Flamborough and Filey Coast SPA Seabird Monitoring Programme

2018 Report

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Summary

The Flamborough and Filey Coast seabird monitoring programme is a partnership between the RSPB and Natural England set up to monitor and report on the condition of this internationally important seabird colony. Established in 2008, the project aims are to establish repeatable baseline census monitoring of the colony and to pursue a number of key areas of research and surveillance required to inform the population trends. The results inform the Special Protection Area (SPA) and underlying Site of Special Scientific Interest (SSSI) condition assessments and provide critical data to inform casework and the establishment of a Marine Protected Area (MPA) network.

In 2018 the seabird monitoring programme was successfully completed by the Bempton Cliffs Seabird Research Officer and a seabird research residential volunteer, assisted by a dedicated team of staff and volunteers. The early part of the season was dominated by the aftereffects of the 'beast from the East' and other weather systems in late February and March, which delayed the return of the auks to the cliffs. Early April felt like February, with periods of days when there were few to no Common Guillemot or Razorbill visible at a time of year when the cliffs should be packed with them. The early season survey of returning Atlantic Puffin rafting on the sea before they disperse onto the cliffs, which has in the last two years been in late March, did not happen until 14 April. The first Northern Gannet egg was spotted 27 April, notably later than 2017 (6 April) or 2016 (13 April). The first Common Guillemot and Razorbill eggs were found on 2 and 3 May respectively, compared to 24 April in 2017.

Overall, it was an average to poor year for breeding for most species with Razorbill apparently bucking the trend, although this may have been due to plot specific factors. Many Black-legged Kittiwake seem not to have bred, with anecdotal reports from monitoring volunteers that nest platforms had not been built on and study plot counts of occupied nests notably lower than last year. Common Guillemot productivity recovered slightly from last year, with no dramatically poor plots, but two plots are still affected by prospecting Northern Gannet and questions must remain about whether they are representative of the larger colony. Razorbill productivity was dramatically up on last year; although this may have been due to the unexplained death of at least four Carrion Crow, a species which has been seen to predate many auk eggs at Bempton Cliffs in the last few years, early in the season. Northern Fulmar productivity remained low, with many apparent new, but unsuccessful, breeding attempts at Cunstone Nab at the north end of the colony. European Herring Gull productivity has been steady for the last three years at a low level. Northern Gannet productivity was on the lower end of the range for the last 10 years.

The productivity results were as follows:-

- Northern Fulmar productivity – 125 pairs were monitored across seven plots from which 52 chicks successfully fledged producing a mean plot productivity of 0.47 (SE ± 0.0535) chicks per apparently occupied site (AOS) and an aggregated productivity of 0.42 chicks per AOS across all plots.

- Northern Gannet productivity – 262 nests were monitored across five plots, from which 209 chicks fledged producing a mean plot productivity of 0.80 (SE ± 0.0139) chicks per apparently occupied nest (AON) and an aggregated productivity of 0.80 chicks per AON across all plots.

- Black-legged Kittiwake productivity at Flamborough/Bempton – 915 nests were monitored across 18 plots, from which 504 chicks fledged producing a mean plot productivity of 0.55 (SE ± 0.0364) chicks per AON and an aggregated productivity of 0.55 chicks per AON across all plots.

- Black-legged Kittiwake productivity at Filey – 100 nests were monitored across two plots, from which 54 chicks fledged, an aggregated productivity of 0.54 chicks per AON.

- European Herring Gull productivity – 106 nests were monitored across five plots, from which 75 chicks fledged producing a mean plot productivity of 0.69 (SE ± 0.0646) chicks per AON and an aggregated productivity of 0.71 chicks per AON across all plots.

- Common Guillemot productivity – 319 pairs were monitored across six plots, from which 196 chicks fledged producing a mean plot productivity of 0.62 (SE ± 0.0394) chicks per AOS and an aggregated productivity of 0.61 chicks per AOS across all plots.

- Razorbill productivity – 341 pairs were monitored across seven plots, from which 248 chicks fledged producing a mean plot productivity of 0.72 (SE ± 0.0186) chicks per AOS and an aggregated productivity of 0.73 chicks per AOS across all plots.

An early season survey of Atlantic Puffin staging on the sea in the pre-breeding period was completed in April this year, and included Filey Cliffs for complete SPA coverage. Approximately 4280 individuals were counted. ***It is important to stress that this survey is not designed to provide an accurate census of the breeding population of Atlantic Puffin at this colony***; it provides an index which we hope will capture large year-to-year changes in the number of birds at this colony.

The Black-legged Kittiwake study-plot counts produced a mean of 1711 AON; the lowest in five years and the third lowest since the study plot counts began in 2009, although Black-legged Kittiwake study-plot means have been more variable than those for Common Guillemot or Razorbill.

The Common Guillemot study-plot counts produced a mean of 1377 individuals, very similar to the previous two years and in line with the general upward trend since 2009 (the highest being 1454 in 2014).

The Razorbill study-plot counts produced a mean count of 731 individuals, a new record high mean (in a year when we also recorded our highest ever high count of individuals) and in line with the general upward trend since the first counts in 2009.

Two MSc students from Leeds University collected data on Common Guillemot and Razorbill chick diet for their dissertaions. As in previous years Common Gullemot chick diet was dominated by Clupeids (86%), while Razorbill chick diet was dominarted by sandeel sp. (97%). Preliminary analysis suggested that there was a statistically significant year-to-year variation in the relative proportions of Clupeids and sandeel sp. in the chick diet of both Common Guillemot and Razorbill chicks.

For the second year, the RSPB Bempton Cliffs seabird team supported a Black-legged Kittiwake tracking project, led by RSPB's Conservation Science team and funded by Ørsted (formerly DONG Energy). Automatic-download tracking devices were fitted to adult birds; employing this technology meant that a bird only needs to be caught once in order to attach the device, after which data is

downloaded to a base station whenever the device is in range. The device is designed to fall off after a few weeks. In total, 30 auto-download devices were deployed.

For 2018, the tracking project was extended to cover Northern Gannet. Catching sufficient birds with tail feathers appropriate for tag attachment proved to be a challenge, but 10 automatic-download tags were deployed and a further 22 Northern Gannet were colour ringed.

Alongside the tracking work, the Bempton Cliffs seabird team assisted the RSPB Conservation Science field team with a new Black-legged Kittiwake colour ringing project at North Landing, Flamborough Head. Fifty-one breeding age birds were caught and fitted with individually coded darvic rings as well as single colour rings to indicate the year of capture.

Recreational disturbance continues to be a threat to the breeding success of the colony. Agreements or voluntary codes of conduct are now in place in respect of angling, personal watercraft and search and rescue training. Despite these agreements, however, a study of disturbance events across the SPA in 2018 highlighted potential issues with a variety of different activities.

Introduction

Background

Seabird population data has been collected in the SPA area since at least 1969. In 1969, all species but European Shag and Atlantic Puffin were counted as part of the 'Operation Seafarer' national seabird census. In 1987, all species were counted during the 'Seabird Colony Register' census. All species were counted again in 2000 for the 'Seabird 2000' census, in 2008 and in 2017 as part of the 'Seabirds Count' national seabird census. Whole-colony counts of Northern Gannet were completed in 1970-77, 1985-94, 1996-99, 2002, 2004-05, 2008-09, 2012 and again in 2015. In addition, whole colony counts for European Herring Gull were completed in 2010 and 2014 and for European Shag in 2014.

Before the commencement of the Flamborough Head and Bempton Cliffs seabird monitoring programme in 2009, breeding success data for Flamborough/Bempton was collected for Northern Gannet during 1973-79, 1986-94, 1996-98, and 2006. Black-legged Kittiwake breeding success has been monitored continuously since 1986. Common Guillemot productivity was monitored during 1991-98 and 2005-06 and Razorbill productivity was monitored in 2005-06. Northern Fulmar and European Herring Gull breeding success were monitored for the first time in 2009, and is ongoing. Unfortunately, it is not possible to monitor breeding success for Atlantic Puffin at this cliff-nesting colony and only limited monitoring of European Shag is possible depending on nest site selection.

At Filey, a whole colony count was carried out in 1986 (Williams 1996). In 2002 the 'Seabird 2000' census team identified a significant colony of cliff-nesting seabirds on the cliffs to the north of Filey Bay (Mitchell et al. 2004). The significance of this colony came to light in 2008 in response to large numbers of Common Guillemot and Razorbill being caught and killed in gillnets set by fishermen in Filey Bay. It was recognised that birds caught in the nets could have originated from either the Flamborough/Bempton or Filey colonies. Unfortunately, at that time there was little current data about the state of the colony at Filey.

The Flamborough and Filey Coast SPA Seabird Monitoring Programme

Flamborough and Filey Coast SPA supports the largest mainland seabird colony in England, the only mainland gannetry in England and one of the largest mainland Black-legged Kittiwake colonies in the UK. The landward boundary of the SPA generally follows the coast at Flamborough Head from South Landing in the south to Speeton in the north with an additional section from the forefront of Filey Brigg headland to Cunstone Nab. The seaward boundary extends approximately 2km parallel to the coast from the landward boundaries before moving seawards and extends approximately 2km into the marine environment (see maps at Appendix 1).

Flamborough Head is a highly protected site both for its wildlife and unique chalk habitats. The site is designated as a European Marine Site (EMS), a Special Area of Conservation (SAC), a Special Protection Area (SPA), a Site of Special Scientific Interest (SSSI) and a Heritage Coast site which includes three Local Nature Reserves (LNR), as well as RSPB Bempton Cliffs nature reserve and the Yorkshire Wildlife Trust Flamborough Cliffs nature reserve.

At the north end of the SPA the Filey Brigg SSSI falls within the SPA and the Gristhorpe Bay and Red Cliff SSSI is just to the north of the SPA.

The Flamborough and Filey Coast SPA qualifies under Article 4.2 of the EU Birds Directive for the following reasons:

- It supports over 1% of the biogeographical population of four regularly occurring migratory species: Black-legged Kittiwake (*Rissa tridactyla*); Northern Gannet (*Morus bassanus*); Common Guillemot (*Uria aalge*); and Razorbill (*Alca torda*).

