Appendix F.2:
Temporal and Spatial Variation in Seabird Attendance at Longhaven Cliffs

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Temporal and Spatial Variation in Seabird Attendance at Longhaven Cliffs

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Contents

Summary

A number of field surveys were completed in order to inform the Ornithological chapter of the Environmental Impact Assessment Report. This report has specifically concentrated on the seabird receptors which may be affected during the installation of two High Voltage Direct Current (HVDC) cables and a fibre optic cable, which will connect Scotland and Norway. These will be installed from the cliffs at Long Haven, which falls within the Buchan Ness to Collieston Coast Special Protection Area (SPA) and the Bullers of Buchan Coast SSSI, both areas designated for breeding seabirds.

Three assessments were made: the seasonal variation in seabird attendance in the area; the diurnal variation in seabird attendance in the area; and the varying spatial distribution of the seabird species along the area studied. Data was collected over a 17 month period from February 2016 to June 2017.

Data revealed that seabirds were present either on the cliffs or on the surrounding sea in all months of the year. The highest numbers of adult birds were recorded between March and August, with peaks in breeding numbers particularly in May to July. The months with fewest birds on the cliffs were October-December and February. Diurnal variation revealed kittiwakes and guillemots were recorded in larger numbers in the morning than later in the day. Fulmars and shags were recorded more frequently during the evening.

During the non-breeding period certain species revisited the cliffs; in particular fulmars, guillemots, herring gulls and shags. The spatial distribution data identified that the cliffs immediately adjacent to the proposed works have low densities of birds present during the non-breeding period. Further work will assess the potential impact of these works on the seabird receptors at the Long Haven cliffs.

1 Introduction

As part of the Environmental Impact Assessment (EIA) for the HVDC cable routing, it is necessary to identify any potential impacts the construction and operation may have on a variety of ecological receptors, including seabirds.

1.1 Project background

NorthConnect is a commercial Joint Venture which aims to develop, build, own and operate a 1400-megawatt High Voltage Direct Current (HVDC) Interconnector between Peterhead, Scotland and Simadalen, Norway. This link will allow electricity transmitted between the two countries.

1.2 Site background

Assessing the potential impacts of the development on seabirds is particularly important as the cable corridor and landfall site falls within the Buchan Ness to Collieston Coast SPA and the Bullers of Buchan Coast SSSI sites, which regularly support over 95,000 seabirds during the breeding period (JNCC 2001). The Buchan Ness SPA has also been given a marine extension to 2km from the cliffs, to ensure that seabirds have protection to carry out “essential activities” and “maintenance behaviours” (Scottish Natural Heritage 2008). The cable corridor is also between 75m and 150km from three other SPAs designated for seabirds.

Table 1.1 presents the designated sites relevant to seabird receptors in the vicinity of the development.

Table 1.1 Designated sites relevant to the seabird receptors within the NorthConnect HVDC interconnector development.

Site	**Distance from Cable Corridor**	**Designated Interests**	**Feature's importance**
Buchan Ness to Collieston Coast (includes marine extension) SPA.	Crossed at HVDC cable landfall.	Northern fulmar, *Fulmarus glacialis* breeding Common guillemot, *Uria aalge* breeding Herring gull, *Larus argentatus* breeding Kittiwake, *Rissa tridactyla* breeding Eurasian shag, *Phalacrocorax aristotelis* breeding Seabird assemblage, breeding	0.3% national population 1.2% national population 2.7% national population 6.2% of national population 2.8% national population Under Article 4.2 of the Directive (79/409/EEC), over 95,000 seabrids supported.
Bullers of Buchan Coast SSSI	Crossed at HVDC cable landfall.	Seabird colony, breeding Common guillemot, breeding Kittiwake, breeding Eurasian shag, breeding Coastal Geomorphology of Scotland Maritime cliff	As designated under SPA. As designated under SPA. As designated under SPA. As designated under SPA.
Turbot Bank MPA	30km South of HVDC cable corridor	Sandeel ground.	
Troup, Pennan and Lion's Heads SPA	75km north-west of UK landfall	Guillemot, breeding Seabird assemblage, breeding	1.3 % of East Atlantic population Under Article 4.2 of the Directive (79/409/EEC), over 15,000 seabrids supported
Fowlsheugh SPA	75km south of UK landfall	Guillemot, breeding Kittiwake, breeding Seabird assemblage, breeding	1.8% of East Atlantic population 1.1% of East Atlantic population Under Article 4.2 of the Directive (79/409/EEC), over 170,000 seabrids supported

Site	**Distance from Cable Corridor**	**Designated Interests**	**Feature's importance**
Firth of Forth Islands SPA	150km south-west of UK landfall.	Arctic terns, *Sterna paradisaea* breeding Common tern, *Sterna hirundo* breeding Roseate tern, *Sterna dougallii* breeding Sandwich tern, *Thalasseus sandvicensis* breeding Gannet, *Morus bassanus* breeding Lesser black-backed gull, *Larus fuscus* breeding Puffin, *Fratercula arctica* breeding European shag, breeding Seabird assemblage, breeding	1.2 % national population 6.5% national population 15% national population 0.2% breeding population of G.B. 13.1% breeding N. Atlantic population 2.4 % of Western Europe population. 2.3% of breeding population. 2.3 % breeding population of Northern Europe. Under Article 4.2 of the Directive (79/409/EEC), over 90,000 seabrids supported

1.3 Report aims

This report aims to assess:

a) What are the seasonal variations in seabird attendance along the Buchan Ness coastline and the surrounding seas up to 2km?
b) What are the diurnal variations in seabird attendance along the Buchan Ness coastline?
c) What is the spatial distribution of the seabird species along the Buchan Ness coastline during breeding and non-breeding periods?

This assessment is to aid the Environmental Impact Assessment for the Ornithology chapter of the Environmental Statement, which will further assess the types of potential impacts there may be on the seabirds. This work will also aid with the work required for a Habitats Regulation Appraisal screening report.

2 Methodology

2.1 Colonial seabird and vantage point surveys

Natural Research Projects Limited (NRP) were commissioned to carry out a series of ornithological work as part of the NorthConnect HVDC EIA (NRP 2017). Methodological information, count data and results from the NRP report are used in this report.

The assessment concentrates on the area of the Buchan Ness coastline closest to the HVDC cable corridor and landfall site. The cliffs from Boddam to Collieston are part of the seabird colony register (SCR) census, and sub-divisions have been defined by JNCC. The cliff area surveyed for the colonial seabird count encompassed 47 defined areas (Appendix B, Figure B1). One additional area, termed "2Z" was added to the cliff survey area. The survey area equates to approximately a 3km section of coastline. Monthly counts were made between February 2016 and January 2017, targeting the seabird species utilising the cliffs both during breeding (end March-end August) and non-breeding (September-February) periods. Where possible, adults and immatures were distinguished. The number of adults at the breeding or non-breeding site was recorded (both as breeders or loafers), as well as the number of birds on the sea. A loafing bird in this sense is defined as an adult bird using the cliffs for resting or preening, but it cannot be determined if they are associated with a breeding site or not.

As part of the work to summarise the spatial variation in seabird distribution, the area within 500m of the HVDC cable corridor (Areas 2I to 3O) and the area which is to be the HVDC cable landfall area were considered in greater detail (areas 2W-3A) (see Appendix B, Figure B1 for marked landfall area and 500m buffer zone). Table 2.1 shows the units which were used for each of the main species counted. Note for puffins it was not the number of occupied burrows recorded, as is the preferred census method for puffins (Gilbert et al. 1998), but instead was a count of individuals along the cliff. For kittiwakes an adjusted AON was used from March to August, which takes into the adults breeding plus other adults noted at the colony, divided by two. This methodology was adopted from the National Census Instructions (Walsh et al. 1995).

Table 2.1 Units used for seabird counts.

Species recorded	Units used	Conversion factor for total adults
European shag ("shag")	AON	2
Black-legged kittiwake ("kittiwake")	AON	2
Gulls: Herring gull/Lesser black-backed/Great black-backed	AON	2
Northern fulmar ("fulmar")	AOS	2
Common guillemots ("guillemots")	Total count	1
Razorbill	Total count	1
Puffin	Total count	1

Two vantage points (VP) were selected on the coastline such that the possibility of any double counting between the two sites was avoided. One is termed VP North (VPN), and the other is VP South (VPS) (Appendix B, Figure B1). The VP watches were to quantify the numbers of different seabird species on the sea out to 2km from the coast. This was achieved by systematically and steadily scanning the area using a spotting scope fitted with an inclinometer.

