importance as a foraging area for the population.

Behaviour

99. The maps showing the distribution of fulmar records show that birds are approximately evenly spread over the Survey Area during the breeding season (Figure 5a) and an apparent emphasis on more inshore waters during the non-breeding season (Figure 5b). The statistical analysis examines variation in estimated density between sub-divisions of the Survey Area and shows that the density differences are small and likely to reflect sampling variation rather than genuine differences (Caloo, 2015).

100. On average, 38% of fulmars present in the Survey Area during the breeding season were seen on the water, rising to 45% in the winter period.

101. Fulmars are primarily surface feeders and mostly seize prey whilst floating or swimming (Cramp and Simmons, 1977), but they also splash-dive (Hudson and Furness 1988) or surface dive down to c3m (Hobson and Welch, 1992). Maximum recorded dive depths range from 3m (Garthe and Furness, 2001) to 5m (Cramp and Simmons, 1977).

Likely origins

102. During the breeding season, fulmars in the Survey Area could potentially originate from colonies anywhere along the north and east coast of Scotland, Orkney and Shetland. The closest breeding fulmar colonies are on the coast line of Hoy, Switha and Swona, but these are small in size compared to colonies further north in Orkney and in Caithness. Using the MMFR of 400km leads to a regional population which stretches as far west as the Western Isles and Inner Hebrides, as far north as Shetland and as far south as northern England.

103. Outside the breeding season fulmars range widely. The birds seen in the Survey Area in the autumn and winter are likely to originate mainly from any of the colonies in eastern and northern Scotland. They are also likely to include birds from colonies in Scandinavia and the Arctic (Wernham *et al.*, 2002).

Status and protection

104. The Scottish population has a favourable conservation status and has undergone a long term increase in numbers during the 20th century (Mitchell *et al.* 2004). In recent years however, UK population development has shown somewhat of a downturn, with a decrease of 13% between 2000 and 2013 (JNCC 2014). Comparing SPA population sizes at the time of citation with recent estimates show that fulmar populations around the Pentland Firth in Orkney and Caithness have decreased by 23% (MacArthur Green, 2013).

Vulnerability to tidal device impacts

105. Fulmars are considered to have very low vulnerability to vessel disturbance, displacement by structures and tidal turbine collision risk (Table 5).

Relevance to Project

106. Concerns are likely to be low as this species is relatively tolerant of disturbance and habitually forages on the sea surface or in the first few meters of the water column.

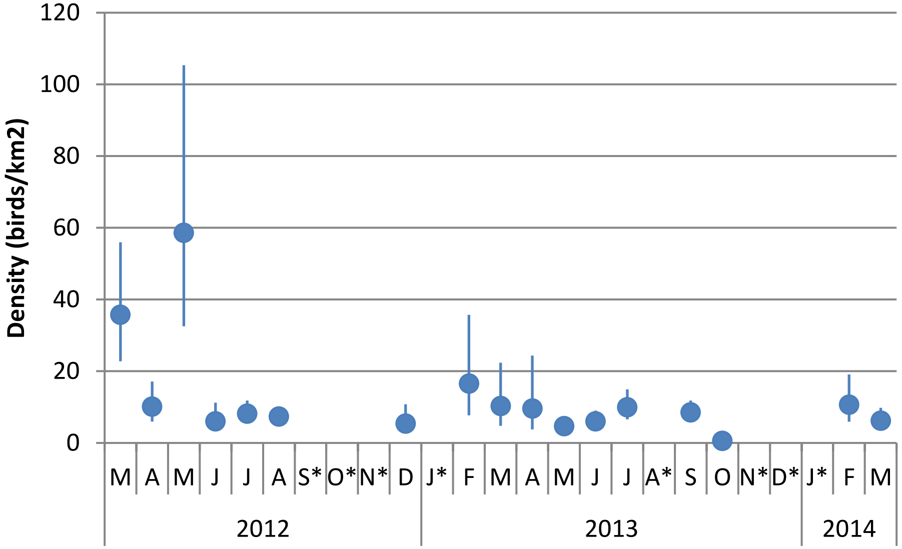
Information gaps

107. None of importance.

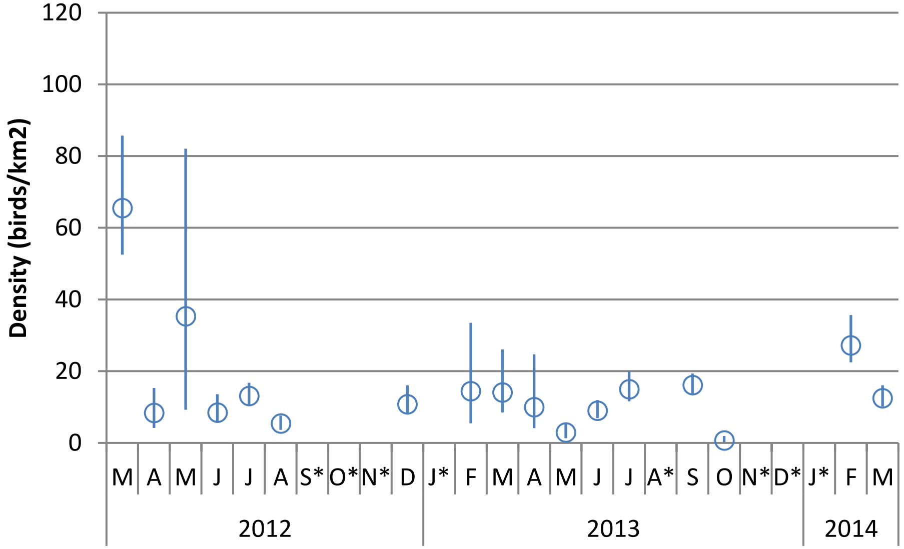
Comparison with MeyGen surveys

108. Comparing the AfL+1km area's average monthly densities with surveys undertaken for the nearby MeyGen project between 2009 and 2011 shows a not dissimilar seasonal pattern (Figure 4d). On average densities are higher than at the MeyGen site during both the breeding and the winter seasons, indicating that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For fulmar the current dataset is therefore considered fit for purpose.

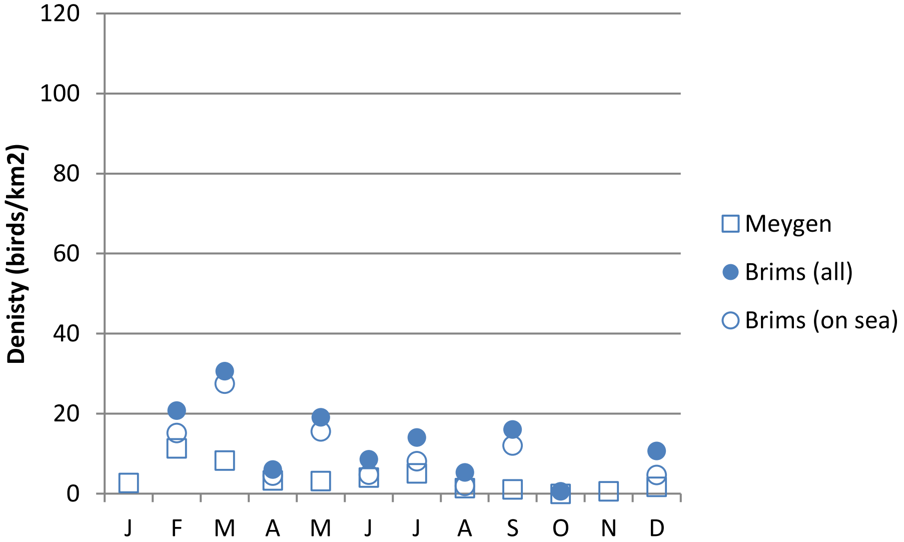
Figure 4. Fulmar density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



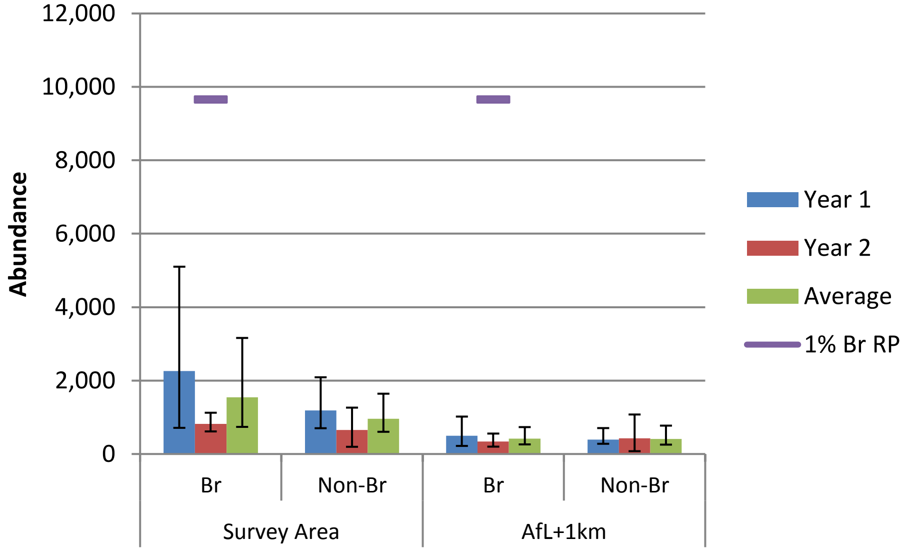
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

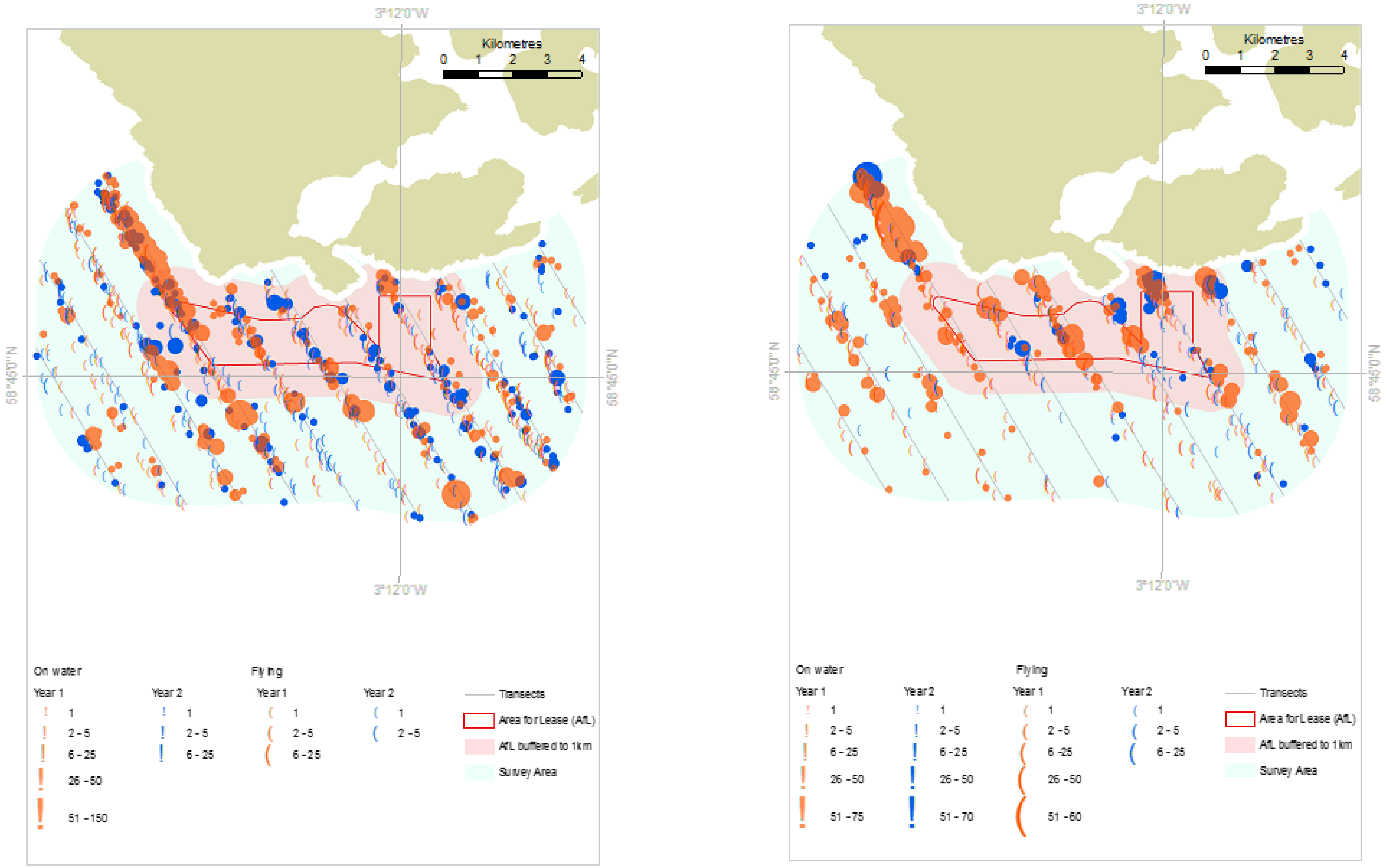


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 5. Distribution and abundance of fulmars recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (May-Sep, 9 survey days), and b) the non-breeding period (Oct-Apr, 11 survey days).



a) Breeding (attending colony)

b) Non-breeding

Manx shearwater

Overview

109.Manx shearwaters are a summer visitor to eastern Scotland and were occasionally recorded in low numbers in the Survey Area in the summer months (Table 11). The birds seen were likely to be non-breeding immature and passage birds, as although wide-ranging in the breeding season, the Survey Area lies substantially beyond the closest colonies (mean maximum range: 330 km, Thaxter *et al.*, 2012) Manx shearwaters habitually spend a lot of time in flight, tend to dive to shallow depths and have low sensitivity to human disturbance.

Table 11 Manx shearwater seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Summer	11	4	7	0.14	4	0	17	1.06	34	106
AfL + 2 km										
Summer	11	5	10	0.11	6	0	20	0.89	47	130
AfL + 3 km										
Summer	11	5	10	0.07	5	0	20	0.58	45	127
Survey Area										
Summer	11	6	13	0.06	7	0	23	0.54	61	147
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Summer period

110.It is unlikely that the small numbers of Manx shearwater seen in the Survey Area during the summer were actively breeding individuals because the Survey Area is further than the MMFR from the closest large breeding colonies. It is considered more likely that the birds seen in the Survey Area were wandering immature birds and passage birds. Manx shearwater does not regularly breed in the region but presumed non-breeding birds are present at low densities (Kober *et al.,* 2010) in the summer.

111.The estimated mean number of Manx shearwaters present in the Survey Area during the colony-attendance period was 7 birds and the 95%UCL of the mean was 23 birds (Table 11). These estimates represent 0.1% and 0.3% respectively of the BDMPS migration population of 8,507 birds for the North Sea area (Furness, 2014). Although technically this reference population does not relate to the breeding season, it has here been used as to provide context the estimated numbers in the Survey Area.

112.The estimated mean numbers present in the AfL+1km area was 4 birds (95%UCL: 17 birds, Table 11). These numbers represent <0.1% and 0.2% of the BDMPS migration population of 8,507 birds for the North Sea area (Furness, 2014) and therefore the AfL+1km area is considered to have **negligible to low** importance as a foraging area for the population.

Behaviour

113.The map of the distribution of Manx shearwater records reflects the scarce status of the species in the Survey Area. No spatial patterns are apparent (Figure 6).

114. On average, 41% of Manx shearwaters estimated to be present were in flight, the remainder were sitting on the sea.

115. Manx shearwaters feed at the sea-surface, either making plunge dives from a height of 1-2m, or making shallow, wing-propelled dives to catch prey items. However, the species is capable of diving depths of up to 26m (Aguilar *et al.,* 2003).

Likely origins

116. Non-breeding and migrant Manx shearwaters wander very extensively from breeding areas (Wernham *et al.,* 2002). The birds present off the northeast coast of Scotland are most likely to originate from the large breeding colonies in north-west Scotland, in particular Rum and St Kilda, and the more moderate sized colonies in Iceland and Faeroe Islands. They also breed in very small numbers in Orkney and Shetland (<10 pairs, Forrester *et al*., 2007) and a handful of pairs has recently established on the Isle of May in the Firth of Forth (Thorne *et al*., 2014).

Status and protection

117. The Scottish population has a favourable conservation status and has undergone long term increase in numbers (Mitchell *et al*., 2004).

Vulnerability to tidal device impacts

118. Manx shearwaters are considered to have very low vulnerability to vessel disturbance, displacement by structures and overall low vulnerability to tidal turbine impacts (Table 5).

Relevance to Project

119. Concerns are likely to be low as this species is scarce in the Survey Area, relatively tolerant of disturbance and tends to forage on the sea surface or predominantly within the first few meters of the water column.

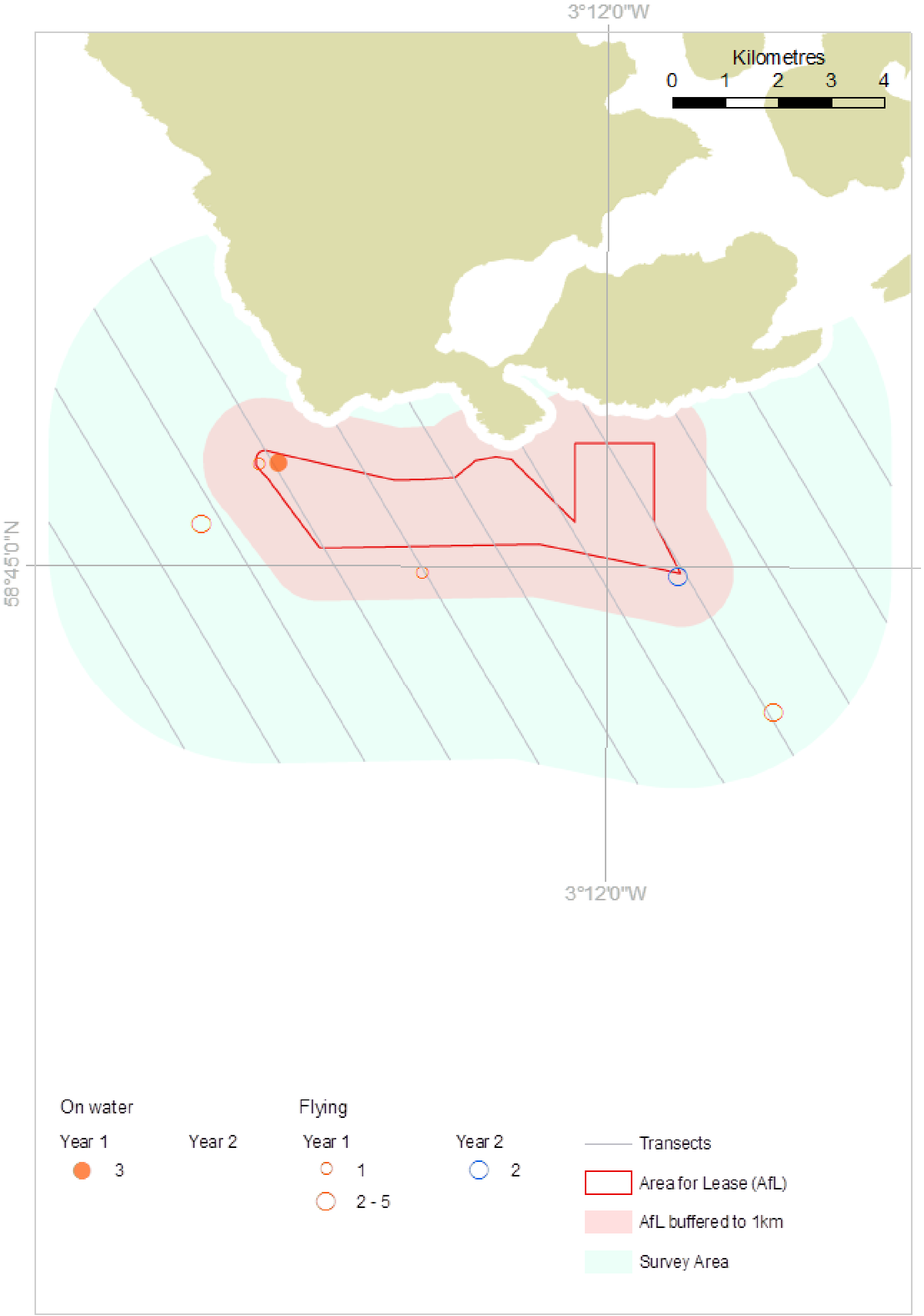
Information gaps

120. None of importance.

Comparison with MeyGen surveys

121. No comparison with the MeyGen surveys is required as Manx shearwater does not occur in either area during the winter period.

Figure 6. Distribution and abundance of Manx shearwater recorded during ESAS surveys between March 2012 and March 2014 for the summer period (May-Oct, 8 survey days). No in-transect records during the non-breeding period.



Storm petrel

Overview

122. Storm petrels are a summer and passage visitor to northern Scotland and were occasionally recorded in very low numbers in the Survey Area in the summer months (Table 12). The birds seen were likely to be breeding birds from the Orkney colonies. This species habitually forages at or close to the sea surface and has low sensitivity to human disturbance.

Summer/colony attendance period

123. Storm petrels breed in Orkney in substantial numbers, although predominantly in the northern parts of the islands. It is likely that the small numbers of storm petrel seen in the Survey Area during the colony attendance period were breeding individuals from nearby colonies on the Pentland Skerries and Swona as several hundred pairs are known to breed there (Mitchell et al. 2004).

124. The mean estimated number of storm petrels present in the Survey Area during the summer was 7 birds (95%UCL: 17; Table 12). This represents approximately 0.1% and 0.3% respectively of the assumed regional summer/migration population of 4,636 birds.

125. No birds were recorded in the AfL+1km during any of the nine summer surveys. However, this may in part be explained by the species' nocturnal habits when visiting colonies, and its preference for oceanic foraging habitat during the day. Therefore, based on the estimated density for the whole Survey Area, the mean number present in the AfL+1km area would be 2 birds (95% UCL: 6 birds, Table 12). These numbers represent approximately 0.2% and 0.4% of the regional breeding population and thus the AfL+1km area is considered to have **negligible to low** importance as a foraging area for the population.

Table 12 Storm petrel seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Summer	9	0	0	-	-	-	-	-	-	-
AfL + 2 km										
Summer	9	0	0	-	-	-	-	-	-	-
AfL + 3 km										
Summer	9	7	7	0.05	4	1	11	0.18	14	43
Survey Area										
Summer	9	13	13	0.07	7	3	17	0.17	19	48
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Behaviour

126. Observations during the breeding season were limited to waters 3-4km offshore (Figure 7).

127. Storm petrels feed by gleaning on the surface but have also been recorded diving below the surface (Griffiths, 1981; Cramp and Simmons 1977). A recent study found a mean of 1.5m and a maximum diving depth of 5.5m (Albores-Barajas *et al.* 2011).

Likely origins

128. Breeding storm petrel are thought to have a moderately large foraging range (>65km, Thaxter *et al.*, 2012; 100km, Langston, 2010), although little empirical data is available. The similar Leach's storm petrel has a mean maximum range of nearly 100km, which was the threshold used for regional population definition for storm petrel. The birds present in the Survey Area are likely to originate from breeding colonies in Orkney and Sutherland.

Status and protection

129. The Scottish population has a favourable conservation status although no national trends are available due to the difficulties involving monitoring this species (Mitchell *et al*., 2004). Comparing population sizes at two SPAs within 80km of the Pentland Firth at the time of citation with more recent estimates show a 74% decrease (MacArthur Green, 2013). At one of those colonies (Auskerry SPA) the decrease in number was a result of reduction in nesting habitat.

Vulnerability to tidal device impacts

130. Storm-petrels are considered to have very low vulnerability to vessel disturbance, displacement by structures and tidal turbine collision risk (Table 12).

Relevance to Project

131. Concerns are likely to be low as this species is scarce, relatively tolerant of disturbance and tends to forage at or near the sea surface, away from a potential underwater collision risk zone.

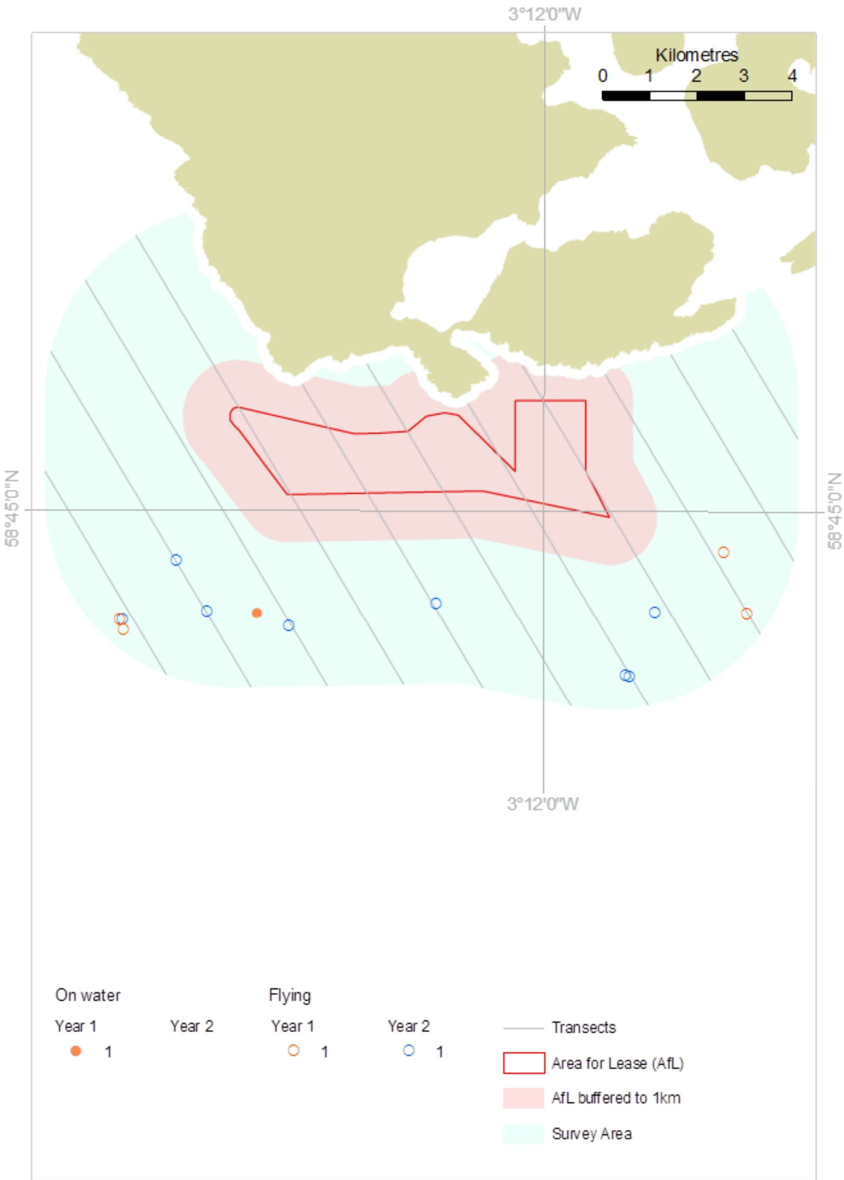
Information gaps

132. None of importance.

Comparison with MeyGen surveys

No comparison with the MeyGen surveys is required as storm petrel does not occur in either area during the winter period.

Figure 7. Distribution and abundance of storm petrels recorded during ESAS surveys between March 2012 and March 2014 for the colony-attendance period (May-Oct, 10 survey days). No in-transect records during the non-breeding period.



Gannet

Overview

133. Gannets were commonly present in the Survey Area throughout the year, with a high proportion of birds seen in flight. Gannets range very widely away from breeding colonies both to forage during the breeding season and during their extensive movements at other times of year. This species regularly dives to depths within potential collision risk zones of tidal turbines and is therefore considered to have some sensitivity to tidal energy developments.

Colony-attendance period

134. The colony-attendance period for gannet is defined as mid-March to September as this covers the period from nest establishment through to young fledging for the great majority of breeding birds.

135. Based on the MMFR (229km +10%) the regional breeding population of gannets was taken to be the sum of birds breeding at West Westray, Sule Skerry and Sule Stack, Fair Isle, Troup Head, Foula, Noss and North Rona and Sula Sgeir. The numbers breeding at these colonies have changed since the Seabird 2000 census, and therefore more recent count data were used. The regional breeding population is thus assumed to be 75,870 adults (SMP database). The actual number of gannets present in the region during the breeding season is likely to be substantially greater than this figure because of the presence of immature birds.

Table 13 Gannet seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	11	48	61	0.90	29	14	63	3.34	107	210
Winter	6	8	9	0.25	8	1	25	0.82	26	87
AfL + 2 km										
Colony attendance	11	82	118	1.00	53	26	97	3.73	197	285
Winter	6	14	19	0.35	18	6	51	1.04	55	150
AfL + 3 km										
Colony attendance	11	111	171	0.98	75	40	142	3.99	308	448
Winter	6	27	45	0.61	47	7	133	2.77	214	399
Survey Area										
Colony attendance	11	144	225	0.90	102	49	179	3.95	446	568
Winter	6	33	52	0.54	61	7	171	2.55	288	487
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

136. Gannets were present in the Study Area year-round with densities highest during the breeding season, generally between 1-2 birds/km^2 with overall (slightly) higher densities in the months prior to the start of the breeding season (Figure 8a). Somewhat higher peaks occurred in September and October 2013 with 4 and 3 birds/km^2 respectively, which probably reflects the start of autumn passage movements. The winter season shows the lowest densities, in line with the species' southerly wintering areas.

137. As one might expect, the seasonal pattern for the AfL+1km is very similar to that for the Survey Area, and shows similar densities as well, indicating gannets to be present across the entire without particular preference for sub sections thereof (Figure 8b).

138. Statistical analysis revealed no clear consistent temporal difference between the breeding season and winter season across both years for gannet (Caloo, 2015).

139. The estimated mean number of gannets present in the Survey Area during the colony-attendance period was 102 (95%UCL: 179, Table 13, Figure 8d). These represent approximately 0.1% and 0.2% of the assumed regional breeding population of 75,870 adults.

140. The estimated mean number of gannets in the AfL+1km was 29 individuals (95%UCL: 63, Figure 8d). These numbers represent <0.1% and 0.1% respectively of the regional breeding population and therefore the AfL+1km area is considered to have **negligible to low** importance as a foraging area for the population.

141. A total of 76% of gannets that were aged during the colony-attendance period were adults and the rest were immature or juvenile birds (Table 14). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance to breeding birds above.

Table 14 Gannet, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Immature	Juvenile		
Colony-attendance period	76.1	22.6	1.3	718	14.9
Winter period	65.2	29.4	5.3	194	3.6

Winter period

142. The mean estimated number of gannets present in the Survey Area during the winter period was 61 (95%UCL: 171 birds; Table 13, Figure 8d). This represents <0.1%-0.1% of the estimated minimum non-breeding period population of 248,385 birds for the North Sea and Channel BDMPS region (Furness, 2014).

143. Based on the density in the winter period, the estimated mean number of gannets in the AfL+1km and 95%UCL of this mean was 8 and 25 individuals respectively (Table 13, Figure 8d). These estimates represent <0.1% of the assumed regional winter period population and therefore the AfL+1km area is considered to have **negligible** importance as a foraging area for the population during this time of year.

144. A total of 65% of gannets that were aged during the colony-attendance period were adults and the rest were immature or juvenile birds (Table 14). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance.

Behaviour

145. The maps presenting the distribution of records show that birds were approximately evenly spread over the Survey Area during the breeding season (Figure 9a), while during the non-breeding season birds were predominantly seen 3-4km from shore (Figure 9b). Analysis revealed that all Survey Area subsections yielded a similar estimate of density, consistent with birds being randomly distributed over the whole area (Caloo, 2015).

146. On average, approximately 88% of gannets estimated to be present during the breeding season were in flight, the remainder were sitting on the sea. Conversely, 77% of birds were seen on the sea surface during the winter period.