- It supports a breeding seabird assemblage of European importance; during the breeding season the area regularly supports over 200,000 seabirds.

Due to the importance of the seabird colony and level of site protection, Natural England and the RSPB proposed in 2008 a project to enable a baseline count, population monitoring and further research to collect data on the health of the colony and the Flamborough Head and Bempton Cliffs SPA and underpinning SSSIs. This proposal led to the establishment of the Flamborough Head and Bempton Cliffs seabird monitoring programme, which began with the 2009 seabird breeding season.

In 2009 there was also evidence to suggest that the cliffs north of Bempton supported a sizeable colony that might also meet the EU Birds Directive criteria. A boat-based whole colony count of the breeding seabird assemblage nesting on the cliffs between Filey and Cayton was carried out by the RSPB. The results suggested that the total number of breeding seabirds in this colony exceeded 20,000 birds, and therefore this colony also met SPA qualifying criteria. In response to this evidence the RSPB, with funding support from Natural England, completed five consecutive years of colony count data to verify these findings. This data supported the proposed extension of the existing Flamborough Head and Bempton Cliffs SPA to include Filey Cliffs to create the Flamborough and Filey Coast pSPA, which was formally designated in November 2018.

The data collected by the now enlarged Flamborough and Filey Coast seabird monitoring programme will inform the condition and management of the Flamborough and Filey Coast SPA and underpinning SSSIs. In addition, the results will also inform current and new planning enquiries and environmental assessments e.g. the proposed Hornsea and Dogger Bank offshore wind arrays that may have a detrimental impact on the features of the designated sites. It is also hoped that seabird tracking data collected from the colony will inform potential new offshore MPAs.

Data collected will also be used to inform the Seabird Monitoring Programme (SMP) coordinated by Joint Nature Conservation Committee (JNCC), the RSPB's Annual Reserve Monitoring (ARM) programme, the RSPB Bempton Cliffs reserve management plan and the Yorkshire Wildlife Trust's reserve management.

The key aims of the seabird monitoring programme, and how they are currently implemented, are as follows:

- **Understanding variation and trends in seabird productivity**

  Northern Fulmar, Northern Gannet, Black-legged Kittiwake, European Herring Gull, Common Guillemot and Razorbill plots have been monitored for breeding productivity annually since 2009.

- **Understanding population numbers and trends**

  Black-legged Kittiwake, Common Guillemot and Razorbill study-plot counts have been carried out annually since 2009. A whole colony census was carried out in 2008 and repeated in 2017. It is intended that a whole colony count be completed every five years within the Bempton Cliffs reserve management plan cycle.

- **Understanding the relationship between the colony and the larger marine environment**

  As the relevant technologies improve we hope to better understand foraging behaviours of birds breeding in the colony and to identify preferred foraging areas and trends in provisioning such as determining key feeding areas for key species, and the factors that influence their location. This includes ongoing seabird tracking, currently focused on Black-legged Kittiwake, and monitoring of Common Guillemot diet composition. In the future this could extend to range finders, remote tracking, and increased use of fish population modeling data and benthic mapping.

- **Understanding how RSPB Bempton Cliffs relates to wider SPA and potential impacts on disturbance by developing research proposals to address the following management issues**

  What are the types of human activities that could disturb the colony and what are their effects? Currently recreational disturbance is monitored and recorded by Bempton Cliffs and others on an ad-hoc basis. For those activities that are of particular concern, we hope to develop specific research proposals which assess level of impact.

The annual programme of monitoring is coordinated by the RSPB Bempton Cliffs seabird team lead by the reserve Warden, the Seabird Research Officer, and a team of dedicated volunteer seabird researchers including members of Flamborough Bird Observatory (FBO) and Filey Bird Observatory & Group (FBOG).

The results of the 2018 Flamborough and Filey Coast seabird monitoring and research programme are detailed in this report. Access to the productivity and population monitoring data collected during the seabird monitoring programme is available to researchers and conservation organisations by agreement with RSPB.

Productivity monitoring

Productivity monitoring was completed for the tenth consecutive year for six of the eight breeding seabird species found in the colony: Northern Fulmar, Northern Gannet, Black-legged Kittiwake, European Herring Gull, Common Guillemot and Razorbill. A small number of European Shag nests at Flamborough Head were monitored for the fourth year. Unfortunately, it is not possible to monitor Atlantic Puffin productivity at this cliff-nesting colony.

The Flamborough and Filey Coast seabird monitoring programme follows the methods and guidelines set out in the '*Seabird monitoring handbook for Britain and Ireland'* (Walsh et al., 1995 – "the Handbook" hereafter), which summarises census and productivity monitoring techniques for seabirds at colonies in Britain and Ireland. The appropriate methods are followed for each species at this colony taking into account the resources available and the physical geography of the colony. All productivity monitoring is based on marking apparently occupied sites (AOS) or apparently occupied nests (AON) on a laminated photograph of the relevant plot. Please refer to the Handbook for more details on methodologies for each species and survey undertaken.

The productivity monitoring plots were identified when the Flamborough Head and Bempton Cliffs seabird monitoring programme was established in 2009. Plots were selected with a view to providing, where possible, a sample size in the region of 50 AOS or AON per plot and a total sample in excess of 250 AOS/AON for each species, while providing safe vantage points for the observer with little or no disturbance to breeding seabirds. In 2011, five additional monitoring plots for Black-legged Kittiwake were established at Filey Cliffs in conjunction with the census work at Filey which led to the extension of the Flamborough Head and Bempton Cliffs SPA to include Filey Cliffs; in 2014 one of the original plots was dropped as too difficult to observe and an additional monitoring plot added on Filey Brigg. In 2017, two additional Northern Fulmar plots were added at Cunstone Nab at the North end of Filey Cliffs in an effort to extend the monitoring of other species to Filey. Indicative maps of the productivity plot locations are included in Appendix 2.

As recommended by the Handbook, we present productivity calculated as the mean of the individual plot results for each species as well as presenting species productivity data by aggregating the results of each plot (total chicks fledged / total nests (or sites) monitored).

Northern Fulmar *Fulmarus glacialis*

Seven productivity plots were monitored, including the two plots at Cunstone Nab at the North end of Filey Cliffs which were first monitored last year. Plots are photographed in early May and AOS are marked on the laminated photographs over three visits over the late May/early June period. A final visit is made in mid-August and large chicks present at that time are assumed to fledge.

Mean productivity for Northern Fulmar was 0.47 (SE ± 0.0535) chicks per AOS. A total of 125 AOS were monitored across the seven plots, from which 52 chicks successfully fledged (Table 1, Figure 1). The mean productivity for Northern Fulmar recorded between 1986-2005 from between 13 and 41 colonies annually was 0.41 (SE ± 0.01) chicks per AOS (Mavor et al., 2008).

Table 1: Northern Fulmar productivity 2018. The new plots added in 2017 are marked *

Plot	AOS	Fledged chicks	Productivity ch/pr
*Cunstone Nab A	46	19	0.41
*Cunstone Nab B	33	10	0.30
New Roll-up	4	2	0.50
Old Dor	12	6	0.50
Newcombe	7	5	0.71
Breil Nook	10	5	0.50
Swineshaw Hole	13	5	0.38
Aggregate productivity	**125**	**52**	**0.42**
Mean of plot results		**0.47**	**± 0.0490 SE**
Original plots aggregate	**46**	**23**	**0.50**
Mean of original plots		**0.52**	**± 0.0535 SE**

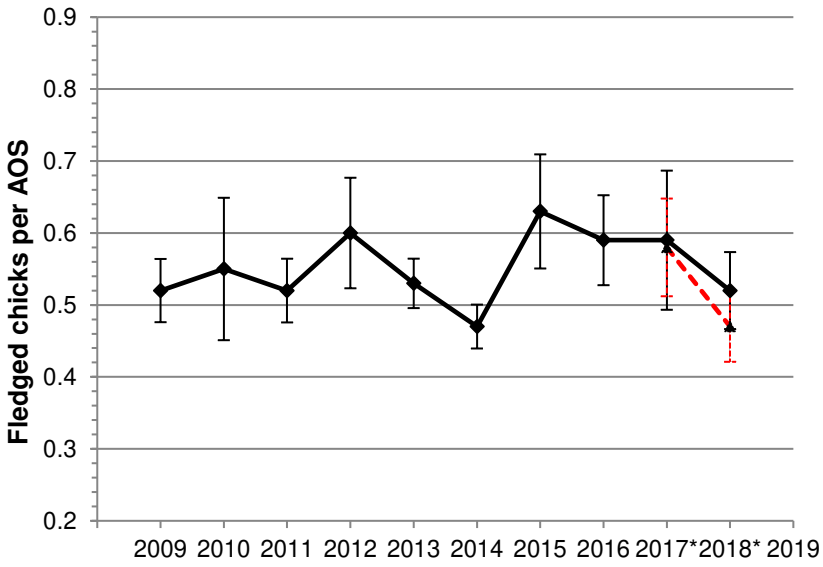

Fig. 1: Northern Fulmar productivity 2009 – 2018, mean of plot productivity results plus/minus SE. *Note: two new plots added in 2017. The black line shows productivity on the original monitoring plots over the 10 year period; the dashed red line shows productivity including the two new plots at Cunstone Nab, Filey added in 2017.

The number of Fulmar pairs on the Old Dor plot was notably reduced in 2018, with 12 breeding attempts recorded compared to an average of 24 sites from 2009 to 2017. Northern Gannets have been observed occupying a number of former Northern Fulmar breeding sites.

Northern Gannet *Morus bassanus*

Five productivity plots were monitored between late April and October. Plots are photographed in mid to late April and 50 to 60 AON are marked on the laminated photographs. The plots are then visited

every 7 – 10 days. Average visit time early in the season is 2 – 2.5 hours per plot, but reduces dramatically once chicks get larger and are more visible. Presence of an egg or chick is recorded (if seen) each visit.

Mean productivity for Northern Gannet was 0.80 (SE ± 0.0139) chicks per AON. A total of 262 AON were monitored across the five plots, from which 209 chicks successfully fledged (Table 2, Figure 2). The mean productivity for Northern Gannet recorded between 1986-2005 from between three and six colonies annually was 0.69 (SE ± 0.01) chicks per AON, (Mavor et al., 2008).