2.2 Time-lapse camera study

Two time-lapse cameras were placed along the cliff, termed "North cam" and "South cam" due to their locations (Appendix B, Figure B1). The cameras were Plot Watcher Pros, fitted with a 2x SDH Telephoto lens AF/37mm. The cameras were set to Auto Detect dawn and dusk and took one picture every 10 minutes during this period. High speed SD cards 32GB were used, and the cameras had SD cards swapped approximately monthly. They were deployed in April 2016 and retrieved in June 2017. Due to a problem with the images saving, August 2016 for the North cam is excluded from analysis as no images were retained. Where the camera image was obscured due to weather or sun glare, the image was not included in further analysis. For kittiwake, fulmar and guillemot counts were made as per the colonial seabird survey with AONs/AOSs/total counts. For shags, the cameras were not set up at sites where shags were breeding but were instead recorded as roosting at the site. Their presence was recorded as a binary data point, either being "present" (1) or "absent" (0) from the image. Three images per day were used for analysis: one in the morning (from dawn to noon), one in the afternoon (noon to 5pm) and one in the evening (5pm to dusk). For winter months when daylight in the evening was limited, a time was chosen as closest to the evening time period as possible, whereby the image was still of suitable quality to feasibly count. Times were randomised in Excel and the photo closest to the randomised time was chosen for analysis. Birds were counted manually using the software ImageJ.

A summary of the camera data analysed is provided in Table 2.2.

Table 2.2 Summary of time-lapse camera images counted per species

Camera	Species counted/presence recorded*	No. of images analysed
North cam	Kittiwake Fulmar Shag*	977 974 987
South cam	Guillemot Shag*	1085 1095

2.3 Statistical analyses

The data was analysed for seasonal and diurnal differences in cliff presence within each species, using the software R version 3.4.2. For comparing differences between times of day in the time-lapse analysis, ANOVAS were carried out and, where appropriate, post-hoc Tukey Honest Significant Difference testing was also carried out. The confidence interval was defined as 95%. Times of day were defined as being factors (morning, afternoon and evening). Statistical significance is taken to be $p<0.05$.

2.4 Limitations of the data

In the non-breeding season the use of the term AON or AOS is not as relevant as during the breeding season. However, we wanted to have a usable term throughout the whole year-long period. It should be noted that for the non-breeding period, we cannot distinguish between territories versus individuals adults utilising the site. For the time-lapse photo counts it is possible that for guillemots in particular, some individuals may have been missed due to the resolution size of the images. However, even with a possible small error in some images in terms of exact numbers, the overall differences between the three time periods will still remain, due to the large number of images analysed. In both these cases, the use of the cliffs throughout the season and throughout the different time periods of the day can still be analysed in broad-scale terms. It should also be noted that the camera could only record images when there was some light present, so no data could be obtained from birds only using the cliffs during the night.

3 Results

3.1 Seasonal variation in seabird attendance

For a full breakdown of the individual species refer to the NRP Ornithology report (2017). The following data presented is a summary of the year-round data collected. Summary tables of the data are shown in Appendix A, Table A1.

3.1.1 Year-round seabird survey data

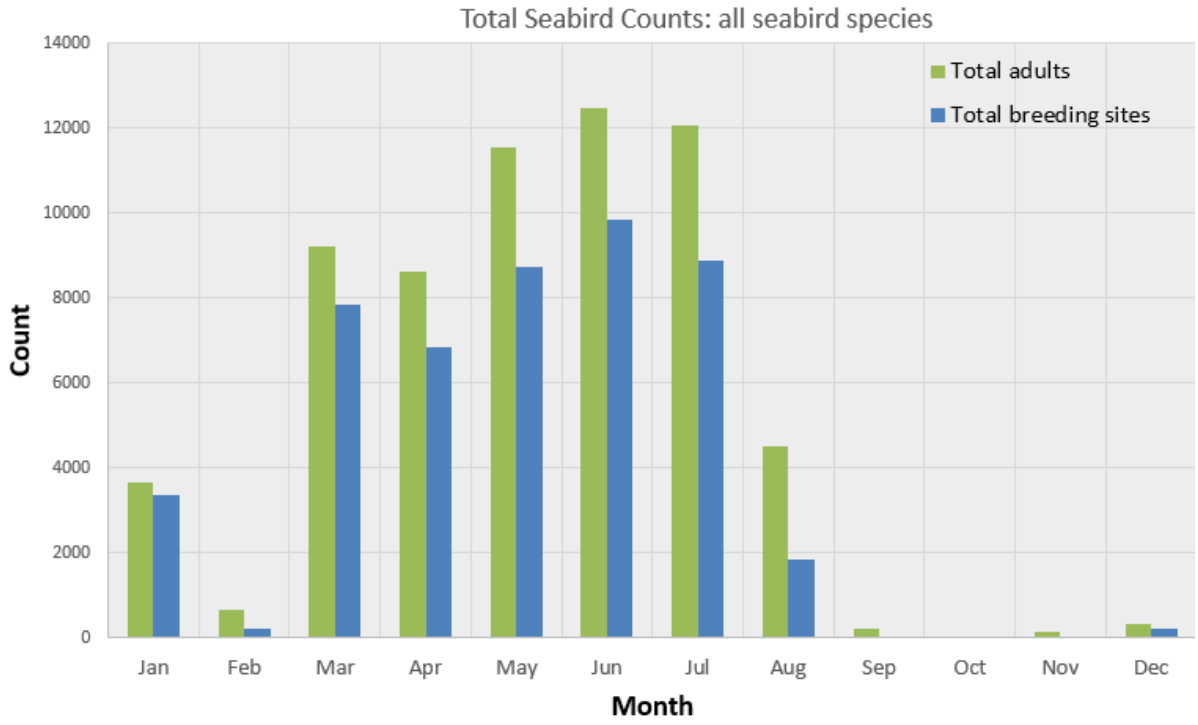

Figure 1 Total number of breeders (blue) and adult loafing birds (green) recorded across the entire bird survey site, per month.

Figure 1 demonstrates that seabirds were recorded as being present along the cliffs in large numbers particularly in the breeding period from March-August. The maximum number of birds recorded in one survey month was in June where 12, 500 adults (approximately 9,900 breeding sites) were recorded. In the non-breeding period, the maximum number of birds recorded in any one month was in January when 3,660 individuals were recorded, 3000 of which were guillemots. September to December shows there is a lower seabird presence in these months, but in January numbers rise again. The peak months for numbers of breeding birds (as shown in the blue in Figure 1) are May (8725), June (9819) and July (8861). The month by month break down for each species is shown in Appendix A Table A1.

Figures 2 and 3 show the total number of breeding sites recorded, split into different species. Figure 2 shows the non-auk seabird species and Figure 3, the auk species (collective term for species such as guillemots, razorbills and puffins).

Figures 2 and 3 demonstrate that fulmar, guillemot and herring gulls are present over the non-breeding period. Roosting shags were also recorded in smaller numbers over the non-breeding period. Fulmars start to return to the site from November onwards, guillemots return in large number in January but have their peak number in March (the pre-laying period). For all the auk species, their numbers drastically decrease by the end of July. Kittiwakes were the second most numerous of the species, after guillemots, being present in high numbers from May to August. Only a small number of puffins and great-black-backed gulls were recorded on the cliffs.

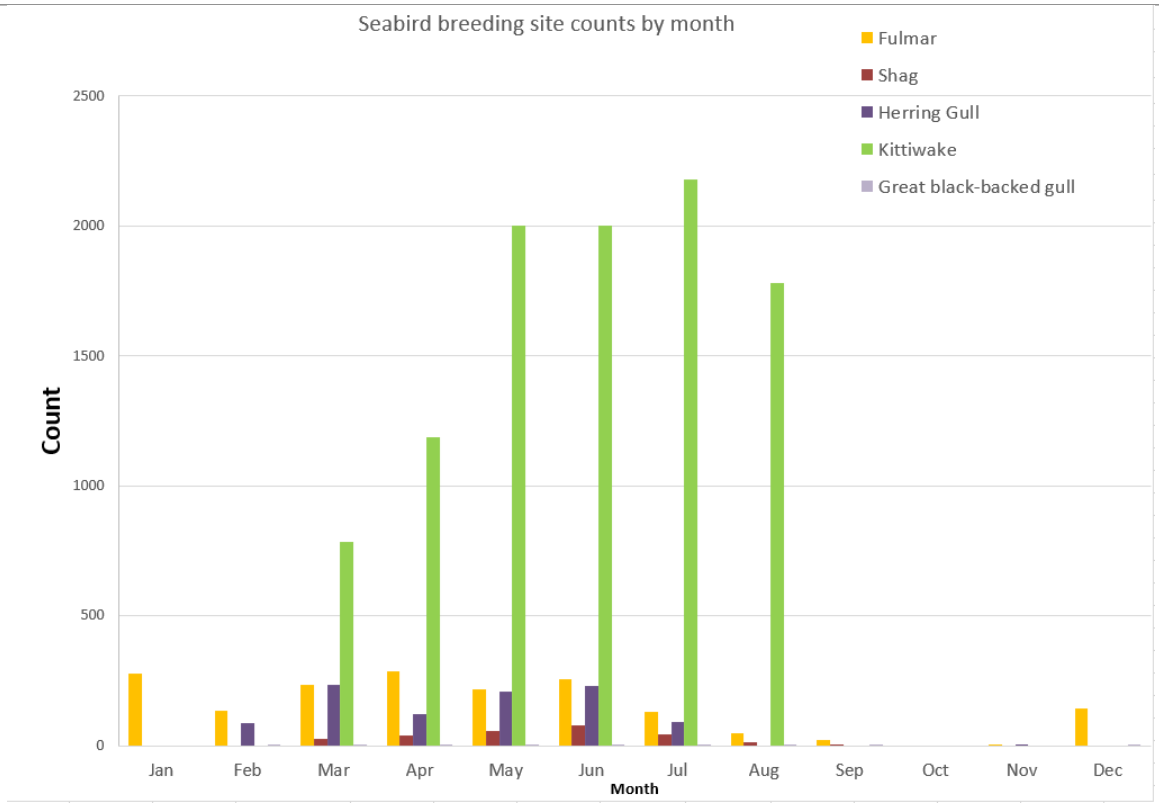

Figure 3 Total number of breeding sites recorded per month for the seabird species (excluding the auk species), per month