147. Gannets are plunge divers, entering the water at considerable speeds (Ropert-Coudert, 2009). Dive records range from a mean depth of 5m (maximum 22m) (Garthe *et al.* 2000) to 20m (maximum 34m) (Brierley and Fernandes, 2001).

148. Out of 708 gannets recorded in the Survey Area during the breeding season 3% were seen foraging, either classified as active searching, diving or feeding (unspecified).

149. During the colony-attendance period there was a strong tendency for gannet flights to be along a E – W/SW orientation (figure not shown), a pattern expected by the layout of the Pentland Firth, bordered by land masses to the north and south. This probably indicates strong connectivity to the Sule Stack and Sule Skerry and Westray colonies, which both lie within mean foraging range. Autumn movements, although much smaller in number showed a predominantly western orientation, with birds apparently moving into the north Atlantic.

Likely origins

150. Breeding gannets range long distances to forage; the mean foraging distance is 93 km and the MMFR is 229 km (Thaxter *et al.,* 2012). The closest gannetries – both within mean foraging range - are the relatively small colony at West Westray (751 AON) and Sule Skerry and Sule Stack (6,420 AON) (SMP database). The remaining four colonies: North Rona and Sula Sgeir, Fair Isle, Noss and Troup Head all lie within MMFR and therefore breeding birds from each of these may also potentially forage in the Survey Area.

151. Outside the breeding season gannets range widely and tend to move south. The birds seen in the Survey Area from September onwards are likely to originate from any of the colonies in northern Scotland, including colonies in Shetland.

Status and protection

152. The Scottish population has a favourable conservation status and has undergone a long term increase in numbers (Mitchell *et al*., 2004). Two SPA populations within 80km of the Pentland Firth have increased by 42% since designation (MacArthur Green, 2013).

Vulnerability to tidal device impacts

153. Gannets are considered to have low vulnerability to vessel disturbance, displacement by structures and the potential impacts of tidal developments in general (Table 5).

Relevance to Project

154. Based on the information available the potential for significant impact on the regional gannet population is considered limited.

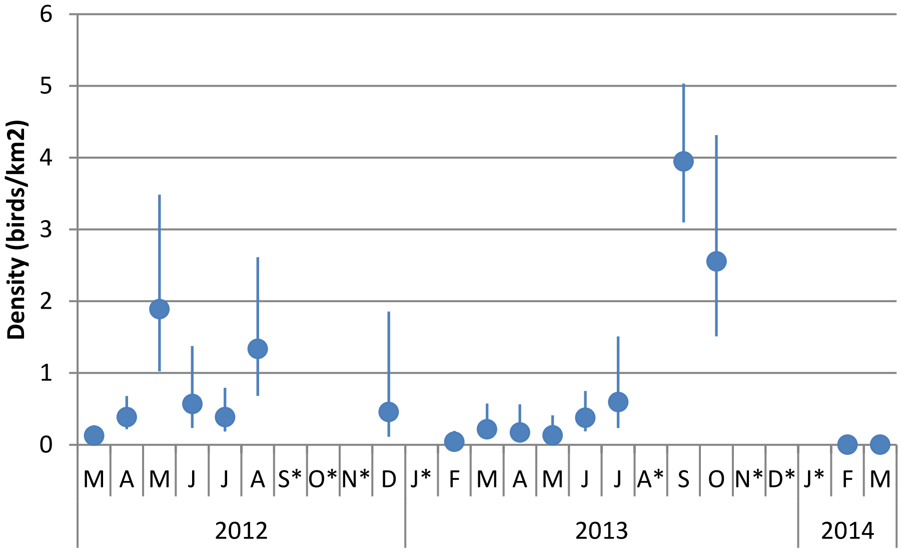
Information gaps

155. None of importance.

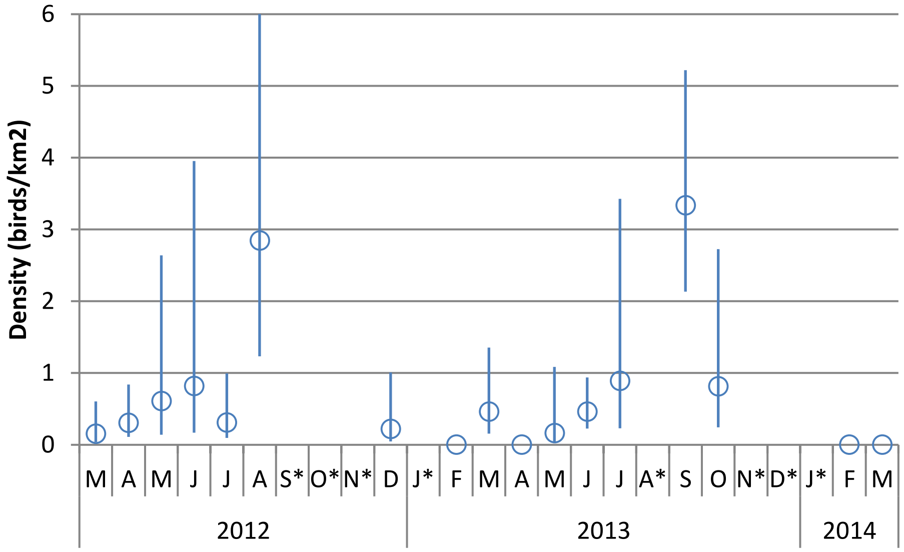
Comparison with MeyGen surveys

156. Comparing the AfL+1km's average monthly densities with surveys undertaken for the nearby MeyGen project between 2009 and 2011 shows a very similar seasonal pattern (Figure 8c). With the exception of the August and September months – towards the end of the breeding season, when abundance for Brims is higher - densities are virtually equal between both sites across both the breeding and the winter season. This indicates that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For gannet the current dataset is therefore considered fit for purpose.

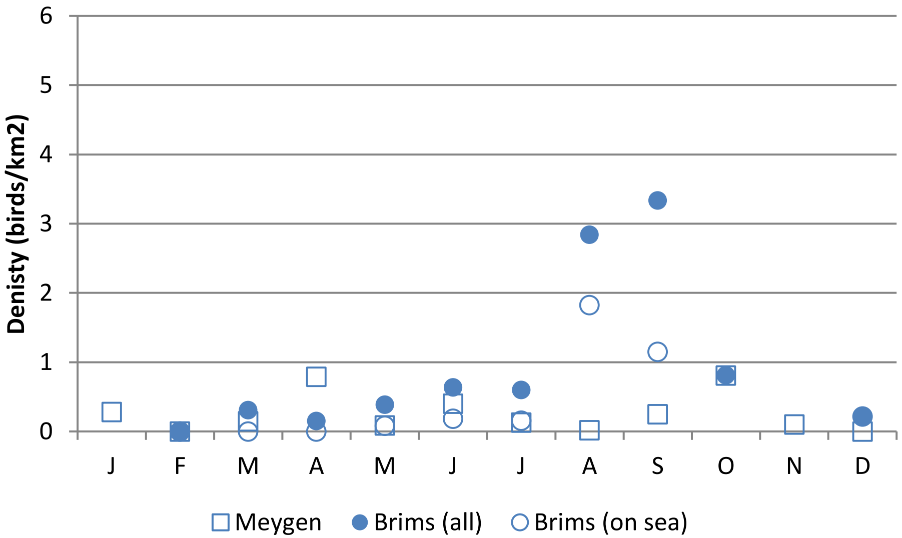
Figure 8. Gannet density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



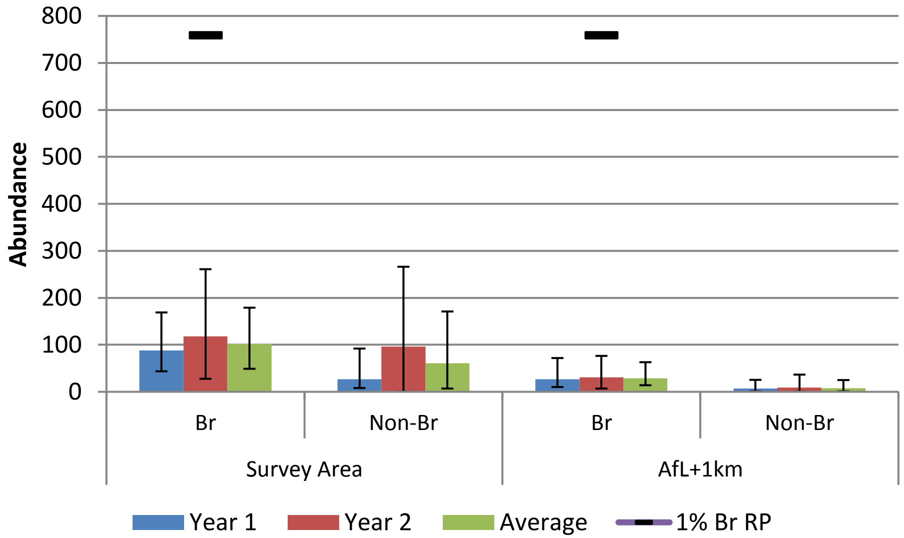
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

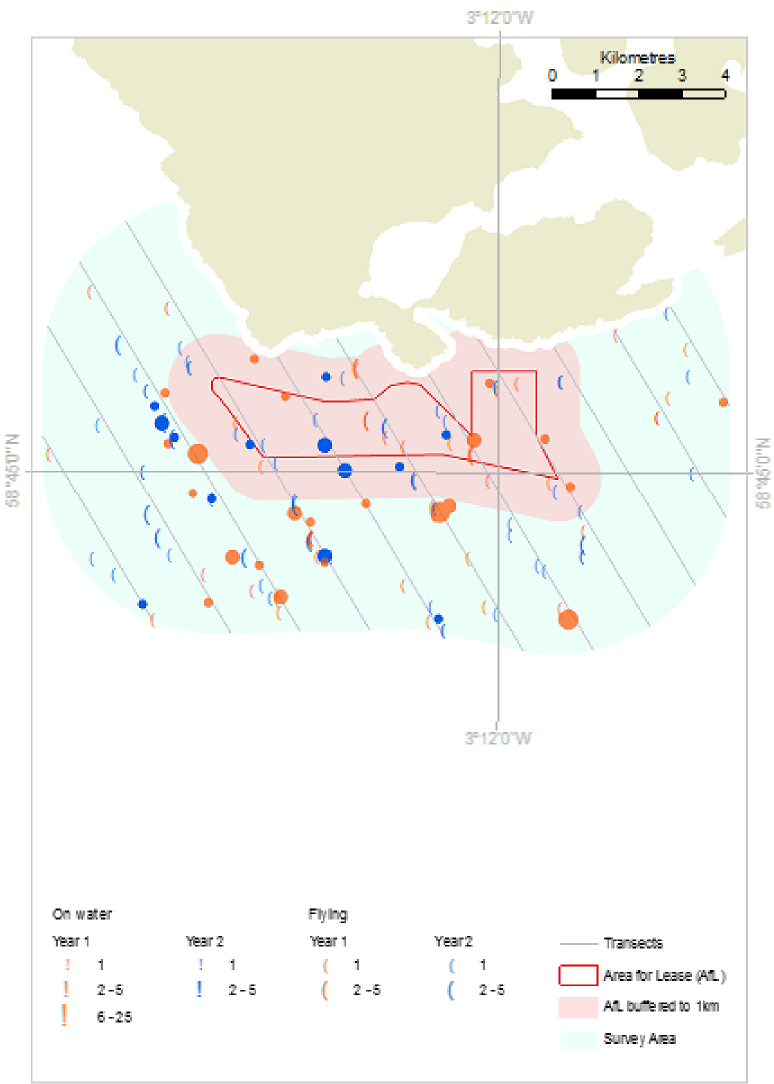


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)

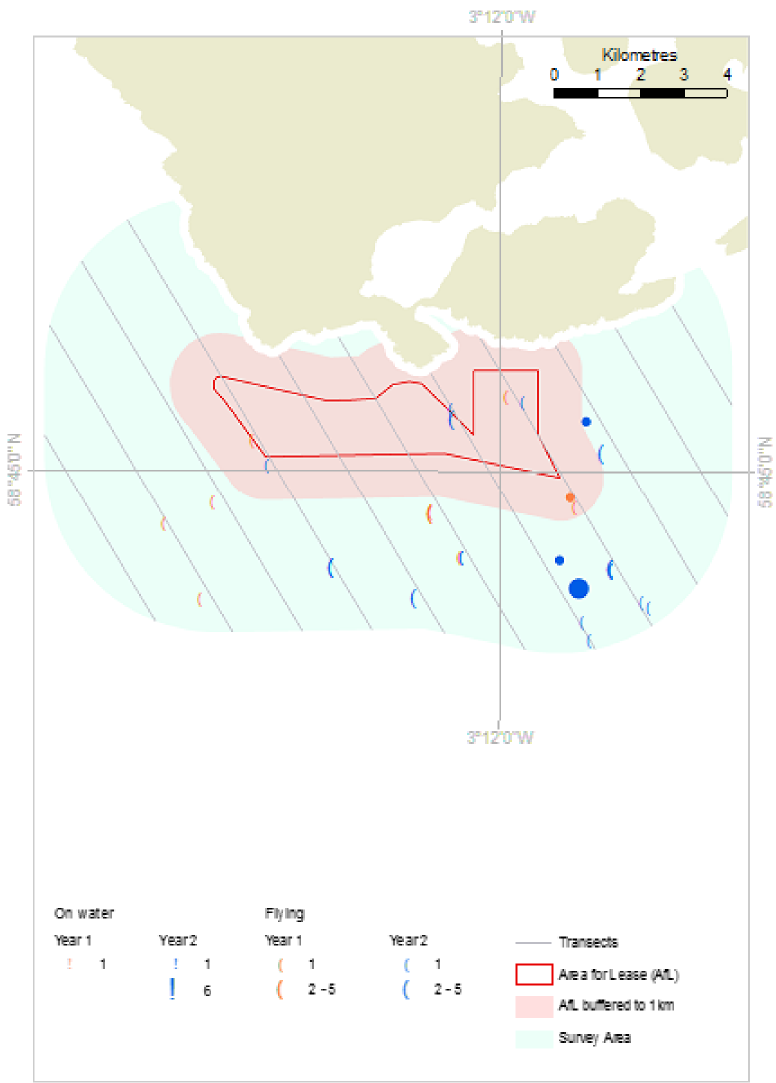


d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 9. Distribution and abundance of gannets recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (late Mar-Sep, 12 survey days), and b) the non-breeding period (Oct-mid Mar, 8 survey days).



a) Breeding (attending colony)



b) Non-breeding (passage and overwintering)

Shag

Overview

157. Shags were relatively common in the Survey Area throughout the year and were recorded on nearly every survey, however during the two-year survey programme no shags were recorded on the sea inside the boundary of the AfL and only a single bird was recorded flying over the AfL.

158. A high proportion of birds seen in the Survey Area were present on the sea surface. The species has a very short foraging range around breeding colonies (mean maximum range: 14.5 km, maximum: 17 km, Thaxter *et al.*, 2012). The birds seen in the Survey Area are likely to be almost exclusively from breeding colonies in southern Orkney. This species dives to moderate depths to forage at or close to the seabed and is considered to have high vulnerability to the potential impacts of tidal energy developments.

Table 15 Shag seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL area										
Colony attendance	11	0	0	0	0	0	0	0	0	0
Winter	5	0	0	0	0	0	0	0	0	0
AfL + 1 km										
Colony attendance	11	38	64	1.49	48	26	165	5.71	183	778
Winter	5	17	21	1.45	47	18	132	2.89	93	350
AfL + 2 km										
Colony attendance	11	46	104	1.31	69	47	205	3.37	178	721
Winter	5	19	23	0.99	52	29	148	1.71	91	306
AfL + 3 km										
Colony attendance	11	48	106	0.89	69	45	187	2.26	174	641
Winter	5	20	24	0.70	54	31	146	1.24	96	296
Survey Area										
Colony attendance	11	54	112	0.67	76	53	191	1.69	191	635
Winter	5	21	25	0.52	59	31	144	0.95	107	298
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony-attendance period

159. The colony-attendance period for shag is defined as the months of March to August as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

160. Based on the maximum foraging range the population in the defined breeding region is 754 adults based on the Seabird 2000 census results (Mitchell *et al.,* 2004). The actual number of shags present in the region during the breeding season is likely to be substantially greater than this figure because of the presence of

immature birds. Modelling of the stable age distribution undertaken by Grant *et al.* (2014) indicates that at the end of the breeding season 51% of shag populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

161. Shag were present in the Study Area year-round, with densities in all months below 2 birds/km^2 (Figure 10a).

162. The seasonal pattern for the AfL+1km is similar to that for the Study Area, although with higher densities on average, particularly in February-March, possibly reflecting birds reappearing near breeding colonies prior to the start of the breeding season (Figure 10b). Note however that these estimates have quite wide confidence intervals, largely as a result of relatively small sample size in the AfL+1km.

163. Statistical analysis revealed no clear consistent temporal difference between the breeding season and winter season across both years for shag. Not only was there no clear consistent difference between the seasons across years, but abundance/density appeared to be relatively constant (compared to other species) during the year. This is consistent with locally breeding birds remaining close to their breeding colonies throughout the year (Wernham *et al.,* 2002).

164. The estimated mean number of shags present in the Survey Area during the colony-attendance period was 76 (95%UCL: 191, Table 15, Figure 10d). These represent approximately 10.1% and 25.3% of the assumed regional breeding population of 754 adults.

165. The estimated mean number of shags in the AfL+1km was 48 individuals (95%UCL: 165). These numbers represent 6.4% and 21.9% respectively of the regional breeding population and therefore the AfL+1km area is considered to have **high** importance as a foraging area for the population. Although the associated confidence intervals are quite wide, it is clear that the estimated bird numbers in the area sit well within regional importance levels.

166. A total of 93.4% of the shags that were aged during the breeding season were adults (or at least birds older than 1 year, as no visual distinction can be made beyond that age) and the rest were immature and juvenile birds (Table 16). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance to breeding birds.

Table 16 Shag, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Immature	Juvenile		
Colony attendance	93.4	1.3	5.2	345	33.6
Autumn/winter	97.1	2.9	0	85	38

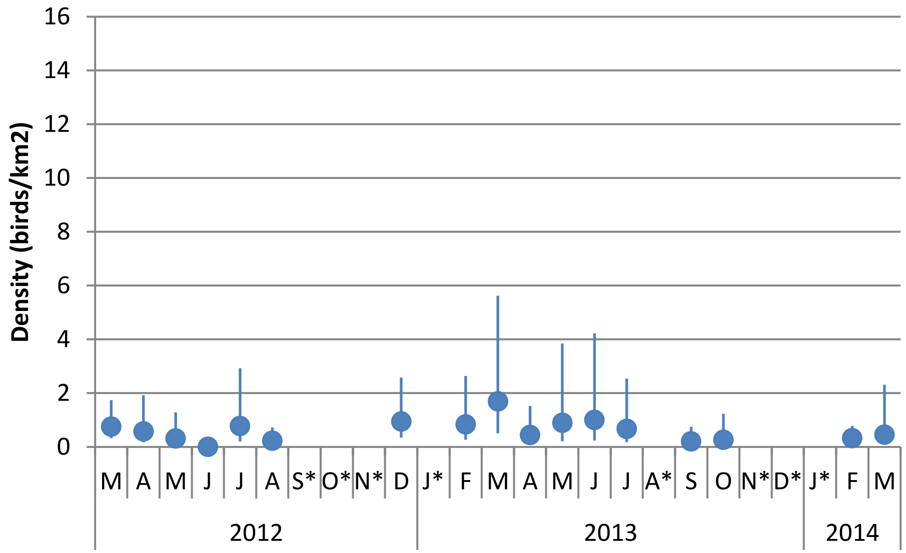
Winter period

167. The mean estimated number of shags present in the Survey Area during the winter period was 59 (95%UCL: 144 birds, Table 15, Figure 10d). This represents 0.1%-0.3% of the estimated minimum non-breeding period population of 41,503 birds for the NW North Sea BDMPS region (Furness, 2014).

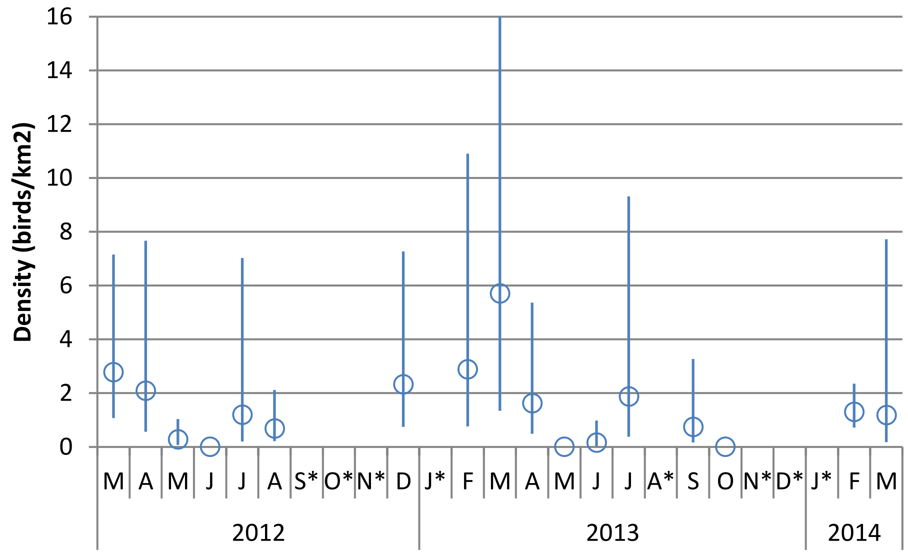
168. Based on the density in the winter period, the estimated mean number of shags in the AfL+1km was 47 individuals (95%UCL: 132, Table 15, Figure 10d). These estimates represent 0.1%-0.3% of the assumed regional winter period population and therefore the AfL+1km area is considered to have **low** importance as a foraging area for the population during this time of year.

169. A total of 97.1% of the shags that were aged during the breeding season were adults (or at least birds two years and older) and the rest were immature birds (Table 16). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance.

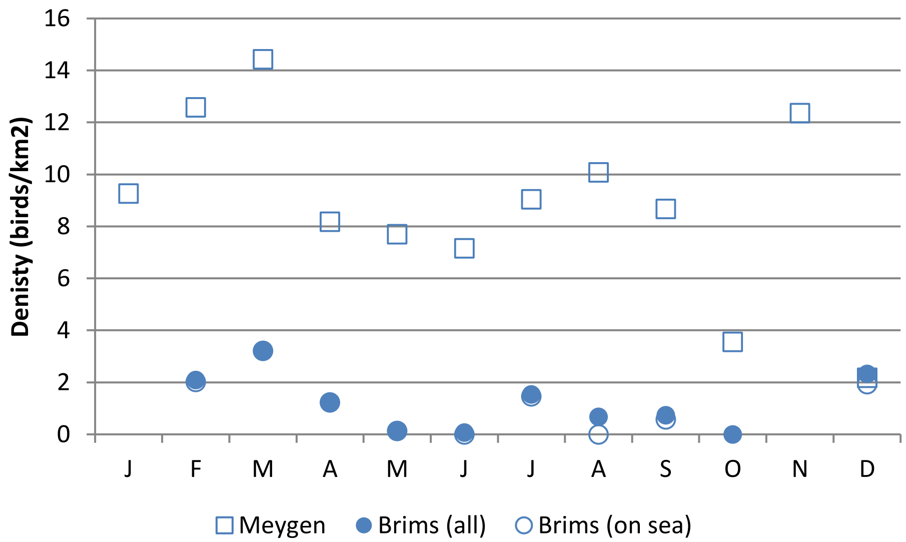
Figure 10. Shag density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



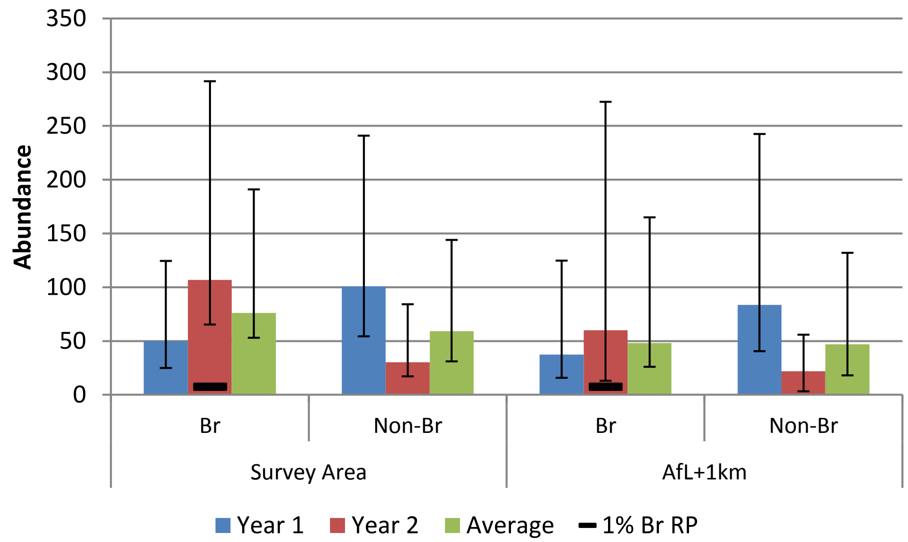
a. Estimated (monthly) survey density for the whole Survey Area, (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

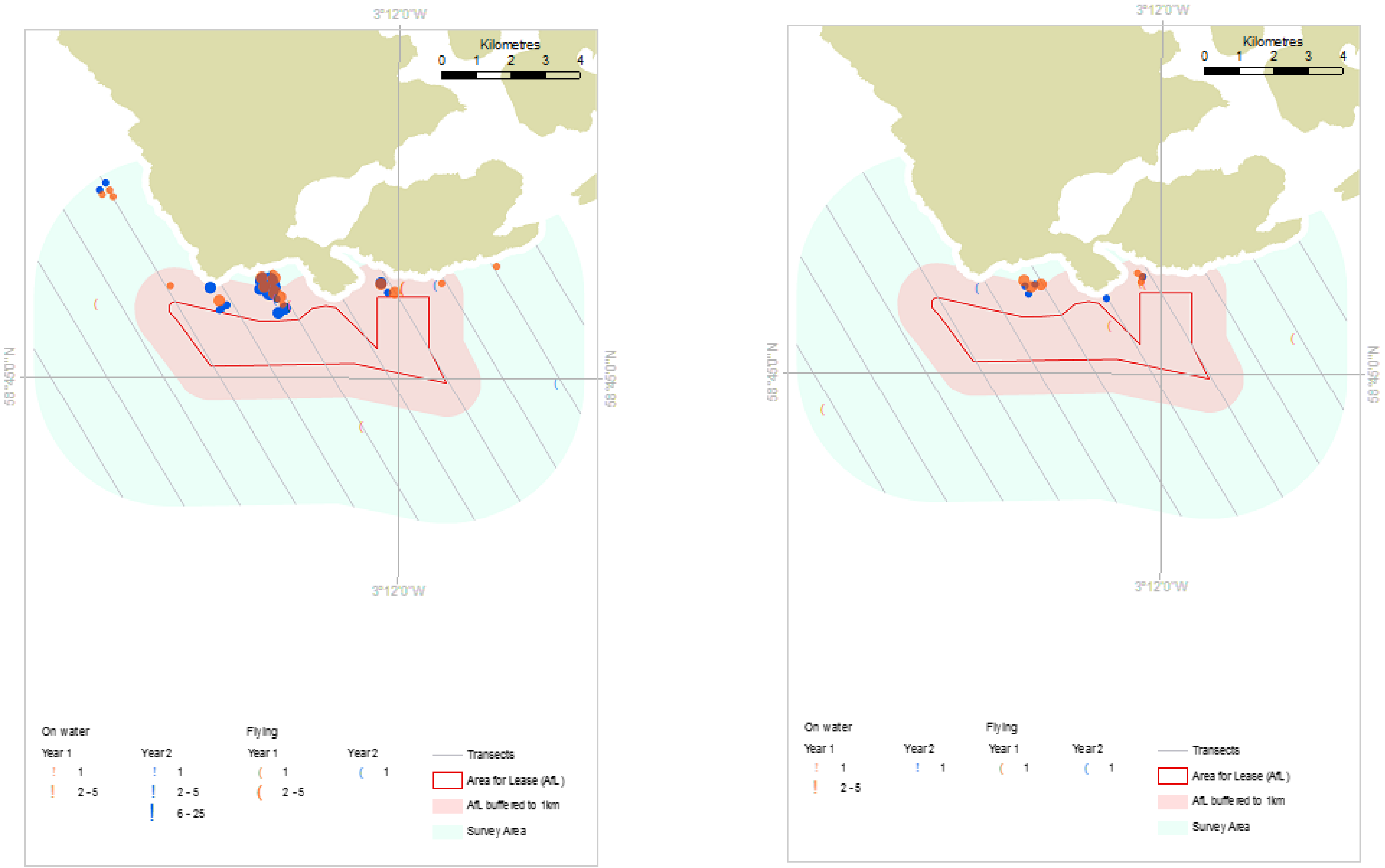


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 11. Distribution and abundance of shags recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Mar-Aug, 14 survey days), and b) the non-breeding period (Sep-Feb, 6 survey days).



a) Breeding (attending colony)

b) Non-breeding (overwintering)

Behaviour

170.The maps presenting the distribution of records show that birds were almost exclusively present in the 1km buffer around the AfL area – with the largest concentrations seen in inshore waters between the AfL and the coast line (Figure 11a and b), regardless of season. In fact, during the 2012-2013 breeding seasons no shags were recorded within the AfL area.

171.During the breeding season a total of 64% of all observations were of birds on the sea surface, with the remaining birds in flight. This percentage fell to 54% during the winter period.

172.Wanless *et al.* (1991) recorded shag diving to mean depths of 33 to 35m (maximum 43m). Daunt *et al.* (2003) observed similar results, recording a maximum dive depth of 26m. Watanuki *et al.* (2005) recorded birds diving between 10 to 43m. The results of Wanless *et al*. (1997) also recorded similar depths in general but with one dive at a study site in Shetland having an exceptional maximum depth of 61m.

173.During the colony-attendance period there was a strong tendency for shag flights to be orientated towards the east and northeast (figure not shown, sample size: 82 birds). This likely indicates connectivity to the nearby colonies on Switha, Swona and Hoy.

Likely origins

138.Breeding shags have one of the shortest foraging ranges of seabirds occurring in the UK, and – even using the maximum range of 17 km, rounded up to 20km - as a result the regional breeding population encompasses a relatively small area in southern Orkney and along the northern Caithness coastline. The closest colonies are on Hoy, Switha, Swona, Flotta and the Pentland Firth Islands– all within mean foraging range – with the remainder located around the maximum range (SMP database). Of the former group of colonies those on the south coast of Hoy, and Flotta and Swona to the east are relatively large (tens of AONs), possibly explaining the predominance of shag observations in the eastern half of the Survey Area.

139.Outside the breeding season shags tend to disperse away from exposed coast lines, although the majority of adult birds remain close to their breeding colonies (<50km, Wernham *et al.* 2002). Immature birds disperse over larger distances than adults, though generally remain within 100km from their natal site. The birds seen in the Survey Area from September onwards are likely to originate from any of the colonies on Orkney, Caithness and Sutherland, as well as birds from Shetland.

Status and protection

140.The UK population has been in decline since the late eighties, with a 41% decrease between 2000 and 2013 (JNCC, 2014). Three SPA populations within 80km of the Pentland Firth have decreased by 65% since designation (MacArthur Green 2013). It is unclear whether declines at large colonies are representative for the population as a whole as smaller colonies are less likely to be affected by density dependence processes such as competition, one of the main drivers behind declining numbers (Furness 2014).

Vulnerability to tidal device impacts

142.Shags are considered to have moderate vulnerability to vessel disturbance and displacement by structures, yet high vulnerability in relation to the potential impacts of tidal developments specifically, largely in relation to potential collision risk (Table 5).