Table 2: Northern Gannet productivity 2018

Plot	AON	Fledged chicks	Productivity ch/pr
Jubilee Corner	52	41	0.79
Nettletrip	53	42	0.79
Staple Newk 1	53	45	0.85
Staple Newk 2	53	42	0.79
Staple Newk 3	51	39	0.76
Aggregate productivity	**262**	**209**	**0.80**
Mean of plot productivity ch/pair		**0.80**	**± 0.0139 SE**

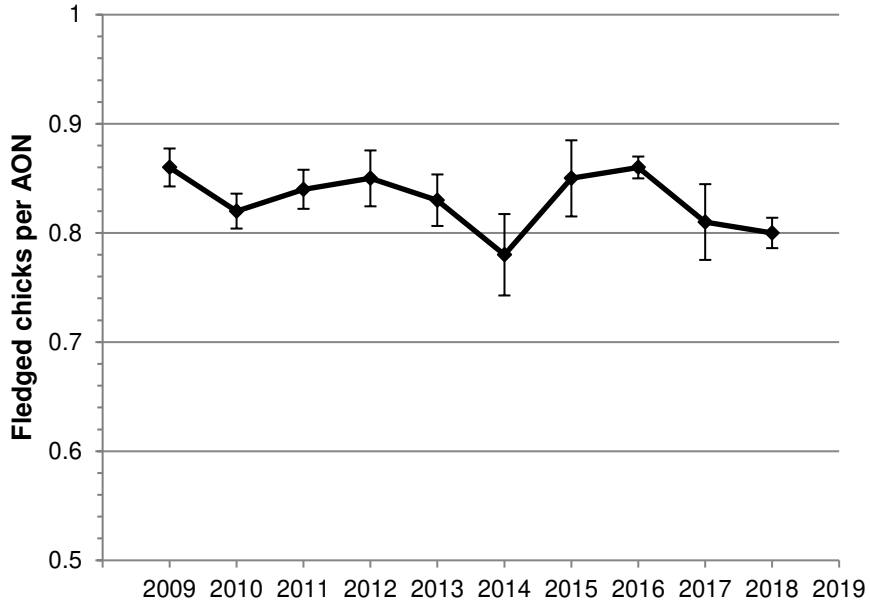

Fig. 2: Northern Gannet productivity 2009 – 2018, mean of plot productivity results plus/minus SE.

Northern Gannet productivity was on the low end of what has been observed over the past 10 years, perhaps reflecting birds not being in peak breeding condition. Anecdotal reports from researchers working on Bass Rock suggested that birds caught for tagging early in the season were lighter than expected based on the experience of previous seasons and it is likely that Gannets in the SPA were also affected.

European Shag *Phalacrocorax aristotelis*

Informal observations were made on six European Shag nests at Breil Nook, Flamborough alongside the nearby auk productivity monitoring plots. These nests were not selected at random – being the nests it was possible to see from existing seabird monitoring points – and three of them were in recesses in the cliff and not possible to see clearly. The nest sites were marked on laminated photographs of the cliffs and checked approximately weekly from 30 April until the end of July. No more than 30 minutes per visit was spent. Presence and number of eggs or chicks (to the extent visible) were recorded each visit.

Of the nests observed, the three that it was possible to see well each fledged three chicks. Of the other three nests, three large chicks were seen at the entrances to two of them and at least one large chick at the entrance to the third. It is therefore estimated that Shag productivity for this small sample was at least 2.8 chicks/nest.

The number of easily visible nests at Breil Nook was lower than in previous years, with only three easily visible nests where in previous years there have been five or six. Anecdotal reports from RSPB seabird cruise volunteers also suggested that there were fewer Shag nests in the area and a colour marked Shag known to have bred in the vicinity in previous years was not seen for the first time since 2010. The small breeding population at Flamborough (25 pairs in 2017) does mean that overwinter mortality of a few birds could have a disproportionate effect on the local breeding population.

Black-legged Kittiwake *Rissa tridactyla*

Twenty productivity plots were monitored across the SPA between May and August, eighteen plots were monitored between Flamborough and Bempton and two plots at Filey. Plots are photographed in early to mid-May and 50 to 60 AON are marked on the laminated photographs. Plots are then visited every week, ideally on the same day so visits are seven days apart. Presence and number of eggs or chicks at each AON is recorded (if seen) each visit. Volunteers are also asked to record chick size using standard codes, but not all do. Average visit time varies according to the volunteer, but 1 – 1.5 hours per visit is probably typical.

Mean productivity for Black-legged Kittiwake at Flamborough and Bempton was 0.55 (SE ± 0.0364) chicks per AON. A total of 915 AON were monitored across 18 plots, from which 504 chicks successfully fledged (Table 3, Figure 3). The mean productivity for Black-legged Kittiwake recorded between 1986-2005 from between 30 and 61 colonies annually was 0.68 (SE ± 0.03) chicks per AON (Mavor et al., 2008).

Table 3: Flamborough/Bempton Black-legged Kittiwake productivity 2018

Plot	AON	Fledged chicks	Productivity ch/pr
Jubilee Far	50	27	0.54
Bartlett Nab Near	50	26	0.52
Bartlett Nab Far	50	23	0.46
Grandstand North Near	50	16	0.32
Grandstand North Near Edge	50	19	0.38
Grandstand North Mid	50	33	0.66
Grandstand North Far Edge	50	34	0.68
Grandstand North Low	50	24	0.48
Old Dor	50	35	0.70
Newcombe	50	8	0.16
Back of Newcombe	54	37	0.69
Carter Lane 1	53	36	0.68
Carter Lane 2	-	-	-
Saddle Nook 1	-	-	-
Saddle Nook 2	50	31	0.62
Saddle from Breil	54	23	0.43
Breil Nook North	50	36	0.72
Breil Nook South	50	32	0.64
Back of Breil Nook	-	-	-
Swineshaw Hole	50	28	0.56
Lighthouse	54	36	0.67
Aggregate productivity	**915**	**504**	**0.55**
Mean of plot productivity ch/pair		**0.55**	**± 0.0364 SE**

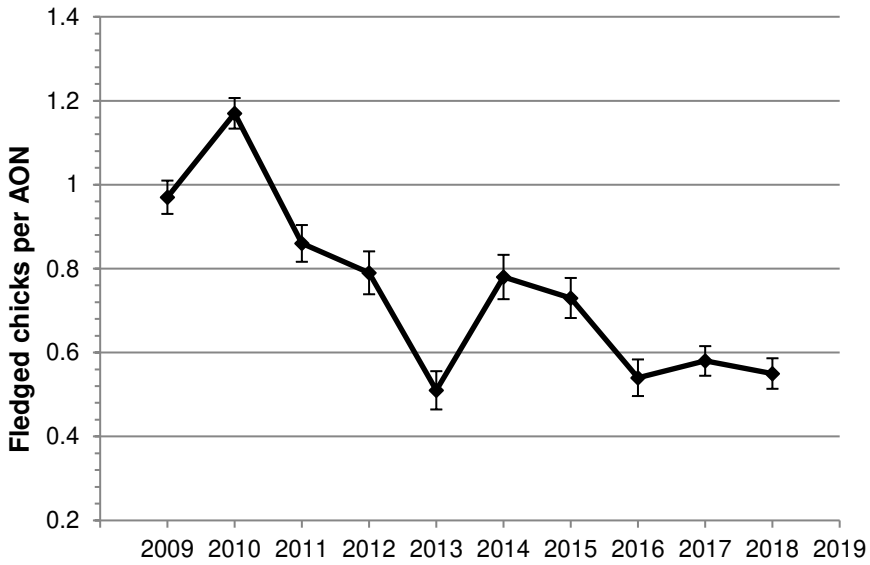

Fig. 3: Flamborough/Bempton Black-legged Kittiwake productivity 2009 – 2018, mean of plot results plus/minus SE.

With 10 years of monitoring data we can compare the relative productivity of the two areas of the SPA where we do the majority of our Kittiwake monitoring. Figure 4 shows the productivity of the Kittiwake monitoring plots on the RSPB Reserve and at Flamborough Head. Both follow a similar pattern, with productivity tending to be a slightly higher on the plots on the RSPB Reserve over the whole of the 10 year period, but not over the last three years, when both areas seem to have converged on a worryingly low productivity.

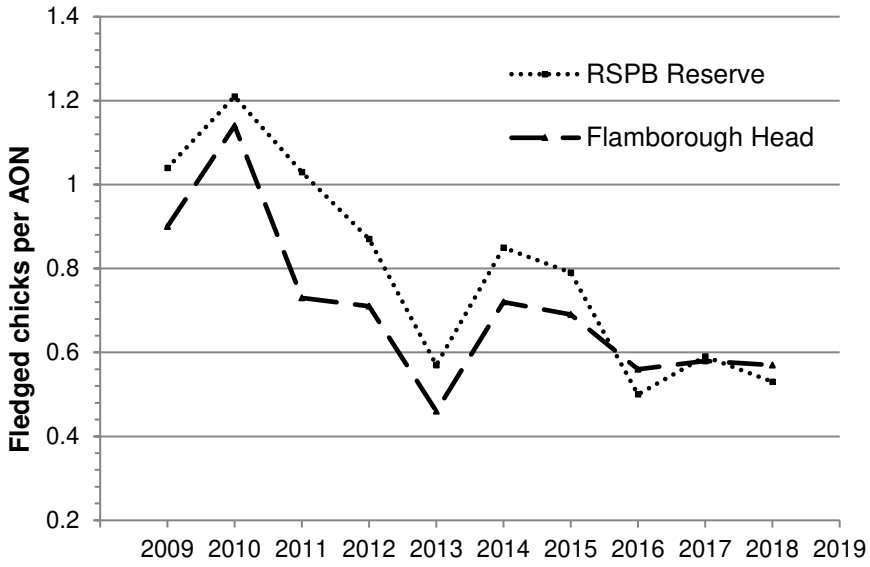

Fig. 4: Black-legged Kittiwake productivity 2009 – 2018 comparing plots on the RSPB Bempton Cliffs Reserve (dotted line) and at Flamborough Head (dashed line). Result for each year is the mean of the relevant plot results.