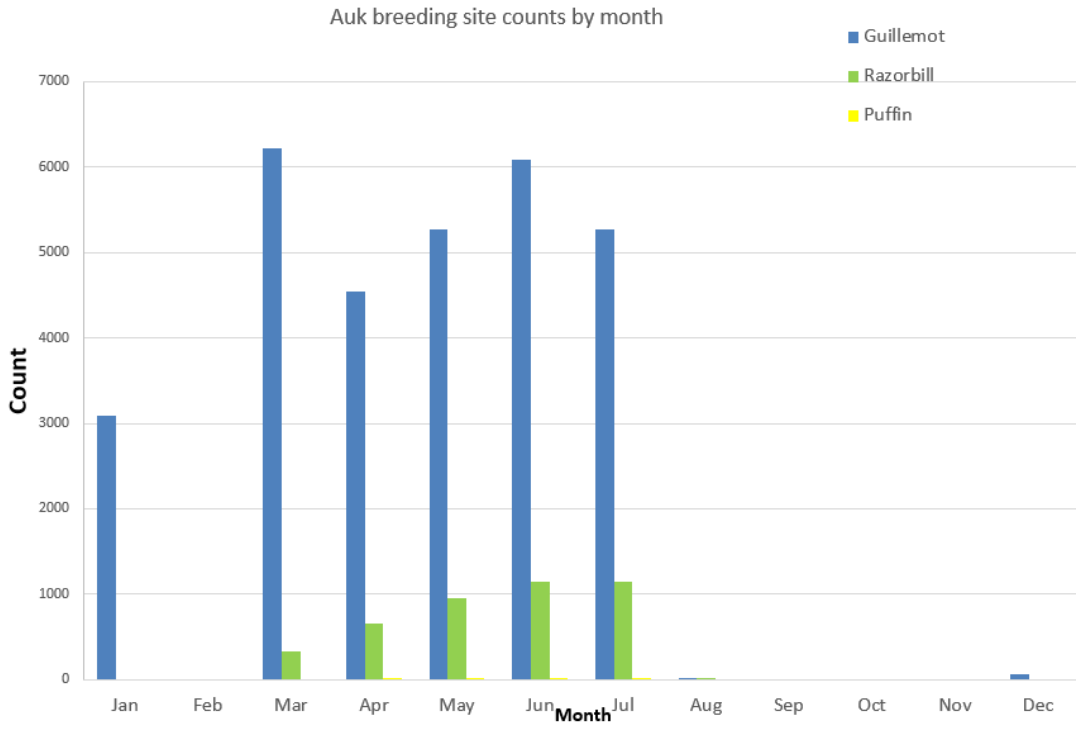

Figure 2 Total number of breeding sites recorded per month for auk species (guillemots, razorbills, puffins), per month

Immature (not yet a breeding adult) and juvenile (within the first year of its life) birds were also noted, the summary of which is in Table A2 (Appendix A). Overall, August had the highest numbers of immatures and juveniles recorded, with 2089 individuals noted. In all species, fewer immatures were noted on the sea compared to on land (Table A2).

Juvenile shags were noted between June and August, immature shags from April until October. Juvenile fulmars were also noted most commonly in August. For kittiwakes, immatures were noted throughout the breeding season sporadically between March and August, however a large number (1687 individuals) of juveniles were recorded in August. Herring gull immatures were observed in every month except October, with a peak being seen in August. Juvenile herring gulls were recorded most commonly between June and August.

Table 3.1 Summary of key seabird species presence along the cliffs. Red is the most sensitive breeding period; Orange is where the birds are recorded at the cliffs during a lower sensitive time period; Green is where the species is not present on the cliffs or are present but in numbers of less than 10% of the maximum number of the species recorded.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fulmars												
Guillemots												
Razorbills												
Herring gull												
Kittwakes												
Shags												

3.1.2 Vantage Point count data

A total of 13 seabird species were recorded from the two VPs. The main target species (fulmar, shag, razorbill, guillemot, kittiwake, and herring gull) were the most frequently recorded species, the remaining species included: cormorant, eider, red-throated diver (*Gavia stellata*), northern gannet, puffin, lesser black-backed gull and great black-backed gull. See Appendix A, Table A3 for the full break down by species. With the exception of red-throated diver, all species were recorded from both VPs.

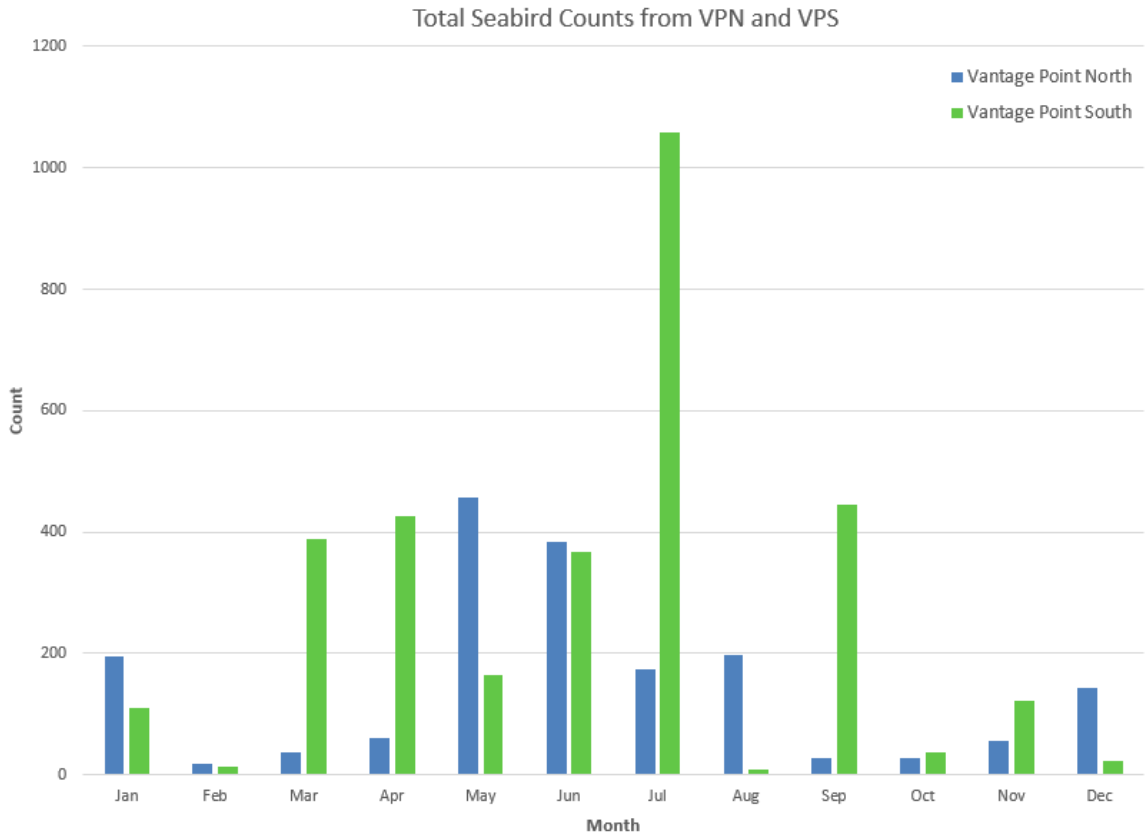

Figure 4 Total seabirds counted at Vantage Point North, and Vantage Point South, by month.

Overall, more birds were observed from the south VP than from the north VP, this was influenced by the high number of birds seen from the south VP in July (Table A3). The largest combined monthly count was in July (1231 individuals), and the lowest combined count was in February (31 individuals).

The most numerous species recorded on the sea was the guillemot, which were recorded from at least one vantage point in all 12 survey months. In May, June and July there were 378, 405 and 817 birds recorded on sea, respectively. Kittiwake was the second most numerous species recorded on the sea from the VPs and were only recorded between March and September (with May having none recorded on the sea). April saw their peak with 344 individuals recorded. Herring gull was the third most numerous species. Herring gulls were recorded during eight monthly counts, and consistently between April and July. The largest combined monthly total was in June (Table A3). Razorbill was the next most numerous species. Most razorbills were seen on the water between April and September, although none were recorded in August. September saw their peak with 200 individuals being recorded, the vast majority (196) from VPS. Fulmar were recorded from the VPs in all months, except

October and November. The highest combined counts for fulmar were in December (125 individuals) and January (127 individuals).