Relevance to Project

143.Based on the information available – high site importance and high vulnerability levels - the potential for significant impacts is considered a possibility.

Information gaps

144.None of importance.

Comparison with MeyGen surveys

145. Comparing the AfL+1km's average monthly densities with surveys undertaken for the nearby MeyGen project between 2009 and 2011 shows a similar seasonal pattern (Figure 10c). Densities are highest from late winter to the start of the breeding season, decrease during the peak incubation period and are somewhat higher again towards the end of the breeding season. Across the year densities in the Brims Survey Area are substantially lower than those at the MeyGen site. This is almost certainly a reflection of MeyGen's proximity to the island of Stroma, which supports substantial numbers of breeding shag. Winter months for which comparison of densities is possible are either similar in magnitude (October, December) or substantially higher for MeyGen (February) – the latter in line with the overarching annual pattern. This indicates that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For shag the current dataset is therefore considered fit for purpose.

Arctic skua

Overview

174. Arctic skuas are a breeding summer visitor and passage migrant to northern Scotland. The species was regularly recorded in low numbers in the Survey Area in the summer months). The birds seen were likely to be breeding and passage birds. This species typically forages at or above the sea surface (aerial predation) and is therefore not exposed to potential underwater collision risk and has low sensitivity to human disturbance.

Table 17 Arctic skua seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	8	1	1	0.02	1	0	3	0.15	5	18
AfL + 2 km										
Colony attendance	8	2	3	0.04	2	0	12	0.23	12	61
AfL + 3 km										
Colony attendance	8	4	5	0.04	3	1	13	0.17	13	61
Survey Area										
Colony attendance	8	8	9	0.05	6	3	18	0.17	19	63
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony attendance period

175. The estimated mean number of Arctic skuas present in the Survey Area during the colony attendance period was 6 birds (95% UCL: 18 birds, Table 17). These numbers represent approximately 0.6% and 1.9% respectively of the regional breeding population of 930 birds (Mitchell *et al.* 2004). Due to the low number of encounters with this species the confidence limits on this estimate are relatively wide.

176. The mean number present in the AfL+1km area during the colony attendance period was just 1 bird (95%UCL: 3 birds, Table 17). These numbers represent approximately 0.1%-0.3% of the regional breeding

population and thus the AfL+1km area is considered to have **low** importance as a foraging area for this species.

Winter period

177. No birds were recorded during the passage or winter seasons.

Behaviour

178. As expected of a wide-ranging, opportunistic predatory species, the distribution of records shows that birds were approximately evenly spread over the Survey Area (Figure 12).

179. On average, 83% of Arctic skuas estimated to be present during the breeding season were in flight, the remainder were sitting on the sea. The species is a true aerial predator and is not known to enter the water column in pursuit of prey (Furness 1987).

Likely origins

180. Tracking studies estimate that the maximum foraging range of breeding Arctic skua is 75 km, and the MMFR is 63 km (Thaxter *et al.* 2012). The closest breeding colonies are in southern Orkney (Hoy, Swona, South Walls) and the Caithness Flows. Therefore, it is certain that the birds seen in the Survey Area in the breeding season are foraging breeding adults.

Status and protection

181. The Scottish population has an unfavourable conservation status. It has undergone a long term decline in numbers, amounting to a 74% reduction since 2000 when 2,100 occupied territories were counted (Mitchell *et al.* 2004, JNCC 2014). It is therefore possible that as few as 500 territories remain across Scotland.

182. Comparison of populations at the Orkney SPAs (and Fair Isle) between the time of citation and more recent estimates shows a 72% decline (MacArthur Green 2013; Orkney Bird Report, 2009).

183. In turn the above makes use of Seabird 2000 data to define the regional breeding population inappropriate. During the national census Orkney was estimated to support a population of 720 territories (Mitchell *et al.*, 2004). Given the magnitude of decline it is possible that there are as few as 400 individual adult birds left on the islands.

Vulnerability to tidal device impacts

184. Arctic skuas are considered to have very low vulnerability to vessel disturbance and displacement by structures as well as potential impacts of tidal energy developments specifically (Table 5).

Relevance to Project

185. Based on the information available – low site importance and very low vulnerability levels - the potential for significant impacts is considered unlikely.

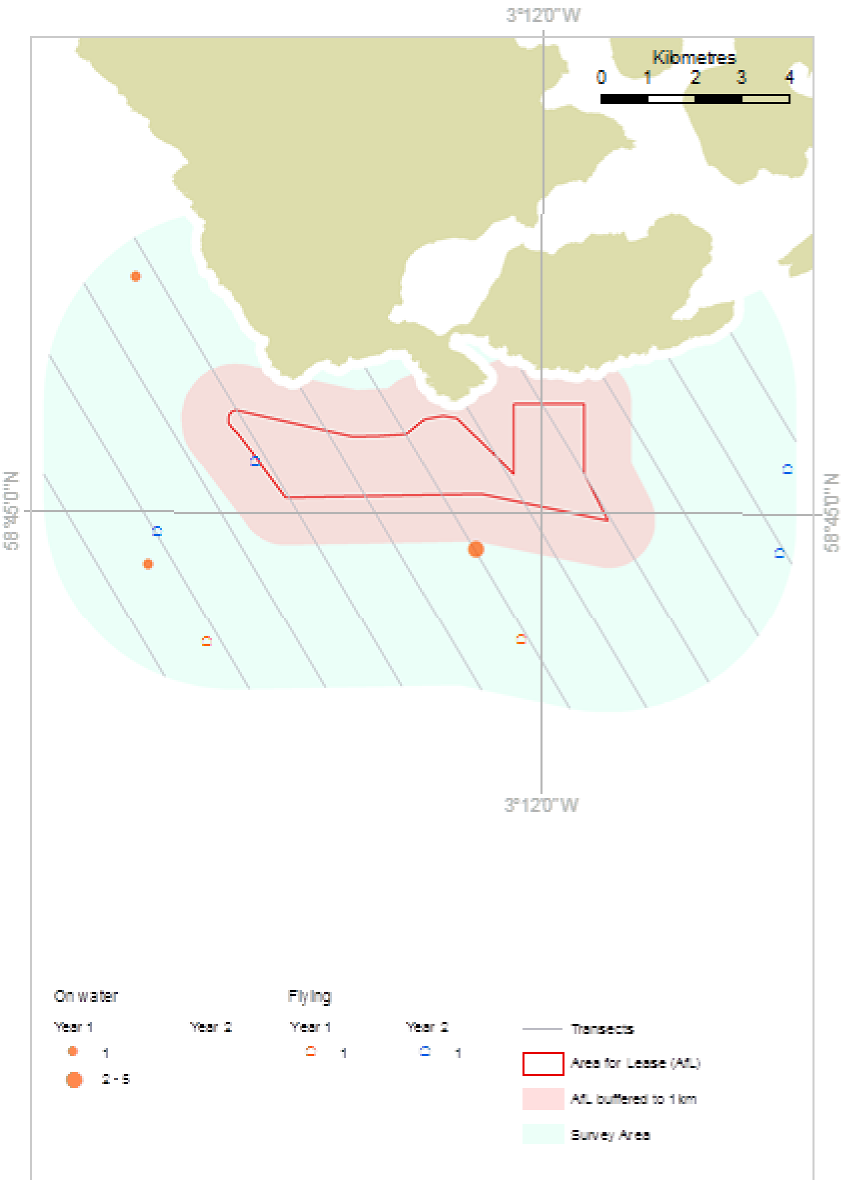
Information gaps

186. None of importance.

Comparison with MeyGen surveys

187. No comparison with the MeyGen surveys is required as Arctic skua does not occur in either area during the winter period.

Figure 12. Distribution and abundance of Arctic skuas recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Aug, 9 survey days). No in-transect records for the non-breeding period.



a) Colony attendance period

Great skua

Overview

188. Great skuas are a breeding summer visitor and passage migrant to northern Scotland. The species was recorded in moderate numbers in the Survey Area in the summer and autumn months. The birds seen were likely predominantly breeding birds. This species typically forages at or above the sea surface (aerial predation) and is therefore not exposed to potential underwater collision risk and has low sensitivity to human disturbance.

Table 18 Great skua seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	9	31	36	0.67	21	15	39	1.62	52	81
AfL + 2 km										
Colony attendance	5	71	149	1.36	72	23	150	4.41	233	386
AfL + 3 km										
Colony attendance	9	76	135	0.99	76	35	161	4.55	351	672
Survey Area										
Colony attendance	9	106	191	0.96	109	51	207	4.41	497	825
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony attendance period

189.The mean estimated number of great skuas present in the Survey Area during the colony attendance period was 109 birds (95%UCL: 207 birds, Table 18). This represents approximately 2.4%-4.6% of the assumed regional breeding population of 4,470 birds (Mitchell *et al.*, 2004).

190.The estimated mean number of great skuas in the AfL+1km area was 21 birds (95%UCL: 39, Table 18). These numbers represent 0.5%-0.9% of the regional breeding population and thus the AfL+1km area is considered to have **low** importance as a foraging area for this population.

Behaviour

191.Great skuas were widespread across the Survey Area, although during the breeding season the majority of birds on the sea surface were recorded to the south and west of the AfL+1km buffer. (Figure 13).

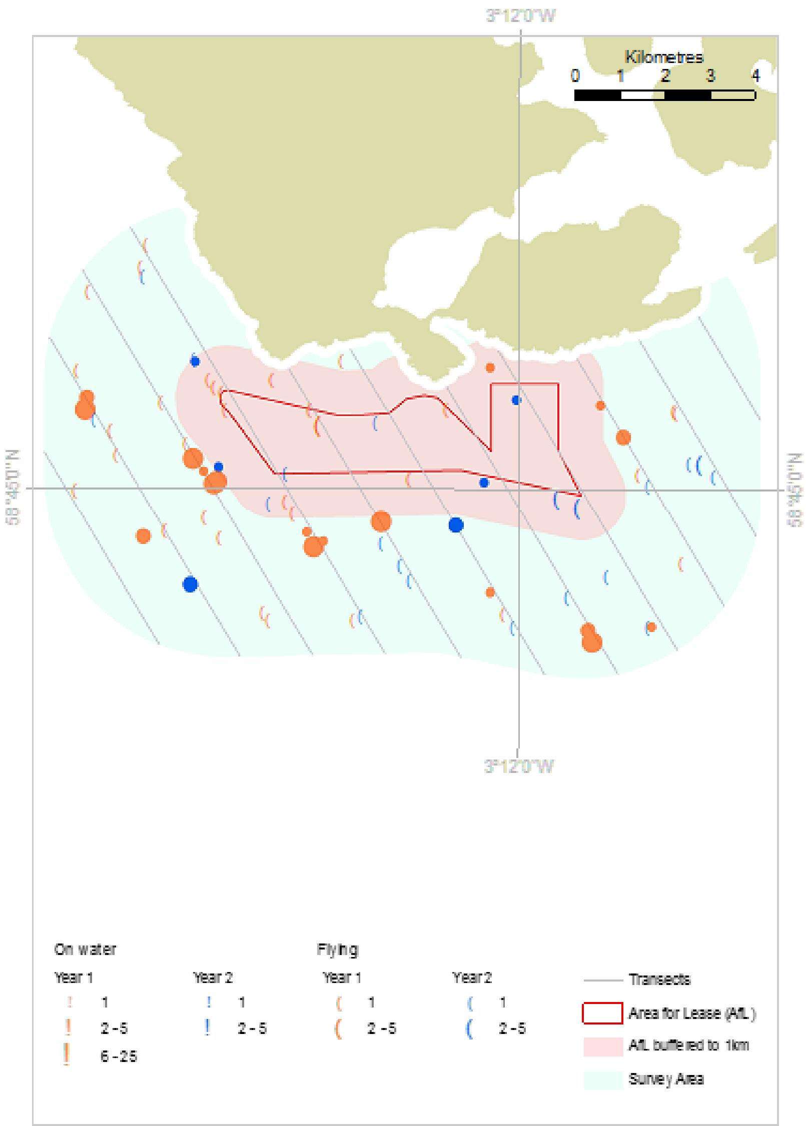
192.On average, 72% of great skuas estimated to be present during the breeding season were in flight, the remainder were sitting on the sea. The species is essentially an aerial predator, and, if entering the water column uses only the first meter (Furness 1987).

Status and protection

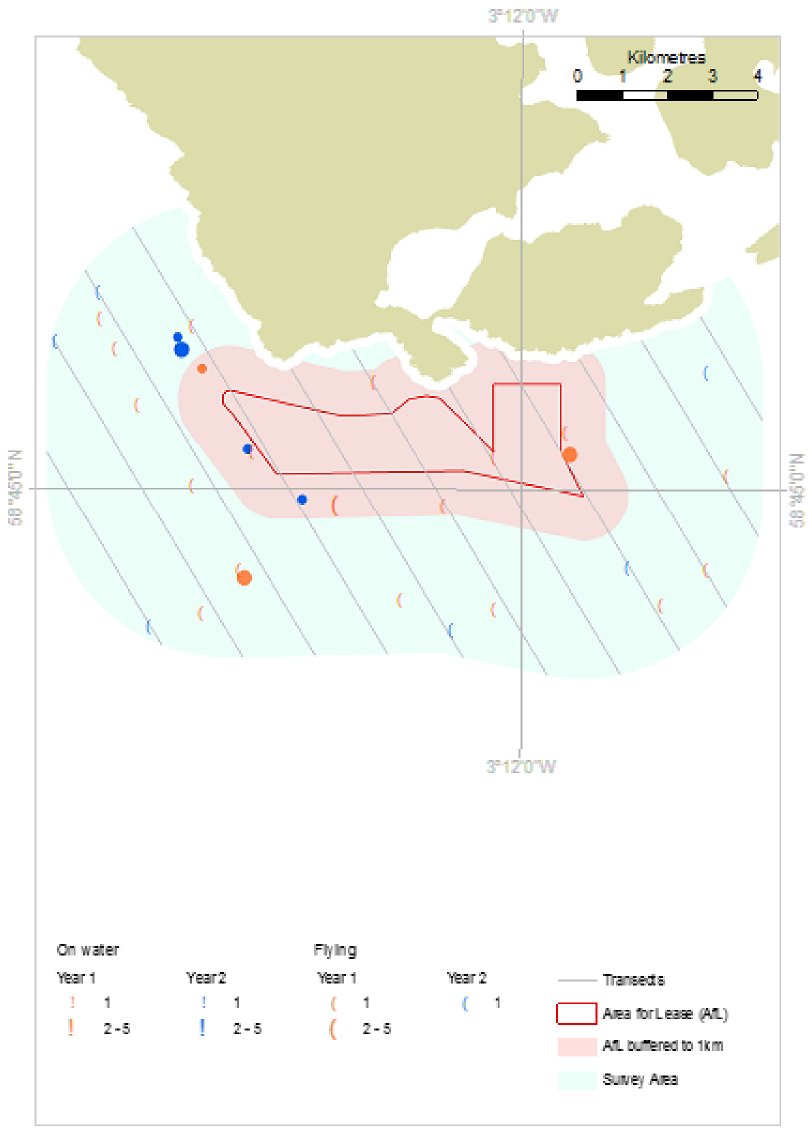
193.The Scottish population has a favourable conservation status and has undergone a long term increase in numbers during the 20th century (Mitchell *et al*., 2004). Great skua has a relatively small global population size. The Scottish breeding population numbers approximately 9,600 pairs and at the time of census represented around 60% of the global population (Mitchell *et al., 2*004). Limited monitoring data means no current information on population change is available (JNCC, 2014).

194.Based on population trends at three SPAs within 80km of the Pentland Firth the species has declined by 13% at these sites since the time of designation.

Figure 13. Distribution and abundance of great skuas recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Aug, 9 survey days). No in-transect records for the non-breeding period.



a) Breeding



b) Non-breeding

Likely origins

195. Tracking studies show that the maximum foraging range of breeding great skua is 219 km, and the MMFR is 86 km (Thaxter *et al.,* 2012). The closest breeding colonies are on southern Orkney, and it is thus highly likely that the vast majority of the birds seen in the Survey Area in the breeding season were foraging adults from these colonies, in particular the large numbers breeding on Hoy. Coastal colonies in Caithness and Sutherland likely contribute to the population in the Survey Area as well. The regional breeding population is estimated at 4,470 birds using the MMFR.

196. The small numbers seen in the Survey Area in spring and autumn are likely passage birds to and from colonies in Orkney and Shetland (Wernham *et al.,* 2002).

Vulnerability to tidal device impacts

197. Great skuas are considered to have very low vulnerability to vessel disturbance and displacement by structures and very low vulnerability to potential impacts from tidal energy developments specifically (Table 5).

Relevance to Project

198. Concerns are likely to be low as great skua is relatively scarce in the AfL+1km area. The species is relatively tolerant of disturbance and displacement and has negligible potential for underwater collision mortality. The potential for significant impacts is therefore considered unlikely.

Information gaps

199. None of importance.

Comparison with MeyGen surveys

200. No comparison with the MeyGen surveys is required as great skua does not occur in either area during the winter period.

Herring gull

Overview

201. Herring gulls were regularly present in the Survey Area in small numbers in the winter period, although no birds were seen at all during the breeding season. The species has low sensitivity to human disturbance and is not considered vulnerable to underwater collision risk as it predominantly feeds at the sea surface.

Table 19 Herring gull seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Winter	8	1	1	0.04	1	0	10	0.30	10	60
AfL + 2 km										
Winter	8	2	2	0.04	2	0	15	0.18	10	64
AfL + 3 km										
Winter	8	5	6	0.09	7	2	37	0.39	30	168
Survey Area										
Winter	8	6	7	0.07	8	3	38	0.30	34	173
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony-attendance period

202. Based on the Seabird 2000 census results (Mitchell *et al.,* 2004) the regional population consists of 5,294 adults. The actual number of herring gulls present in this defined region during the breeding season is likely to be substantially greater than this figure because of the presence of immature birds. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 48% of herring gull populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

203. Despite the presence of substantial regional population no birds were seen in the Survey Area during the colony-attendance period (Table 19). The area is therefore considered to have **negligible** importance as a foraging area for the regional breeding population.

Table 20 Herring gull, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Juvenile	Immature		
Colony attendance	-	-	-	0	-
Autumn/winter	65.1	27.9	7	43	0

Winter period

204. The mean number of herring gulls present in the Survey Area during the winter period was 8 birds (95%UCL: 38 birds, Table 19). This represents <0.1% of the estimated minimum non-breeding period population of 466,511 birds for the North Sea and Channel BDMPS region (Furness, 2014).

205. In the winter the estimated mean number of herring gulls in the AfL+1km was 1 individual (95%UCL: 10 birds, Table 19). These estimates both represent <0.1% of the assumed regional winter period population and thus the AfL+1km area is considered to have **negligible** importance as a foraging area for this population.

206. A total of 65.1% of the herring gulls that were aged during the winter period were adults and the rest were immature or juvenile birds (Table 20). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance.

Behaviour

207. The distribution map reflects the scarce status of the species in the Survey Area, with no spatial pattern apparent (Figure 15).

208. Of the herring gulls seen in the winter period 89% were in flight, the remainder were sitting on the sea.

209. Herring gulls use various methods of feeding: dipping-to-surface to take items on or just below surface; surface- (or sometimes shallow-) plunging; surface-seizing, on occasion immersing head and front part of body; and shallow surface-diving, though no deeper than to 1m (Snow and Perrins, 1998).

Likely origins

210. Breeding herring gulls range moderate distances to forage; the MMFR is 61 km, although the mean foraging range is a rather modest 10.5km (Thaxter *et al.,* 2012). It is possible that birds in Orkney habitually forage much closer to their breeding sites than in other parts of the UK, which would go some way to explain the species' absence during the breeding season. A small colony was found on the Brims peninsula during breeding bird surveys in 2012 (Aquatera, 2012).

211. Outside the breeding season herring gulls from northern Scottish breeding colonies show a mixture of sedentary behaviour and short to moderate distance southwards movements (Wernham *et al.,* 2002). The birds seen in the Survey Area from September onwards are likely to originate from colonies throughout eastern and northern Scotland. From November onwards these will be joined by birds from northern Scandinavia (Wernham *et al.,* 2002).

Status and protection

212. The species' UK population as a whole has decreased by 30% between 2000 and 2013 (JNCC 2014). Similarly, the Scottish population has an unfavourable conservation status on account of a long term decline of as much as 58% over the past 25 years, equating to an average decline rate of 3.4% per annum (SNH, 2012). This decline is linked to available food supply, as well as to changes in human activities such as fishing and refuse management (Mitchell *et al*., 2004).

213. East Caithness Cliffs SPA has seen a decrease of 64% between 1986 and 1999 (MacArthur Green 2013). Given the known decline of the species it is possible that the nearest colonies to the Survey Area in the Pentland Firth have either disappeared or have been substantially reduced, which would be an alternative explanation as to the absence of the species during the breeding season.

Vulnerability to tidal device impacts

214. Herring gulls are considered to have very low vulnerability to vessel disturbance and displacement by structures as well as the potential impacts of tidal energy developments specifically (Table 5).

Relevance to Project

215. Concerns are likely to be low as herring gull is a scarce winter visitor to the AfL+1km area and entirely absent during the breeding season. The species is relatively tolerant of disturbance and displacement and has negligible potential for underwater collision mortality.

Information gaps

216. None of importance.

Comparison with MeyGen surveys

217. Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea; insufficient data available from the AfL+1km sector to allow for comparison) and MeyGen sites (birds on sea only) show similar, very low densities across both sites during the winter season (Figure 14). This indicates that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For herring gull the current dataset is therefore considered fit for purpose.

218. Of interest is that density estimates for the MeyGen site - although only referring to birds on the water – are zero throughout the breeding season, exactly the same pattern as observed in the Brims Survey Area.

Figure 14. Herring gull comparison of average monthly density between the BTA Survey Area and the MeyGen site

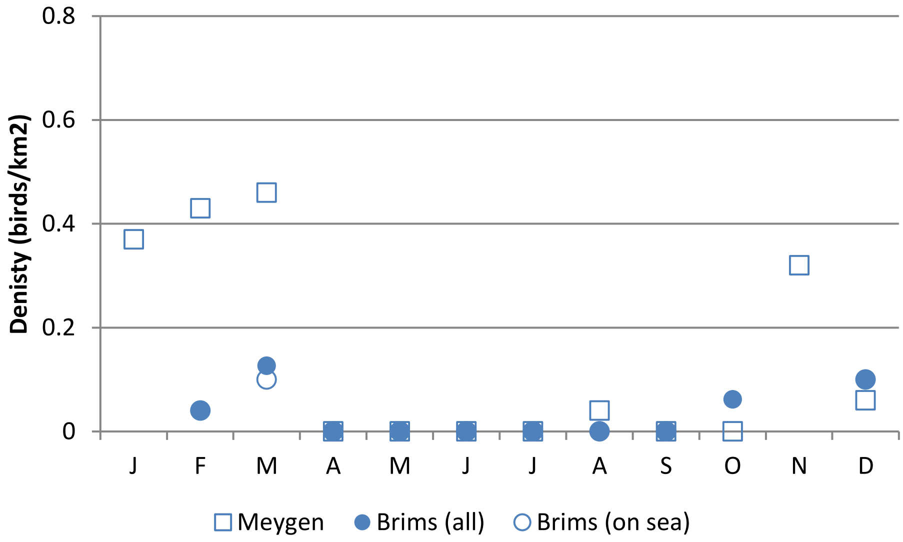
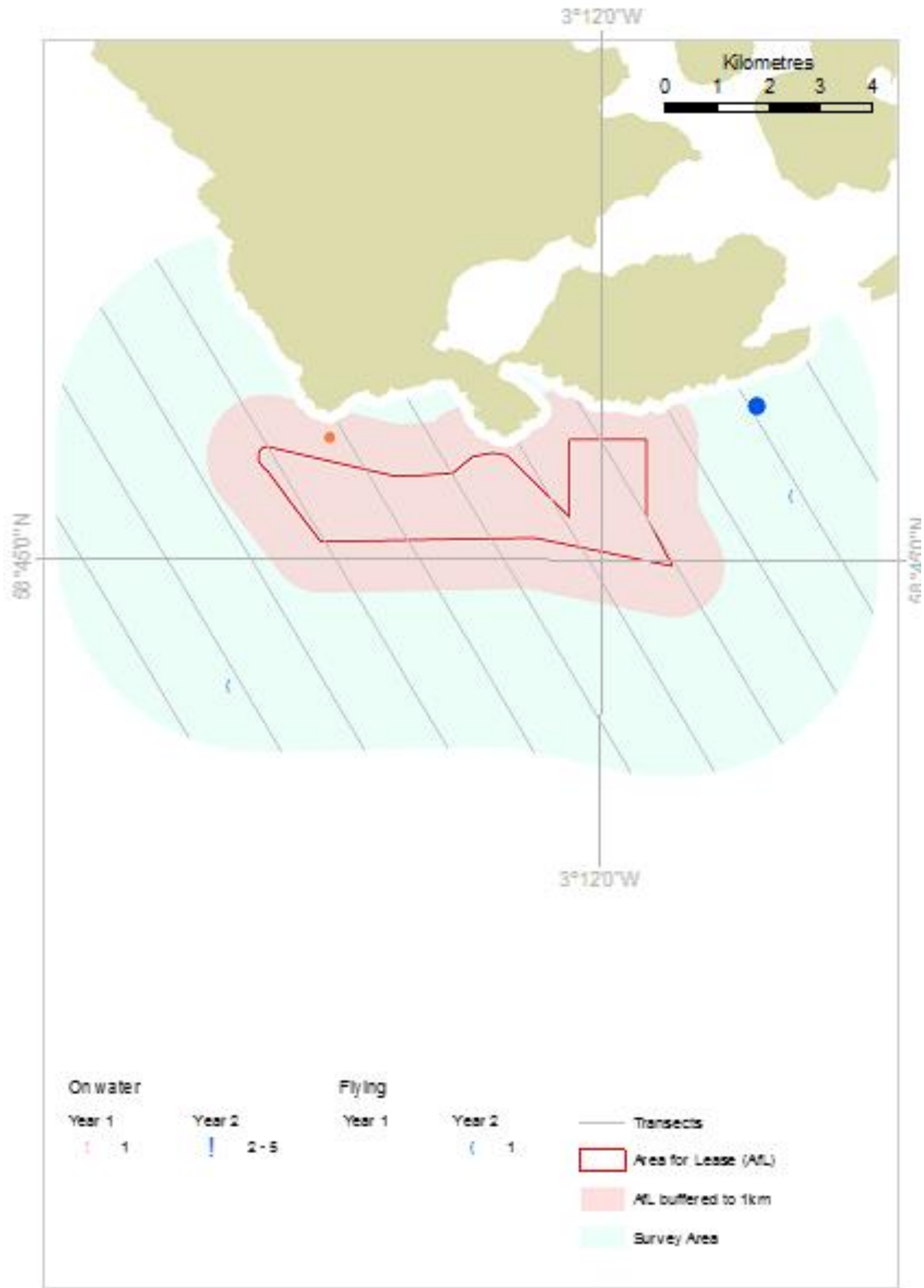


Figure 15. Distribution and abundance of herring gulls recorded during ESAS surveys between March 2012 and March 2014 for a) the non-breeding period (Sep-Mar, 11 survey days). No in-transect records during the breeding period.



Great black-backed gull

Overview

219. Great black-backed gulls were regularly present in the Survey Area, with small numbers of birds present year-round. The species has low sensitivity to human disturbance and is not considered vulnerable to underwater collision risk as it predominantly feeds at the sea surface.

Table 21 Great black-backed gull seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	8	1	1	0.02	1	0	5	0.16	5	34
Winter	8	4	4	0.09	3	0	13	0.37	12	41
AfL + 2 km										
Colony attendance	8	2	2	0.02	1	0	7	0.09	5	27
Winter	8	7	7	0.12	6	1	19	0.44	23	69
AfL + 3 km										
Colony attendance	8	3	3	0.02	2	0	9	0.07	5	26
Winter	8	11	11	0.14	11	4	36	0.39	30	167
Survey Area										
Colony attendance	8	3	3	0.02	2	0	8	0.05	5	24
Winter	8	15	16	0.15	17	8	44	0.40	45	173
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony-attendance

220. The defined regional breeding population based on the Seabird 2000 census results (Mitchell *et al.,* 2004) is 5,156 adults. The actual number of great black-backed gulls present in this defined region during the breeding season is likely to be substantially greater than this figure because of the presence of immature birds. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 44% of great black-backed populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

221. The mean estimated number of great black-backed gulls present in the Survey Area during the colony-attendance was 2 birds (95%UCL: 8 birds, Table 21).

222. The estimated mean number of great black-backed gulls in the AfL+1km area during the breeding season was 1 bird (95%UCL: 5 birds, Table 21) representing <0.1%-0.1% of the regional breeding population and thus the area is considered to have **negligible** importance as a foraging area for the regional breeding population.

223. A total of 86.7% of the great black-backed gulls that were aged during the breeding season were adults and the rest were immature birds (Table 22). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance to breeding birds.

Table 22 Great black-backed gull, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Immature	Juvenile		
Colony attendance	86.7	13.3	0	15	0
Autumn/winter	58	30	12	52	3.8

Winter period

224. The mean number of great black-backed gulls present in the Survey Area during the winter period was 17 birds (95%UCL: 44, Table 21). This represents <0.1% of the estimated minimum non-breeding period population of 91,399 birds for the North Sea BDMPS region (Furness, 2014).

225. In the winter the estimated mean number of great black-backed gulls in the AfL+1km area was 3 birds (95%UCL: 13, Table 21). These estimates represent <0.1% of the assumed regional winter period population thus the area is considered to be of **negligible** importance as a foraging area for the population.

226. A total of 58% of the great black-backed gulls that were aged during the winter period were adults and the rest were immature or juvenile birds (Table 22). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance.

Behaviour

227. With only few sightings, no pattern is apparent from the species' distribution in the Survey Area (Figure 16).

228. On average, 100% of great black-backed gulls present during the breeding season were in flight, while in winter 81% of all birds were recorded in flight.