Mean productivity for Black-legged Kittiwake at Filey was 0.54 (SE ± 0.28) chicks per AON. A total of 100 AON were monitored across two plots, from which 54 chicks successfully fledged (Table 4, Figure 5). The mean productivity for Black-legged Kittiwake recorded between 1986-2005 from between 30 and 61 colonies annually was 0.68 (SE ± 0.03) chicks per AON (Mavor et al., 2008).

Table 4: Filey Black-legged Kittiwake productivity 2018

Plot	AON	Fledged chicks	Productivity ch/pr
Plot 1	50	41	0.82
Plot 7	-	-	-
Plot 8	50	13	0.26
Plot 9(a)	-	-	-
Plot 10(a)	-	-	-
Aggregate productivity	**100**	**54**	**0.54**
Mean of plot productivity ch/pair		**0.54**	**± SE**

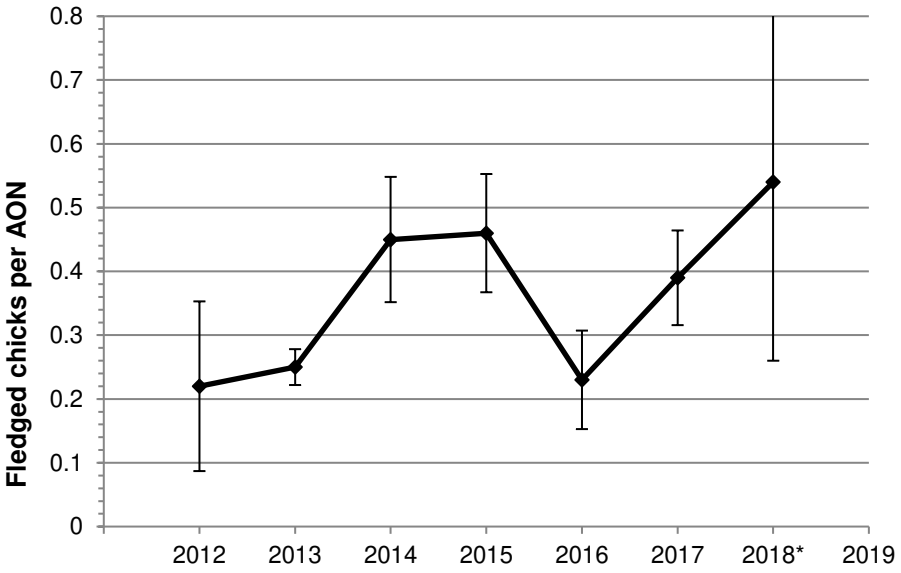

Fig. 5: Filey Black-legged Kittiwake productivity 2012– 2018, mean of plot results plus/minus SE. *In 2018 only two plots were monitored with a total sample size of 100 AON. Note that in 2012 productivity on three plots was 0.0 due to landslip.

The small sample size at Filey in 2018 was largely down to a lack of nesting Kittiwake on two plots at Cunstone Nab at the far Northern end of the colony; when we visited to take plot pictures there were almost no nests and few Kittiwakes visible. A further plot was not monitored due to volunteer illness. It is hoped that the sample size on Filey Cliffs will be larger in 2019.

Combining the Flamborough and Filey productivity data shows how Black-legged Kittiwake productivity across the SPA including Filey Cliffs differs from the Flamborough/Bempton productivity (Figure 6).

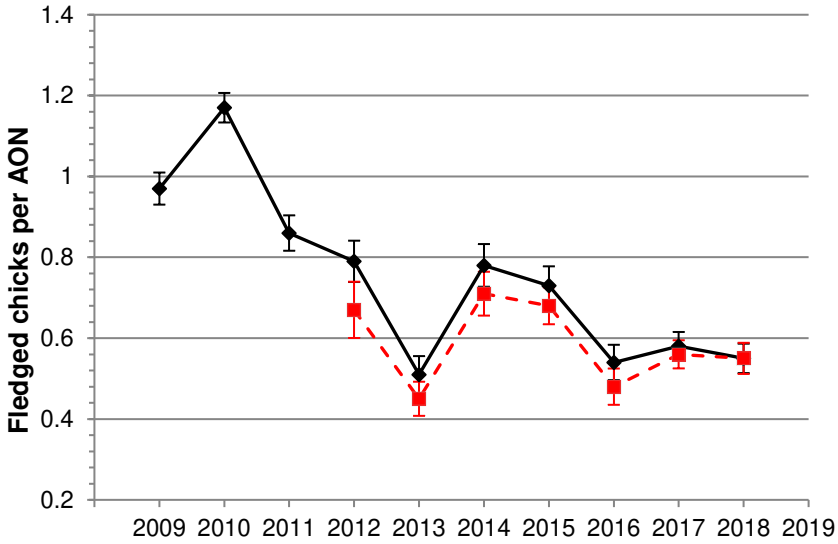

Fig. 6: Black-legged Kittiwake productivity 2009 – 2018, mean of plot results plus/minus SE. The black line is the mean of plot productivity on the Flamborough/Bempton plots; the red line is the mean including the Filey plots (note that in 2017 only three Filey plots were monitored and in 2018 only two).

European Herring Gull *Larus argentatus*

Five productivity plots were monitored between May and August. Two of the plots are linear and include all safely observable nests found on a defined stretch of cliff. One linear plot is at Bempton Cliffs and one is at Flamborough Head. Plots are photographed around early/mid-May and AON are marked on the laminated photographs over two visits. Additional AON may be added over the course of the season. Plots are then visited every week, ideally on the same day so visits are seven days apart. Presence and number of eggs or chicks at each AON is recorded (if seen) each visit. Volunteers are also asked to use size codes for chicks but not all do. Average visit time varies according to the volunteer, but 1 – 2 hours per visit is probably typical.

Mean productivity for European Herring Gull was 0.69 (SE ± 0.0646) chicks per AON. A total of 106 AON were monitored across five plots, from which 75 chicks successfully fledged (Table 5, Figure 6).

Table 5: European Herring Gull productivity 2018

Plot	AON	Fledged chicks	Productivity ch/pr
Jubilee to Old Dor	29	17	0.59
Newcombe North	8	4	0.50
The Saddle Rock	24	20	0.83
Breil Nook Stack	16	13	0.81
Newcombe to Breil	29	21	0.72
Aggregate productivity	**106**	**75**	**0.71**
Mean of plot productivity ch/pair		**0.69**	**± 0.0646 SE**

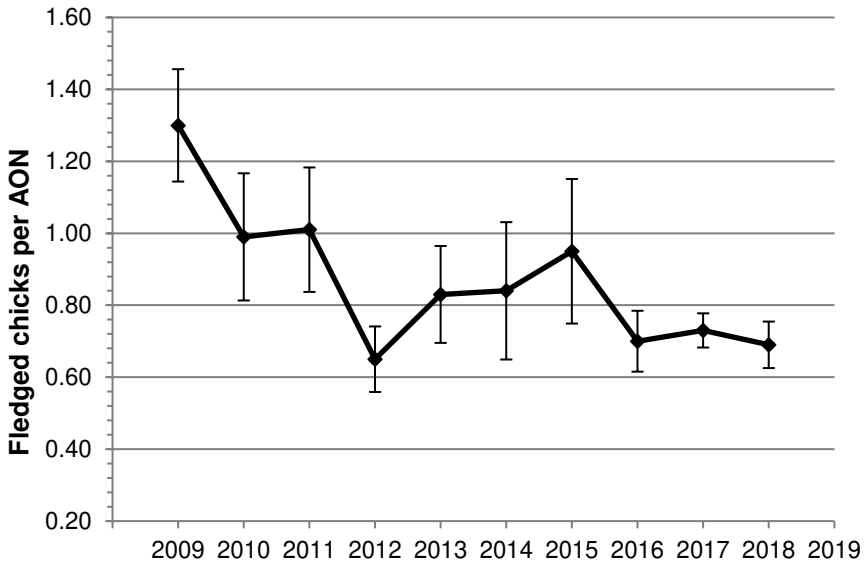

Fig. 6: European Herring Gull productivity 2009 – 2018, mean of plot results plus/minus SE.

European Herring Gull productivity appeared steady, albeit at a low level, for the third consecutive year. On a more positive note, the number of AON on our plots increased after two years at a lower

level (Figure 7). However, the unanswered question for the moment remains the size and productivity of the breeding population in the towns close to the SPA, particularly Bridlington and Filey.

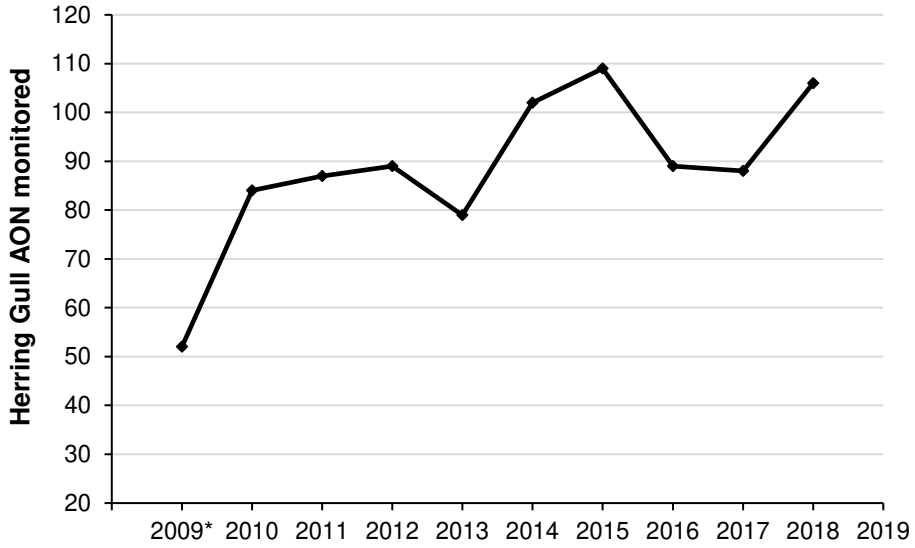

Fig. 7: European Herring Gull apparently occupied nests monitored 2009 – 2018; *in 2009 only three plots were monitored but that from 2010 onwards the same five plots have been monitored

Common Guillemot *Uria aalge*

Six productivity plots were monitored between late April and end of July. Plots are photographed in late April/early May and 50 to 60 AOS are marked on the laminated photographs over two visits. Plots are then visited every third day. Additional sites may be added over the course of the season, especially if it has been hard to get 50 AOS. Presence of an egg or chick is recorded (if seen) each visit. Average visit time early in the season is 2 – 2.5 hours, but reduces once chicks get larger and are more visible.