Shag was less numerous than the other main target species but were recorded on the sea in all months except May. Their peak months recorded at sea was in December, with 22 individuals noted. Overall more birds were recorded from the south VP, which had higher counts in eight of the eleven months when birds were seen.

The remaining species had few records: gannet was recorded in four of the monthly counts; puffin was recorded consistently from April to August but was absent from all other monthly counts; great black-backed gull was recorded in six of the monthly counts. Species' total annual counts were of less than ten individuals for: eider, red-throated diver, cormorant and lesser black-backed gull (Table A3).

3.2 Diurnal variation in seabird attendance

For each species recorded as part of the time-lapse study the average number of birds recorded during the morning, afternoon and evening were considered on a month by month basis.

For kittiwakes, in the pre-laying period (March and April), numbers of birds recorded were found to be significantly different between different times of the day ($F_{(2,179)} = 7.33$, $p < 0.001$) (Figure 5). Further analysis revealed that fewer birds were recorded in the morning compared to both the afternoon (Tukey HSD p=0.02) and the evening (Tukey HSD p<0.001). In the main breeding period (May-July), once again there were significant differences between the times of day the birds were recorded ($F_{(2,265)}$=5.63, p=0.004). In contrast to the pre-laying period, more birds were recorded in the morning compared to the afternoon (Tukey HSD p=0.004) or the evening (Tukey HSD p=0.046) (Figure 5).

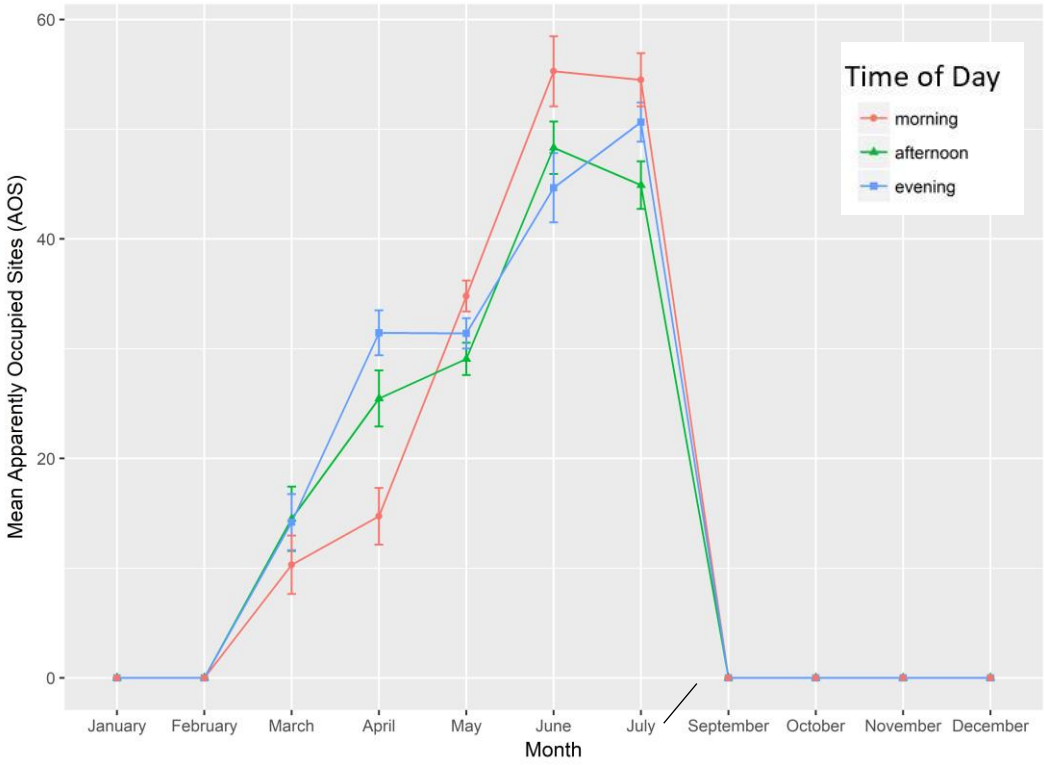

Figure 5 The mean number of kittiwakes recorded at each time period across a year, with the standard error.

For fulmars, there were significant differences between when birds were recorded during the day, across the whole year ($F_{(2,961)}$=5.48, p=0.004). In every month except June they were recorded in higher numbers during the evening than earlier in the day (Figure 6). This difference was significant (Tukey HSD evening-morning: p=0.004; Tukey HSD evening-afternoon: p=0.04). This difference was more pronounced during the non-breeding period (September to February).

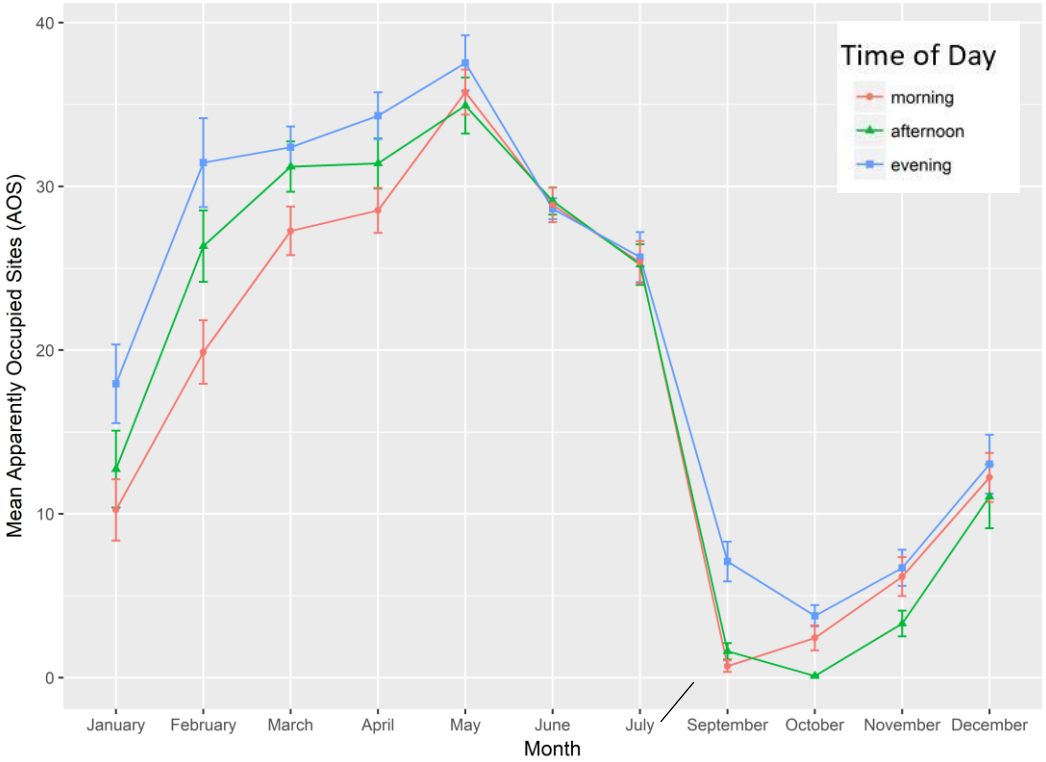

Figure 6 The mean number of fulmars recorded at each time period across a year, with the standard error.

Guillemots were recorded in higher numbers during the morning time compared to the afternoon or evening time (Figure 7). These differences between times of day and the numbers recorded were statistically significant ($F_{(2,1073)}$=7.00, p<0.001). Post-hoc tests revealed that differences between numbers recorded in the evening and afternoon were not statistically significant across the whole year (Tukey HSD p=0.849), but differences were significant between the morning and the afternoon (Tukey HSD p=0.001) and the morning and the evening (Tukey HSD p=0.010).