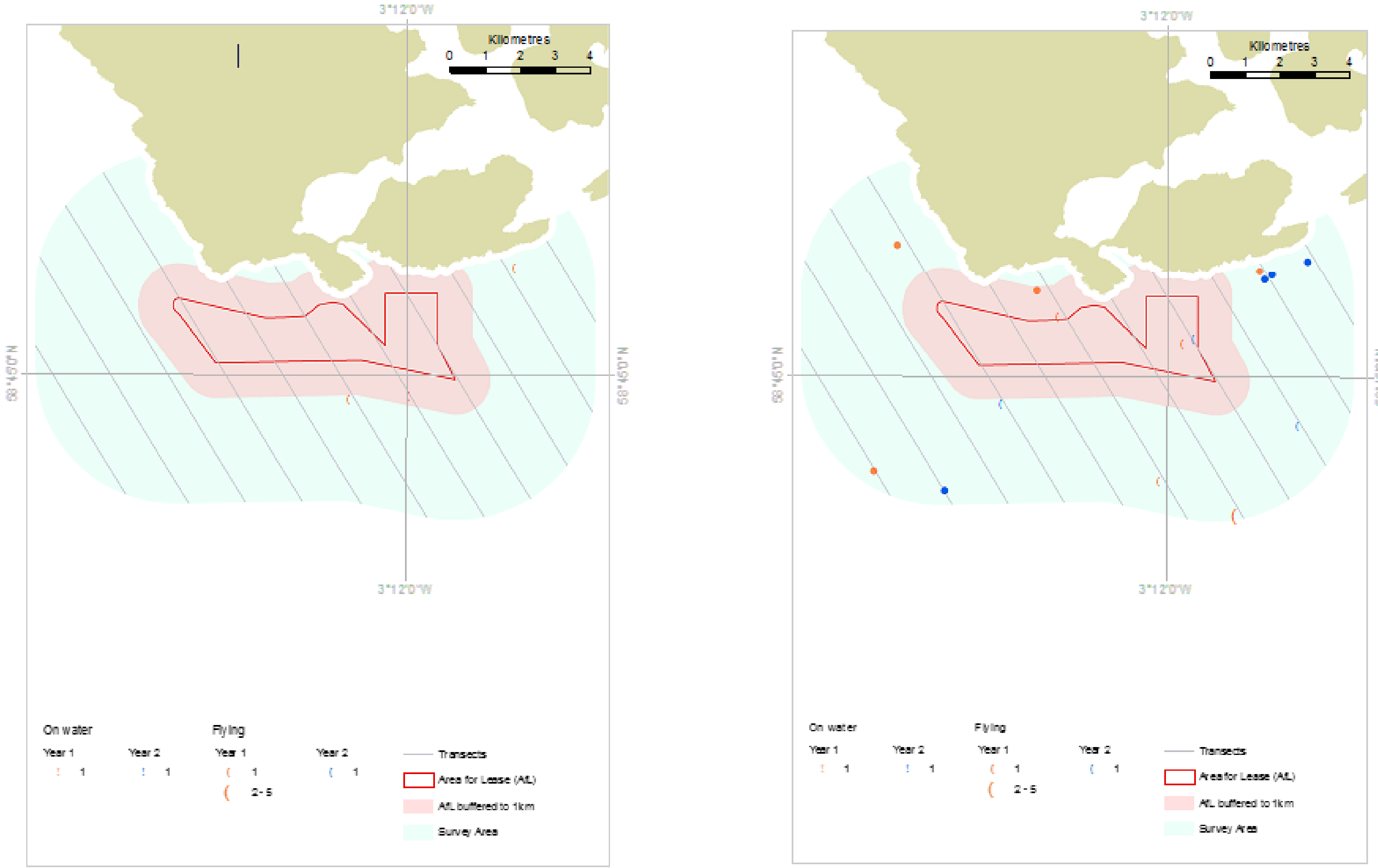
229. The species has similar feeding behaviour to herring gull, and is not known to enter the water column beyond 1m of depth (Cramp and Simmons, 1980).

Likely origins

230. Breeding great-black backed gulls range over relatively small distances (up to 40 km) to forage, though this is based on only a small sample size of tracked birds (Ratcliffe *et al*., 2000). Based on this distance the regional population is defined as most of southern Orkney as well as parts of the Caithness coast. Birds recorded in the breeding season were therefore almost certainly locally breeding birds.

231. Outside the breeding season great-black backed gulls from northern Scottish breeding colonies show a mixture of sedentary behaviour and short to moderate distance southwards movements (Wernham *et al.,* 2002). The birds seen in the Survey Area from September onwards are likely to originate from colonies throughout eastern and northern Scotland. From November onwards these will be joined by birds from northern Scandinavia (Wernham *et al.,* 2002).

Figure 16. Distribution and abundance of great black-backed gulls recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Aug, 9 survey days), and b) the non-breeding period (Sep-Mar, 11 survey days).



a) Breeding (attending colony)

b) Non-breeding (overwintering)

Status and protection

232. The UK population has declined by 24% between 2000 and 2013 (JNCC 2014). Similarly, the Scottish population has an unfavourable conservation status on account of a long term decline. It is has declined by 53% over the past 25 years, equating to an average decline rate of 3.0% per annum (SNH 2012) The decline has been linked to food supply and changes in human activities such as fishing and refuse management (Mitchell *et al.,* 2004).

233. Comparison of four SPAs within 80km of the Pentland Firth show that these colonies have decreased by as much as 57% since the time of designation (MacArthur Green 2013).

Vulnerability to tidal device impacts

234. Great black-backed gulls are considered to have very low vulnerability to vessel disturbance and displacement by structures as well as the potential impacts of tidal energy developments specifically (Table 5).

Relevance to Project

235. Concerns are likely to be low as great black-backed gull is a scarce winter visitor to the AfL+1km area and entirely absent during the breeding season. The species is relatively tolerant of disturbance and displacement and has negligible potential for underwater collision mortality.

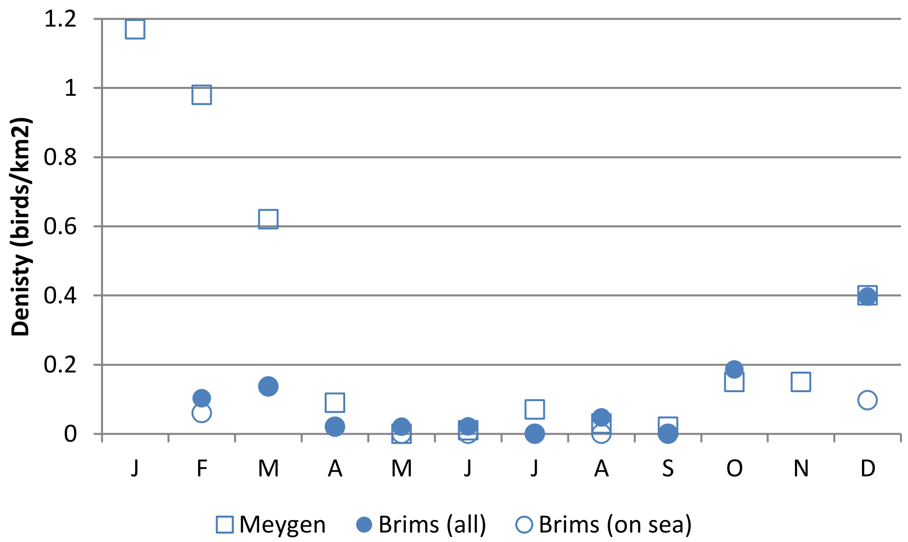
Information gaps

236. None of importance.

Comparison with MeyGen surveys

237. Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea; insufficient data available from the AfL+1km sector to allow for comparison) and the MeyGen site (birds on sea only) show similar, very low densities across both sites during the winter season (Figure 17). This indicates that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For great black-backed gull the current dataset is therefore considered fit for purpose.

Figure 17. Great black-backed gull comparison of average monthly density between the BTA Survey Area and the MeyGen site



Common gull

Overview

238. Common gulls were regularly present in the Survey Area in small numbers during the year. The species has low sensitivity to human disturbance and is not considered vulnerable to underwater collision risk as it predominantly feeds at the sea surface.

Table 23 Common gull seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	8	1	1	0.02	1	0	4	0.15	5	27
Winter	8	1	1	0.03	1	0	7	0.20	6	41
AfL + 2 km										
Colony attendance	8	3	4	0.05	3	0	14	0.32	17	70
Winter	8	3	3	0.04	2	0	10	0.13	7	39
AfL + 3 km										
Colony attendance	8	3	4	0.03	3	0	9	0.22	17	52
Winter	8	4	4	0.04	3	0	14	0.20	15	54
Survey Area										
Colony attendance	8	5	10	0.06	6	0	24	0.36	41	117
Winter	8	7	7	0.06	6	1	19	0.27	31	82
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony-attendance period

239. The estimated mean number of common gulls present in the Survey Area during the colony-attendance period was 6 birds (95%UCL: 24 birds, Table 23). These estimates represent 0.1% and 0.4% respectively of the assumed regional breeding population of 5,930 adults.

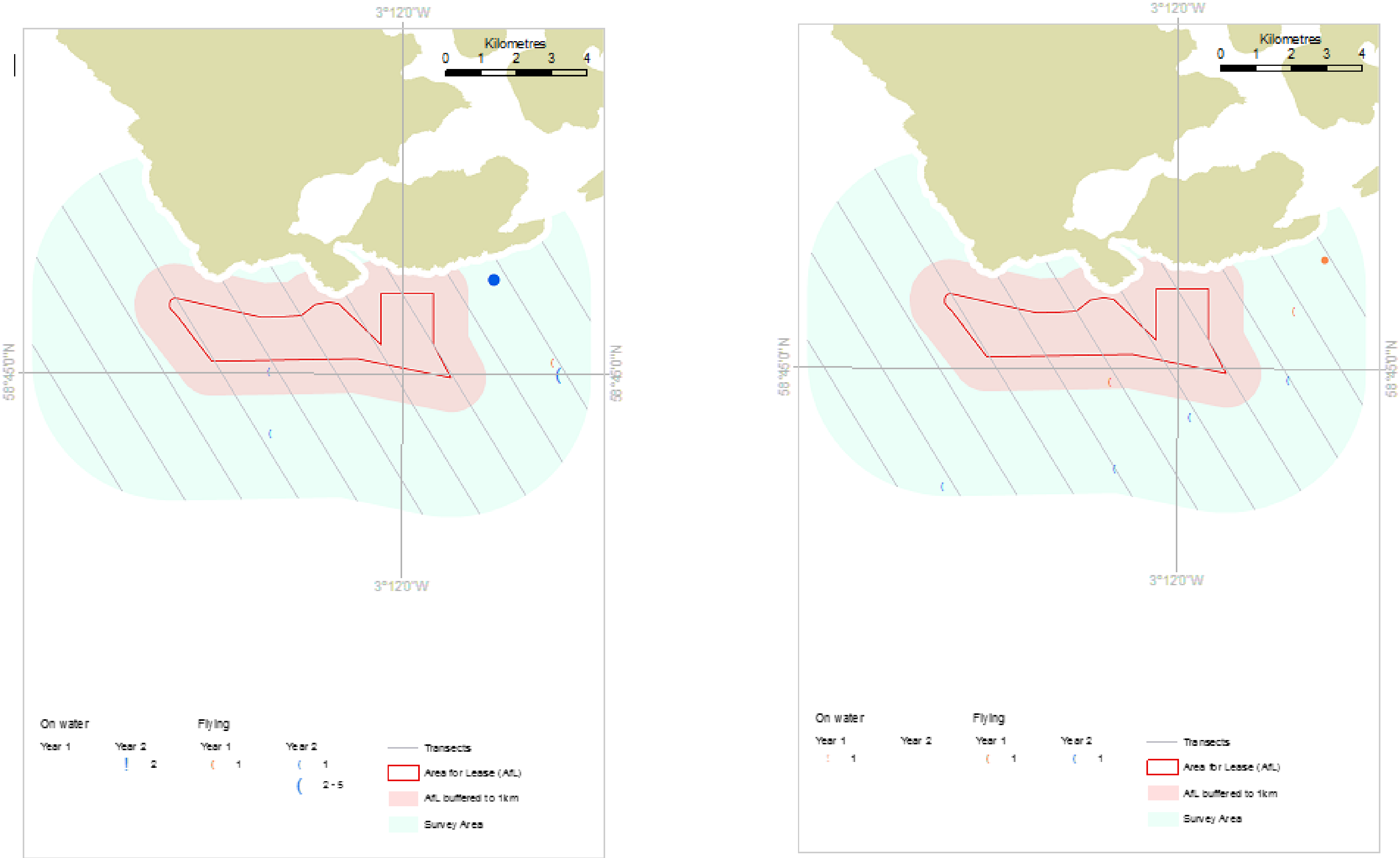
240. The estimated mean number of common gulls during the breeding season in the AfL+1km area was 1 individual (95%UCL: 4 birds). These numbers represent <0.1% and 0.1% respectively of the regional breeding population and thus the AfL+1km area is considered to have **negligible to low** importance as a foraging area for the regional breeding population.

Winter period

241. The mean number of common gulls present in the Survey Area during the winter period was 6 birds (95%UCL: 19 birds, Table 23). These estimates represent 0.1% to 0.3% of the Orkney winter and passage population of 6,000 birds (Forrester *et al.*, 2007).

242. The estimated mean number of common gulls in the AfL+1km area was 1 individual (95%UCL: 7 birds, Table 23). These numbers represent <0.1% to 0.1% of the Orkney winter population and thus the area is considered to have **negligible to low** importance as a foraging area for the population.

Figure 18. Distribution and abundance of common gulls recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Jul, 8 survey days), and b) the non-breeding period (Aug-Mar, 12 survey days).



a) Breeding (attending colony)

b) Non-breeding

Behaviour

243. No apparent distribution patterns emerged from plotting the data as the species occurred in very low numbers and is largely a habitat generalist (Figure 18).

244. During the breeding and winter season respectively 92% and 97% of all birds recorded were seen in flight. The species is not known to enter the water column below 1m of depth (Cramp and Simmons 1980).

Likely origins

245. The few birds recorded during the breeding season are almost certainly local breeding birds from the Orkney population. In winter time large numbers of birds from the continent join the UK population.

Status and protection

246. No UK population trend is available, largely as a result of insufficient monitoring effort. The Scottish population has declined somewhat during the last 10 years (JNCC 2014).

Vulnerability to tidal device impacts

247. Common gulls are considered to have very low vulnerability to vessel disturbance and displacement by structures as well as the potential impacts of tidal energy developments specifically (Table 5).

Relevance to project

248. Based on the information available – negligible to low site importance and very low vulnerability levels - the potential for significant impacts is considered unlikely.

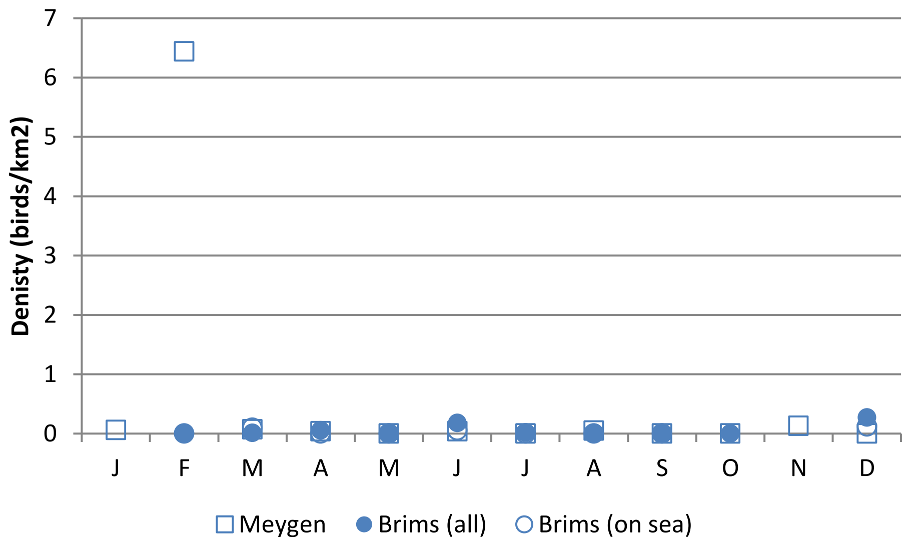
Information gaps

249. No information gaps of importance.

Comparison with MeyGen surveys

250. With the exception of estimates for February surveys, estimated densities for the BTA Survey Area and the MeyGen site during the winter season are very similar and equally low (Figure 19). This indicates that it is unlikely that the existing survey gap (November and January wholly, October and December once) is a cause for concern. For common gull the current dataset is therefore considered fit for purpose.

Figure 19. Common gull comparison of average monthly density between the BTA Survey Area and the MeyGen site



Kittiwake

Overview

251. Kittiwakes were regularly present in the Survey Area in moderate numbers in the summer and smaller numbers in the winter. The species has low sensitivity to human disturbance and is not considered vulnerable to underwater collision risk as it predominantly feeds at the sea surface. Large numbers of kittiwakes breed in northern Scotland but they are undergoing rapid decline.

Colony-attendance period

252. Kittiwakes breeding in Scotland are undergoing rapid decline, at an average rate of -4.2% per annum (derived from SNH, 2012). Thus in the 14-year period since the Seabird 2000 census numbers have declined by approximately 45%. Therefore the current regional breeding population is assumed to be the number estimated by Seabird 2000 census (133,528 adults) multiplied by 0.55, which is 73,440 adults. The actual number of kittiwakes present in this defined region during the breeding season is likely to be greater than this figure because of the presence of immature birds. However, poor breeding success in recent years (a feature of the decline) means that relatively few immature birds are to be expected, as transpired in survey results. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 53% of kittiwake populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

Table 24 Kittiwake seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	9	25	262	5.02	161	11	690	32.69	1,049	3,686
Winter	8	9	13	0.26	8	2	34	0.92	29	158
AfL + 2 km										
Colony attendance	9	67	678	7.77	411	183	1,263	21.18	1,120	3,848
Winter	8	25	34	0.41	22	9	48	1.27	67	174
AfL + 3 km										
Colony attendance	9	120	1619	12.52	966	312	2,609	68.16	5,260	12,441
Winter	8	31	41	0.39	30	10	69	1.46	113	222
Survey Area										
Colony attendance	9	188	2423	13.31	1,503	465	3,863	49.15	5,550	14,296
Winter	8	43	57	0.50	57	17	119	2.26	255	458
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

253. The estimated mean number of kittiwakes present in the Survey Area during the colony-attendance period was 1,503 birds (95%UCL: 3,863 birds, Table 24, Figure 20d). These estimates represent 2.4% and 6.2% respectively of the assumed regional breeding population of 62,792 adults.

254. The estimated mean number of kittiwakes during the breeding season in the AfL+1km area was 161 individuals (95%UCL: 690 birds, Table 24, Figure 20d). These numbers represent 0.3% and 1.1% respectively

of the regional breeding population and thus the AfL+1km area is considered to have low to medium importance as a foraging area for the regional breeding population.

Table 25 Kittiwake, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Immature	Juvenile		
Colony attendance	98.3	1.0	0.7	3,886	60.4
Autumn/winter	76.4	3.4	20.2	92	2.2

255. A total of 98.3% of the kittiwakes that were aged during the colony-attendance period were adults and the rest were immature or juvenile birds (Table 25). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance to breeding birds.

Winter period

256.The mean number of kittiwakes present in the Survey Area during the winter period was 57 birds (95%UCL: 119 birds, Table 24). These estimates both represent <0.1% of the estimated minimum non-breeding period population of 627,816 birds for the North Sea BDMPS region (Furness, 2014).

257.The estimated mean number of kittiwakes in the AfL+1km area was 8 individuals (95%UCL: 34 birds, Table 24). These numbers represent <0.01% of the winter BDMPS population of 627,816 birds for the North Sea region (Furness, 2014) and thus the area is considered to have **negligible** importance as a foraging area for the population.

258.A total of 76.4% of the kittiwakes that were aged during the colony-attendance period were adults and the rest were immature or juvenile birds (Table 25). No attempt has been made to correct for the presence of the latter two age groups in the evaluation of the site's importance.

Behaviour

259.The distribution maps show that although kittiwakes occurred across the Survey Area, bird concentrations were found almost exclusively out with the AfL+1km area (Figure 21 a and b). The statistical analysis examined variation in estimated density between sub-divisions of the Survey Area and showed that the density differences are small and likely to reflect sampling variation rather than genuine differences (Caloo, 2015). Analysis did however establish that for kittiwakes on the sea surface there was a 5% chance that the absence of such observations from the AfL area (without buffer) was a chance occurrence, indicating a preference for surface-dwelling behaviour away from this area.

260.Between 70% (breeding) and 3% (winter) of kittiwakes in the Survey Area were recorded in flight, with the remainder sitting on the sea. The winter value is heavily affected by small sample size during two surveys.

261.Out of 3,796 kittiwakes recorded in the Survey Area during the breeding season 51% were seen foraging, either classified as active searching, surface pecking, dip feeding or feeding (unspecified). Average group size of foraging birds was 27 (range: 1-600 birds).

262.Kittiwakes obtain prey by snatching items from the surface or splash diving just below the surface (Ratcliffe *et al.,* 2000).

263.During the colony-attendance period there was a strong tendency for kittiwake flights to be orientated towards the north and northeast (figure not shown, sample size: 756 birds). This possibly indicates strong connectivity to the nearby colonies on Hoy and South Ronaldsay, although given the proximity to the large numbers of breeding kittiwakes on the north Caithness coastline it is surprising that no clear NE-SW flight axis is apparent from the data.

Likely origins

264. Breeding kittiwakes range moderate distances to forage; the MMFR is 60 km (Thaxter *et al.,* 2012). The closest large colonies are those along the north Caithness coast.

265. Outside the breeding season kittiwakes range very widely (Wernham *et al.,* 2002). The birds seen in the Survey Area from September onwards are likely to originate from any of the colonies in eastern and northern Scotland, and overseas colonies in particular those in Norway.

Status and protection

266. The Scottish population has an unfavourable conservation status on account of a long term decline. It has declined by approximately 66% over the past 25 years, equating to an average decline rate of 4.2% per annum (SNH 2012, Mitchell *et al*., 2004). The decline is linked to food supply and sea temperature changes and is likely to continue (JNCC, 2014).

267. Colonies in Orkney have been declining at an average rate of 12.3% per annum (JNCC 2014). No recent information is available for the large colonies in Caithness.

Vulnerability to tidal device impacts

268. Kittiwakes are considered to have low vulnerability to vessel disturbance and displacement by structures as well as very low vulnerability to potential impacts from tidal energy developments (Table 5).

Relevance to Project

269. The numbers of kittiwake using the AfL+1km area are low in the context of the regional population size and potential for impacts are likely to be limited due to very low vulnerability to tidal arrays and low-medium site importance.

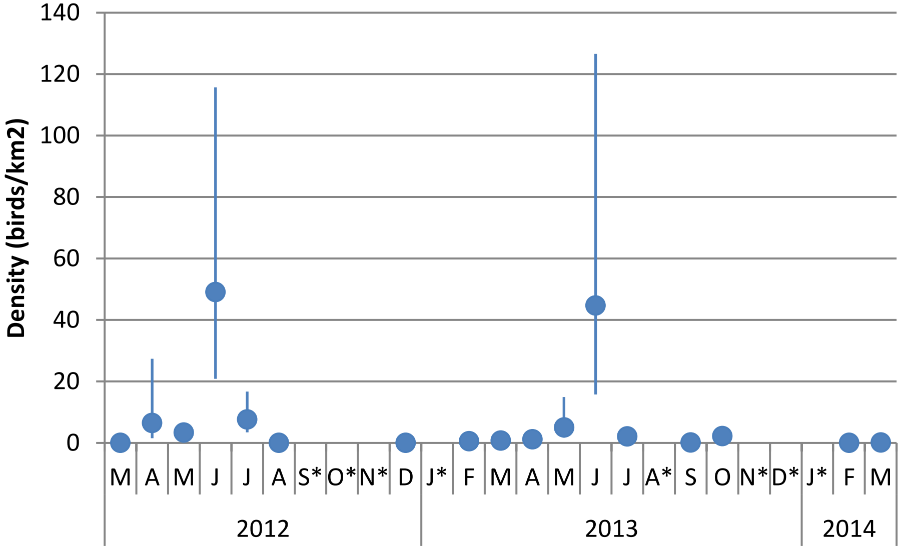
Information gaps

270. None of importance.

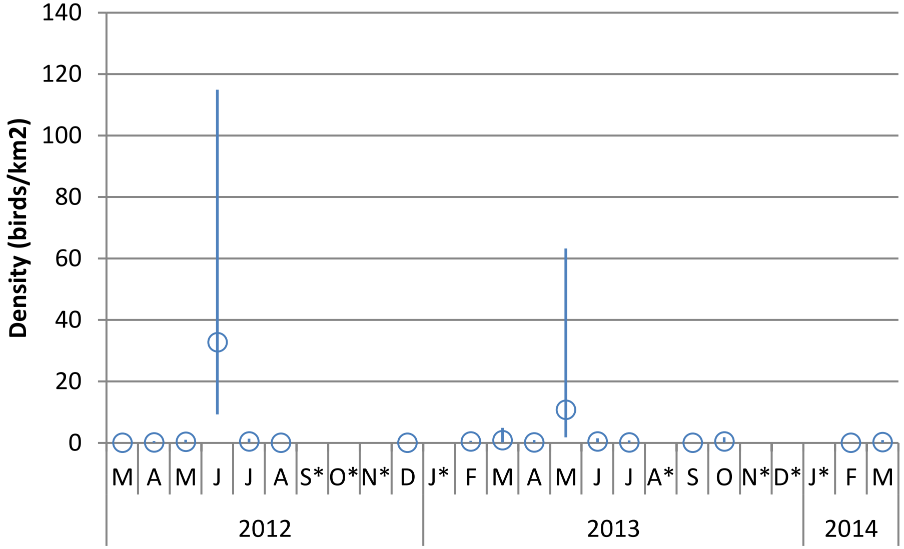
Comparison with MeyGen surveys

271. Comparing average monthly densities between the BTA Survey Area (all birds and birds on sea; insufficient data available from the AfL+1km sector to allow for comparison at that level) and the MeyGen site (birds on sea only) show similar, very low densities across both sites during the winter season (Figure 20 c). This indicates that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For kittiwake the current dataset is therefore considered fit for purpose.

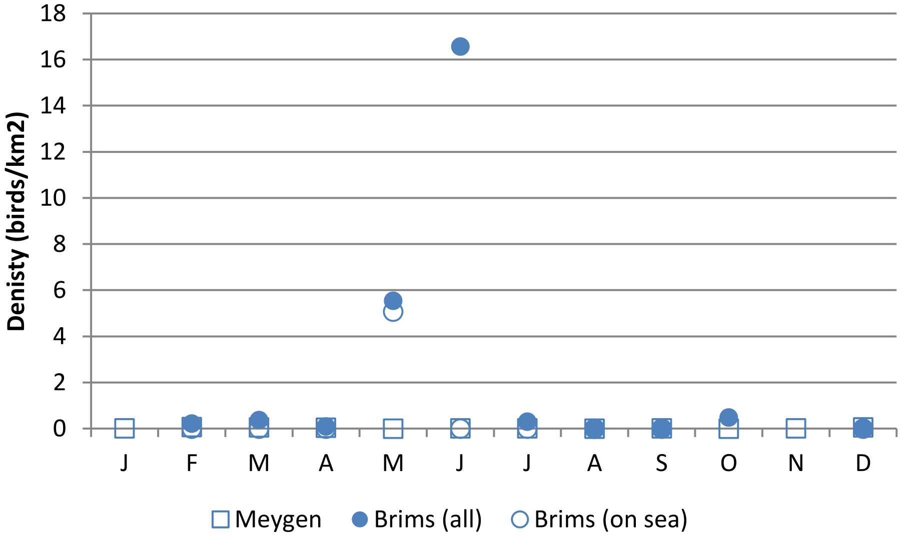
Figure 20. Kittiwake density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



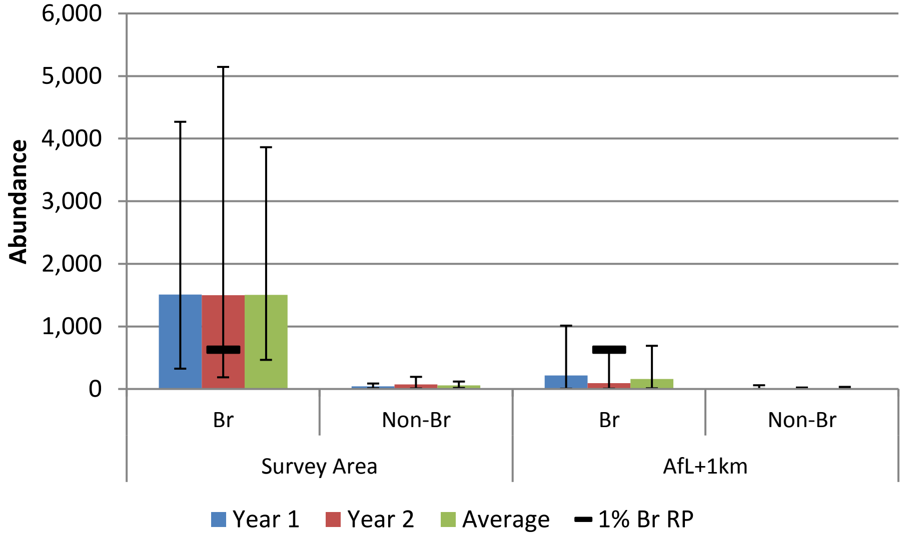
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

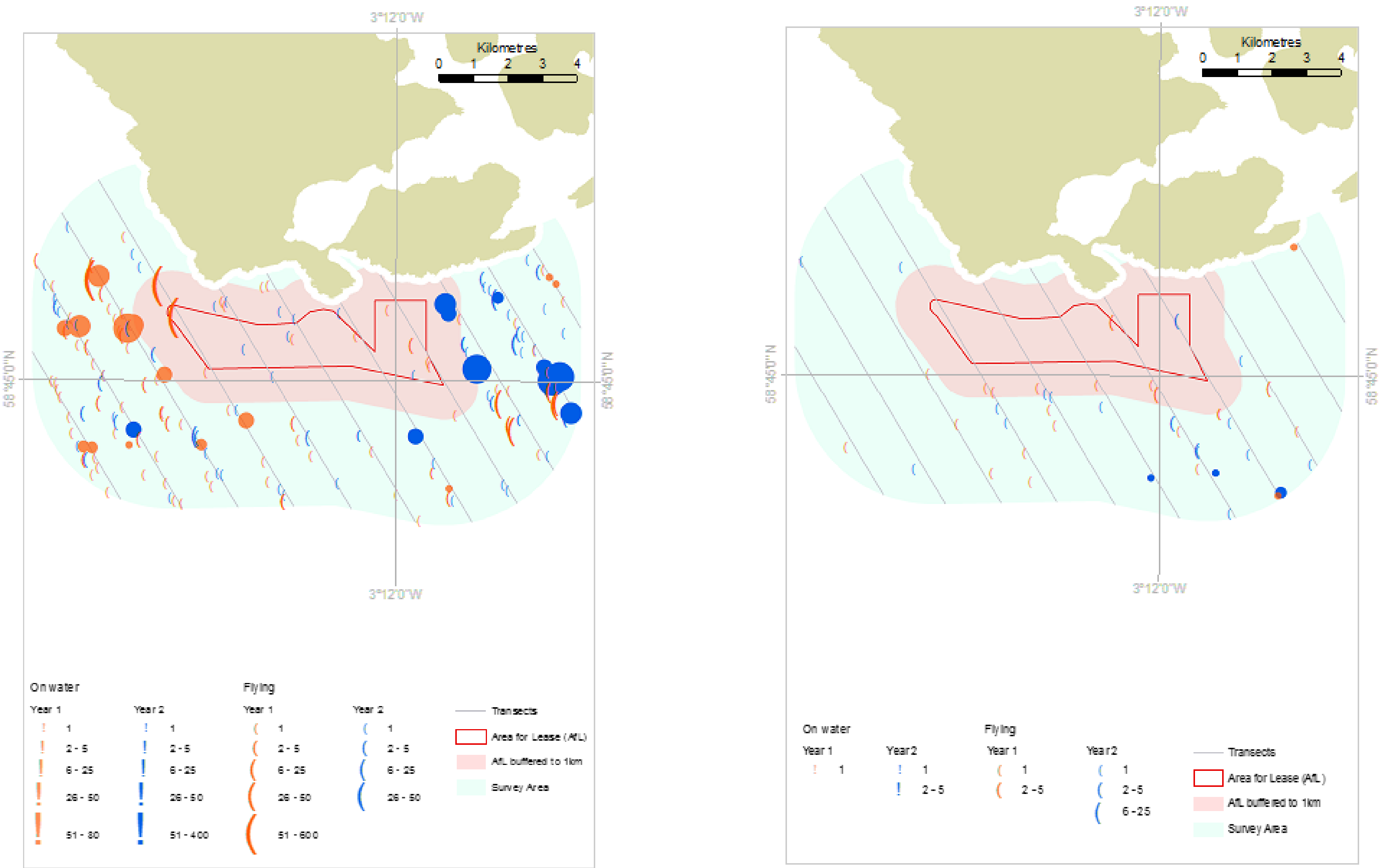


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 21. Distribution and abundance of kittiwakes recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (late Mar-mid Aug, 10 survey days), and b) the non-breeding period (mid Aug-late Mar, 10 survey days).



a) Breeding (attending colony)

b) Non-breeding (passage and overwintering)

Arctic tern

Overview

272. Arctic terns are a strict summer migrant to Scotland and were recorded in low numbers between May and July only (Table 26). The birds seen were likely predominantly breeding birds given the proximity to colonies in the Pentland Firth. This species has low sensitivity to human disturbance and typically forages at or above the sea surface and is therefore not exposed to potential underwater collision risk. No birds were recorded during the autumn passage period.