Mean productivity for Common Guillemot was 0.62 (SE ± 0.0896) chicks per AOS. A total of 319 AOS were monitored across six plots, from which 196 chicks successfully fledged (Table 6, Figure 8). The mean productivity for Common Guillemot recorded between 1986-2005 from between three and 15 colonies annually was 0.69 (SE ± 0.02) chicks per AOS (Mavor et al., 2008).

Table 6: Common Guillemot productivity 2018

Plot	AOS	Fledged chicks	Productivity ch/pr
Nettletrip	55	31	0.56
Grandstand North	64	32	0.50
Grandstand South	52	35	0.67
Carter Lane 1	47	36	0.77
Carter Lane 2	48	27	0.56
Breil Nook	53	35	0.66
Aggregate productivity	**319**	**196**	**0.61**
Mean of plot productivity ch/pair		**0.62**	**± 0.0394 SE**

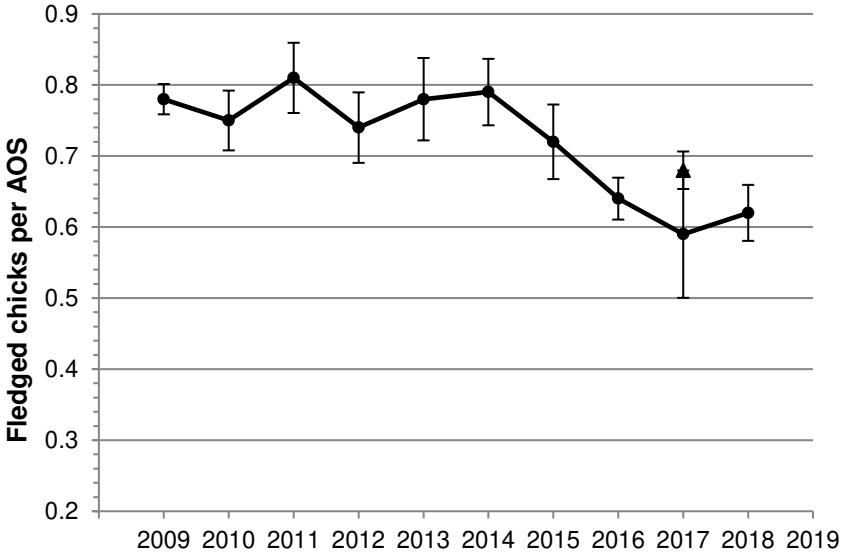

Fig. 8: Common Guillemot productivity 2009 – 2018, mean of plot results plus/minus SE. ▲ = mean of 2017 plot results excluding Grandstand North plus/minus SE.

In 2018 Common Guillemot productivity recovered slightly from an historic low point in 2017. The 2017 result was mainly due to remarkably low (0.16) productivity on the Grandstand North plot. However even excluding that result productivity was below all but one previous years (Figure 8). The decline since 2014 appears to be linked to a reasonably obvious decrease in productivity on the two plots at the Reserve – Nettletrip and Grandstand North – on which Northern Gannet numbers have been increasing. However, it remains possible that (i) the effect of sharing a breeding area with Northern Gannets was evident before 2009 and (ii) some other factor may be affecting Common Guillemot productivity. To investigate these possibilities, Figure 9 shows the productivity of the six individual Common Guillemot monitoring plots divided between those on which Northern Gannets are nesting and those on which there are no Northern Gannet nests. From this graph it appears that the two plots on which Northern Gannets nest have had the lowest productivity since 2012 and some of the lowest since the seabird monitoring programme began in 2009. But it also appears that the decline in productivity since 2014 affects all plots, and not just those with nesting Northern Gannet. Some other factor or factors must be driving this apparent general decline in productivity.

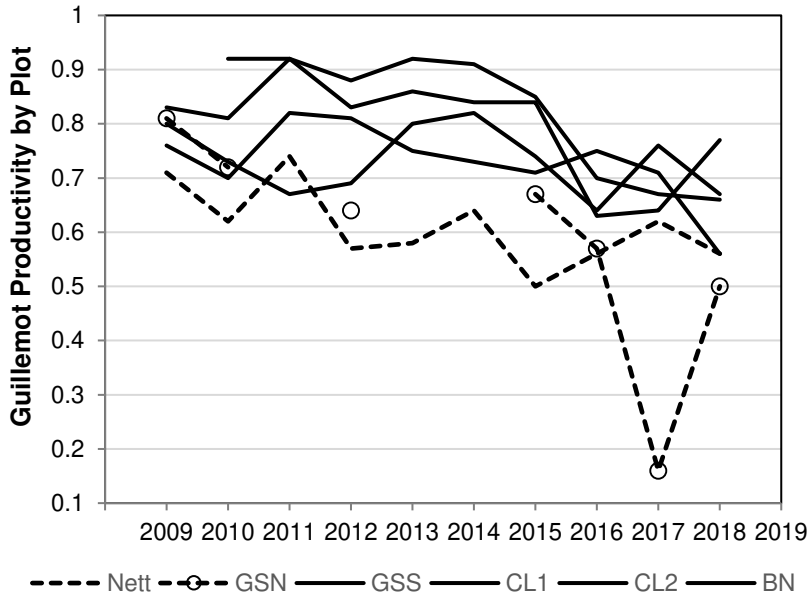

Fig. 9: Common Guillemot productivity 2009 – 2018 by plot. Dashed lines = plots with Northern Gannets nesting on them; solid lines = plots without nesting Northern Gannets.

Figure 10 compares Common Guillemot productivity on the three plots at Flamborough Head with the three plots on the Bempton Cliffs reserve. Productivity on the Flamborough plots is consistenly higher, which may reflect the influence of Northern Gannets on the two plots at Bempton which have Northern Gannet nests on them. But it also appears that productivity on the Flamborough plots has declined since 2014, adding additional support to the idea that an additional factor or factors may be affecting Common Guillemot productivity in the colony in the short term.

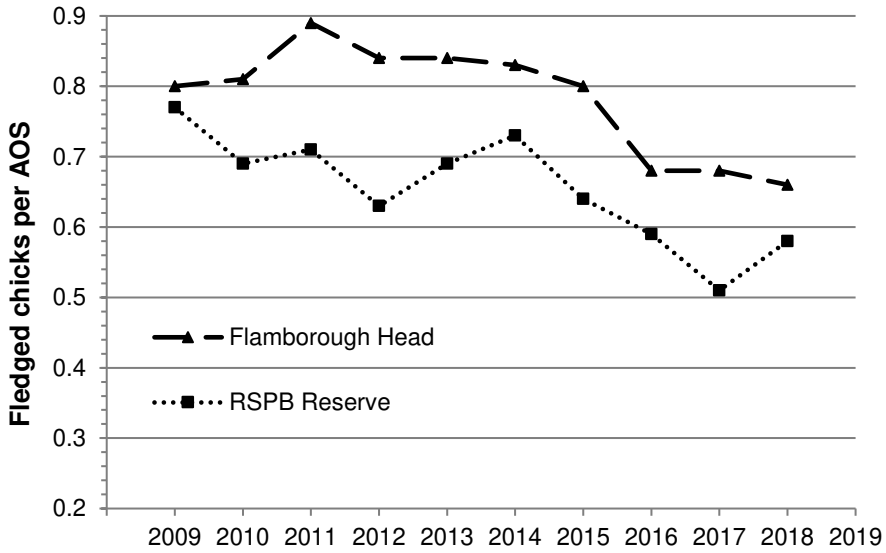

Fig. 10: Common Gillemot productivity 2009 – 2018 comparing plots on the RSPB Bempton Cliffs Reserve (three plots; dotted line) and at Flamborough Head (three plots; dashed line). Result for each year is the mean of the relevant plot results.

Razorbill *Alca torda*

Seven productivity plots were monitored between late April and the end of July; we usually monitor eight plots but fewer auk monitoring volunteers were available than in previous years. To maintain the balance of monitoring effort the plot not monitored was selected at random from those plots at Flamborough Head which did not have a regular volunteer monitor. Plots are photographed in late April/early May and 50 to 70 AOS are marked on the laminated photographs over two visits. Plots are then visited every third day. Additional sites may be added over the course of the season, especially if it has been hard to get 50 AOS. Presence of an egg or chick is recorded (if seen) each visit. Average visit time early in the season is 2 – 2.5 hours, but reduces once chicks get larger and are more visible.

Mean productivity for Razorbill was 0.72 (SE ± 0.0186) chicks per AOS. A total of 341 AOS were monitored across seven plots, from which 248 chicks successfully fledged (Table 7, Figure 11). The mean productivity for Razorbill recorded between 1986-2005, from between one and seven colonies annually, was 0.65 (SE ± 0.02) chicks per AOS (Mavor et al., 2008).