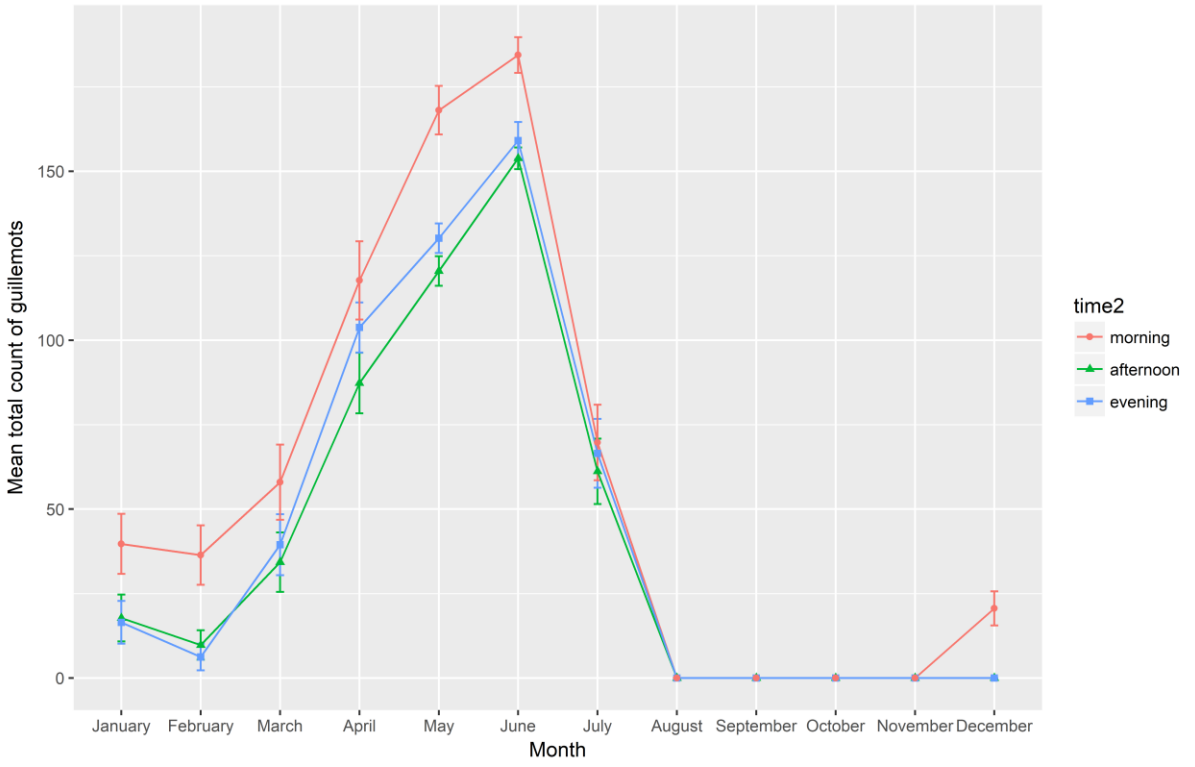

Figure 7 The mean number of guillemots recorded at each time period across a year, with the standard error.

Figure 8 demonstrates the number of times that non-breeding shags were found roosting at the time-lapse locations. Note that there are no shags recorded between April and July because they only used these two time-lapse locations for loafing, resting or roasting – not for breeding. Overall, shags were recorded at these locations in larger numbers in the evening time. Overall, fewest shags were recorded during the morning period.

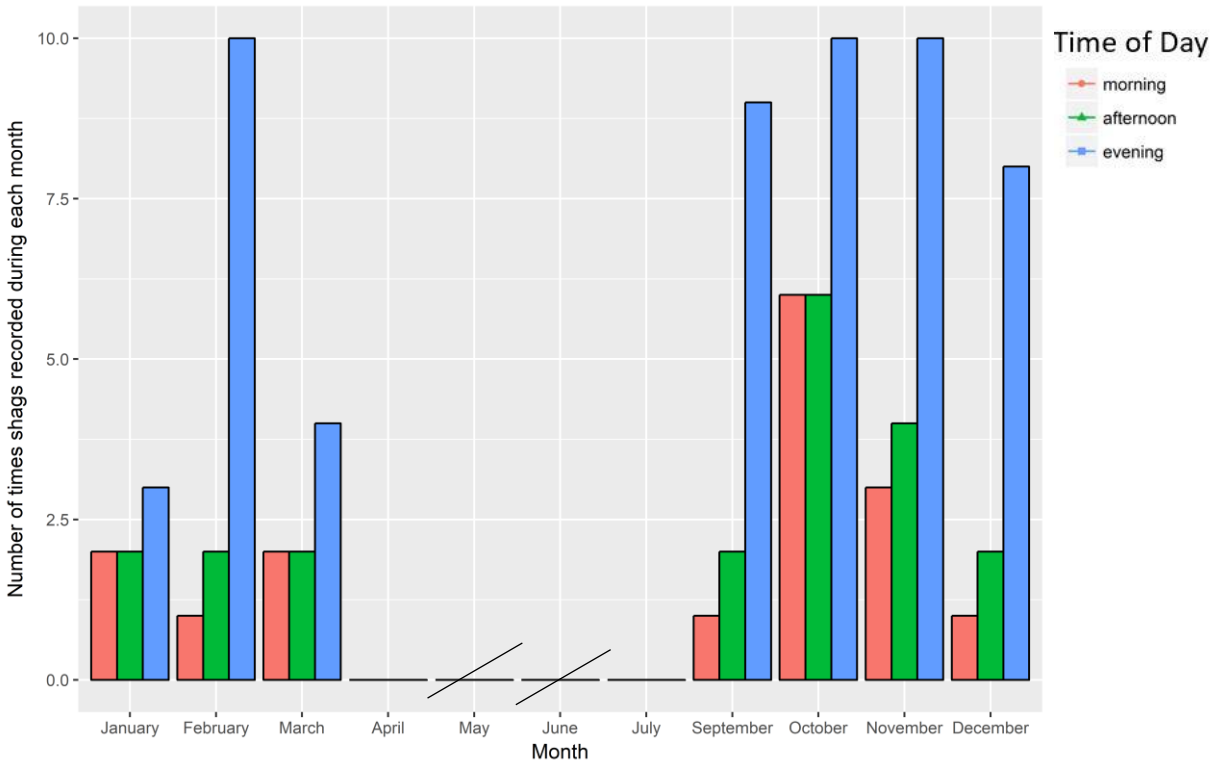

Figure 8 The number of instances shags were recorded during the non-breeding period on the camera per month during different times of the day. Note this is not the absolute number of shags recorded.

3.3 Spatial variation in seabird attendance

The NRP report presents detailed information on spatial variation in seabird attendance. They concluded that the distribution of the seabird species was not regular along the cliffs, with clusters noted in a number of areas. The NRP presents figures of maximum counts recorded, which demonstrate this. One of the most important outputs from the seabird survey results was what seabird species utilise the areas which are within the 500m buffer zone from the landfall site (encompassing areas 2I to 3O), and which seabirds are specifically utilising areas adjacent to where the landfall will be (encompassing areas 2Z,2W,2X,2Y, and 3A). Figures from the NRP report are reproduced in Appendix B. Summary tables of the data are shown in Appendix A, Tables A5-A10. A summary table of the number of occupied sites throughout the year within the 500m buffer zone and in the landfall area are shown in Table 3.2. The proportion of birds compared to the total number recorded across the whole 3km area are also shown in brackets.

Table 3.2 Summary of the number of key seabird species recorded within the 500m buffer zone and within the adjacent landfall area. The proportion of birds recorded in relation to the whole 3km surveyed are shown in brackets.

	Fulmar AOS		Kittiwake AON		Guillemot total		Razorbill total		Herring gulls AON		Shag AON	
	500m	Landfall	500m	Landfall	500m	Landfall	500m	Landfall	500m	Landfall	500m	Landfall
January	214 (77%)	0	0	0	2910(94%)	0	0	0	0	0	0	0
February	77 (57%)	3 (2%)	0	0	0	0	0	0	60(71%)	0	0	0
March	150 (64%)	3 (1%)	479 (61%)	38 (5%)	4683(75%)	12(<1%)	169(51%)	11(3%)	171(74%)	27(12%)	16(64%)	0
April	195 (68%)	7 (2%)	693 (58%)	67 (6%)	3456(76%)	12(<1%)	425(65%)	54(8%)	76(63%)	7(6%)	26(70%)	0
May	123 (57%)	4 (2%)	1324 (66%)	91 (5%)	4336(82%)	10(<1%)	538(56%)	48(5%)	131(64%)	16(8%)	30(53%)	0
June	164 (64%)	5 (2%)	1315 (66%)	101 (5%)	4999(82%)	0	578(51%)	35(3%)	155(67%)	21(8%)	48(60%)	0
July	76 (58%)	8 (6%)	1360 (62%)	90 (4%)	4171(79%)	11(<1%)	644(56%)	43(4%)	78(84%)	2(2%)	21(49%)	0
August	36 (73%)	1 (2%)	988 (56%)	69 (4%)	8(89%)	0	0	0	0	0	6(46%)	0
September	15 (68%)	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0	0
December	107 (74%)	1 (1%)	0	0	64(100%)	0	0	0	0	0	0	0

3.3.1 Seabirds distributed within 500m of the landfall site (landfall included)

3.3.1.1 Kittiwakes

The densest areas of breeding kittiwakes within the 500m buffer zone were areas 2N, 2O, 2P and 3F. Kittiwakes are well distributed around the coastline, with very few areas having no kittiwakes recorded. No kittiwakes were recorded along the coastline during the non-breeding period.

3.3.1.2 Fulmars

In the breeding period, the densest number of breeding sites was recorded in area 2P, a stack just off the cliffs, with 80 sites noted. From area 2N to 2S there were between 11 and 23 nests recorded in each area. There were a number of section which had 0-5 nests recorded per area.

During the non-breeding period, the densest patch of fulmars utilising the coastline were once again recorded in area 2P, a stack just off the cliffs. Areas 2N and 2R were the next densest parts of the cliff with 33 and 27 sites being recorded respectively.

3.3.1.3 Guillemots

There are dense patches of breeding guillemots within 500m from the landfall site, with two offshore stacks having the largest number of guillemots recorded out of all the areas (area 2P and 2V with 2550 and 1075 birds respectively). A further stack to the south of the landfall site in area 3B also had a large number of guillemots recorded during the breeding period (512).

In the non-breeding period, area 2P is again the preferred area with 1804 being recorded. The stacks at 2V and 3B also recorded the second and third highest numbers of 520 and 230 respectively.