Colony-attendance period

273. The colony-attendance period for shag is defined as the months of March to August as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

274. Based on the maximum foraging range the population in the defined breeding region is 754 adults based on the Seabird 2000 census results (Mitchell *et al.,* 2004).

275. The estimated number of Arctic terns present in the Survey Area during the colony attendance period was 44 birds (95%UCL: 151 birds, Table 26). These numbers represent 2.6% and 8.8% respectively of the regional breeding population of 1,724 birds (Mitchell et al., 2014)

276. The estimated mean number of Arctic terns during the same period in the AfL+1km area was 2 individuals (95%UCL: 9 birds, Table 26). These numbers represent 0.1% and 0.5% respectively of the regional breeding population and thus the area is considered to have **low** importance as a foraging area during this time of year.

277. For all Arctic terns recorded age was determined, with 98% of all observations relating to adult birds (

278. Table 27).

Table 26 Arctic tern seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	6	1	2	0.05	2	0	9	0.31	10	39
AfL + 2 km										
Colony attendance	6	3	5	0.07	4	0	15	0.35	19	56
AfL + 3 km										
Colony attendance	6	5	12	0.12	9	1	30	0.36	28	112
Survey Area										
Colony attendance	6	11	54	0.39	44	13	151	1.49	168	565
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Table 27 Arctic tern, age frequency by season

Season	% of aged birds			Sample size	% birds not aged
	Adult	Immature	Juvenile		
Colony attendance	98	0	2	343	0

Behaviour

279. A relatively scarce visitor to the Survey Area, Arctic tern distribution was centred on the southern half of the area (Figure 22).

280. Of the Arctic tern numbers present during the breeding season 90% were recorded in flight, with the remainder on the sea surface.

281. Out of 339 Arctic terns recorded in the Survey Area during the breeding season 89% were seen foraging, either classified as active searching, dip feeding or feeding (unspecified).

282. Arctic terns are mainly plunge divers, often preceded by hovering, but they also surface dip for floating prey (Kirkham and Nisbet, 1987). Immersion during dives is normally just complete, i.e. less than 20cm, but will be only partial if prey visibility is restricted to the surface (Snow and Perrins, 1998).

Likely origins

283. The maximum foraging range of breeding Arctic tern is 30 km, and the MMFR is 24 km (Thaxter *et al., 2*013). Using the species' maximum range the regional breeding population includes Hoy, Burray and South Ronaldsay on Orkney (and islands in Scapa Flow), Pentland Firth Islands and Stroma.

284. No birds were seen during spring or passage.

Status and protection

285. The Scottish population has an unfavourable conservation status and has undergone a 72% decline in numbers since the mid-1980s, a long term decline linked to poor food supply and nest predation (SNH, 2012).

286. Comparison of populations at the Orkney SPAs (and Fair Isle) between the time of citation and more recent estimates shows an 87% decline (MacArthur Green 2013; Orkney Bird Report, 2009). As non-SPA colonies are monitored less frequently it is unclear whether these have suffered a similar magnitude of decline.

Vulnerability to tidal device impacts

287. Arctic terns are considered to have low vulnerability to vessel disturbance and displacement by structures (Table 5) and a low vulnerability to the potential impacts of tidal developments specifically.

Relevance to Project

288. On account of the above information, - low levels of vulnerability to tidal arrays and low site importance – the potential for significant impacts is considered to be unlikely.

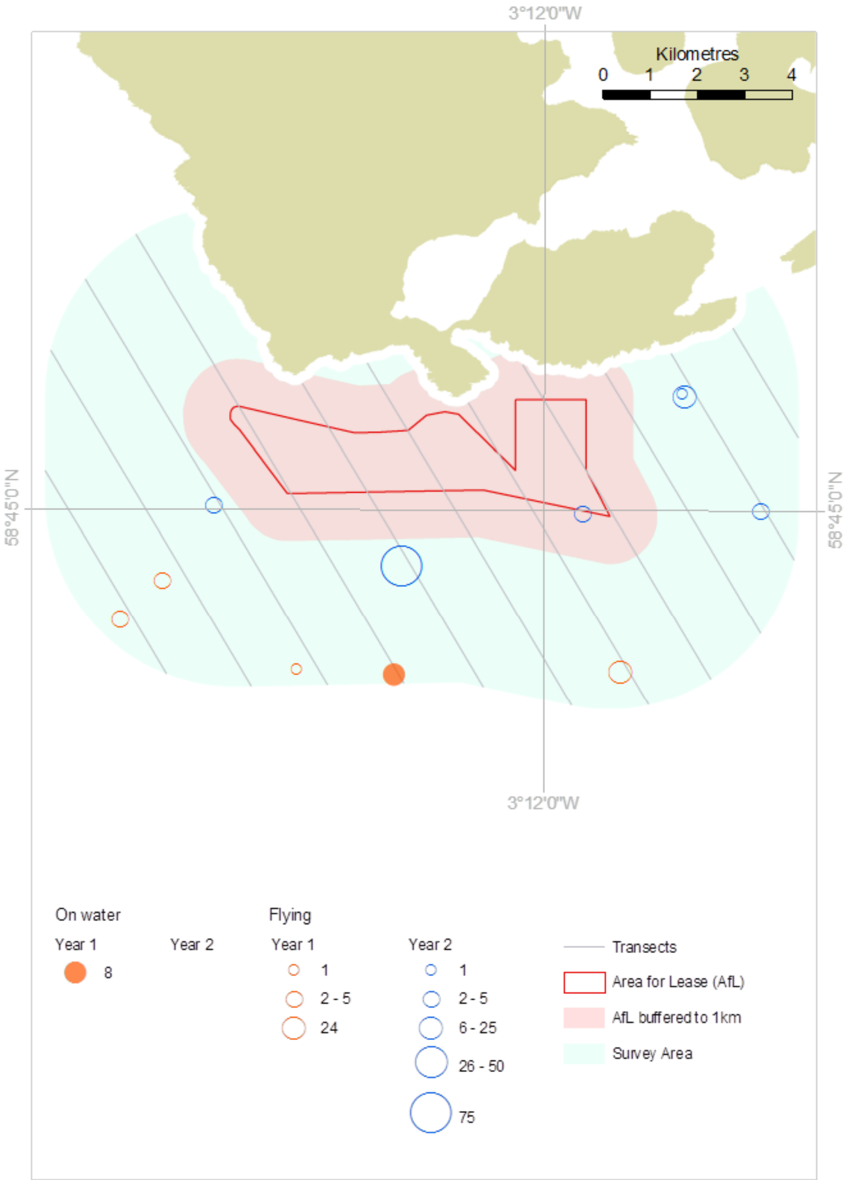
Information gaps

289. None of importance.

Comparison with MeyGen surveys

290. No comparison with the MeyGen surveys is required as Arctic tern does not occur in either area during the winter period.

Figure 22. Distribution and abundance of Arctic terns recorded during ESAS surveys between March 2012 and March 2014 (May-mid Aug, 7 survey days). No in-transect records during the non-breeding period.



Common guillemot

Overview

291. Common guillemots were present in the Survey Area in large to very large numbers throughout the year, with the vast majority of birds seen being on the sea surface. This species typically forages at depths which could expose it to underwater collision risk and has moderate sensitivity to human disturbance.

Colony-attendance period

292. The colony-attendance period for common guillemot is defined as the months of mid-March to July as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

293. The defined regional breeding population is based on the Seabird 2000 census results (Mitchell *et al.,* 2004) and using the MMFR of 84km, extended to 100km to account for some large colonies at that distance. After accounting for adults that were not attending the colonies at the time of counting (using a correction factor of x1.34, Mitchel *et al.*, 2004), the size of the regional population for the colony-attendance part of the

breeding season is estimated at 609,250 adults. The actual number of birds present in this period is likely to be greater because of the presence of non-breeding immature birds. A recent study into correction factors for breeding auks indicated there is substantial variation in this factor between colonies depending on local conditions (Harris *et al.*, 2015). Pending advice from JNCC/SNH on this matter the established factor has been used in this report.

294. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 57% of common guillemot populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

295. Common guillemots were present in the Survey Area year-round, with densities in most months between 1 and 18 birds/km^2 with the highest densities occurring during the breeding season and the lowest during autumn and mid-winter (Figure 23 a). The single exception to this pattern is the peak in May 2012, when the estimated density reached 148 birds/km^2.

296. The seasonal pattern for the AfL+1km is similar to that for the Study Area, although with two pronounced peaks in May 2012 and 2013 (Figure 23 b).

297. Statistical analysis revealed a consistent temporal difference in abundance between the breeding season and winter season across both years for common guillemot, with the species more prevalent during the former (Caloo 2015). This is consistent with locally breeding birds moving away from their breeding colonies after the breeding season (Wernham *et al.* 2002).

298. The mean estimated number of common guillemots present in the Survey Area during the colony-attendance period was 2,527 birds (95%UCL: 5,529, Table 28, Figure 23 d). These estimates represent 0.4% and 0.9% respectively of the assumed regional breeding population.

299. The estimated mean number of common guillemots in the AfL+1km was 446 individuals (95%UCL: 825, Table 28, Figure 23 d). These numbers represent 0.1% of the regional breeding population and thus the area is considered to have **low** importance as a foraging area during the colony-attendance period.

Chicks-on-sea period

300. The assumed regional population during the chick-on-sea period is based on the size of the regional breeding population. Although this period is defined as August there were nevertheless chicks present on the June and July surveys, however at least these would have been recently fledged and therefore unlikely to have moved far from their breeding colony.

301. The percentage of common guillemots that were aged to be chicks during the chicks at sea period together with overall abundance gives a rough indication of the value the Survey Area and AfL+1km have as a nursery area for chicks. However, the single August (2012) survey undertaken during the baseline programme encountered no chicks at all, and did in fact record only a single common guillemot. Surveys in late June and mid-July of the same year found only three chicks in the whole Survey Area. In 2013 surveys in both those months recorded no guillemot chicks at all.

302. Flux rate of adult birds with chicks can be high during the chick-on-sea period, with birds moving through areas quickly (Camphuysen, 2002). However, it is unlikely that five surveys in the span of two consecutive breeding seasons would have missed the presence of even moderate numbers of chicks between late June and mid-August. Breeding success in Orkney has been below par for several years, with average productivity between 2009 and 2012 poor and particularly dire in 2013 (JNCC, 2014). It is therefore possible that the dearth of common guillemot chicks in the Survey Area during the baseline programme is at least in part a result of this. Of interest is that the MeyGen surveys undertaken in 2009-2011 similarly found very low densities in August as well.

303. It follows that the AfL+1km area (and the Survey Area as a whole for that matter) is considered to have **negligible** importance as a foraging area for the regional population at this time of year.

Table 28 Common guillemot seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	10	292	583	13.92	446	234	825	48.35	1,551	2,799
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	5	23	34	2.50	80	25	253	6.79	218	586
AfL + 2 km										
Colony attendance	10	526	1,396	24.83	1,313	386	2,829	160.72	8,498	14,064
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	5	38	54	2.42	128	36	348	6.55	346	846
AfL + 3 km										
Colony attendance	10	730	1,905	22.31	1,721	507	3,755	142.93	11,030	17,017
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	5	48	66	1.89	146	55	356	5.26	406	708
Survey Area										
Colony attendance	10	1,034	2,999	22.37	2,527	764	5,529	148.98	16,825	24,866
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	5	58	78	1.57	178	67	373	4.31	487	805
Refer to Caloo 2015 for further details on estimates, detection functions and covariates.										

Winter period

304. The mean estimated number of common guillemots present in the Survey Area during the winter period was 178 birds (95%UCL: 373, Table 28, Figure 23 d). These estimates both represent <0.1% of the estimated minimum non-breeding period population of 1,617,306 birds for the North Sea and Channel BDMPS region (Furness, 2014).

305. The estimated mean number of common guillemots in the AfL+1km was 80 individuals (95%UCL: 253, Table 28, Figure 23 d). These estimates represent <0.1% of the assumed regional winter period population and thus the area is considered to have **negligible** importance as a foraging area during this time of year.

Behaviour

306. Distribution maps show that common guillemots were approximately evenly spread over the Survey Area during the breeding and non-breeding seasons (Figure 24 a and b). No observations were made during surveys in the chicks-at-sea period. Statistical analysis did not reveal a trend in spatial distribution across the Survey Area (Caloo, 2015).

307. Between zero (chicks-on sea period) and 48% (colony-attendance period) of the common guillemots estimated to be present were sitting on the sea surface, the remainder were in flight. Up to 80% of all common guillemots recorded in winter were seen in flight, although this is based on a relatively small sample size.

308.Out of 5,116 common guillemots recorded in the Survey Area during the breeding season 2% were seen actively foraging, either classified as carrying food (on water or in flight), diving or feeding (unspecified).

309.In a study of chick-rearing common guillemot off Norway (Tremblay *et al.*, 2003), mean dive depth was found to be 10m, with 50% of dives less than 6m and 90% less than 22m (maximum depth: 37m). Barrett and Furness (1990) however, report on breeding birds off Norway diving to 70m, and Thaxter *et al*., (2010) and Daunt *et al.* (2003) observed maximum dive depths of 53m and 67m respectively for birds off the Scottish east coast. Dives of less than 50m depth are probably typical, however (Bradstreet and Brown, 1985).

310.During the colony-attendance period there was a strong tendency for common guillemot flights along a W-E orientation (figure not shown, sample size: 3,020 birds). This possibly indicates strong connectivity to the colonies on the Caithness coast, as these are the nearest large colonies. Out of 74 birds seen in flight carrying food, 74% flew in W or SW direction.

Likely origins

311.Breeding common guillemots travel moderate distances to forage; the maximum foraging distance is reported to be 135 km and the MMFR is 84 km (Thaxter *et al.,* 2012). During the colony-attendance part of the breeding season the birds using the Project area are most likely from colonies from most of Orkney, except possibly the far northeast, Sule Skerry and Sule Stack and on mainland Scotland as far west as Cape Wrath and as far south as the East Caithness Cliffs SPA. Large colonies exist across the Pentland Firth on Stroma and at Dunnet Head.

312.The birds present in the chicks-on-sea part of the breeding season (August), by when common guillemots will have departed breeding colonies, are likely to comprise a mix of birds from the areas listed above and from further afield, in particular from colonies in Caithness.

313.The birds seen in the Survey Area during the autumn and winter are likely to originate from any of the colonies in eastern and northern Scotland, and may also include birds from Scandinavia (Wernham *et al*., 2002; Furness 2014).

Status and protection

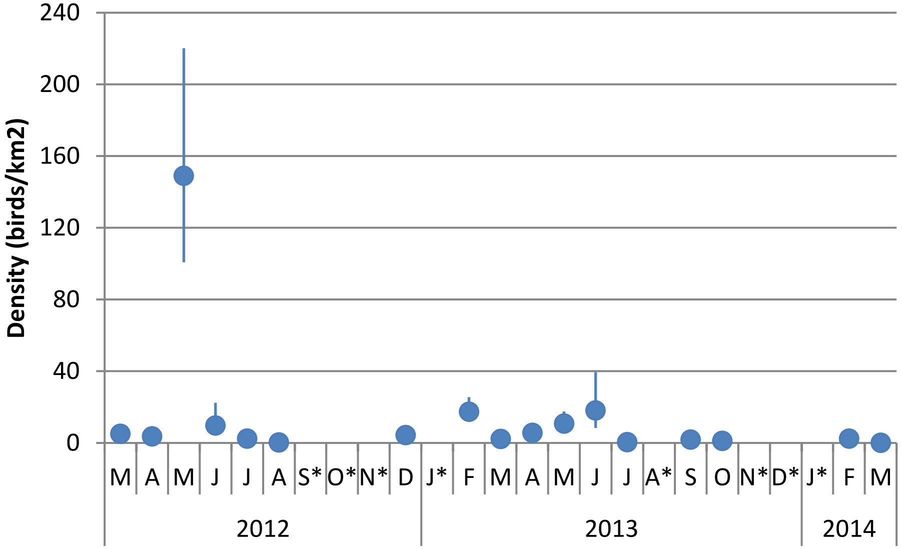
314.Between 2000 and 2013 the UK population as a whole has shown a 9% increase (JNCC 2014), but this trend is not applicable at regional levels. In fact, the Scottish population has an unfavourable conservation status, it has shown moderate long-term decline amounting to -26% since 1986 (SNH, 2012; Mitchell *et al*., 2004). The decline is linked to changes in food supply and sea temperature changes (JNCC, 2014).

315.Twelve SPA populations within 80km of the Pentland Firth have increased by 5% since designation (MacArthur Green, 2013). However, this comparison is heavily affected by several large SPA colonies for which the most recent estimate itself is 15 years old. When comparing five colonies on Orkney for which the latest estimates are from the last eight years it turns out that these have suffered a 20% decrease. The Orkney Bird Report (2009) indicates that the species declined across all monitoring plots in the first decade of the 21st century.

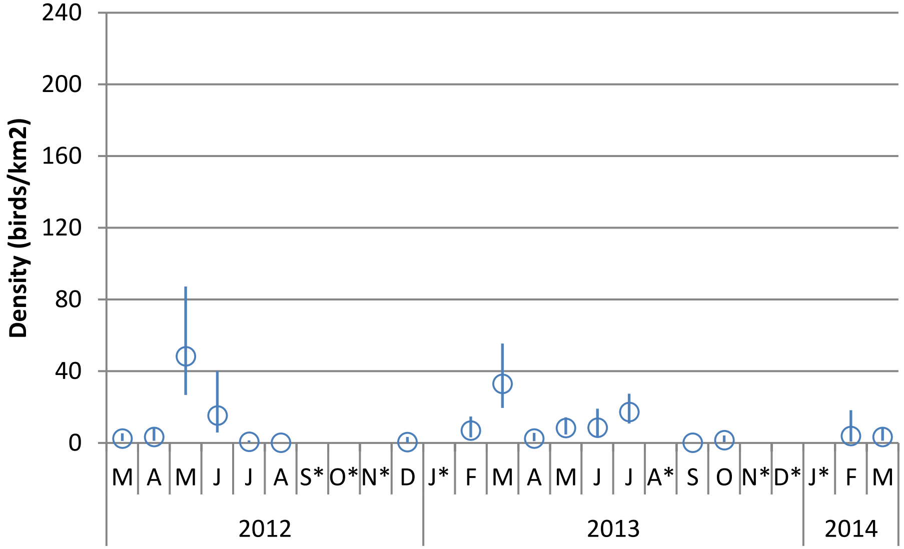
Vulnerability to tidal device impacts

316.Common guillemots are considered to have moderate vulnerability to vessel disturbance and low vulnerability to displacement by structures (Table 5); their vulnerability to disturbance is heightened during the chicks-on-sea part of the breeding season due to the presence of dependent chicks and because adults undergo complete wing moult at this time of year rendering them temporarily flightless. The species is considered to have high vulnerability tidal energy developments in general, largely as a result of its diving behaviour (Furness *et al.*, 2012).

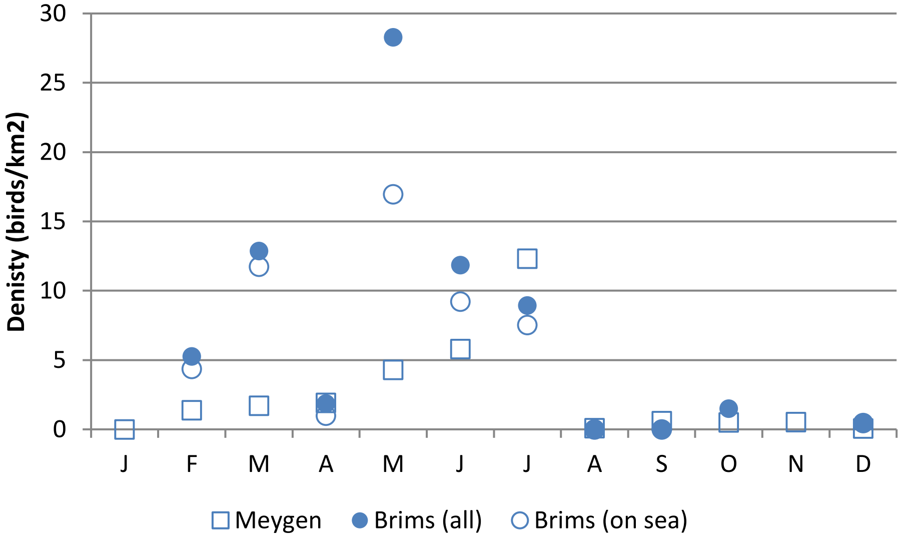
Figure 23. Common guillemot density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



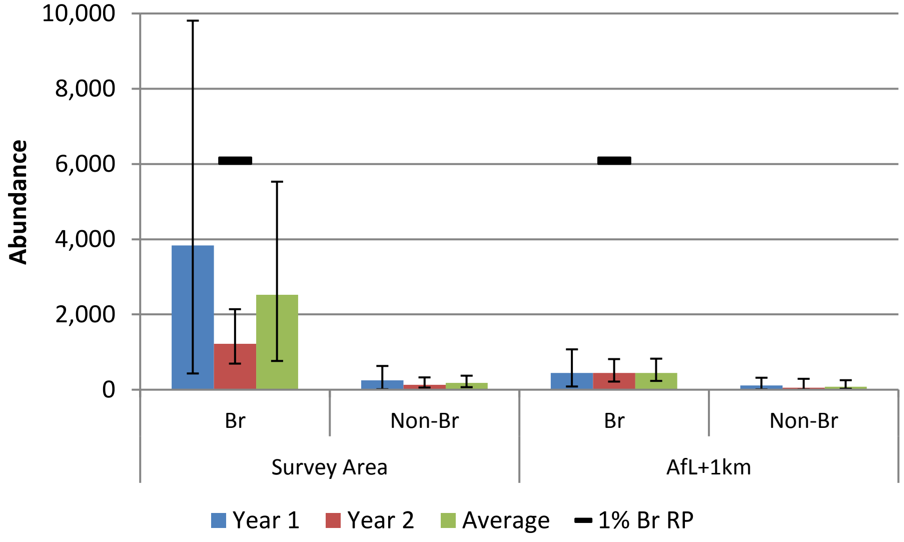
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

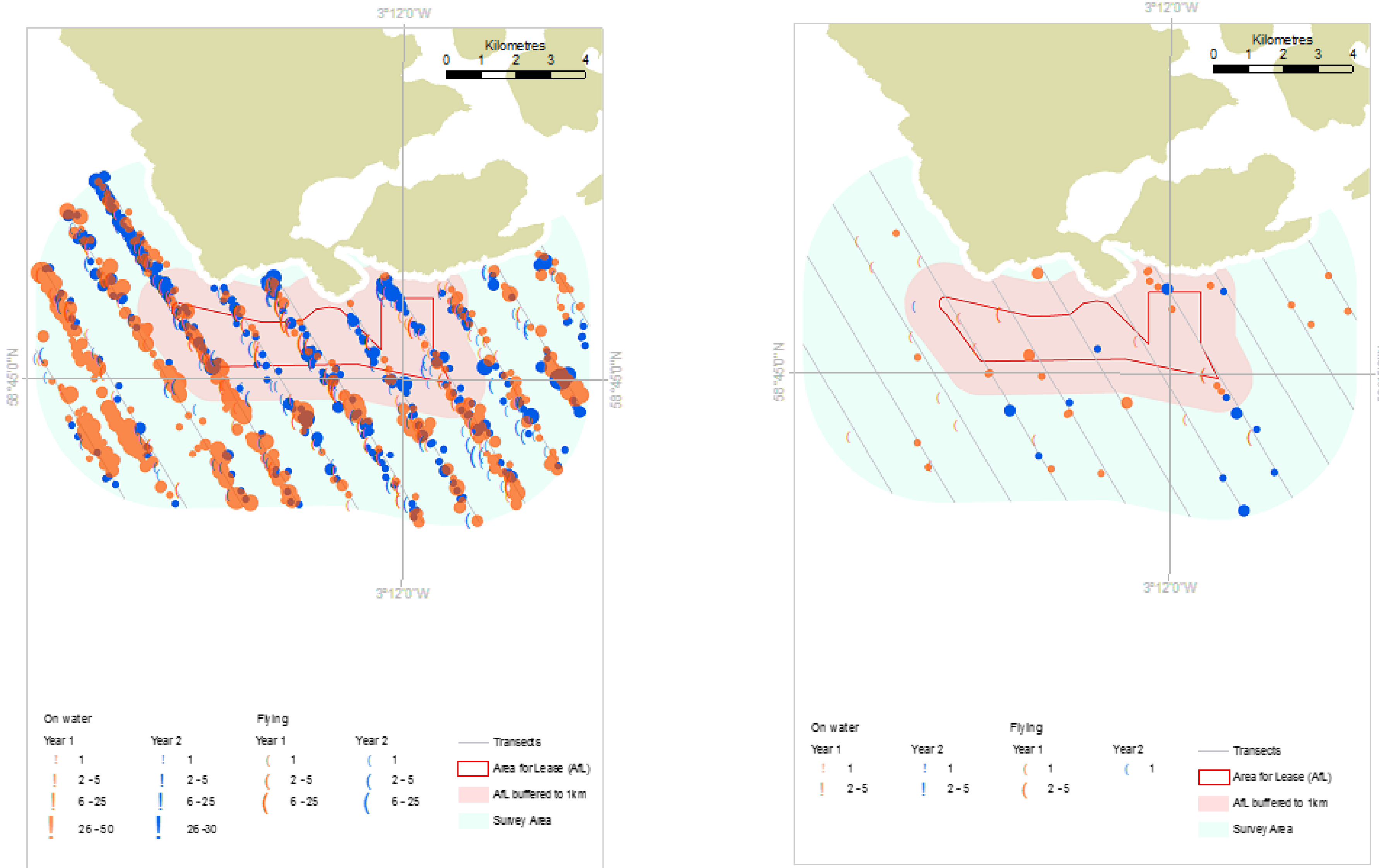


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 24. Distribution and abundance of common guillemots recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Mar-Jul, 13 survey days) and b) the non-breeding period (Sep-Feb, 6 survey days). No in-transect records during the chicks-on-sea period (Aug).



a) Breeding (attending colony)

b) Non-breeding (passage and overwintering)

Relevance to Project

317. On account of the above information, - high vulnerability to tidal arrays and low site importance – it is considered there is some potential for significant impacts, largely through exposure to collision risk.

Information gaps

318. There is some uncertainty whether the very low to non-existent densities of guillemots recorded in the Survey Area in August 2012 (the chicks-on-sea period) are a regular feature. Furthermore there is a lack of up to date colony census information, particularly from the Caithness coast where large SPA colonies (East Caithness and North Caithness Cliffs) have not been monitored since 2000.

319. These information gaps do not prevent the undertaking of a robust impact assessment.

Comparison with MeyGen surveys

320. Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea) and the MeyGen site (birds on sea only) show a similar seasonal pattern, although densities in the former tend to be higher during the breeding season, at times substantially so (Figure 23 c). Densities in autumn and winter are very similar indicating that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For guillemot the current dataset is therefore considered fit for purpose.

Razorbill

Overview

321. Razorbills were present in the Survey Area in moderate to large numbers throughout the year, with the vast majority of birds seen being on the sea surface. This species typically forages at depths which will expose it to potential underwater collision risk and has moderate sensitivity to human disturbance.

Colony-attendance period

322. The colony-attendance period for razorbill is defined as the months of April to July as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

323. The defined regional breeding population is based on the Seabird 2000 census results (Mitchell *et al.,* 2004). After accounting for adults that were not attending the colonies at the time of counting using a correction factor of x1.34 (Mitchel *et al*., 2004), the size of the regional breeding population is estimated at 10,739 adults. The actual number of razorbills present in the defined region during the breeding season is likely to be greater than this figure because of the presence of non-breeding immature birds. A recent study into correction factors for breeding auks indicated there is substantial variation in this factor between colonies depending on local conditions (Harris *et al.* in prep.). Pending advice from JNCC/SNH on this matter the established factor has been used in this report.

324. Razorbills were present in the Survey Area in most months during the year, with densities between 1 and 10 birds/km^2. The highest densities occurred during the middle of the breeding season and the lowest during autumn and mid-winter (Figure 25 a). Substantial peaks occurred in May 2012 and June 2013, although the associated confidence intervals are wide.

325. The seasonal pattern for the AfL+1km is similar to that for the Study Area (Figure 25 b).

326. Statistical analysis revealed a consistent temporal difference in abundance between the breeding season and winter season across both years for razorbill, with the species more prevalent during the former (Caloo, 2015). This is consistent with locally breeding birds moving away from their breeding colonies after the breeding season (Wernham *et al.,* 2002).

327. The mean estimated number of razorbills present in the Survey Area during the colony-attendance period was 981 birds (95%UCL: 1,834 birds, Table 29, Figure 25 d). These estimates represent 9.1% and 17.1% respectively of the assumed regional breeding population of 11,312 adults.

328. The estimated mean number of razorbills during colony-attendance period in the AfL+1km area was 223 individuals (95%UCL: 433, Table 29, Figure 25 d). These numbers represent 2.1% and 4% respectively of the regional population and thus the AfL+1km area is considered to have **medium** importance as a foraging area.

Table 29 Razorbill seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	7	79	164	6.94	223	119	433	12.08	387	1,169
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	8	5	7	0.19	6	2	44	0.51	16	94
AfL + 2 km										
Colony attendance	7	130	323	7.88	416	243	866	13.49	713	2,501
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	8	8	10	0.21	11	5	44	0.77	41	146
AfL + 3 km										
Colony attendance	7	188	448	7.57	584	380	1,112	11.52	889	2,645
Chicks at sea	1	0	0	-	-	-	-	-	-	-
Winter	8	18	31	0.49	38	16	126	1.84	142	524
Survey Area										
Colony attendance	7	265	808	8.69	981	610	1,834	20.27	2,289	5,407
Chicks at sea	1	7	7	1.06	119	38	369	1.06	119	353
Winter	8	27	44	0.53	60	30	158	1.31	148	524
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Chicks-on-sea period

329. The mean estimated number of razorbills present in the Survey Area during the chicks-on-sea period was 119 (95%UCL: 369, Table 29, Figure 25 d). These estimates represent 1.1% and 3.4% respectively of the assumed regional breeding population.

330. The estimated mean number of razorbills in the AfL+1km area during this period was 0 individuals (all age classes, Table 29, Figure 25 d). Despite the apparent absence of the species, given the mobility of parent birds and dependent chicks it is likely that birds in the wider Survey Area are easily capable of reaching the AfL+1km area during this time of year. Therefore the area is considered to have **medium** importance as a foraging area for the regional population at this time of year.

331. The percentage of razorbills that were aged to be chicks during the months of July and August, together with abundance in these months, give a rough indication of the value the Survey Area and AfL+1km as a nursery

area for chicks (Table 30). There was a similar pattern in both 2012 and 2013; very low to zero percentages in late June and small percentages (<5%) of chicks present in early July. The single August survey had a high percentage of chicks at 43%, but that was based on a very small sample size in the Survey Area of only 14 birds on the sea surface. These changes, together with the variable numbers of birds present, suggest that there is considerable flux of birds using the Survey Area at this time of year. The chicks present in early July will have been recently fledged from colonies and therefore likely to have been of relatively local origin compared to chicks seen on later dates by when birds would have had time to disperse well away from their breeding colonies.

Table 30 The percentage of razorbills seen on survey visits that were chicks.

Year	Survey visit	No of birds seen	% chicks
2012	30/06	151	1.3%
	20/07	21	4.8%
	20/08	14	43%
2013	25/06	307	0%
	10/07	42	2.4%

Winter period

332. The mean estimated number of razorbills present in the Survey Area during the winter period was 60 birds (95%UCL: 158 birds, Table 29, Figure 25 d). These estimates represent <0.1% of the estimated minimum non-breeding period population of 218,622 birds for the North Sea and Channel BDMPS region (Furness, 2014).