Table 7: Razorbill productivity 2018

Plot	AOS	Fledged chicks	Productivity ch/pr
Grandstand Gully	17	12	0.71
Grandstand North	42	27	0.64
Grandstand South	26	20	0.77
Newcombe	84	64	0.76
Back of Newcombe	48	37	0.77
Saddle Nook	-	-	-
Breil Nook	61	45	0.74
Swineshaw Hole	63	43	0.68
Aggregate productivity	**341**	**248**	**0.73**
Mean of plot productivity ch/pair		**0.72**	**± 0.0186 SE**

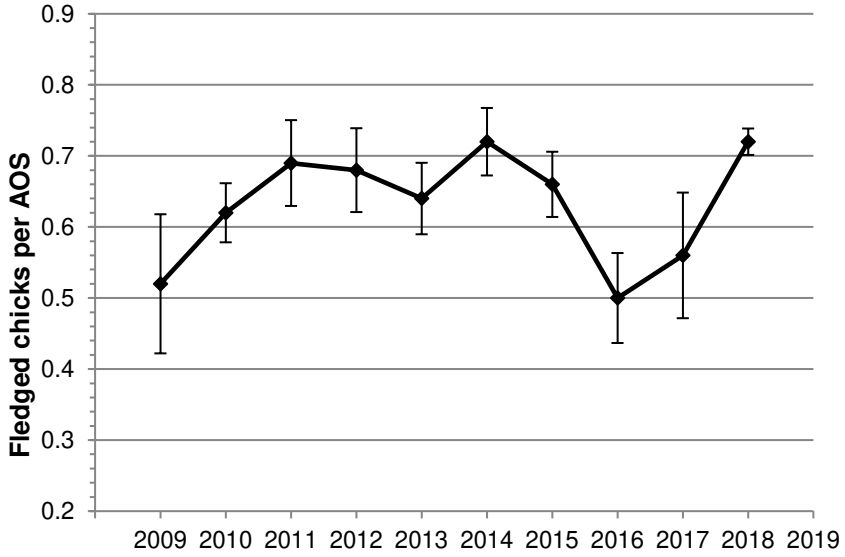

Fig. 11: Razorbill productivity 2009 – 2018, mean of plot results plus/minus SE.

Razorbill productivity in 2018 bounced back to 2011 – 2015 levels after two years of notably low productivity, particularly on the Bempton Cliffs plots in 2016 and 2017. In contrast to 2016 and 2017 there were no reports of corvid predation on auk eggs in the Grandstand area of the RSPB Bempton Cliffs Reserve where there are three Razorbill monitoring plots. This is in all probability linked to the discovery of four dead (cause unknown) Carrion Crow on the Reserve early in the season. As in the case of Common Guillemot, plotting Razorbill productivity at Bempton Cliffs and Flamborough Head separately suggests that productivity at Flamborough Head tends to be higher, at least on our monitoring plots (Figure 12). The two areas do appear to follow a broadly similar pattern except for the years 2016 and 2017, in which corvid predation was regularly reported at the Grandstand plots at Bempton Cliffs.

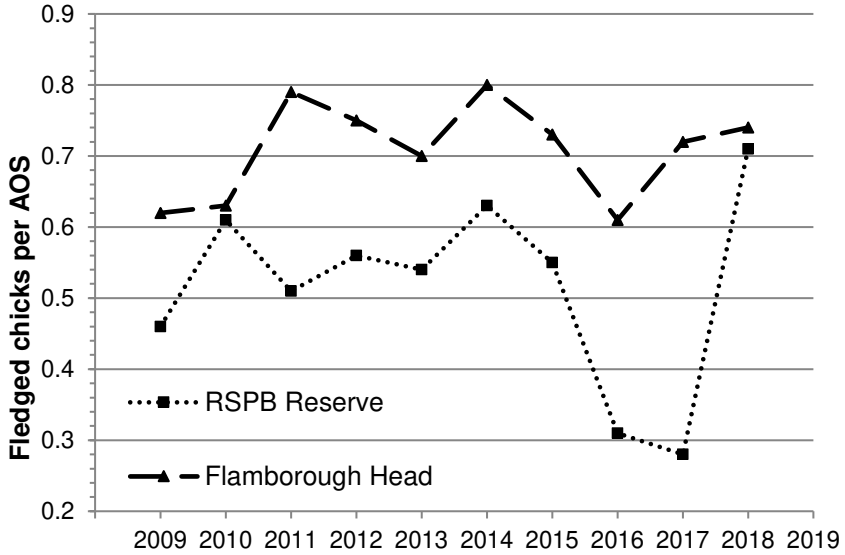

Fig. 12: Razorbill productivity 2009 – 2018 comparing plots on the RSPB Bempton Cliffs Reserve (three plots; line) and at Flamborough Head (usually five plots; dashed line). Result for each year is the mean of the relevant plot results.

Early season Atlantic Puffin survey

For the third successive year, Atlantic Puffin rafting on the sea in the pre-breeding period were counted. The whole colony count was completed on 14 April, later than 2017 (24 March) and 2016 (22/23 March). The reason for the delayed arrival of significant numbers of Puffin seems to have been persistent poor weather throughout March, which likely affected the arrival and attendance at the colony of most species.

The results were as follows: -

Flamborough Head to Thornwick Bay:	493
Thornwick Bay to Bartlett Nab:	1821
Bartlett Nab to Speeton:	1791
Filey Brigg to Cunstone Nab:	174

The table shows the data for the last three years.

	Flamborough Head to Thornwick	Thornwick to Speeton	Filey	SPA Total (not incl Filey)	SPA Total
2016	805	1462	n/a	2267	n/a
2017	712	1924	243	2636	2879*
2018	493	3612	174	4105	4279

* Estimated that several hundred Puffins were on the cliffs along the length of the colony; these were not included in the survey.

Although this cannot be considered to provide an accurate census of the breeding population, it does provide an index with which significant changes from year-to-year may be compared. The methodology is based on advice from Puffin expert Professor Mike Harris, who recommended that we count adults staging on the sea when large numbers of birds return to the colony at the very start of the breeding season (M Harris pers. comm., 2016).

Study-plot counts

The size and nature of the Flamborough and Filey Coast colony mean that is not practicable to conduct annual whole colony population monitoring. Accordingly, study-plots for population monitoring of Black-legged Kittiwake, Common Guillemot and Razorbill were established at Flamborough and Bempton in 2009. Plots were selected to be dispersed through the colony as randomly as possible given the need to provide a safe vantage point and minimise disturbance to breeding birds. Counts have been conducted each year since 2009 (except 2011, when counts of Common Guillemot and Razorbill were abandoned due to an early breeding season).

For each species the same plots are used each year as required by the Handbook; plot boundaries, based on clear cliff features, are marked on laminated photographs of the relevant area of cliff. Indicative maps of the study-plot locations at Flamborough and Bempton are included in Appendix 3.

The Handbook suggests that study-plot counts are not recommended for general use when counting Black-legged Kittiwake, as population changes may not be detected due to movements within the

colony or colony extensions, or losses rather than through changes of density across the colony. However, as the SPA holds one of the largest mainland populations in the UK, it is important that trends are monitored.

Black-legged Kittiwake study-plot counts

Seven study-plots were counted between 08:00 and 16:00 on at least two occasions during the period from 1 June to 22 June. The mean of the two counts was 1711 AON (Table 8), notably lower than in most of the last five years and in line with the anecdotal reports from Kittiwake monitoring volunteers of birds standing on their nest platforms but not building nests.

Table 8: Black-legged Kittiwake study plot count results - last five years

Visit	2014 AON Total	2015 AON Total	2016 AON Total	2017 AON Total	2018 AON Total
1	1917	1966	1858	1945	1733
2	1996	1977	1816	1940	1688
Mean	1957	1972	1837	1943	1711

Common Guillemot study-plot counts

Seven study-plots were counted between 08:00 and 16:00 on five occasions during the period from 1 June to 22 June. The mean of the study-plot counts for Common Guillemot was 1377 IND (Table 9). Both the high count and mean were similar to the last two years.

Table 9: Common Guillemot study plot count results - last five years

Count	2014 Total Ind	2015 Total Ind	2016 Total Ind	2017 Total Ind	2018 Total Ind
1	1411	1396	1491	1335	1265
2	1486	1410	1342	1428	1363
3	1327	1494	1361	1424	1424
4	1475	1420	1351	1323	1460
5	1573	1226	n/a	1231	1372
Mean	**1454**	**1389**	**1386**	**1348**	**1377**

Razorbill study-plot counts

Seven study-plots were counted between 08:00 and 16:00 on five occasions during the period from 1 June to 22 June. The mean of the study-plot counts for Razorbill was 731 IND (Table 10); this is the highest mean count recorded, and we also had the highest high count, in line with the general upward trend since the first counts in 2009 and with the results of the whole colony count undertaken in 2017.

Table 10: Razorbill study plot count results - last five years

Count	2014 Total Ind	2015 Total Ind	2016 Total Ind	2017 Total Ind	2018 Total Ind
1	584	592	570	731	753
2	694	535	654	700	718
3	565	662	686	657	766
4	591	607	660	689	766
5	754	482	n/a	658	650
Mean	**638**	**576**	**643**	**687**	**731**

Common Guillemot chick diet study

This year we were fortunate to have two Leeds University MSc students collecting data on Common Guillemot and Razorbill diet for their MSc projects: a summary of their work is presented below.

Diet - Methods

Data on chick diet composition was collected between 9 June and 29 June 2018; delayed from the intended start date of 2 June as there were not enough chicks due to the late start to the breeding season. Observations were made at Bempton Cliffs at the Grandstand South productivity plot viewed from the Grandstand viewpoint and at Flamborough Head at the Carter Lane productivity plots (Appendix 3). At Grandstand South there were an estimated 290 pairs of Common Guillemot and 27 pairs of Razorbill visible and at Carter Lane there were an estimated 230 Common Guillemot pairs and 100 Razorbill pairs visible.

Data was collected for the times 05:00-10:00 and 16:00-21:00. These were selected as they are when feeding activity peaks (Hatchwell, 1991; Jeavons, 2015). Sunrise and sunset were approximately 04:30 and 21:30 respectively throughout the data collection period. Observations began half an hour after sunrise and before sunset to ensure that light levels were sufficient to make accurate sighting of prey items (Elliot *et al.*, 2008). Observations rotated between morning observations of 05:00-07:30 and 07:30-10:00 and evening observations of 16:00-18:30 and 18:30-21:00. Observation periods were limited to 2.5 hours to ensure continued observer focus and the quality of the data collected. Data collection periods were dedicated to a single species so that it took two days to collect a full 10 hours of data for either of the species at each site. The 10-hour data collection periods were repeated twice for each species at each of the two study sites.