3.3.1.1 Razorbills

The densest patches of breeding razorbills were recorded in the offshore stack area 2P (132 pairs), 2N (80 pairs), 3B (96 pairs) and 3C (66 pairs). Razorbills were scattered along the coastline within the 500m zone, with numbers varying around the coastline. In the non-breeding razorbills were not noted on the cliffs.

3.3.1.2 Herring gulls

In the breeding period, herring gulls within the 500m buffer were recorded in greatest numbers on three stacks just off the cliffs: in area 2P (45 nests), area 2V (33 nests) and area 3B (30 nests).

During the non-breeding period the two areas with the highest numbers recorded are once again area 2P (29 birds) and 3B (14 birds).

3.3.1.3 Shags

During the breeding period low numbers of shags were recorded within the 500m of the landfall. In area 3B there were 14 breeders recorded. Only one other area had more than 5 shags breeding with area 2N being recorded as having 8 breeders. Juvenile shags were also recorded during the breeding period, with the maximum being recorded in area 3B, with 20 juveniles recorded.

3.3.2 Seabirds distributed adjacent to the landfall site

3.3.2.1 Kittiwakes

A total of 106 kittiwake sites were recorded in the areas adjacent to the landfall site, with the densest patch being 75 sites in area 2X. The number of kittiwakes recorded during the breeding period in this area equates to between 4% and 6% of the total number of kittiwakes recorded in the seabird survey area (Table 3). In the non-breeding period, no kittiwakes were noted in these areas. Kittiwake juveniles

were also noted in these areas: in area 2W there were 10 recorded and in area 2X there were 59 during August.

3.3.2.2 Fulmars

A total of 9 site were recorded in the landfall sections: 8 in area 2Z and 1 in area 3A. In the non-breeding period 3 fulmars were noted in area 2Z. The number of fulmars recorded during year in this area equates to between 1% (December) up to 6% (July) of the total number of fulmars recorded in the seabird survey area (Table 3).

3.3.2.3 Guillemots

A total of 12 guillemots were recorded breeding in the area adjacent to the landfall, in area 3A. The number of razorbills recorded during the breeding period in this area equates to less than 1% of the total number of guillemots recorded in the seabird survey area (Table 3). No guillemots were recorded in the areas adjacent to the landfall site in the non-breeding period.

3.3.2.4 Razorbills

A total of 68 razorbills were recorded breeding in the area adjacent to the landfall area, over half of which within area 3A. The number of razorbills recorded during the breeding period in this area equates to between 3% to 8% of the total number of razorbills recorded in the seabird survey area (Table 3).

3.3.2.5 Herring gulls

During the breeding period area 2Y had 22 nests recorded in it. No other area adjacent to the landfall site had more than 5 herring gull nests. The number of herring gulls recorded during the breeding period in this area equates to between 2% to 12% of the total number of herring gulls recorded in the seabird survey area (Table 3). No herring gulls were recorded as being present in the areas directly adjacent to the landfall site during the non-breeding period.

3.3.2.6 Shags

No breeding or non-breeding shags were recorded in areas adjacent to the landfall site. No juvenile shags were recorded in these areas either.

4 Discussion

4.1 Seasonal variation in seabird attendance

The largest number of seabirds present on the cliffs was during March to August in the breeding period, with a peak count during June of 12,500 individuals. Nearly 59,000 adults were recorded in total using this 3km stretch of coastline over 6 surveys, indicating its ecological importance and demonstrating why the Buchan Ness to Collieston is a designated site. Immature and juvenile birds were also recorded throughout the year. The evidence from the year-round seabird counts demonstrates that for certain species, for example fulmars and kittiwakes, whilst many adults will have left the breeding colony in August, juvenile birds may still be present.

During the non-breeding period (September to February) certain seabird species will head to their wintering and moulting grounds. Nevertheless, there was a peak of 3660 seabirds present along the cliffs during this period, demonstrating that some seabird species do visit the colony periodically throughout the non-breeding period. By considering the numbers on a month to month basis, it was noted that September-December, and February were the months with the lowest numbers of birds recorded. Further analysis into what species were present over the non-breeding period revealed that fulmars, herring gulls and guillemots are recorded on the cliffs, with peaks of attendance being in

January. These winter peaks were mostly on offshore stacks from the cliffs, not in the immediate vicinity of the landfall area. One possibility as to why certain species revisit the breeding colony during the non-breeding period is to ensure that the nesting territory is maintained (Quinn 2014), as nest site fidelity has been proven as a factor affecting breeding success in certain seabird species (Naves et al. 2007). Furthermore, partners have been known to meet at the colony during the non-breeding period, so the ability to reconnect with your partner over the non-breeding period may be another important factor to return to the colony. Maintaining a pair bond can be important for certain long-lived seabird species (Quinn 2014; Sánchez-Macouzet et al. 2014).

The seabird species analysed demonstrated peak attendance at the cliffs during May until July, with the exception of the guillemots which had peak numbers in March, and kittiwakes, which were recorded in high numbers into August. It is not surprising that these are the months with peak numbers: most seabirds begin returning to their colonies in March/April to establish both their nest site and find or reconnect with their partner. The majority of the egg laying period will be in late April/May, although this may be early or later depending on weather conditions and food conditions of that particular year (Frederiksen et al. 2004; Reed et al. 2009). Depending on the egg incubation period, the chicks will begin hatching towards the end of May/June. The chick-rearing period will then take place during June and July, and for some species this will continue into August. Non-breeding adults at seabird colonies may still return to the colony and will loaf around the colony. In general, they will leave the colony earlier than breeders, in order to complete their moult (Allard et al. 2008; Bridge 2006).

The vantage point data revealed that seabirds were recorded on the sea close to the cliffs in every month of the year. The highest numbers of birds noted on the sea occurred during April until September, with June and July being the peak months for birds recorded at sea. The species recorded in highest numbers were guillemots, kittiwakes and herring gulls. Whilst there are exceptions due to individual preference in adult seabirds for particular foraging patches, in general seabirds forage closer to their nest site during the chick rearing period (Guilford et al. 2008; Phillips et al. 2004; Rayner et al. 2012). Thus, it makes sense that more birds were recorded on the sea during June and July, as these are peak chick-rearing months. It could be that these birds are using the waters for direct foraging, or they could be using the waters for cleaning and preening, or the waters may also be a place for them to rest. As tracking data has revealed that many species of seabird can travel hundreds of kilometres to feed during the breeding period (BirdLife International 2018), even thousands of kilometre in certain species (e.g. fulmars, (Edwards et al. 2013), it is likely that these close-by waters (i.e. within the 2km of the vantage point survey) provide varying needs for seabirds beyond simply a foraging patch. The importance of nearby waters to seabirds has been recognised within the marine extension to 2km from the sea cliffs, which has been designated to ensure that seabirds have protection to continue their “essential activities, such as preening, bathing, displaying, and other maintenance behaviours” (Scottish Natural Heritage 2008).

Other seabird species; eider, red-throated diver, puffins, manx shearwater, gannets, cormorants, lesser black-backed and great-black backed gulls, were noted either flying past the cliffs or utilising the waters off the cliffs. Of these, only the puffin, cormorant, and great-black backed gull were recorded as having breeding adults within the seabird survey site. It is possible that some of these species using the waters will be coming from nearby seabird colonies. For example, the gannets may be coming from the mainland gannet colony at Troup Head, or could also be from Bass Rock, within the Forth islands SPA.

Of all the seabirds recorded three are Annex 1 species on the EU Birds Directive list: guillemots, shags and red-throated divers. In conjunction with the qualifying species for the Buchan Ness to Collieston SPA designation, particular attention will be paid to these species when carrying forward with the Environmental Impact Assessment.

4.2 Diurnal variation in seabird attendance

The overall results of the diurnal study revealed that certain species may be more likely to be present in larger number depending on the time of day. For kittiwakes and guillemots, which were both found in larger numbers during the morning than later in the day. It was particularly interesting to note the early return of guillemots to the colony, as during December in particular, they were only ever at the colony first thing in the morning. Due to the cameras having limited capabilities in dark light conditions, it is not possible to say if the guillemots are using the site to roost overnight. However, it is likely this is the case, as common guillemots have been recorded foraging more frequently during the daylight hours compared to darkness (Thaxter et al. 2009). This means that depending on the time of day surveys take place during the non-breeding period, the numbers in the year-round survey could be an underestimation of how many guillemots are utilising the cliffs during the non-breeding time period.

For fulmars and shags more birds were recorded in the evening compared to earlier in the day, for most of the year. Previous studies have shown that shags are daylight foragers (Wanless et al. 1999), which may explain why they are more likely to roost overnight at particular colonies. Fulmars have been recorded foraging both at night at during the day, depending on the colony studied (Furness and Todd 1984; Quinn 2014). It is possible some fulmars are using the cliffs as an evening roosting site.