333. The estimated mean number of razorbills in the AfL+1km was 6 individuals (95%UCL: 44, Table 29, Figure 25 d). These estimates both represent <0.1% of the assumed regional winter period population and therefore the area is considered to be of **negligible** importance for foraging purposes.

334. Modelling of the stable age distribution undertaken by Furness (2014) indicates that during the non-breeding season 57% of razorbill populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

Behaviour

335. Distribution maps show that razorbills were approximately evenly spread over the Survey Area during the breeding and non-breeding period. Very few observations were made during the chicks-on-sea period (Figure 26).

336. Between zero (chicks-on sea period) and 56% (colony-attendance period) of the razorbills estimated to be present were in flight, the remainder were sitting on the sea. In winter, 84% of all birds recorded were in seen in flight, although this is based on a relatively small sample size (75 birds).

337. Razorbills off Scotland have been reported to favour relatively shallow water areas for diving and to rarely exceed 30m below the surface, with most underwater time being spent within 15m of the surface (Wanless *et al.*, 1990; Thaxter *et al*., 2010). Breeding razorbills off Norway were recorded diving to a median depth of 25m – 30m (Barrett and Furness, 1990). Similarly, chick-rearing razorbills off Iceland were observed foraging at depths rarely greater than 35m (maximum 41m) (Dall'Antonia *et al.*, 2001).

338. Out of 1,710 razorbills recorded in the Survey Area during the breeding season 4% were seen actively foraging, either classified as carrying food (in flight or on water) or diving.

339. An in-depth study of chick-rearing razorbills in the Baltic Sea (Benvenuti *et al.*, 2001) found more than 50% of dive depths to be less than 15m, the most frequent depth interval to be 5m – 10m, and dives rarely to exceed 40m (maximum 43m).

340. During the colony-attendance period there was a strong tendency for razorbill flights along a W-E orientation (figure not shown, sample size: 839 birds). This possibly indicates strong connectivity to the colonies on the

Caithness coast, as these are the nearest large colonies. Out of 51 birds seen in flight carrying food, 56% flew in W, SW or S direction.

Likely origins

341. Breeding razorbills travel moderate distances to forage; the maximum foraging distance is reported to be 95 km and the MMFR is 48.5 km (Thaxter *et al.,* 2012). Using the latter value plus 10% results in a regional breeding population encompassing mainland Orkney, Copinsay and parts of the Caithness coast.

342. The birds present in Survey Area in August, by when razorbills have departed breeding colonies, are likely to comprise a mix of birds breeding within the region - in particular the colonies listed above - and birds from further afield, in particular from colonies in Caithness and Orkney.

343. Birds from north Scotland and the northern isles tend to move east during the winter period, to southwest Norway and Denmark or to the southern North Sea with relatively few reaching further south (Wernham *et al.,* 2002).

Status and protection

344. Between 2000 and 2013 the UK population as a whole has shown a 13% increase (JNCC 2014), but this trend is not necessarily applicable at regional levels as there is uncertainty about recent population trends for Scottish breeding razorbill due to low monitoring effort. Between 2005 and 2010 the UK population was one of slow decline, but since then the population appears to have increased again, although estimates come with wide confidence intervals, requiring caution in interpretation. In recent years productivity at monitoring sites has decreased again, possibly leading up to a future decline (JNCC 2014).

345. Five SPA populations within 80km of the Pentland Firth have decreased by 23% since designation (MacArthur Green 2013). However, this comparison is heavily affected by several large SPA colonies for which the most recent estimate itself is 15 years old or more. When comparing three colonies on Orkney for which the latest estimates are from the last five to eight years it turns out that these have suffered a 45% decrease. The Orkney Bird Report (2009) indicates that declines of 5-34% were found across all monitoring plots between 2006 and 2009.

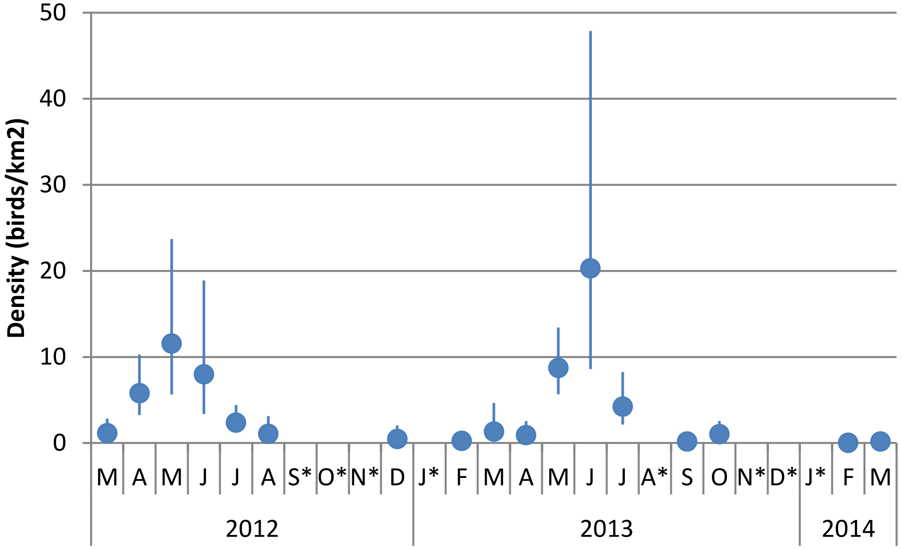
Vulnerability to tidal device impacts

346. Razorbills are considered to have moderate vulnerability to vessel disturbance and low vulnerability to displacement by structures (Table 5); their vulnerability to disturbance is heightened during the chicks-on-sea part of the breeding season due to the presence of dependent chicks and because adults undergo complete wing moult at this time of year rendering them temporarily flightless. The species is considered to have high vulnerability tidal energy developments in general, largely as a result of its diving behaviour (Furness *et al.* 2012).

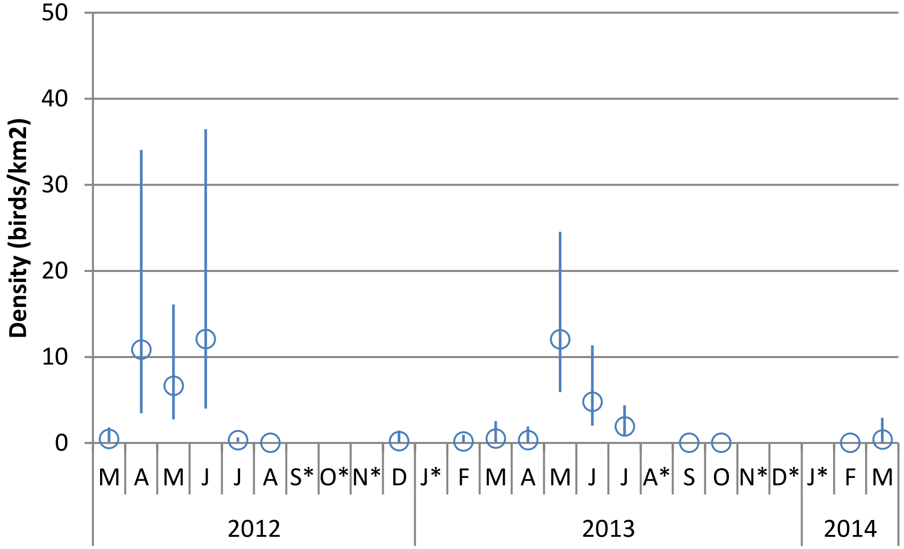
Relevance to Project

347. On account of the above information, - high vulnerability to tidal arrays and low site importance – it is considered there is some potential for significant impacts, largely through exposure to collision risk.

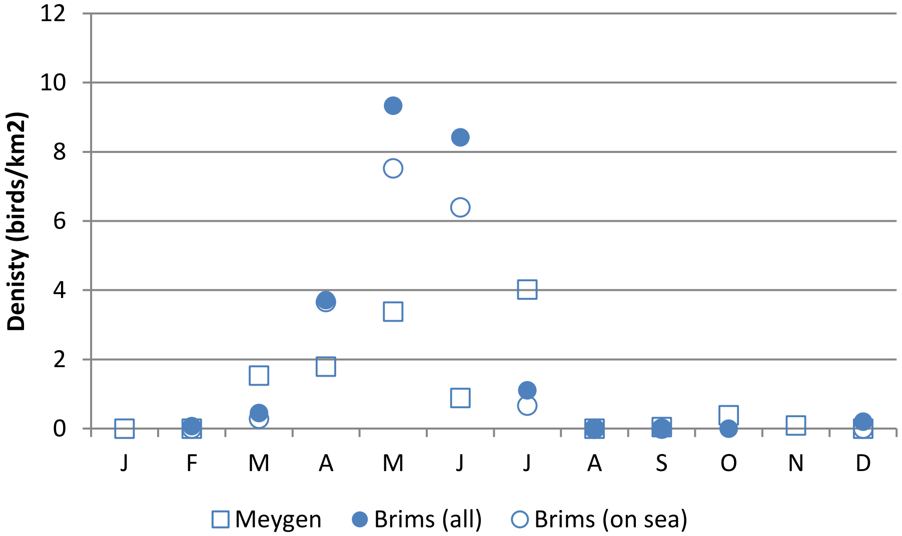
Figure 25. Razorbill density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



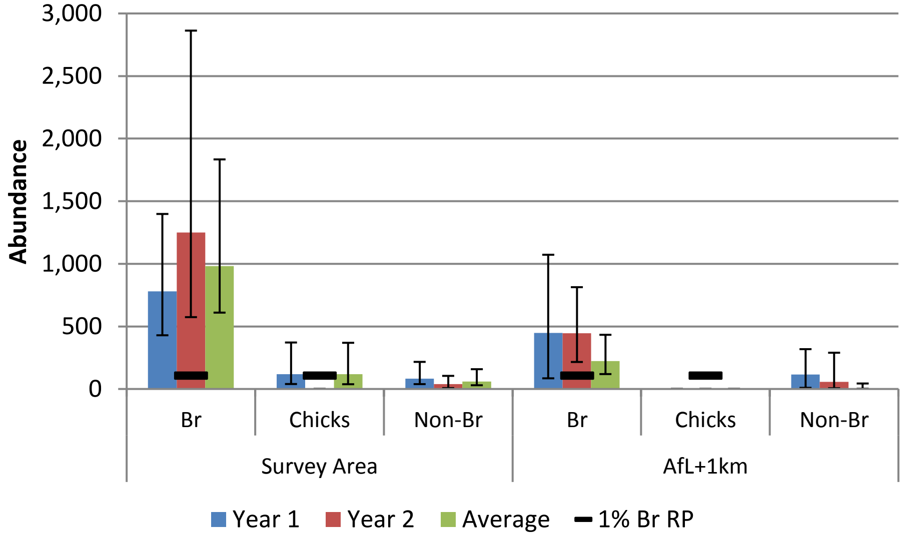
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

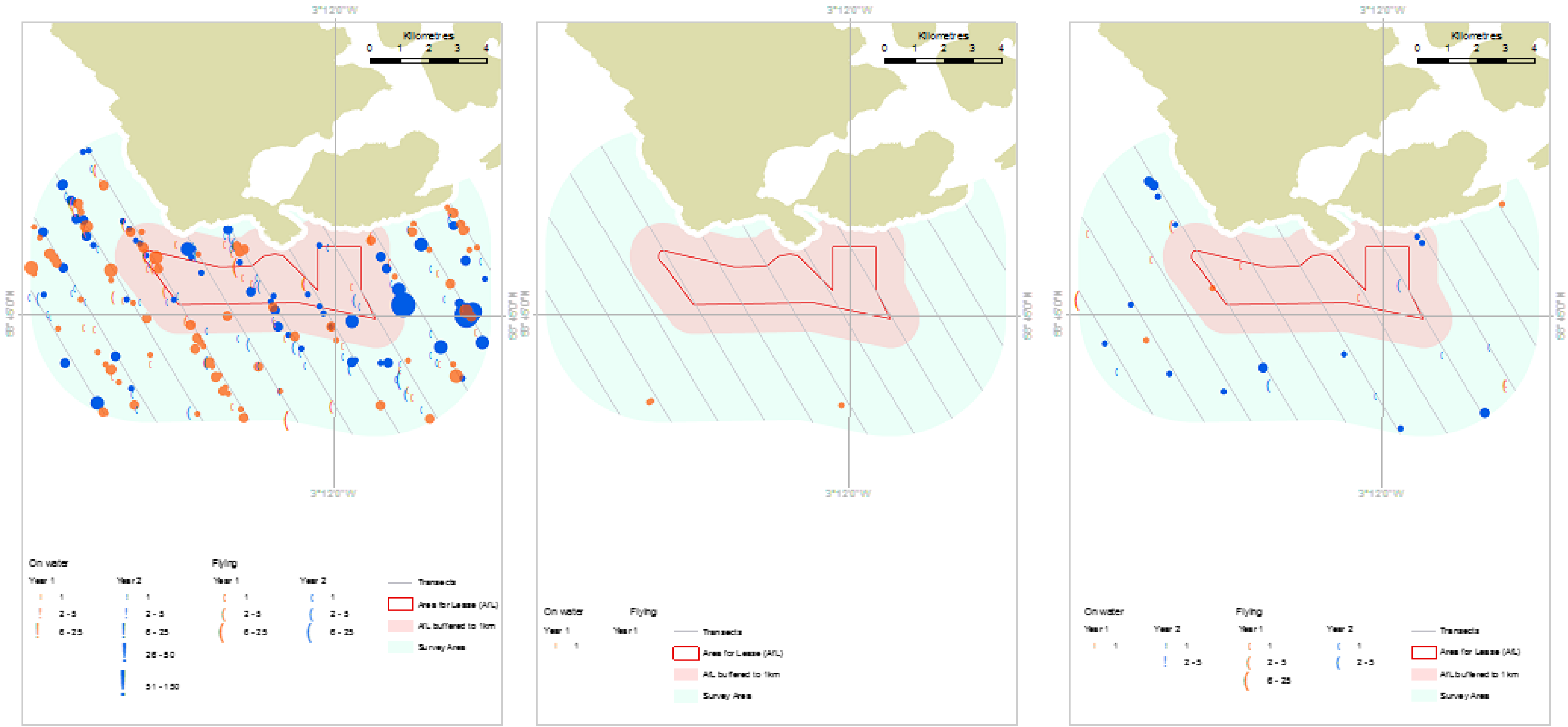


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 26. Distribution and abundance of razorbills recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Jul, 8 survey days), b) the chicks-on-sea period (Aug, 1 survey day and c) the non-breeding period (Sep-Mar, 11 survey days).



a) Breeding (attending colony)

b) Chicks-on-the-sea / moulting

c) Non-breeding (passage and overwintering

Information gaps

348. There is some uncertainty whether the very low densities of razorbill chicks recorded in the Survey Area in August 2012 (the chicks-on-sea period) are a regular feature. As a result this season is taken forward to the EIA assessment as a moderate priority (see above). Furthermore there is a lack of up to date colony census information, including from the Caithness coast where the SPA colonies at North Caithness Cliffs have not been monitored since 2000.

349. These information gaps do not prevent the undertaking of a robust impact assessment.

Comparison with MeyGen surveys

350. Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea) and the MeyGen site (birds on sea only) show a similar seasonal pattern, although densities in the former tend to be higher during the breeding season, at times substantially so (Figure 25 c). Densities in autumn and winter are very similar indicating that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For razorbill the current dataset is therefore considered fit for purpose.

Black guillemot

Overview

351. Black guillemots were present in the Survey Area year-round in very low to low numbers. In fact, the entire two year survey programme only yielded a total ‘raw’ count of 49 individuals and no black guillemots were recorded inside the boundary of the AfL.

Colony-attendance period

352. The colony-attendance period for black guillemot is defined as the months of April to July as this covers the period from nest establishment through to young fledging for the great majority of breeding birds. At other times of year some individuals may be present at colonies, but they are unlikely to be engaged in breeding activities.

353. The defined regional breeding population based on the Seabird 2000 census results is 1,212 adults (Mitchell *et al.,* 2004). The actual number of black guillemots present in the defined region during the breeding season is likely to be greater than this figure because of the presence of non-breeding immature birds. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 43% of black guillemot populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

354. Black guillemots were present in the Survey Area in most months during the year, with densities between 0.1 and 0.3 birds/km^2 (Figure 27 a).

355. The seasonal pattern for the AfL+1km is similar to that for the Study Area (Figure 27 b). The slightly higher densities, up to 1 birds/km^2, are a result of smaller sample size in this area, something emphasised by the wider confidence intervals.

356. Statistical analysis did not reveal a consistent temporal difference in abundance between the breeding season and winter season across both years for black guillemot (Caloo, 2015). This is consistent with the very sedentary nature of local breeding birds (Wernham *et al.,* 2002).

357. The mean estimated number of black guillemots present in the Survey Area during the colony-attendance period was 11 birds (95%UCL: 47 birds, Table 31, Figure 27 d). These estimates represent 0.7% and 3% respectively of the assumed regional breeding population.

358. The estimated mean number of black guillemots during the breeding season in the AfL+1km area was 8 individuals (95%UCL: 48 birds, Table 31, Figure 27 d). These numbers represent 0.5%-3% of the regional

breeding population and thus the area is considered to have **low to medium** importance as a foraging area. Note that no black guillemots were recorded within the AfL area itself

Table 31 Black guillemot seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

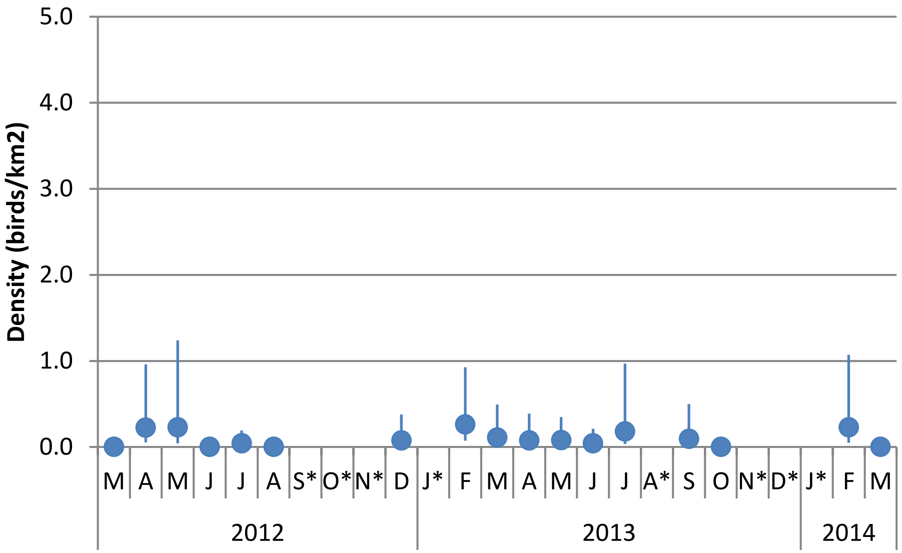
Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL area										
Colony attendance	8	0	0	0	0	0	0	0	0	0
Winter	8	0	0	0	0	0	0	0	0	0
AfL + 1 km										
Colony attendance	8	7	8	0.26	8	3	48	0.83	27	168
Winter	8	5	5	0.31	10	3	46	0.94	30	159
AfL + 2 km										
Colony attendance	8	7	8	0.15	8	3	40	0.48	25	146
Winter	8	5	5	0.19	10	3	39	0.57	30	183
AfL + 3 km										
Colony attendance	8	8	10	0.14	11	5	48	0.34	26	148
Winter	8	6	6	0.14	11	4	40	0.37	29	141
Survey Area										
Colony attendance	8	8	10	0.10	11	5	47	0.23	26	140
Winter	8	7	7	0.11	12	5	40	0.26	29	121
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Winter period

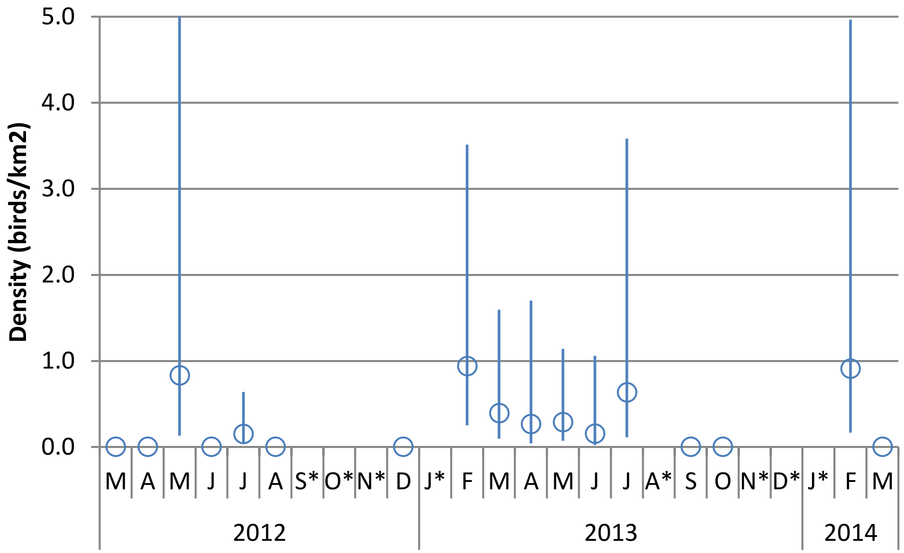
359. The mean estimated number of black guillemots present in the Survey Area during the winter period was 12 birds (95%UCL: 40, Table 31, Figure 27 d). These estimates represent 0.3%-1.1% respectively of the estimated winter period population of 2,819 birds within 20km distance for the development site (including immature birds, as suggested by Furness, 2014; SMP database).

360. The estimated mean number of black guillemots in the AfL+1km was 10 birds (95%UCL: 46 birds, Table 31, Figure 27 d). These estimates represent 0.3%-1.3% of the assumed regional winter period population and thus the area is considered to have **low to medium** importance as a foraging area.

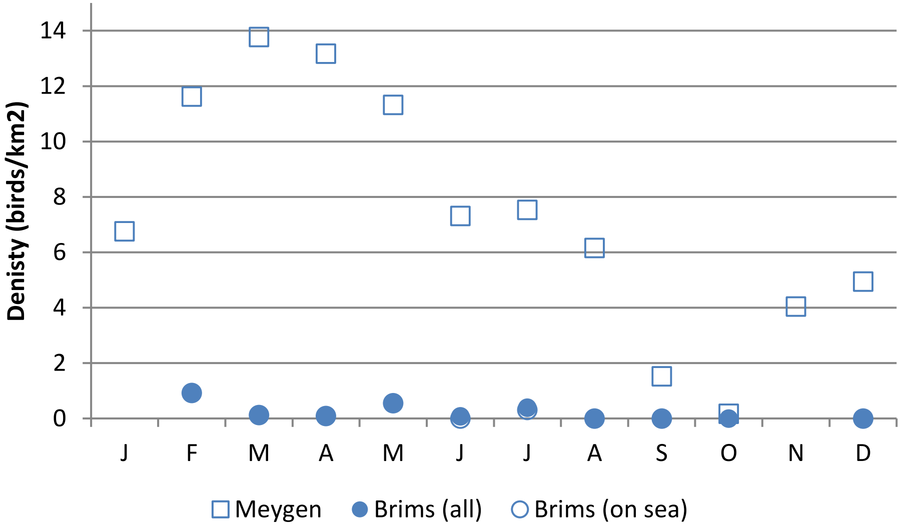
Figure 27. Black guillemot density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



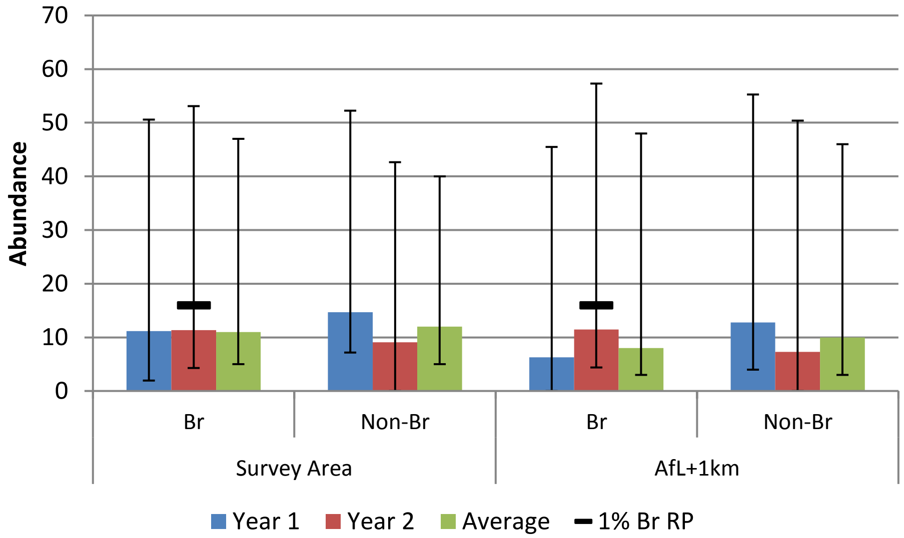
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

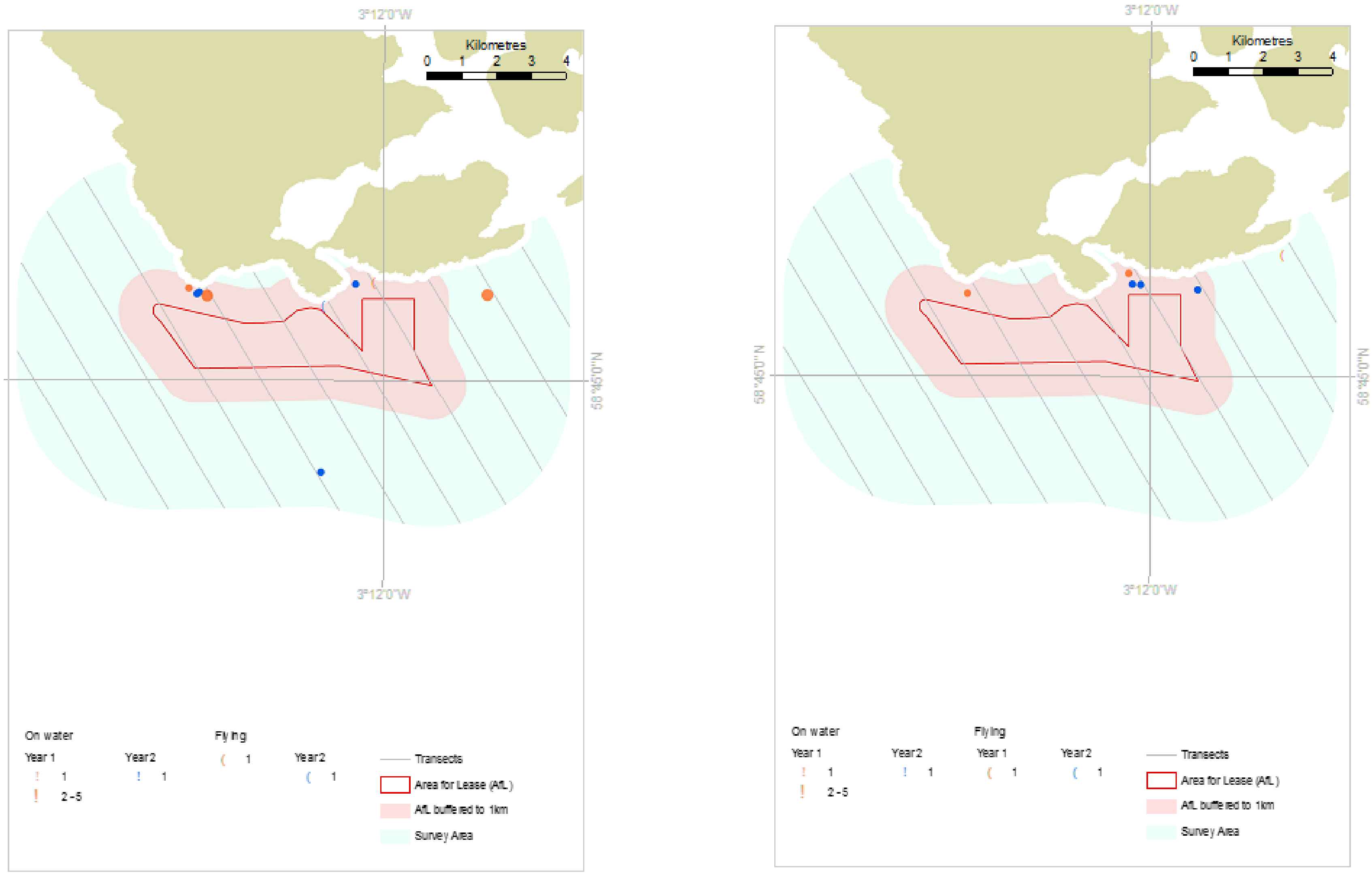


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 28. Distribution and abundance of black guillemots recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-Aug, 10 survey days), and b) the non-breeding period (Sep-Mar, 10 survey days).



a) Breeding (attending colony)

b) Winter period

Behaviour

361. Distribution maps for black guillemot show the species was almost exclusively recorded in inshore waters within 1km from the Hoy coastline. Two years of baseline surveys yielded not a single observation within the AfL (Figure 28).

362. During the breeding season as many as 82% of all black guillemots were recorded in flight, with the remainder sitting on the sea surface. This percentage dropped to 52% during the winter period. Note however, that the total sample size across all 18 surveys was only 49 birds.

363. Out of 36 black guillemots recorded in the Survey Area during the breeding season 3% were seen foraging, classified as carrying food in flight.

364. Fish are caught at or close to the seabed by surface-diving, mostly in depths up to 20m (Snow and Perrins, 1998; Cairns, 1987). Masden *et al*. (2013) reported mean dive depth of 32m and a maximum depth of 43m for breeding birds foraging in the Pentland Firth at a study site only approximately 10km from the Brims AfL. Shoji *et al*. (2015) reported mean dive depth of 9m and a maximum depth of 15m for breeding birds at a study site in Northern Ireland where seabed depths were relatively shallow compared to the Pentalnd Firth.

365. During the colony-attendance period there was a tendency for black guillemot flights to have an E and NE orientation (sample size: 30 birds, figure not shown). This likely indicates connectivity with the breeding pairs on nearby Swona and Switha. Very few birds in flight were recorded during the winter period (<10).

Likely origins

366. Breeding black guillemots travel short distances to forage, ranges from 0.5 to 15km have been published (BirdLife International 2000). The species is relatively common around the Pentland Firth, breeding on Orkney and the Caithness coast as well as smaller islands in the Firth.

367. Black guillemots move very short distances during winter, with immature birds slightly more mobile than adults (Wernham *et al.,* 2002).

Status and protection

368. As the species breeds at low densities at often difficult to access sites there is a limited amount of monitoring data available. As a result no national trend is available for the breeding population (JNCC 2014).

369. No information on population trends was available for Orkney (Furness 2014). A recent survey at the East Caithness Cliffs SPA found large numbers of birds: a total of 1,569 individuals in breeding plumage were counted in 2014, compared to 939 counted in 2000 (Swann 2014). Parts of north Caithness have seen similar increases since the national Seabird 2000 census (Swann 2013).

Vulnerability to tidal device impacts

370. Black guillemots are considered to have moderate to low vulnerability to vessel disturbance and displacement by structures respectively, and a high vulnerability to the potential impacts of tidal developments specifically (Table 5).

Relevance to Project

371. On account of the above information, there is some potential for impacts, largely in relation to disturbance in the 1km buffer zone, as – due to the species' absence from the AfL – the potential for collision risk is essentially non-existent.