Two observers collected the chick diet data. At the beginning of each observation session the following variables were recorded: temperature, rainfall, wind speed (km/h), sea condition (Beaufort), visibility (km) and cloud cover (%). This environmental data provided information that could be used if there was any extreme events that may have influenced the results. During the observation period the cliffs were watched for incoming birds; once an incoming bird was spotted the observers would follow the bird in using 8 x 42 or 8 x 33 binoculars. Once it was confirmed a bird was carrying fish, the prey item(s) were identified to family level using binoculars or a telescope, using pictures as references, as either sandeel sp., Clupeid or Gadoid, or as Other if the family could not be identified, and the time of the feed was recorded. Prey size was also recorded; this was estimated by reference to bill length. When observing Razorbills the number of prey items carried was recorded. Guillemots without chicks often bring back display fish that are not intended to be fed to chicks, for this reason birds with fish had to be watched to confirm a feed (Heubeck, 2009). If a bird was seen with a fish in its beak on the cliffs for more than 5 minutes it was assumed to be a display fish and was recorded as such. Some discretion to this rule was applied when a bird seemed to have a display fish despite interacting with a bird that was guarding a chick, accordingly some birds were watched for slightly longer.

Diet - Results

A total 80 hours of chick diet composition data was collected. 20 hours of data were collected for each species at both sites. In total 701 prey items were recorded for chick diet composition. 355 prey items were recorded for Guillemots, of which 240 were observed chick feeds. 346 prey items were recorded for Razorbills, of which 345 were observed chick feeds. Guillemot chick diet composition over the

observation period was made up of 14.2% sandeel sp. and 85.8% Clupeid; Razorbill chick diet composition was made up of 96.8% sandeel sp., 2.9% Clupeid and 0.3% Gadoid (Figure 13). There was a significant difference in the composition of sandeel sp. and Clupeid in Razorbill chick diet compared to Guillemots ($\chi^2 = 1968.068$, df = 1, $p<0.001$).

Figure 13: Auk chick diet composition 2018; no Gadoids were recorded being fed to Common Guillemot chicks and the proportion of Gadoids in the Razorbill chick diet was very small (0.3%)

Diet composition data was also compared for the three years for which students or a dedicated auk diet monitoring volunteer collected this data (Figure 14: Table 11)

- for Common Guillemot there was a significant difference in the proportions of sandeel sp. and Clupeid in chick diet between years (Wald $X^2 = 58.574$ df=2, $p<0.001$), with the odds of a prey item being a sandeel sp. increasing by 80.4% in 2017 and decreasing by 72.9% in 2015 compared to 2018; and

- for Razorbill there was a significant difference in the proportions of sandeel sp. and Clupeid in Razorbill chick diet between 2015 and 2018 (Wald $X^2 = 15.184$, df =1, $p<0.001$), with the odds of a prey item being a sandeel sp. decreasing by 74.4% in 2015 compared to 2018.

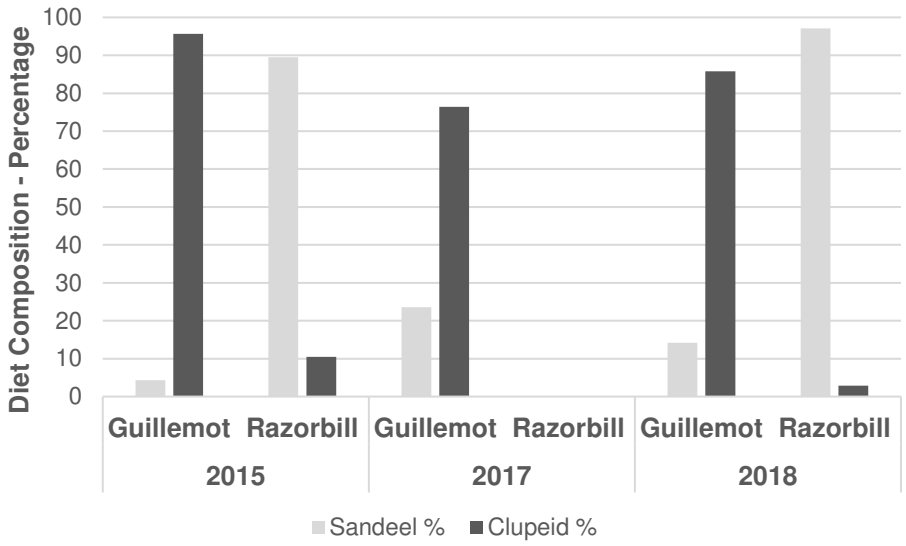

Figure 14: Year-to-year comparison of the percentage of sandeel sp. and Clupeid in Common Guillemot and Razorbill chick diet. Razorbill diet data was not collected in 2017.

Table 11: Year-to-year proportion of sandeel sp. and Clupeid in Common Guillemot and Razorbill diet for 2015, 2017 and 2018. Note that no Razorbill data was collected in 2017

	2015		2017		2018	
	Guillemot	Razorbill	Guillemot	Razorbill	Guillemot	Razorbill
Sandeel %	4.3	89.5	23.6	n/a	14.2	97.1
Clupeid %	95.7	10.5	76.4	n/a	85.8	2.9

Diet - Discussion

This is likely the first study at Bempton Cliffs and Flamborough Head to include a multi-year comparison of Guillemot and Razorbill chick diet. Each year, Razorbills feed their chicks a high proportion of sandeel sp. compared to Guillemot and Guillemot feed their chicks a high proportion of Clupeid compared to Razorbills.

Understanding the composition of seabird diet is important as it gives insight into how they may be affected by climate change and how they can mitigate for these changes. For example, there is strong evidence that climate forcing has the potential to affect population dynamics of fish (Paulsen et al., 2017), especially the Clupeid and sandeel species that UK seabirds feed on during breeding season (Anderson et al., 2013). The main threat of climate change to seabirds is the response of their prey to changes in warmth (Crick, 2004). The European sprat (*Sprattus sprattus*), is a species of clupeid that is present in the North Sea, the sea utilised by seabirds at Flamborough Head and Bempton Cliffs. The ICES (International Council for the Exploration of Seas) states that climate warming affects the community structure of zooplankton, the prey that supports sprat stocks in the North Sea. There has been a long-term decrease in the abundance of zooplankton (ICES, 2012) and this could result in indirect consequences for seabirds at higher trophic levels. Another Clupeid species commonly found in the North Sea is the Atlantic Herring (*Clupea harengus*). Graham and Harrod (2009) concluded that this species is also sensitive to temperature changes and that there is a direct physiological effect of temperature on their growth and development (Graham and Harrod, 2009).

Furthermore, colder temperatures were associated with a higher abundance of juvenile *C. harengus* (Nash and Dickey-Collas, 2005) emphasising their sensitivity to temperature change. Clupeids are one of the three main families that make up UK seabird diet (Anderson et al., 2013), and their vulnerability to climate change has the potential to affect seabird productivity. This is especially the case for Guillemot, as their diet is made up almost entirely of Clupeid species.

Clupeids are not the only fish sensitive to climate warming in the North Sea. Sandeel sp. numbers have decreased significantly in the past 25 years (ICES, 2017) and Razorbill diet at this site was found to contain over 90% sandeel sp. in 2015 and 2018. The North Sea is becoming less favourable to sandeel sp. (MCCIP, 2010) and this idea was supported by the conclusions made by Jeavons (2015). The 2015 data concluded that Guillemot chick diet was just 4% sandeel sp., which differed significantly to Anderson's study, conducted between 2007 and 2011. Anderson et al found that sandeel sp. made up approximately 25% of Guillemot diet and Clupeid made up the remaining 75% (Anderson et al., 2013). Looking at the 2015 data alone, it seems to support the emerging view that the North Sea is becoming less favourable to sandeel species (MCCIP, 2010), however when you consider the 2017 and 2018 data these numbers seem to have recovered slightly. Despite this, the numbers are still significantly lower than in previous years. Wanless et al (2005) found that between 1981 and 2003, Guillemot diet was made up of 58.7% sandeel sp. and 39.4% sprats. The data collected at Flamborough Head and Bempton Cliffs over the past 10 years ranges from 25% to 4% sandeels, but this significantly lower than the data collected in the previous decades. This suggests that seabirds are having to adapt their diet to deal with the changing abundance of their prey in the North Sea. These diet adaptations have the potential to lead to a lower productivity of the colony, as the prey items are less suitable.

Similarly to the 2015 data, there were very few Gadoids observed, and those that were observed were display fish, and therefore not used in the chick diet composition analysis. It had been suggested that Guillemot can change the composition of their diet depending on the prey species available (Chivers et al., 2012), however Gadoid species have a lower calorie content and other fish of similar size (Hislop et al., 1991), and therefore are not preferable. Furthermore, colonies of Guillemots that feed their chicks higher proportions of Gadoids generally have more breeding failures (Mitchell and Daunt, 2010). This, and the fact that Gadoids have a lower energy content than other prey items, suggest they are only foraged when no other suitable prey can be found. The absence of any Gadoids being fed to Guillemot or Razorbill chicks in 2018 may suggest that there is enough suitable other prey available for the chicks.

Historic diet data on Guillemot and Razorbill diet in the North Sea suggests that both species mainly relied on sandeel sp. to feed their chicks on during the breeding season and were both considered sandeel specialists (Harris and Wanless, 1986; Harris and Riddiford; 1989; Wanless et al., 2005; Parsons et al., 2008). Yet, in more recent years there has been growing observational evidence that Guillemots are relying on alternative species during the chick-rearing period (Wanless et al., 2005; Heubeck, 2009; Anderson et al., 2014; Macdonald, 2015; Jeavons, 2015; Kadin et al., 2016). Contrastingly, with Razorbill chick diet comprising of nearly 100% sandeels this year and with previous studies of colonies at Bempton Cliffs and Flamborough Head, Isle May and St. Abbs showing similar results. (Jeavons, 2015; Daunt et al., 2007; Harris and Wanless, 1986), suggests that Razorbills that breed around the British Isles may be less flexible than Guillemots in their prey selection. This is in line with studies that rank Razorbills are less able to switch their prey than Guillemots (Furness and Tasker, 2000). Ultimately it seems that Guillemots and Razorbills are showing relatively large degrees of segregation in their foraging ecology during the chick-rearing season.