4.3 Spatial variation in seabird attendance

Within the 500m bird study site, different spatial clusters were noted. The densest patches of birds were recorded on stacks just off the cliffs (e.g. area 2P, 2V, 3B). Seabirds may have preferences for offshore stacks for their nesting sites, as it affords them greater protection from potential land predators. The variation along the cliffs in the species present will also relate in part to the habitat type available. For example, guillemots and razorbills require exposed rock to be able to lay their eggs on the hard surface. Additionally, razorbills can nest amongst boulders and rocks on shallower sloping ground. Kittiwakes will require areas of cliff face or rock where they can build nests, as will shags. Fulmars often nest higher up on the cliffs so that they can more easily take-off and land at their nest sites. Fulmars also prefer having some form of vegetation when nesting on a cliff, so will often be found in grassier areas. Herring gulls may also favour patches of grass but can also nest on flat rocks. The land adjacent to the landfall has a mixture of habitat types with areas 2Y and part of 3A being gently sloped and with grassy sections; 2Z, 2W, 2X and the southern part of 3A being largely cliff-based habitat.

From the spatial maps, the birds likely to be present in the land adjacent to the landfall site during the breeding period will predominantly be kittiwakes, herring gulls, guillemots, razorbills and fulmars. These are all qualifying species of the SPA and as such will be considered in detail during the EIA. No breeding or non-breeding adults or immature shags were noted in the land adjacent to the landfall site.

5 Conclusions

Four seabird species recorded during the surveys are on the Red list of the Birds of Conservation Concern (BoCC), (shag, puffin, kittiwake and herring gull) and seven are on the Amber list of BoCC) (fulmar, guillemot, razorbill, lesser black-backed gull, gannet, manx shearwater, great skua). The

potential impact of the development on the seabird receptors within and close-by the site are being considered as part of the design process and in the schedule of mitigation.

For onshore works at the landfall site at Long Haven, the least sensitive months for seabirds are between from September until end of March. The optimum months within this period would be the beginning of October to the end of February.

For works at the marine exit point, which is just off the cliffs by Long Haven, the most sensitive time period for birds utilising the cliffs and the surrounding waters will be from April to August. The peak of breeding is during May to July.

As it was noted that fulmars and shags return to the colony more in the evening time it is possible that if artificial light was to be used during the evening time that this may cause more disturbance to these species. Also, due to their presence first thing in the morning it is thought that guillemots use the cliffs at night time too. If artificial light is required during installation then this will need considered as part of the ecological assessment.

To conclude, the numbers and spatial distribution of seabirds recorded around the specific landfall site confirm the site's choice as being a quieter sector of the Buchan Ness coastline. Impact assessments and further design work will need to further consider the particular sensitive timings of the seabirds to mitigate against disturbance during the work. Any disturbance effects are likely to be temporary in nature. When considering the overall SPA population size for Buchan Ness and Collieston and the SPA's conservation objectives, the numbers of individuals potentially affected should not compromise the integrity of the SPA or the SSSI.

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Appendix A Summarised data tables

Table A1. Summary of number of adults (AD) and breeding adults (AOS/AON) recorded for the key species recorded along the seabird study area during each month of the survey year. *AOS for guillemots, razorbills and puffins relate to total breeding individuals noted. Maximum count is in bold.

Month	Fulmar		Shag		Herring Gull		Kittiwake		Guillemot		Razorbill		Puffin		Great black-backed gull		Total AD	Total AON
	AD	AOS	AD	AON	AD	AON	AD	AON	AD	AOS*	AD	AOS*	AD	AOS*	AD	AON		
Jan	436	278	3	0	130	0	0	0	3091	3091	0	0	0	0	0	0	3660	3369
Feb	201	135	39	0	417	85	0	0	0	0	0	0	0	0	2	2	659	222
Mar	352	236	52	25	663	**232**	1567	783	**6219**	**6219**	334	334	0	0	6	**5**	9193	7834
Apr	**450**	**288**	95	37	474	121	2403	1186	4541	4541	649	649	8	5	4	2	8624	6829
May	268	217	144	57	629	206	4000	2000	5447	5271	1026	954	25	17	4	3	11543	8725
Jun	331	256	149	**80**	636	230	4003	2001	6149	6091	1165	1139	29	**19**	5	3	**12467**	**9819**
Jul	275	130	184	43	**721**	92	**4358**	**2179**	5264	5264	**1178**	**1148**	**71**	4	**7**	1	12058	8861
Aug	64	49	**192**	13	688	0	3561	1780	9	9	2	2	0	0	3	1	4519	1854
Sep	37	22	86	2	56	0	17	3	0	0	0	0	0	0	5	1	201	25
Oct	0	0	29	0	1	0	0	0	0	0	0	0	0	0	2	0	32	0
Nov	11	6	1	0	122	2	0	0	0	0	0	0	0	0	0	0	134	8
Dec	221	144	3	0	14	0	0	0	64	64	0	0	0	0	2	1	304	209

Table A2. Summary of the number of immature birds (IMM) recorded on land or at sea for key seabird species, and the number of juvenile (JUV) birds recorded on land, in each month. Note that blank boxes relate to zero immature or juvenile birds being recorded in these months.

Month	Fulmar			Shag			Kittiwake			Herring Gull			Total IMM and JUV
	IMM (land)	IMM (sea)	JUV	IMM (land)	IMM (sea)	JUV	IMM (land)	IMM (sea)	JUV	IMM (land)	IMM (sea)	JUV	
Jan										8	15		23
Feb								1		33	8		42
Mar							9			85			94
Apr				7				2		9			18
May				22						46			68
Jun				11		90	3		1	39		140	284
Jul				35	1	14	2			104	18	4	178
Aug			46	96	2	14	3		1687	58	74	109	2089
Sep	1			30	2					54			87
Oct				7								3	10
Nov										4	8		12
Dec				1						4			5
Total	1	0	46	209	5	118	17	3	1688	444	123	256	2910

Table A3. Summary of the birds recorded from Vantage Point North (VPN) and Vantage Point South (VPN), per month. Blank boxes relate to there being zero birds recorded.

Species	VP	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Total
Eider	VPN					1					5			6
	VPS							1						1
Total						**1**		**1**			**5**			**7**
Red-throated diver	VPN											2		2
Total												**2**		**2**
Fulmar	VPN	12	5	3	8	10	7		21			108	90	264
	VPS	1	27		6	6	22	1	6			17	37	123
Total		**13**	**32**	**3**	**14**	**16**	**29**	**1**	**27**			**125**	**127**	**387**
Gannet	VPN									9				9
	VPS		10				1		4	2				17
Total			**10**				**1**		**4**	**11**				**26**
Cormorant	VPN						1							1
	VPS			1		1								2
Total				**1**		**1**	**1**							**3**
Shag	VPN	6		1		1	1	1	1	1	17	1	2	32
	VPS		7	9		5	3	2	17			2	20	65
Total		**6**	**7**	**10**		**6**	**4**	**3**	**18**	**1**	**17**	**3**	**22**	**97**
Puffin	VPN				4	3	5	1						13
	VPS			4		1	4							9
Total				**4**	**4**	**4**	**9**	**1**						**22**
Razorbill	VPN			2	120	16	9		4		2			153
	VPS		1	8	18	11	181		196					415
Total			**1**	**10**	**138**	**27**	**190**		**200**		**2**			**568**
Guillemot	VPN		33	27	237	264	149	5	1	17	3	23	103	862
	VPS	11	321	59	141	141	668	1	84	35	6		53	1520
Total		**11**	**354**	**86**	**378**	**405**	**817**	**6**	**85**	**52**	**9**	**23**	**156**	**2382**
Kittiwake	VPN					12	1	191						204
	VPS		22	344		70	99	4	1					540
Total			**22**	**344**		**82**	**100**	**195**	**1**					**744**
Lesser black-backed gull	VPN				3									3
	VPS					3								3
Total					**3**	**3**								**6**
Herring gull	VPN			25	80	76					27	8		216
	VPS	1		2		129	80		131		115	1		459
Total		**1**		**27**	**80**	**205**	**80**		**131**		**142**	**9**		**675**
Great black-backed gull	VPN			2	4						1	2		9
	VPS					1			6		1	2		10
Total				**2**	**4**	**1**			**6**		**2**	**4**		**19**

Table A4. Summary of the number of birds recorded at different times of the day (Morning, Afternoon, Evening). The averages are rounded to the nearest whole bird and the standard errors are given to two decimal places.