Information gaps

372. None of importance.

Comparison with MeyGen surveys

Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea) and the MeyGen site (birds on sea only) shows a very different seasonal pattern (Figure 28 c). Although densities in autumn are nearly identical for both sites, during the remainder of the year densities at the MeyGen site are six to 12-fold higher, indicating that the MeyGen site supports substantially larger numbers of black guillemot than the Brims Survey Area. This is almost certainly a reflection of MeyGen's proximity to the island of Stroma, which supports substantial numbers of breeding black guillemot as well as the very deep waters which across much of the Brims Survey Area, strongly reducing the potential for foraging at or near the seabed. There is no compelling reason to believe that the very consistent year-round pattern detected in the BTA Survey Area is affected by survey gaps in the winter period (November and January wholly, October and December once). For black guillemot the current dataset is therefore considered fit for purpose.

Puffin

Overview

374. Puffins were present in the Survey Area in moderate numbers in the spring and summer months but were relatively scarce in the winter. This species typically forages at depths which will expose it to potential underwater collision risk and has low sensitivity to human disturbance.

Table 32 Puffin seasonal density and abundance estimates derived from Distance Analysis for birds on the sea surface and in flight combined for different parts of the Survey Area. Values for the 95% lower confidence limit (LCL) and 95% upper confidence limit (UCL) of abundance are also presented.

Season	Sample size			Average for season				Maximum for season		
	Surveys	Records	Birds	Density (km^{-2})	No. of birds	95% LCL no. birds	95% UCL no. birds	Density (km^{-2})	No. of birds	95% UCL no. birds
AfL + 1 km										
Colony attendance	7	105	186	6.30	202	122	339	14.36	460	722
Winter	9	1	1	0.05	2	0	7	0.43	14	50
AfL + 2 km										
Colony attendance	7	222	428	8.77	464	273	753	24.20	1,280	1,967
Winter	9	6	6	0.15	8	3	27	0.46	24	83
AfL + 3 km										
Colony attendance	7	343	641	9.42	727	474	1,108	20.44	1,577	2,354
Winter	9	16	19	0.30	23	12	58	0.75	58	227
Survey Area										
Colony attendance	7	530	957	10.05	1,134	716	1,709	20.37	2,301	3,475
Winter	9	32	36	0.41	46	23	116	1.49	168	502
Refer to Caloo (2015) for further details on estimates, detection functions and covariates.										

Colony-attendance period

375. The defined regional breeding population based on the Seabird 2000 census results is 142,670 adults (Mitchell *et al.,* 2004). The actual number of puffins present in the defined region during the breeding season is likely to be greater than this figure because of the presence of non-breeding immature birds. Modelling of the stable age distribution undertaken by Furness (2014) indicates that at the end of the breeding season 55% of puffin populations consist of adult birds, with the remainder made up of immature and juvenile individuals.

376. Puffins were present in the Survey Area in most months during the breeding season, with densities between 2 and 20 birds/km^2 in 2012 and between 2 and 10 birds/km^2 in 2013. The highest densities occurred between May and July during the peak of the breeding season (though note relatively wide confidence intervals), while the species was virtually absent during autumn and mid-winter (Figure 29 a).

377. The seasonal pattern for the AfL+1km is similar to that for the Study Area (Figure 29 b).

378. Statistical analysis revealed a consistent temporal difference in abundance between the breeding season and winter season across both years for puffin, with the species more prevalent during the former (Caloo 2015). This is consistent with locally breeding birds moving away from their breeding colonies after the breeding season (Wernham *et al.,* 2002).

379. The mean estimated number of puffins present in the Survey Area during the colony-attendance period was 1,134 birds (95%UCL: 1,709 birds, Table 32, Figure 29 d). These estimates represent 0.8% and 1.2% respectively of the assumed regional breeding population.

380. The estimated mean number of puffins during the breeding season in the AfL+1km area was 202 individuals (95%UCL: 202 birds). These numbers represent <0.1% of the regional breeding population and thus the area is considered to have **low** importance as a foraging area.

Winter period

381. The mean estimated number of puffins present in the Survey Area during the winter period was 46 birds (95%UCL: 116, Table 32, Figure 29 d). These estimates represent <0.1%-0.1% respectively of the estimated minimum non-breeding period population of 231,957 birds for the North Sea and Channel BDMPS region (Furness, 2014).

382. The estimated mean number of puffins in the AfL+1km was 2 birds (95%UCL: 7 birds, Table 32, Figure 29 d). These estimates represent <0.1% of the assumed regional winter period population and thus the area is considered to have **negligible** importance as a foraging area.

Behaviour

383. Distribution maps shows that puffins were approximately evenly spread over the Survey Area (Figure 30).

384. On average, approximately 59% of puffins estimated to be present during the breeding season were in flight, the remainder were sitting on the sea. During the winter period this percentage dropped to 56%.

385. Out of 1,976 puffins recorded in the Survey Area during the breeding season 2.4% were seen actively foraging, either classified as carrying food (in flight or on water) or diving.

386. Puffins are capable of diving to 60m, although they usually forage at depths of less than 30m (Piatt and Nettleship, 1985; Burger and Simpson, 1986; Spencer, 2012). Breeding puffins off Norway were recorded diving to median depths of 25m – 30m (Barrett and Furness, 1990). Spencer (2012) reports a mean maximum dive depth of 27.8m based on logger data for over 8,000 dives of breeding puffins foraging off the Maine coast, USA.

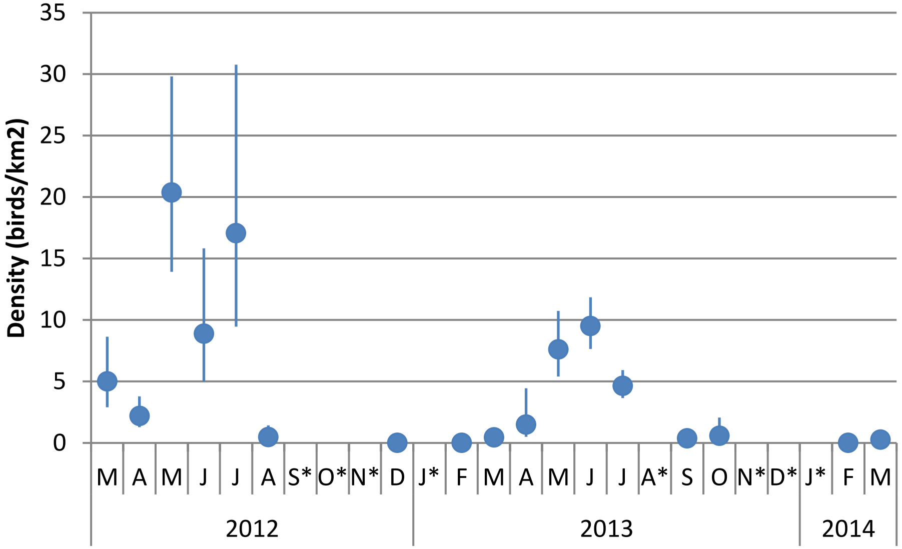
387. During the colony-attendance period there was a strong tendency for puffin flights to have a W and S orientation (figure not shown). This probably indicates strong connectivity to the large Sule Stack and Sule Skerry and North Caithness Cliffs colonies, which both lie within range. Very few birds in flight were recorded during the winter period (<10).

Likely origins

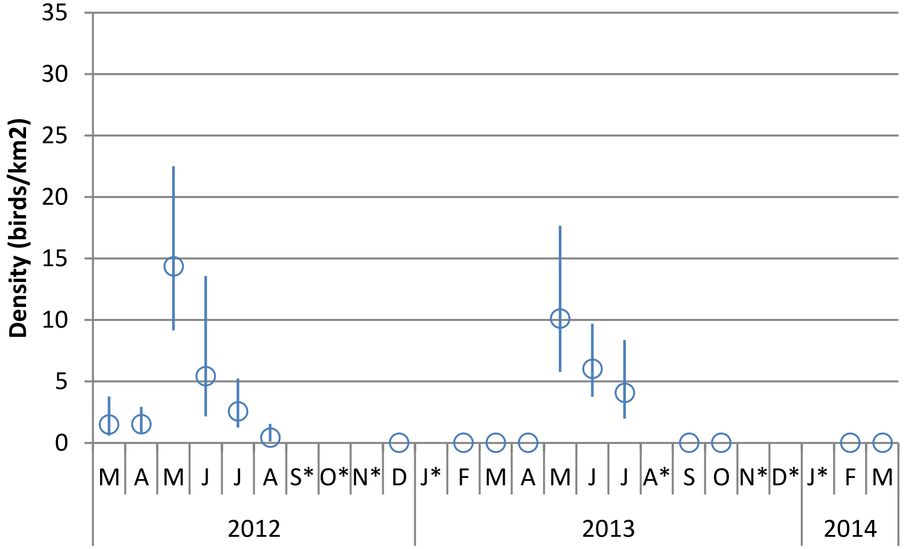
388. Breeding puffins travel large distances to forage; the maximum foraging distance is reported to be 200 km and the MMFR is 105 km (Thaxter *et al.,* 2012). Substantial numbers breed within 105 km from the Survey Area, particularly along the Caithness and Sutherland coast line and across Orkney.

389. During the autumn and winter most puffins move out of the North Sea, and those that remain in the region are likely to be from breeding grounds in eastern Britain and Norway (Wernham *et al.,* 2002).

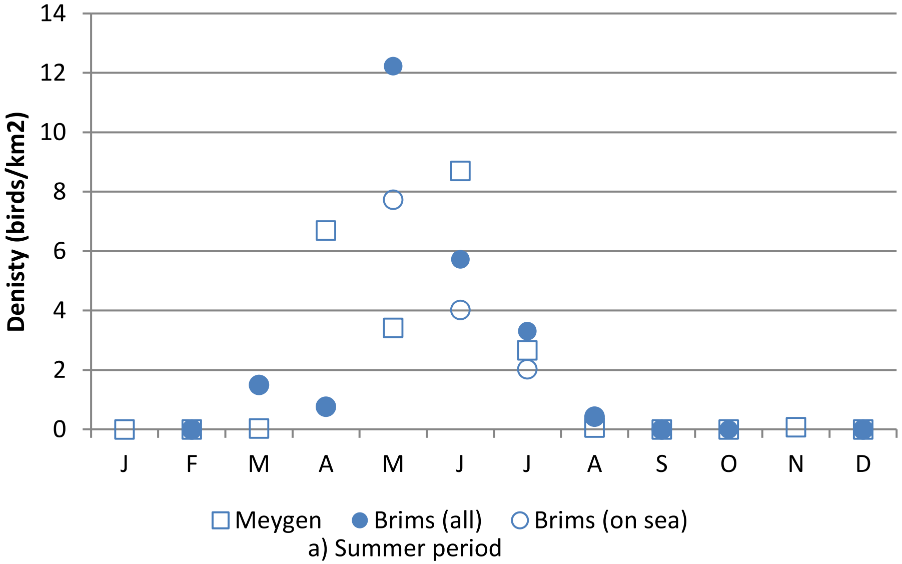
Figure 29. Puffin density and population estimates, seasonal site importance in the breeding season, 95% CLs and comparison with MeyGen results



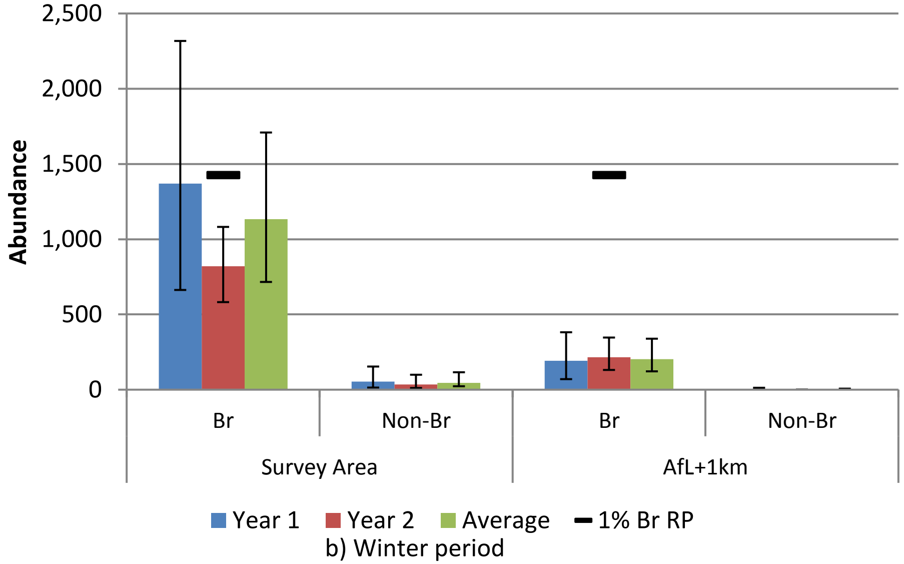
a. Estimated (monthly) survey density for the whole Survey Area (*=no survey)



b. Estimated (monthly) survey density for the Area for Lease (AfL +1km), (*=no survey)

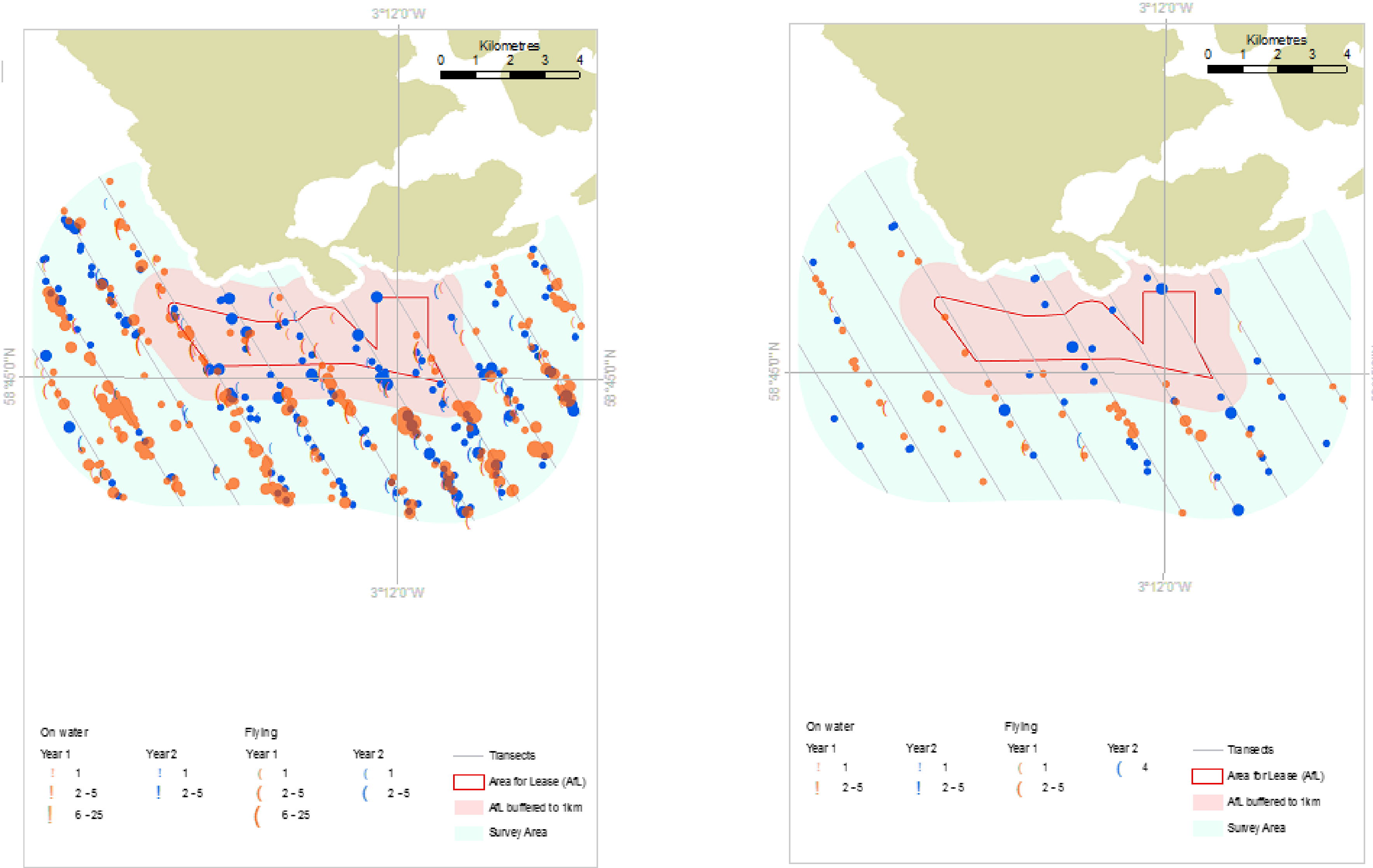


c. Monthly density for AfL+1km (all birds/on sea only) and MeyGen (on sea only)



d. Importance of Survey Area and AfL+1km irt to regional breeding population.

Figure 30. Distribution and abundance of puffins recorded during ESAS surveys between March 2012 and March 2014 for a) the colony-attendance period (Apr-mid Aug, 10 survey days) and b) the non-breeding period (mid Aug-Mar, 10 survey days).



a) Breeding (attending colony)

b) Non-breeding (passage and overwintering)

Status and protection

390. Between the mid-1980s and 2000 numbers breeding in Scotland increased by 13% (Mitchell *et al.*, 2004). No trend is available for the period since then as insufficient monitoring data is available (JNCC 2014).

Vulnerability to tidal device impacts

391. Puffins are considered to have low vulnerability to vessel disturbance and displacement by structures and a moderate vulnerability to the potential impacts of tidal developments specifically (Table 5).

Relevance to Project

392. On account of the above information, it is considered there is some potential for significant impacts, predominantly as a result of exposure to collision risk.

Information gaps

393. None of importance.

Comparison with MeyGen surveys

394. Comparing average monthly densities between the Brims Survey Area (all birds and birds on sea) and the MeyGen site (birds on sea only) show a very similar seasonal pattern (Figure 29 c). Densities in autumn and winter are nearly identical for both sites indicating that it is unlikely that the survey gaps in the latter period (November and January wholly, October and December once) are a cause for concern. For puffin the current dataset is therefore considered fit for purpose.

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APPENDIX 1: ESAS SURVEY RESULTS

Table A33 Survey coverage March 2012 – March 2014.

Survey	Date	Transects completed	Transects not completed	ESAS	MMO	PAMS	Seal haul-out sites checked	Comments
1	27/03/2012	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
2	18/04/2012	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
3	27/05/2012	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
4	30/06/2012	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
5	20/07/2012	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
6	20/08/2012	2,4,6,8,10,12,14,16,18,20	22	Yes	Yes	Yes	Yes	
7	11/12/2012	2,4,6,8,10,12,14	16,18,20,22	Yes	Yes	Yes	Yes	
8	17/02/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	No	Yes	
9	05/03/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	No	No	
(suppl.) 9	04/03/2013	2,4,6,8,10,12,14	16,18,20,22	Yes	Yes	Yes	Yes	
10	30/03/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
11	16/05/2013	None	14	Yes	Yes	Yes	Yes	*ca.*5.4 of 7.4km of T14 surveyed
12	03/06/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	No	
13	25/06/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
14	10/07/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
15	09/09/2013	2,4,6,8,10,12,14,16,18,20,22	None	Yes	Yes	Yes	Yes	
16	23/10/2013	2,4,6,8,10,12,14,16,18	20,22	Yes	Yes	No	Yes	
17	17/02/2014	2,4,6,8,10,	12,14,16,18,20,22	Yes	Yes	Yes	No	

Survey	Date	Transects completed	Transects not completed	ESAS	MMO	PAMS	Seal haul-out sites checked	Comments
17	19/02/2014	20,22	18	Yes	Yes	Yes	No	*ca.*5 of 10km of T18 surveyed
18	12/03/2014	2,4,6,8,10,12,14	16,18,20,22	Yes	Yes	Yes	No	

Table A34 Survey conditions March 2012 – March 2014

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
27/03/2012	07:25	W	2	3	W	2	0	N	3
	07:35	W	2	4	W	2	0	N	3
	07:52	W	2	3	W	2	0	N	3
	08:09	W	2	5	W	2	0	N	3
	08:20	W	2	2	W	2	0	N	3
	08:36	W	2	1	W	2	0	N	3
	08:50	W	2	3	W	2	0	N	3
	09:13	W	2	2	W	2	0	N	3
	09:19	W	2	0	W	2	0	N	3
	09:25	W	2	2	W	2	0	N	3
	09:42	W	2	2	W	2	0	N	3
	10:00	W	2	2	W	2	0	N	3
	10:15	W	2	2	W	2	0	N	3
	10:34	W	2	3	W	1	0	N	3
	10:40	W	2	1	W	1	0	N	3
	10:55	W	2	1	W	1	0	N	3

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	11:02	W	2	0	W	1	0	N	3
	11:15	W	2	1	W	1	0	N	3
	11:30	W	2	1	W	1	0	N	3
	11:45	W	2	1	W	1	0	N	3
	11:58	W	2	1	W	0.5	0	N	3
	12:10	W	2	1	W	0.5	1	N	3
	12:27	W	2	1	W	0.5	0	N	3
	12:45	W	2	1	W	0.5	0	N	3
	12:55	W	2	0	W	0.5	0	N	3
	13:09	W	2	0	W	0.5	0	N	3
	13:20	W	2	0	W	0.5	0	N	3
	13:38	W	2	0	W	0.5	0	N	3
	13:55	W	2	2	W	0.5	0	N	3
	14:03	W	2	2	W	0.5	0	N	3
	14:10	W	2	1	W	0.5	0	N	3
18/04/2012	09:52	SE	2	3	SE	1	0	N	4
	10:06	SE	2	3	SE	1	0	N	4
	10:10	SE	2	3	SE	1	2	N	4
	10:15	SE	2	3	SE	1	2	N	4
	10:34	SE	2	3	SE	2	0	N	4
	10:50	SE	2	3	SE	2	0	N	4
	11:02	SE	2	2	SE	2	2	N	4
	11:15	SE	3	3	SE	2	1	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	11:20	SE	4	4	SE	2	1	N	4
	11:23	SE	3	3	SE	2	1	N	4
	11:27	SE	3	2	SE	2	0	N	4
	11:41	SE	3	2	SE	2	0	N	4
	11:55	SE	3	2	SE	2	0	N	4
	12:10	SE	3	4	SE	2	1	N	4
	12:17	SE	2	2	SE	2	0	N	4
	12:30	SE	2	2	SE	2	0	N	4
	12:45	SE	2	2	SE	2	0	N	4
	13:00	SE	2	3	SE	2	0	N	4
	13:11	SE	2	3	W	2	0	N	4
	13:25	SE	2	3	W	2	0	N	4
	13:53	SE	2	5	W	2	0	N	4
	14:05	SE	2	2	W	2	0	N	4
	14:15	SE	2	2	W	2	0	N	4
	14:23	SE	2	2	W	3	0	N	4
	14:40	SE	2	2	W	2	0	N	4
	14:53	SE	2	2	W	2	0	N	4
	15:18	SE	2	4	W	2	0	N	4
	15:38	SE	3	3	W	2	0	N	4
	16:00	SE	3	3	W	2	0	N	4
	16:13	SE	3	3	W	2	0	N	4
27/05/2012	10:01	SE	2	2	SE	0.5	1	N	3

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	10:16	SE	2	2	SE	0.5	1	N	3
	10:28	SE	2	2	SE	0.5	0	N	3
	10:45	SE	2	3	SE	0.5	0	N	3
	11:00	SE	2	3	SE	0.5	0	N	3
	11:09	SE	3	4	SE	0.5	2	N	3
	11:24	SE	3	4	SE	0.5	1	N	3
	11:39	SE	3	4	SE	0.5	1	N	3
	11:46	SE	3	3	SE	0.5	0	N	3
	12:00	SE	3	3	SE	0.5	0	N	3
	12:15	SE	3	3	SE	0.5	0	N	3
	12:30	SE	3	3	SE	0.5	0	N	3
	12:45	SE	3	3	SE	0.5	0	N	3
	13:03	SE	3	3	SE	0.5	0	N	3
	13:18	SE	3	3	SE	0.5	0	N	3
	13:33	SE	3	3	SE	0.5	0	N	3
	13:45	SE	3	3	SE	0.5	0	N	3
	14:00	SE	3	3	SE	0.5	0	N	3
	14:21	SE	3	2	SE	0.5	0	N	3
	14:36	SE	3	3	SE	0.5	0	N	3
	14:50	SE	3	2	SE	0.5	0	N	3
	15:05	SE	3	2	SE	0.5	0	N	3
	15:20	SE	3	2	SE	0.5	0	N	3
	15:28	SE	2	2	SE	0.5	0	N	3

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	15:43	SE	2	2	SE	0.5	0	N	3
	15:56	SE	2	2	SE	0.5	0	N	3
	16:10	SE	2	2	SE	0.5	0	N	3
	16:21	SE	2	2	SE	0.5	0	N	3
30/06/2012	06:56	NW	1	1	SE	0	0	N	2
	07:15	NW	2	2	SE	0.5	0	N	2
	07:39	NW	2	2	SE	0.5	0	N	2
	07:50	NW	3	3	SE	1	0	N	2
	08:07	NW	4	4	SE	1	0	N	2
	08:38	NW	4	4	SE	1	0	N	2
	09:10	NW	4	4	SE	1	0	N	2
	09:41	NW	4	4	SE	1	0	N	2
	10:00	NW	4	4	SE	1	0	LR	2
	10:19	NW	4	4	SE	1	0	HR	2
	11:02	NW	4	4	E	1	0	HR	2
	12:05	NW	4	4	E	1	0	LR	2
	12:34	NW	4	4	E	1	0	LR	2
20/07/2012	08:12	W	2	2	N	0.5	1	N	4
	08:33	W	3	3	N	0.5	1	N	4
	08:47	W	4	4	N	0.5	0	R	4
	09:15	W	2	2	N	0.5	0	LR	4
	09:40	W	2	2	N	0.5	0	N	4
	10:09	W	2	2	N	0.5	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	10:20	W	2	1	N	0.5	0	N	4
	10:35	W	2	2	N	0.5	0	N	4
	11:00	W	2	2	N	0.5	0	N	4
	11:23	W	2	2	N	0.5	1	N	4
	11:27	W	2	1	N	0.5	0	N	4
	11:45	W	2	1	N	0.5	0	N	4
	11:53	W	2	2	N	0.5	0	N	4
	12:10	W	2	1	N	0.5	0	N	4
	12:37	W	2	2	N	0.5	0	N	4
	12:55	W	2	2	N	0.5	0	N	4
	13:11	W	2	2	N	0.5	0	N	4
	13:25	W	3	3	N	0.5	0	N	4
	13:43	W	3	3	N	0.5	0	N	4
	13:49	W	2	1	N	0.5	0	N	4
	14:05	W	2	1	N	0.5	0	N	4
	14:20	W	2	1	N	0.5	0	N	4
	14:31	W	2	3	N	0.5	0	N	4
	14:54	W	2	3	N	0.5	0	N	4
	15:04	W	2	3	N	0.5	0	N	4
20/08/2012	10:04	SE	2	2	0	0	1	N	4
	10:22	SE	2	2	0	0	0	N	4
	10:46	SE	2	2	0	0	2	N	4
	11:00	SE	2	2	0	0	1	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	11:13	SE	2	2	0	0	0	N	4
	11:35	SE	2	3	0	0	0	N	2
	11:55	SE	2	2	0	0	0	N	2
	12:03	SE	2	3	0	0	0	N	2
	12:29	SE	2	3	0	0	0	N	2
	12:58	SE	2	2	0	0	0	N	2
	13:14	SE	2	2	0	0	0	LR	2
	13:55	SE	2	2	0	0	0	R	2
	14:10	SE	2	2	0	0	0	N	2
	14:32	SE	2	2	0	0	0	N	2
	14:47	SE	2	2	0	0	0	LR	2
	15:06	SE	2	2	0	0	0	N	1
	15:17	SE	2	2	0	0	0	N	2
	15:33	SE	2	2	0	0	0	N	4
	15:40	SE	2	2	0	0	0	N	1
	15:43	SE	2	2	0	0	0	N	1
	15:45	SE	2	2	0	0	0	N	1
11/12/2012	08:57	W	2	2	0	0	0	N	4
	09:18	W	2	2	W	0.5	0	N	4
	09:31	W	2	1	W	0.5	0	N	4
	09:43	W	2	2	W	0.5	0	N	4
	10:00	W	2	2	E	1	0	N	4
	10:14	W	2	2	E	1	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	10:45	W	2	2	E	1	0	N	4
	11:10	W	2	3	E	1	0	N	4
	11:26	W	2	3	W	1	0	N	4
	11:41	W	2	4	W	1	0	N	4
	12:02	W	2	2	W	1	0	N	4
	12:26	W	2	3	W	1	0	N	4
17/02/2013	09:29	SW	3	3	W	0.75	2	N	4
	09:59	SW	3	4	NW	0.75	0	N	4
	10:15	SW	3	3	NW	0.75	0	N	4
	10:38	SW	4	3	NW	0.75	2	N	4
	11:04	SW	4	3	NW	0.75	2	N	4
	11:16	SW	4	3	NW	0.75	0	N	4
	12:21	SW	4	4	NW	0.75	2	N	4
	12:39	SW	4	3	NW	0.75	2	N	4
	12:48	SW	4	3	NW	0.75	0	N	4
	12:58	SW	4	2	NW	0.75	0	N	4
	13:20	SW	4	3	NW	0.75	0	N	4
	13:36	SW	4	2	NW	0.75	2	N	4
	14:01	SW	4	3	NW	0.75	0	N	4
	14:42	SW	4	2	NW	0.75	2	N	4
	15:09	SW	4	2	NW	0.75	0	N	4
	15:33	SW	4	2	NW	0.75	2	N	4
04/03/2013	09:50	SW	3	3	W	1	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	10:05	SW	3	2	W	1	0	N	4
	10:26	SW	3	2	W	1	0	N	4
	10:45	SW	3	3	W	1	0	N	4
	10:52	SW	3	2	W	1	0	N	4
	11:12	SW	3	3	W	1	0	N	4
	11:32	SW	3	2	W	1	0	N	4
	11:40	SW	3	3	W	1	0	N	4
	11:55	SW	3	2	W	1	0	N	4
	12:14	SW	3	2	W	1	0	N	4
	12:30	SW	3	3	W	1	0	N	4
	12:41	SW	3	2	W	1	0	N	4
	13:11	SW	3	2	W	1	0	N	4
05/03/2013	09:54	SW	2	2	NW	1	0	N	4
	10:02	SW	2	3	NW	1	0	N	4
	10:27	SW	2	3	NW	1	0	N	4
	11:03	SW	2	2	NW	1	0	N	4
	11:27	SW	2	3	NW	1	0	N	4
	11:47	SW	2	3	NW	1	0	N	4
	12:10	SW	2	2	NW	1	0	N	4
	12:58	SW	2	3	NW	1	0	N	4
	13:02	SW	2	2	NW	1	0	N	4
	13:26	SW	2	1	NW	0.5	0	N	4
	13:36	SW	2	2	NW	0.5	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	14:18	SW	2	2	NW	0.5	0	N	4
	14:48	SW	2	2	NW	0.5	0	N	4
	15:33	SW	2	1	NW	0	0	N	4
	16:03	SW	2	1	NW	0	0	N	4
	16:30	SW	2	1	NW	0	0	N	4
30/03/2013	10:30	E	2	2	0	0	0	N	4
	10:44	E	2	2	0	0	2	N	4
	11:07	E	2	2	0	0	0	N	4
	11:45	E	2	2	0	0	0	N	4
	12:16	E	2	2	0	0	0	N	4
	12:53	E	2	2	0	0	0	N	4
	13:24	E	2	2	0	0	0	N	4
	14:04	E	2	2	0	0	0	N	4
	15:09	E	2	2	0	0	0	N	4
	15:42	E	2	2	0	0	0	N	4
	16:34	E	2	2	0	0	0	N	4
16/05/2013	09:25	SW	4	4	W	2	3	N	4
03/06/2013	08:30	S	2	1	0	0	0	N	4
	08:44	S	2	1	0	0	0	N	4
	09:14	S	2	2	0	0	0	N	4
	09:40	S	2	1	0	0	0	N	4
	10:11	S	2	1	NW	1	0	N	4
	10:45	S	2	1	NW	1	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	11:07	S	2	1	NW	1	2	N	4
	12:01	S	2	2	NW	1.5	0	N	4
	12:44	S	2	3	NW	1	0	N	4
	13:30	S	2	3	NW	2	0	N	4
	14:00	S	2	2	NW	1	0	N	4
	14:20	S	2	2	NW	1.5	0	N	4
	14:53	S	2	2	NW	1.5	0	N	4
25/06/2013	07:50	W	2	2	W	1	0	N	4
	08:35	W	2	2	W	1	0	N	4
	08:57	W	2	3	W	1	0	N	4
	09:04	W	2	2	W	1	0	N	4
	09:32	W	2	3	W	1	0	N	4
	09:45	W	2	2	W	1	0	N	4
	10:11	W	2	2	W	1	1	N	4
	10:36	W	2	1	W	1	1	N	4
	10:46	W	2	1	W	1	0	N	4
	11:04	W	2	2	W	1	0	N	4
	11:31	W	2	2	0	0	0	N	4
	11:36	W	2	1	0	0	0	N	4
	12:02	W	2	1	0	0	0	N	4
	12:38	W	2	2	0	0	0	N	4
	12:41	W	2	1	0	0	0	N	4
	13:12	W	2	1	0	0	0	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	13:30	W	2	2	0	0	0	N	4
	13:44	W	2	1	0	0	0	N	4
	13:53	W	2	1	0	0	0	N	4
	14:00	W	2	2	0	0	0	N	4
	14:15	W	2	2	0	0	0	N	4
10/07/2013	07:33	NW	3	2	SW	1	0	ILR	2
	07:59	NW	3	3	SW	1	0	ILR	2
	08:12	NW	3	2	SW	1	0	ILR	2
	08:50	NW	3	1	SW	0.5	0	0	2
	09:13	NW	3	2	SW	0.5	0	ILR	2
	09:21	NW	3	2	SW	0.5	0	ILR	2
	09:55	NW	3	1	SW	0.5	0	0	2
	10:38	NW	3	1	SW	0.5	0	0	3
	11:04	NW	3	1	SW	0.5	0	0	3
	11:51	NW	3	1	0	0	0	0	4
	12:19	NW	3	1	0	0	0	0	4
	12:39	NW	3	2	0	0	0	0	4
	12:55	NW	3	2	0	0	0	0	4
	13:25	NW	3	2	0	0	0	0	4
	13:50	NW	3	2	0	0	0	0	4
09/09/2013	07:08	E	2	2	SW	0.5	0	N	3
	07:36	E	2	2	SW	0.5	0	N	3
	08:08	E	2	1	SW	0.5	0	N	3

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	08:28	SE	2	1	SW	0	0	N	4
	08:45	SE	2	2	SW	0	0	N	4
	08:48	SE	2	2	SW	0	0	N	4
	09:29	SE	2	1	SW	0	0	N	4
	10:27	SE	2	1	NW	0.5	0	N	4
	10:46	SE	2	1	NW	0.5	1	N	4
	11:13	SE	2	2	NW	0.5	0	N	4
	12:11	SE	2	2	NW	0.5	0	N	4
	12:41	SE	2	2	NW	0.5	0	N	4
	13:18	SE	2	2	NW	0	0	N	4
	13:25	SE	2	1	NW	0	0	N	4
	13:51	SE	2	3	NW	0	0	N	4
	14:14	SE	2	2	NW	0	0	N	4
23/10/2013	07:00	SE	4	4	SE	1	0	N	3
	07:22	SE	4	4	SE	0.5	0	N	3
	07:49	SE	4	4	SE	1	0	N	3
	08:06	SE	4	4	SE	0.5	0	N	3
	08:22	SE	3	3	SE	0.5	0	N	3
	09:00	SE	3	3	SE	0.5	0	N	3
	09:20	SE	4	4	SE	0.5	0	N	3
	09:42	SE	4	4	SE	0.5	0	N	3
	10:10	S	3	3	SE	0.5	0	N	3
	10:35	S	2	2	SE	0.25	0	N	3

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	10:47	W	4	4	SE	0.25	0	N	3
	11:05	W	2	2	SE	0.25	0	N	3
	11:21	W	2	2	SE	0.25	0	N	3
	12:07	W	3	3	SE	0.25	0	N	3
	12:12	W	4	4	SE	0.25	0	R	3
17/02/2014	09:19	SE	2	2	SE	0.5	2	N	4
	09:44	SE	2	2	SE	0.5	0	N	4
	10:19	SE	2	2	SE	0.5	2	N	4
	10:30	SE	3	3	SE	0.5	2	N	4
	10:48	SE	3	3	SE	0.5	0	N	4
	11:31	SE	3	3	SE	0.5	0	N	4
	11:35	SE	4	4	SE	1	0	N	4
	11:45	SE	4	4	SE	1	1	N	4
19/02/2014	08:49	E	2	2	N	0.5	0	N	4
	09:14	SE	2	2	N	0.5	0	N	4
	10:06	SE	3	3	N	0.5	0	N	4
	10:17	SE	4	4	N	0.5	0	N	4
12/03/2014	09:42	S	2	2	W	0.5	3	N	4
	10:23	S	2	2	W	1	3	N	4
	11:08	S	2	2	W	0.75	3	N	4
	11:49	S	2	2	W	0.75	3	N	4
	12:18	S	2	2	W	0.5	3	N	4
	12:37	S	2	2	W	1	3	N	4

Survey date	Time GMT	Wind direction	Wind force	Sea state	Swell direction	Swell height (m)	Sun glare	Rain	Visibility
	12:53	S	2	2	W	0.5	3	N	4
	13:18	S	3	2	W	0.75	3	N	4
	13:21	S	3	2	W	1	3	N	4

Table A35 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 27th March 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	1	0	0	1	0	0	1	1	1	0	1	2
	Fulmar	188	7	30	225	211(40)	3	54	268	392(61)	24	89	505	791(101)	34	173	998
	Manx shearwater	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	Gannet	0	0	1	1	0	1	1	2	0	2	7	9	0	3	9	12
	Shag	0	0	2	2	11	0	1	12	0	0	2	2	11	0	5	16
	Great skua	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
	Common gull	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Herring gull	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2
	G. black-backed gull	0	0	0	0	0	0	1	1	1	0	1	2	1	0	2	3
	Kittiwake	0	0	0	0	0	0	3	3	0	4	12	16	0	4	15	19
	Guillemot	2	0	3	5	5	2	18	25	46	13	64	123	53	15	85	153
	Razorbill	0	0	0	0	1	0	2	3	1	14	26	41	2	14	28	44
	Guillemot/razorbill	0	0	0	0	0	0	4	4	2(2)	3	14	19	2(2)	3	18	23
	Black guillemot	0	0	1	1	0	0	0	0	0	0	1	1	0	0	2	2
	Puffin	1	0	0	1	4	0	5	9	39	13	57	109	44	13	62	119
	Meadow Pipit	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2
Mammals	Passerine sp.	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2
	Harbour porpoise	0	0	0	0	0	0	0	0	4	0	0	4	4	0	0	4
	Grey seal	0	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2

	Seal sp.	0	0	0	0	1(1)	0	0	1	1	0	0	1	2(1)	0	0	2

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A36 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 18th April 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	9(8)	6	19	34	22	14	44	80	178(80)	48	233	459	209(88)	68	296	573
	Manx shearwater	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Gannet	0	0	3	3	0	2	21	23	2	5	19	26	2	7	43	52
	Shag	0	0	1	1	6	0	1	7	6	0	1	7	12	0	3	15
	Greylag goose	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
	Eider	0	0	2	2	2	0	0	2	0	0	0	0	2	0	2	4
	Arctic skua	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Great skua	0	0	3	3	1	1	2	4	0	0	16	16	1	1	21	23
	Common gull	0	0	0	0	0	0	0	0	0	1	3	4	0	1	3	4
	G. black-backed gull	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	Kittiwake	0	0	150	150	0	1	3	4	123	5	91	219	123	6	244	373
	Guillemot	0	0	44	44	4	12	74	90	19	22	165	206	23	34	283	340
	Razorbill	0	0	11	11	26	1	15	42	24	15	78	117	50	16	104	170
	Guillemot/razorbill	40(40)	0	20	60	0	0	20	20	7	3	110	120	47(40)	3	150	200
	Black guillemot	0	0	0	0	0	0	0	0	2	0	2	4	2	0	2	4
	Puffin	1	0	0	1	3	0	3	6	18	2	43	63	22	2	46	70
	Auk sp.	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
	Meadow Pipit	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Passerine sp.	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2

Mammals	Seal sp.	0	0	0	0	0	0	0	0	1(1)	0	0	1	1(1)	0	0	1

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A37 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 27th May 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 1-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	Fulmar	55	16	29	100	97	18	58	173	979	59	104	1142	1131	93	191	1415
	Gannet	0	4	2	6	0	0	5	5	37	2	2	41	37	6	9	52
	Cormorant	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Shag	0	0	0	0	1	0	6	7	3	0	6	9	4	0	12	16
	Greylag goose	0	0	0	0	0	0	0	0	0	0	12	12	0	0	12	12
	Arctic skua	0	0	2	2	0	0	0	0	3	0	1	4	3	0	3	6
	Great skua	0	0	5	5	0	4	4	8	89	5	16	110	89	9	25	123
	Common gull	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	G. black-backed gull	0	0	0	0	0	0	0	0	0	1	1	2	0	1	1	2
	Kittiwake	0	2	5	7	0	0	7	7	34	18	43	95	34	20	55	109
	Arctic tern	0	0	0	0	0	0	0	0	8	26	7	41	8	26	7	41
	Guillemot	31	49	101	181	96(3)	59	141	296	1652	61	366	2079	1779(3)	169	608	2556
	Razorbill	2	7	7	16	11	8	16	35	79	8	36	123	92	23	59	174
	Guillemot/razorbill	0	3	17	20	65	11	0	76	773	3	47	823	838	17	64	919
	Black guillemot	0	0	0	0	3	0	4	7	0	0	1	1	3	0	5	8
	Puffin	4	21	16	41	28(1)	33	10	71	215	29	110	354	247(1)	83	136	466
	Auk sp.	0	0	0	0	0	0	0	0	3	0	4	7	3	0	4	7
	Swallow	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 1-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Mammals	Common seal	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Grey seal	0	0	0	0	1	0	0	1	3(2)	0	0	3	4(2)	0	0	4
	Seal sp.	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A38 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 30th June 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	Fulmar	8	17	53	78	5	11	62	78	29	48	199	276	42	76	314	432
	Manx shearwater	3	0	1	4	0	1	27	28	5(5)	6	56	67	8(5)	7	84	99
	Storm petrel	0	0	0	0	0	0	0	0	0	3	7	10	0	3	7	10
	Gannet	1	3	2	6	0	1	3	4	1	7	16	24	2	11	21	34
	Shag	0	0	0	0	0	0	1	1	0	0	3	3	0	0	4	4
	Arctic skua	0	0	0	0	0	0	0	0	0	0	4	4	0	0	4	4
	Great skua	0	3	4	7	1	1	8	10	6(5)	9	45	60	7(5)	13	57	77
	Common gull	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	G. black-backed gull	0	0	2	2	0	1	0	1	0	0	1	1	0	1	3	4
	Kittiwake	0	103	16	119	0	102	32	134	172	649	153	974	172	854	201	1227
	Arctic tern	0	0	0	0	0	0	0	0	0	3	5	8	0	3	5	8
	Guillemot	24	9	55	88	3	5	78	86	40	12	275	327	67	26	408	501
	Razorbill	21	8	19	48	2	6	36	44	36	10	97	143	59	24	152	235
	Guillemot/razorbill	0	0	3	3	0	0	0	0	44	2	62	108	44	2	65	111
	Black guillemot	0	0	1	1	0	0	1	1	0	0	0	0	0	0	2	2
	Puffin	4	3	9	16	4	2	11	17	53	13	110	176	61	18	130	209
	Auk sp.	0	0	0	0	10	0	0	10	0	0	2	2	10	0	2	12
Mammals	Grey seal	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A39 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 20th July 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	6	22	31	59	18	33	57	108	18	81	234	333	42	136	322	500
	Manx shearwater	0	1	4	5	0	0	0	0	0	0	0	0	0	1	4	5
	Storm petrel	0	0	0	0	0	0	1	1	0	0	2	2	0	0	3	3
	Gannet	0	1	5	6	2	0	0	2	0	7	15	22	2	8	20	30
	Shag	0	0	0	0	6	0	5	11	7	1	2	10	13	1	7	21
	Arctic skua	0	0	0	0	0	0	0	0	1	0	5	6	1	0	5	6
	Great skua	0	1	2	3	0	2	4	6	1	7	23	31	1	10	29	40
	Kittiwake	0	2	2	4	0	1	17	18	0	176	238	414	0	179	257	436
	Arctic tern	0	0	0	0	0	0	1	1	0	0	3	3	0	0	4	4
	Guillemot	0	0	8	8	0	4	21	25	27	9	36	72	27	13	65	105
	Razorbill	0	0	6	6	0	2	17	19	21	14	39	74	21	16	62	99
	Guillemot/razorbill	0	0	0	0	0	0	1	1	0	0	14	14	0	0	15	15
	Black guillemot	0	0	0	0	1	1	1	3	0	0	2	2	1	1	3	5
	Puffin	1	10	28	39	3	3	38	44	184	28	149	361	188	41	215	444
	Auk sp.	0	0	0	0	0	0	0	0	1	0	1	2	1	0	1	2
Mammals	W-beaked dolphin	2	0	0	2	3 (3)	0	0	3	0	0	0	0	5(3)	0	0	5
	Harbour porpoise	0	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2
	Seal sp.	1	0	0	1	0	0	0	0	1	0	0	1	2	0	0	2
	Minke whale	0	0	0	0	0	0	0	0	1(1)	0	0	1	1(1)	0	0	1

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A40 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of 10 of 11 transects on 20th August 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	3	3	25	31	4	17	53	74	34	77	131	242	41	97	209	347
	Manx shearwater	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Storm petrel	0	0	0	0	0	0	0	0	1	1	6	8	1	1	6	8
	Gannet	7	2	1	10	3	4	6	13	6	4	11	21	16	10	18	44
	Shag	0	0	2	2	0	4	2	6	0	1	1	2	0	5	5	10
	Arctic skua	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Great skua	0	1	2	3	2	6	2	10	2	12	11	25	4	19	15	38
	G. black-backed gull	0	0	0	0	0	0	0	0	0	1	2	3	0	1	2	3
	Kittiwake	0	0	0	0	0	0	2	2	0	1	4	5	0	1	6	7
	Razorbill	0	0	0	0	0	0	0	0	7	0	0	7	7	0	0	7
	Puffin	0	0	0	0	1	0	0	1	3	0	0	3	4	0	0	4
	Swallow	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2
	Grey seal	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Table A41 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of 7 of 11 transects on 11th December 2012.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
	Fulmar	0	16	30	46	20	14	51	85	0	19	44	63	20	49	125	194
	Gannet	0	0	0	0	1	0	0	1	0	5	2	7	1	5	2	8
	Shag	0	1	0	1	4	1	1	6	0	1	9	10	4	3	10	17
	Greylag goose	0	0	0	0	0	22	0	22	0	0	100	100	0	22	100	122
	goosesp.	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	Common gull	0	0	0	0	0	1	0	1	1	1	3	5	1	2	3	6
	Herring gull	0	0	0	0	0	0	1	1	0	0	6	6	0	0	7	7
	G. black-backed gull	0	0	0	0	0	1	0	1	1	3	6	10	1	4	6	11
	Kittiwake	0	0	0	0	0	0	3	3	0	1	0	1	0	1	3	4
	Guillemot	0	0	0	0	1	0	1	2	0	0	12	12	1	0	13	14
	Razorbill	0	1	0	1	0	0	5	5	0	5	2	7	0	6	7	13
	Guillemot/razorbill	0	0	1	1	0	0	0	0	0	0	4	4	0	0	5	5
	Black guillemot	0	0	0	0	0	0	0	0	0	1	5	6	0	1	5	6
Mammals	Grey seal	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Table A42 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 17th February 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	19	7	32	58	30	20	16	66	164	110	149	423	213	137	197	547
	Gannet	0	0	0	0	0	0	0	0	0	1	11	12	0	1	11	12
	Shag	0	0	0	0	6	1	1	8	3	1	0	4	9	2	1	12
	Greylag goose	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	Eider	0	0	0	0	0	0	3	3	0	0	0	0	0	0	3	3
	Herring gull	0	0	6	6	1	0	1	2	0	0	8	8	1	0	15	16
	Great black-backed gull	0	1	2	3	1	0	2	3	1	0	3	4	2	1	7	10
	Large gull sp.	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Kittiwake	0	0	0	0	0	3	0	3	2	5	9	16	2	8	9	19
	Guillemot	5	10	23	38	9	0	24	33	16	13	53	82	30	23	100	153
	Razorbill	0	1	1	2	0	0	1	1	1	1	0	2	1	2	2	5
	Guillemot/razorbill	0	0	18	18	0	0	6	6	0	4	2	6	0	4	26	30
	Black guillemot	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
	Puffin	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Raven	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	3	0	0	3	3	0	0	3

Table A43 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 5th March 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	5	12	29	46	52(1)	9	53	114	209(115)	34	128	371	266(116)	55	210	531
	Gannet	0	2	0	2	0	1	8	9	0	2	21	23	0	5	29	34
	Cormorant	0	0	0	0	0	0	0	0	0	0	3	3	0	0	3	3
	Shag	0	0	1	1	23	0	3	26	1	0	3	4	24	0	7	31
	Pink-footed goose	0	0	0	0	0	0	0	0	0	0	5	5	0	0	5	5
	Greylag goose	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	Common gull	0	0	0	0	0	0	2	2	0	1	2	3	0	1	4	5
	Herring gull	0	0	1	1	0	0	1	1	0	1	1	2	0	1	3	4
	G. black-backed gull	0	0	0	0	0	0	0	0	1	0	1	2	1	0	1	2
	Kittiwake	0	0	4	4	0	6	2	8	0	11	26	37	0	17	32	49
	Guillemot	34	0	25	59	80	7	12	99	111	7	43	161	225	14	80	319
	Razorbill	0	3	1	4	0	0	3	3	11	1	6	18	11	4	10	25
	Guillemot/razorbill	0	0	0	0	0	1	5	6	0	1	8	9	0	2	13	15
	Black guillemot	0	0	0	0	1	0	0	1	0	0	2	2	1	0	2	3
	Little Auk	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
	Puffin	0	0	0	0	0	0	0	0	4	1	2	7	4	1	2	7
	Raven	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
Mammals	Small cetacean	0	0	0	0	0	0	0	0	1(1)	0	0	1	1(1)	0	0	1
	Harbour porpoise	0	0	0	0	1	0	0	1	10(1)	0	0	10	11(1)	0	0	11
	Grey seal	0	0	0	0	0	0	0	0	3(1)	0	0	3	3(1)	0	0	3

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A44 Birds and marine mammals: summary of uncorrected numbers recorded during supplementary ESAS survey of 7 of 11 transects on 4th March 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	2	8	22	32	8	9	17	34	32	6	56	94	42	23	95	160
	Gannet	0	1	0	1	0	0	1	1	0	3	6	9	0	4	7	11
	Shag	0	0	0	0	10	0	4	14	7	0	2	9	17	0	6	23
	Pink-footed goose	0	0	0	0	0	0	0	0	0	0	44	44	0	0	44	44
	Eider	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	Herring gull	0	0	0	0	0	0	0	0	0	0	4	4	0	0	4	4
	Gr. black-backed gull	0	0	0	0	0	0	0	0	2	1	1	4	2	1	1	4
	Kittiwake	0	1	5	6	0	2	5	7	1	1	7	9	1	4	17	22
	Guillemot	4	0	21	25	8	5	13	26	39	5	43	87	51	10	77	138
	Razorbill	0	0	0	0	0	0	0	0	0	0	4	4	0	0	4	4
	Guillemot/razorbill	0	0	0	0	0	0	0	0	0	0	3	3	0	0	3	3
	Puffin	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	5	0	0	5	5	0	0	5
	Grey seal	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1

Table A45 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 30th March 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	8	4	12	24	36	7	22	65	118	25	91	234	162	36	125	323
	Gannet	0	0	0	0	0	0	0	0	0	4	8	12	0	4	8	12
	Shag	0	0	1	1	6	0	1	7	4	0	1	5	10	0	3	13
	Common gull	0	0	0	0	0	0	0	0	0	3	4	7	0	3	4	7
	Herring gull	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	G. black-backed gull	0	0	1	1	0	0	0	0	1	0	3	4	1	0	4	5
	Kittiwake	0	1	1	2	0	0	1	1	0	26	49	75	0	27	51	78
	Guillemot	2	1	2	5	3	4	1	8	14	2	13	29	19	7	16	42
	Razorbill	0	0	0	0	1	0	0	1	5	5	14	24	6	5	14	25
	Guillemot/razorbill	0	0	0	0	0	0	0	0	2	0	1	3	2	0	1	3
	Black guillemot	0	0	0	0	1	0	0	1	0	0	1	1	1	0	1	2
	Puffin	0	0	0	0	1	0	0	1	14	0	1	15	15	0	1	16
	auk sp.	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Common seal	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1
	seal sp.	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Table A46 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS part survey of 1 of 11 transects on 16th May 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	0	1	2	3	0	2	3	5	0	0	0	0	0	3	5	8
	Great skua	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Kittiwake	0	0	0	0	0	0	4	4	0	0	2	2	0	0	6	6
	Arctic tern	0	0	0	0	0	0	170	170	0	75	0	75	0	75	170	245
	Guillemot	1	0	21	22	2	19	18	39	0	3	13	16	3	22	52	77
	Razorbill	0	0	1	1	1	2	4	7	0	1	3	4	1	3	8	12
	Puffin	0	0	2	2	4	0	2	6	0	0	9	9	4	0	13	17

Table A47 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 3rd June 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	2	3	18	23	4	7	31	42	35	42	131	208	41	52	180	273
	Storm petrel	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Gannet	1	0	0	1	0	0	2	2	0	2	3	5	1	2	5	8
	Shag	0	0	0	0	0	0	1	1	17	1	0	18	17	1	1	19
	Greylag goose	0	0	0	0	0	0	0	0	3	0	0	3	3	0	0	3
	Arctic skua	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Great skua	0	1	4	5	1	4	6	11	0	4	25	29	1	9	35	45
	Common gull	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	G. black-backed gull	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Kittiwake	0	2	7	9	40	2	28	70	30	3	16	49	70	7	51	128
	Common tern	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Arctic tern	0	0	0	0	0	2	0	2	0	3	9	12	0	5	9	14
	Guillemot	3	6	36	45	6	24	46	76	32	27	163	222	41	57	245	343
	Razorbill	4	0	16	20	30	5	20	55	57	16	67	140	91	21	103	215
	Guillemot/razorbill	0	0	0	0	0	0	0	0	0	0	9	9	0	0	9	9
	Black guillemot	0	0	1	1	1	0	1	2	0	0	1	1	1	0	3	4
	Puffin	13	0	9	22	18	5	17	40	49	15	84	148	80	20	110	210
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2
	Grey seal	1	0	0	1	0	0	0	0	1	0	0	1	2	0	0	2
	Seal sp.	1	0	0	1	0	0	0	0	1	0	0	1	2	0	0	2

Table A48 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 25th June 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	G. northern diver	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Fulmar	13	12	29	54	13	9	28	50	30	45	82	157	56	66	139	261
	Manx shearwater	0	0	0	0	0	0	0	0	0	0	5	5	0	0	5	5
	Storm petrel	0	0	0	0	0	0	0	0	0	3	4	7	0	3	4	7
	Gannet	0	2	7	9	0	1	0	1	0	6	9	15	0	9	16	25
	Shag	0	0	0	0	0	1	6	7	15	0	3	18	15	1	9	25
	Arctic skua	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Great skua	1	0	1	2	1	3	2	6	0	4	11	15	2	7	14	23
	Black-headed gull	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Common gull	0	0	1	1	0	0	0	0	2	6	5	13	2	6	6	14
	Kittiwake	0	0	6	6	0	3	3	6	755	125	58	938	755	128	67	950
	Common tern	0	0	0	0	0	0	2	2	0	2	1	3	0	2	3	5
	Arctic tern	0	0	0	0	0	0	0	0	0	5	0	5	0	5	0	5
	Guillemot	5	12	44	61	13	5	35	53	104	45	190	339	122	62	269	453
	Razorbill	2	7	25	34	7	4	33	44	298	28	80	406	307	39	138	484
	Guillemot/razorbill	0	0	0	0	0	0	29	29	3	1	6	10	3	1	35	39
	Black guillemot	0	0	0	0	0	1	1	2	0	0	1	1	0	1	2	3
	Puffin	5	9	32	46	5	8	18	31	76	28	110	214	86	45	160	291
Mammals	Grey Seal	1	0	0	1	0	0	0	0	2	0	0	2	3	0	0	3

Table A49 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 10th July 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Fulmar	23	11	34	68	35	12	58	105	70	41	126	237	128	64	218	410
	Manx shearwater	0	0	0	0	0	2	4	6	0	0	4	4	0	2	8	10
	Storm petrel	0	0	0	0	0	0	2	2	0	4	4	8	0	4	6	10
	Gannet	0	0	5	5	0	6	6	12	0	8	14	22	0	14	25	39
	Shag	4	0	0	4	4	1	3	8	2	0	2	4	10	1	5	16
	Arctic skua	0	0	0	0	0	1	0	1	0	1	1	2	0	2	1	3
	Great skua	0	0	0	0	1	0	4	5	5	6	14	25	6	6	18	30
	Common gull	0	0	1	1	0	1	0	1	0	0	1	1	0	1	2	3
	G. black-backed gull	0	0	0	0	0	0	0	0	0	0	3	3	0	0	3	3
	Kittiwake	0	0	2	2	0	1	12	13	5	40	59	104	5	41	73	119
	Arctic tern	0	0	0	0	0	0	0	0	0	6	0	6	0	6	0	6
	Guillemot	20	9	24	53	37	6	45	88	160	38	148	346	217	53	217	487
	Razorbill	2	2	15	19	3	2	14	19	37	14	23	74	42	18	52	112
	Guillemot/razorbill	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Black guillemot	0	0	0	0	2	0	3	5	0	0	1	1	2	0	4	6
	Puffin	3	0	1	4	9	4	17	30	34	12	24	70	46	16	42	104
Mammals	Harbour porpoise	0	0	0	0	1	0	0	1	5	0	0	5	6	0	0	6
	Common seal	1	0	0	1	0	0	0	0	2	0	0	2	3	0	0	3
	Grey seal	0	0	0	0	0	0	0	0	3	0	0	3	3	0	0	3
	seal sp.	0	0	0	0	1	0	0	1	2	0	0	2	3	0	0	3

Table A50 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of all transects on 9th September 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	Fulmar	14	11	53	78	48	15	57	120	28	55	223	306	90	81	333	504
	Sooty shearwater	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Storm petrel	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Gannet	2	8	20	30	6(1)	7	18	31	9	59	222	290	17(1)	74	260	351
	Shag	0	0	0	0	2	1	2	5	0	0	2	2	2	1	4	7
	Grey heron	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Pomarine skua	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Great skua	0	0	0	0	2	0	2	4	3	6	9	18	5	6	11	22
	G. black-backed gull	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
	Kittiwake	0	0	0	0	0	0	2	2	0	4	0	4	0	4	2	6
	Guillemot	0	0	0	0	0	0	0	0	5	0	1	6	5	0	1	6
	Razorbill	0	0	0	0	0	0	0	0	1	1	0	2	1	1	0	2
	Guillemot/razorbill	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Black guillemot	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Puffin	0	0	0	0	0	0	0	0	4	0	1	5	4	0	1	5
	Meadow Pipit	0	0	0	0	0	0	0	0	0	1	1	2	0	1	1	2
Mammals	Marine mammal sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harbour porpoise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Grey seal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seal sp.	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.

Table A51 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of 9 of 11 transects on 23th October 2013.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Great northern diver	0	0	1	1	0	0	1	1	0	0	0	0	0	0	2	2
	Fulmar	0	1	5	6	0	3	5	8	0	5	13	18	0	9	23	32
	Storm petrel	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Gannet	0	3	56	59	0	2	14	16	9	26	61	96	9	31	131	171
	Cormorant	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
	Shag	0	0	1	1	2	0	1	3	0	0	3	3	2	0	5	7
	Goose sp.	0	0	0	0	0	0	0	0	0	0	3	3	0	0	3	3
	Common gull	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
	Herring gull	0	0	1	1	0	0	1	1	0	1	0	1	0	1	2	3
	G. black-backed gull	0	1	0	1	0	0	0	0	0	2	5	7	0	3	5	8
	Large gull sp.	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
	Kittiwake	0	3	8	11	0	0	15	15	7	12	18	37	7	15	41	63
	Guillemot	1	0	5	6	2	0	7	9	8	0	30	38	11	0	42	53
	Razorbill	0	0	2	2	0	0	7	7	5	1	30	36	5	1	39	45
	Guillemot/razorbill	0	0	1	1	0	0	0	0	0	0	4	4	0	0	5	5
	Puffin	0	0	0	0	0	0	0	0	2	4	3	9	2	4	3	9
	Meadow Pipit	0	0	0	0	0	0	4	4	0	0	3	3	0	0	7	7
	Rook	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
Mammals	Grey seal	1	0	0	1	1	0	0	1	1	0	0	1	3	0	0	3

Table A52 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of 7 of 11 transects on 17/19th February 2014.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
	Fulmar	4	6	18	28	49	18	51	118	13	32	136	181	66	56	205	327
	Gannet	0	0	1	1	0	0	0	0	0	0	2	2	0	0	3	3
	Shag	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
	Common gull	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2
	G. black-backed gull	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2
	Guillemot	0	0	0	0	5	1	4	10	1	0	24	25	6	1	28	35
	Razorbill	0	0	0	0	0	0	0	0	0	0	3	3	0	0	3	3
	Black guillemot	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
	Little Auk	0	0	0	0	0	0	0	0	1	1	0	2	1	1	0	2
Mammals	Harbour porpoise	0	0	0	0	0	0	0	0	4	0	0	4	4	0	0	4

Table A53 Birds and marine mammals: summary of uncorrected numbers recorded during ESAS survey of 7 of 11 transects on 12th March 2014.

Type	Species	Area for Lease (AfL)				AfL 0-1km buffer				AfL 2-4km buffer				Survey Area totals			
		On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen	On water	Flying - in transect	Flying - not in transect	Total seen
Birds	Red-throated diver	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
	Black-throated diver	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
	Fulmar	26	10	18	54	6	14	22	42	4	12	53	69	36	36	93	165
	Gannet	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Shag	0	0	0	0	4	0	5	9	0	0	1	1	4	0	6	10
	Common gull	0	0	4	4	0	0	2	2	0	0	5	5	0	0	11	11
	Herring gull	0	0	0	0	0	0	1	1	3	0	0	3	3	0	1	4
	G. black-backed gull	0	0	0	0	0	0	1	1	3	0	0	3	3	0	1	4
	Kittiwake	0	0	1	1	0	1	4	5	0	1	0	1	0	2	5	7
	Guillemot	0	5	12	17	4	1	49	54	6(1)	6	45	57	10	12	106	128
	Razorbill	0	0	5	5	1	0	19	20	0	0	22	22	1	0	46	47
	Guillemot/razorbill	0	0	19	19	0	3	21	24	0	0	14	14	0	3	54	57
	Puffin	0	0	0	0	0	0	0	0	2	0	1	3	2	0	1	3

Number in brackets indicates how many of the total number of individuals on the water were recorded on-effort but not in-transect.