Month	Time of day	Fulmar (x̄±se)	Kittiwake (x̄±se)	Guillemot (x̄±se)	Shag (number of times presence recorded)
January	Morning	10±1.87	0	40±8.88	2
	Afternoon	12.±2.34	0	18±6.91	2
	Evening	18±2.41	0	16±6.32	3
February	Morning	20±1.94	0	36±8.82	1
	Afternoon	26±2.18	0	10±4.37	2
	Evening	31±2.71	0	6±4.00	10
March	Morning	27±1.48	10±2.66	58±11.12	2
	Afternoon	31±1.54	14±2.92	34±8.80	2
	Evening	33±1.27	14±2.56	39±9.02	4
April	Morning	29±1.38	15±2.58	118±11.58	N/A
	Afternoon	31±1.53	25±2.55	87±8.95	
	Evening	34±1.43	31±2.05	104±7.42	
May	Morning	36±1.37	35±1.40	168±7.17	N/A
	Afternoon	35±1.71	29±1.46	120±4.37	
	Evening	38±1.69	31±1.38	130±4.38	
June	Morning	29±1.05	55±3.12	184±5.28	N/A
	Afternoon	29±0.83	48±2.39	154±3.20	
	Evening	29±0.64	45±3.16	159±5.52	
July	Morning	25±1.29	55±2.42	70±11.18	N/A
	Afternoon	25±1.24	45±2.17	61±9.70	
	Evening	26±1.52	51±1.78	66±11.18	
August	Morning	N/A	N/A	0	N/A
	Afternoon			0	
	Evening			0	
Sept	Morning	1±0.35	0	0	1
	Afternoon	2±0.49	0	0	2
	Evening	7±1.21	0	0	9
Oct	Morning	2±0.76	0	0	6
	Afternoon	0±0.05	0	0	6
	Evening	4±0.65	0	0	10
Nov	Morning	6±1.19	0	0	3
	Afternoon	3±0.79	0	0	4
	Evening	7±1.10	0	0	10
Dec	Morning	12±1.49	0	21±5.06	1
	Afternoon	11±1.95	0	0	2
	Evening	13±1.80	0	0	8

Table A5: Kittiwake AONs recorded from February to January 2017.

	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb																										
Mar	43	31	10	30	39	14		2	25	25	2	30	2	40	45	182	8	20	0	2	18	3	22	43		
Apr	100	55	20	81	53	23		14	40	75	1	45	3	75	70	275	15	25	2	11	33	8	50	100		
May	87	40	0	55	90	25		13	75	84	0	68	3	135	115	515	19	36	15	16	28	13	63	87		
Jun	100	65	69	41	60	10		5	39	67	5	48	0	130	80	435	15	30	15	17	66	13	75	100		
Jul	93	90	19	105	88	30		17	76	75	0	55	7	125	84	490	18	36	15	22	71	11	61	93		
Aug	108	103	25	75	85	32		20	75	63	13	51	0	90	70	338	15	33	7	27	58	8	54	108		
Sep																3										
Oct																										
Nov																										
Dec																										
Jan																										

	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb																					
Mar	13	29	15	37	7	21	4	2	3	0	0	12	0	0		23	11	20	0	29	15
Apr	9	18	4	50	4	46	0	1	0	0	0	0	1	0		1	0	1	0	18	4
May	16	60	25	75	9	88	4	3	23	10	6	0	55	9		65	31	35	0	60	25
Jun	13	12	40	94	23	100	28	9	24	10	6	24	59	5		60	37	78	0	12	40
Jul	19	74	23	90	11	110	10	7	20	3	5	0	60	5		48	26	88	0	74	23
Aug	7	59	17	55	5	74	3	7	15	1	3	0	47	4		46	24	72	1	59	17
Sep																					
Oct																					
Nov																					
Dec																					
Jan																					

Table A6 Count of fulmar AOSs in each section between February 2016 and January 2017.

	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb	6	6			2	3			3				3	2	1	42	9				2	1				3
Mar	8	3		1	2	15	1		11				3	18	2	53	8	13	12		4	2				3
Apr	16	8		4	6	17		5	7	3				14	11	80		21	17	6		3				6
May	9	4	1		9	8	2	3	4	2			4	8	11	50	2	10	9	4	1	2				4
Jun	9	9	5	4	3	14			2				4	23		57	12	16	10	5	2					5
Jul	13	4		3	7	10	1	6	4	1			5	11			5	13	6	5						8
Aug				3	1			3					2	5	1	18		2	5	2	1					1
Sep	2			1								1				10			1	2						
Oct																										
Nov	6																									
Dec	3	5				8			10				3	10		65		21	7							1
Jan	6	5		5	4	12	1		6				2	33	3	95		27	12	6	7	1				

	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb			5	4	1				1		1		3	2		7		3		8	4
Mar			6	2	4	1			2			15	2	3	5	3		1	2	20	9
Apr	1		9	9	4			2	1		1		8	2	6			5	1	13	6
May			2	1	1	1			2		2		12	1	10	8			3	10	12
Jun			5	4	4	3			2		2	6	6	2	11	2				16	13
Jul			4	4	5	3					4		6	2							
Aug											1					2				2	
Sep				1									1			1				2	
Oct																					
Nov																					
Dec				1		2									3	4				1	
Jan			3	4	3	5						5	10					16			7

Table A7: Count of adult guillemots in each section between February 2016 and January 2017.

	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb																										
Mar	80	60	30	60	35	140			100	20		20		400	36	1900			100		100	1075				
Apr	45	60	30		18	105			20	10		10		100	150	1350			40	2	70	725				
May	53	55		22	20	140			35	10		8		200	75	2000			110	31	60	950				
Jun	74	67	35	20	27	133			80	14	30	12		260	56	2550			110	17	60	950				
Jul	61	52	19	23	26	121			75	11		9		250	63	1710			160	35	64	960				
Aug																2			2							
Sep																										
Oct																										
Nov																										
Dec																64										
Jan		6				25								53	58	1804			88	38	10	520				

	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb																					
Mar	12	400		20		300		290		20		30				50	1	90	150	700	
Apr	12	512		20		190	1	200		14			70			2		135	150	500	
May	10	342		23		225		240		30			40			25	3	60	100	400	4
Jun		422		24		270	2	180		27		60	11			2	3	55	100	440	
Jul	11	471		17	3	231	2	108		26			60			5	6	135	100	450	
Aug		2				1		1												1	
Sep																					
Oct																					
Nov																					
Dec																					
Jan		230				17	12	60						20		25	5	120			

Table A8: Count of razorbills in each section between February 2016 and January 2017.

Month	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb																										
Mar		4		5	6	25		2	5					20	2	60					4	20	4			
Apr		26	4	15	29	70		15	1					12	39	83			1		29	48	19			
May	13	57	6	20	14	66	1	13	15	2		8	2	41	15	74			7	5	16	40	15	9		
Jun	7	52	30	29	47	91	5	28	15	12	10	16	2	80	3	130			24	15	8	38	9	5	2	
Jul	21	61	3	11	38	40	2	18	31	7		7	2	52	20	132		1	18	3	40	49	13	3	5	
Aug																										
Sep																										
Oct																										
Nov																										
Dec																										
Jan																										

Month	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb																					
Mar	7	9	4	12		17	9		1							13	12	18	15	60	
Apr	35	70	21	19		26	10	2		1			10		4	14	10	27	1	8	
May	24	80	66	29		60	21	14	2	7	3		10		3	8	14	40	40	80	14
Jun	19	89	61	26		26	12	8	3	5	3	4	8		2	33	18	39	24	100	1
Jul	22	96	43	50	9	49	15	3		8	5		8		5	24	20	66	30	110	8
Aug																		2			
Sep																					
Oct																					
Nov																					
Dec																					
Jan																					

Table A9: Herring gull AONs between February 2016 and January 2017.

	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb	6	1			5										1	29						8				
Mar					1						2				10	28		1	7		17	33	4		22	
Apr			1	2	1							1			3	15		3	4	4	2	14			7	
May	2			2		1			2			2	1		2	26		7	3	3	16	22			14	
Jun			5	1	3	7		1				3				45		7	5	3	13	21			16	
Jul					1	3			3	2		3	2	2	3	18		3		3	15	13	2			
Aug																										
Sep																										
Oct																										
Nov																										
Dec																										
Jan																										

	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb		14	2						3	2			1			1				12	
Mar	1	30	4			3	3		5	2	1					29	5	1	8	14	1
Apr		12	2			1	2		2		1		4			8	4	3	8	14	3
May	2	24	2				3		6				1		3	27	2	3	11	17	2
Jun	5	25	2	1			3		5	3			1			18	2	4	13	15	3
Jul		2				2	2	3	5	1	1	3									
Aug																					
Sep																					
Oct																					
Nov																					
Dec																			2		
Jan																					

Table A: Adult shag AONs between February and January 2017.

	2A	2B	2C	2D	2E	2F	2G	2H	2I	2J	2K	2L	2M	2N	2O	2P	2Q	2R	2S	2T	2U	2V	2W	2X	2Y	2Z
Feb																										
Mar	1				1									2					2							
Apr		1			1			1						2		1			2		2					
May	2	2			1	1		4						8		2			2		1					
Jun	2	5	1		4			3	1	1				8		1			2		3					
Jul	2	3		1	4	1		9	1	1				8					3		1					
Aug		2				1			1					4												
Sep																										
Oct																										
Nov																										
Dec																										
Jan																										

	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R	4A	4B	4C
Feb																					
Mar		7	2			2						1				5	2				
Apr		10	4	2		2							1			2	2			4	
May		12				2	1			1			1		1	8	3			5	
Jun		14	5	2		4	1			4		3	1			7	4			4	
Jul		4		3		2															
Aug						2										2			1		
Sep																2					
Oct																					
Nov																					
Dec																					
Jan																					

Appendix B Seabird Study Areas

nrp NATURAL RESEARCH PROJECTS LIMITED

Key

- Cable corridor
- 500m buffer
- Vantage point
- Camera
- Section count area
- Landfall area

Date produced: 15/08/2017
Source: NRP LTD

Cable corridor and 500m buffer, Vantage points, Camera locations and Section count areas

North Connect