As temperatures in the North Sea continue to rise and the commercial fishing industry continues to exploit sandeels in the region, the outlook for Razorbills at Bempton may be pessimistic. Guillemots have shown the potential to switch prey and have greater access to different depths, which they can utilise to exploit alternative prey species (Anderson et al., 2013; Thaxter *et al*., 2010; Wanless et al., 2005; Furness and Tasker, 2000). Although Guillemots are considered less vulnerable to sandeel loss (Daunt et al., 2008; Furness and Tasker, 2000), if the distribution of their current target prey of *Clupeidae* species moves north, it is unknown whether Guillemots will be able to switch as readily to another alternative prey. Additionally, as obligate single-prey loaders Guillemots are particularly sensitive to declines in prey quality (Frederiksen *et al*., 2006), as unlike Razorbills who can make up for low quality prey by catching more, Guillemots are restricted to carrying one prey item at a time.

Long-term data is essential in providing the basis to create effective management plans (RSPB, 2017). The overriding message is that data collection on Guillemot and Razorbill chick diet must continue at this colony. The work over recent years will have provided a baseline that will enable any marked change in chick diet to be highlighted in the future and should aid in further conservation management decisions.

Seabird tracking

The RSPB Bempton Cliffs seabird team supported a Black-legged Kittiwake tracking project, led by RSPB's Conservation Science team and funded by Ørsted (formerly DONG Energy). Automatic-download tracking devices were fitted to adult birds; employing this technology meant that a bird only needs to be caught once in order to attach the device, after which data is downloaded to a base station whenever the device is in range. The device is designed to fall off after a few weeks. In total, 30 auto-download devices were deployed.

For 2018, the tracking project was extended to cover Northern Gannet. Catching sufficient birds with tail feathers appropriate for tag attachment proved to be a challenge, but 10 automatic-download tags were deployed and a further 22 Northern Gannets were colour ringed.

All fieldwork was carried out under licenses from the British Trust of Ornithology (BTO) and Natural England and with the consent of relevant landowners/land managers. The data comprised of GPS, accelerometer and altimeter measurements should assist with our understanding of the risk from collision with blades and turbines as well as, in future, understanding changes in flight pattern related to or associated with avoidance of Hornsea wind farm.

At the time of writing the Black-legged Kittiwake and Northern Gannet tracking data for the 2018 season is being analysed by the RSPB Conservation Science team.

Black-legged Kittiwake colour ringing project

Alongside the Black-legged Kittiwake and Northern Gannet tagging work, the RSPB Bempton Cliffs seabird team also assisted the RSPB Conservation Science field team with a new Kittiwake colour ringing project at North Landing, Flamborough Head. Fifty-one breeding age birds were caught and fitted with individually coded colour rings as well as single colour rings to indicate the year of capture. It is hoped that this project will be registered with the BTO as a RAS (Retrapping Adults for Survival)

project and continued for the next five years, both by the capture and colour ringing of additional adult Kittiwakes and by colour ring re-sighting. Fieldwork was carried out under licenses from the BTO and Natural England and with the consent of Yorkshire Wildlife Trust.

European Shag colour ring re-sighting

Winter roost counts of European Shag, begun in 2014 at Breil Nook, Flamborough Head, were discontinued in 2017 after several years of counts did not show the numbers originally anticipated. It remains possible that this is due to the impracticality of seeing some of the areas used to roost from land and with little to no access to boat-based observing in winter.

Throughout the seabird monitoring season, however, colour ring codes are recorded, where practicable, and during the autumn and winter specific visits are made in appropriate conditions. In each case records are submitted to the Centre for Ecology & Hydrology's winter Shag distribution project. Colour ring re-sightings provide valuable insight in to the origins and movements of European Shag using the colony. To date, 33 individuals have been re-sighted, including three new individuals in 2018 (Table 12).

Table 12: European Shag colour ring re-sightings at Flamborough Head 2014 – 2018

Code	BTO ring number	Year Ringed	Age	Colony	First and last date recorded at Flamborough Head
EUH		2014	Pullus	Fidra	10/11/14 - 13/05/17
CLR		2014	Pullus	Farnes	10/11/14 - 21/10/15
END	1478565	2014	Pullus	Inchmickery	10/11/14 - 22/05/17
CHC	G8898	2006	Pullus	Isle of May	25/11/14 - 04/08/17
CNE		2014	Pullus	Farnes	04/12/14
ACE	1472974	2014	Adult	Craigleith	19/01/15 - 18/02/16
ESB	1478625	2014	Pullus	Inchmickery	19/01/15
ARI		2014	Pullus	Craigleith	24/07/15
NEJ		2015	Pullus	Farnes (Inner)	21/10/15
DAN	1485389	2016	Pullus	North Sutor, Inverness-shire	06/02/17
UWE		2016	Pullus	Farnes (Inner)	20/05/17
FTA		2016	Pullus	Isle of May	21/05/17
IAX		2016	Pullus	Isle of May	21/05/17
HUD		2016	Pullus	Isle of May	22/05/17 - 07/08/17
DAN		2016	Pullus	Isle of May	04/08/17
LRR		2016	Pullus	Farnes	13/06/18
TPC	1396622	2009	Adult	Craigleith	10/11/14 - 28/02/17
RZF		2013	Adult	Farnes	21/10/15
PCA		2010	Pullus	Farnes (Staple)	21/10/15 - 26/08/16
AUL	1483281	2015	Adult	Isle of May	18/02/16 - 06/02/17
AFP		2014	Pullus	Isle of May	10/11/14
AUH	1483074	2014	Pullus	Isle of May	18/02/16 - 31/10/18
ADA	1473962	2014	Pullus	Isle of May	18/02/16
IPJ		2016	Pullus	Isle of May	13/09/16 - 3/10/18
DAP	1472058	2015	Pullus	Isle of May	11/03/17
IDT		2016	Pullus	Isle of May	04/08/17
CUX	1472024	2015	Pullus	Isle of May	13/02/17

HZA		2015	Pullus	Isle of May	19/06/17
EZS		2018	Pullus	Farnes	10/10/18 - 31/10/2018
NDC		2014	Pullus	Isle of May	10/11/14
FTX		2012	Pullus	Isle of May	16/12/14
CTF		2018	Pullus	Isle of May	15/11/18
AFN	1453306	2011	Pullus	Isle of May	28/02/17

Recreational disturbance

The Flamborough Head European Marine Site (EMS) study into recreational activity has identified recreational disturbance as an ongoing issue across the SPA. Recreational disturbance can include: anglers descending the cliffs to access the foreshore; cliff-top angling during the breeding season; boat, powered personal watercraft and kayak use; paragliders, powered hang gliders and low flying aircraft. Wherever possible, disturbance events are recorded and photographed. The information is passed to the EMS Project Officer, Heather Davison-Smith, who is gathering data on recreational disturbance across the SPA in an attempt to build a better picture of the activities taking place, the frequency that they occur and the possible impact they may have on the SPA. A future challenge is to determine how to assess the impact of these activities on the breeding seabird assemblage and then manage this impact.

The voluntary code of conduct developed with local angling clubs for Bempton and Buckton Cliffs, incorporating a closed season for cliff-top angling from 1 March to 30 September, was largely considered to be a success. Review meetings will continue, however, to ensure the code of conduct remains relevant and effective.

A personal watercraft (Jet Ski) code of conduct applies from 1 March to 30 September; users are asked to maintain a no-wake speed within 300m of the cliffs and near rafts of birds. The EMS Project Officer continues to work with personal watercraft users, the Personal Watercraft Partnership, local authorities, Natural England and the RSPB in order to ensure that the voluntary agreement is effective and to identify any new management measures which may need to be implemented.

In 2016, the EMS Project Officer facilitated an agreement with the Chief Pilot of the Humberside Search and Rescue helicopter whereby from 15 March to 15 August crews will not carry out training exercises between North Landing and High Stacks (just south of the Flamborough lighthouse). This agreement compliments the existing Ministry of Defense 'Environmental Avoidance' area around Bempton Cliffs and does not cover emergency responses, which will continue as normal.

A PhD student from Leeds University conducted research around the Flamborough EMS in 2017, in partnership with the Yorkshire Wildlife Trust and the Flamborough Head EMS Management Scheme, to look at recreational activity issues in comparison with another marine protected area in Bulgaria. This work included local recreational activity monitoring and interviews with managers and stakeholders of the SPA. The report will be used, alongside data collected on-site since 2013, to inform management of the protected area. The full report is available on request from the EMS Project Officer.

Comment

It seems fitting that the formal designation of the Flamborough and Filey Coast Special Protection Area was finally confirmed in this the 10th year of the seabird monitoring programme managed from RSPB Bempton Cliffs. The extension of the SPA to cover Filey Cliffs and the 2km marine extension shown in the maps at Appendix 1 is a testament to the vision and hard work of the founders of the seabird monitoring programme, particularly Keith Clarkson, who, with the support of Natural England, was the driving force behind the Filey colony counts in 2009 and subsequent years which confirmed the importance of the seabird assemblage on Filey Cliffs and the need for increased protections.

The formal designation of the enlarged SPA should not, however, obscure the risks facing UK seabirds, and seabirds from the SPA in particular. There are very few offshore protections for seabirds feeding from colonies like Bempton Cliffs during the breeding season and there is minimal protection for seabirds once they have left the colony for their key foraging and wintering areas.

Globally, seabirds are threatened by overfishing, pollution, habitat degradation and climate change (Croxall et al. 2012). Stressors in their environment such as marine plastics and offshore developments are likely contributors to additional population declines (Wilcox et. al., 2015; Bailey et. al. 2014).

In January 2018, construction started on Hornsea Project One, one of the largest offshore windfarms in the world, and the first of four planned development phases. (Figure 15). This development is within the foraging and flight path of several seabird species using the SPA (Aitken et. al., 2017) and so we are working collaboratively with Ørsted UK (the project developers) on data gathering to better understand any potential for impacts of collision or avoidance in the windfarm footprint. This work includes Ørsted-funded tagging and tracking of Black-legged Kittiwake and Northern Gannet lead by our colleagues in the RSPB Conservation Science division, and supported by the Bempton Cliffs Seabird Research team.

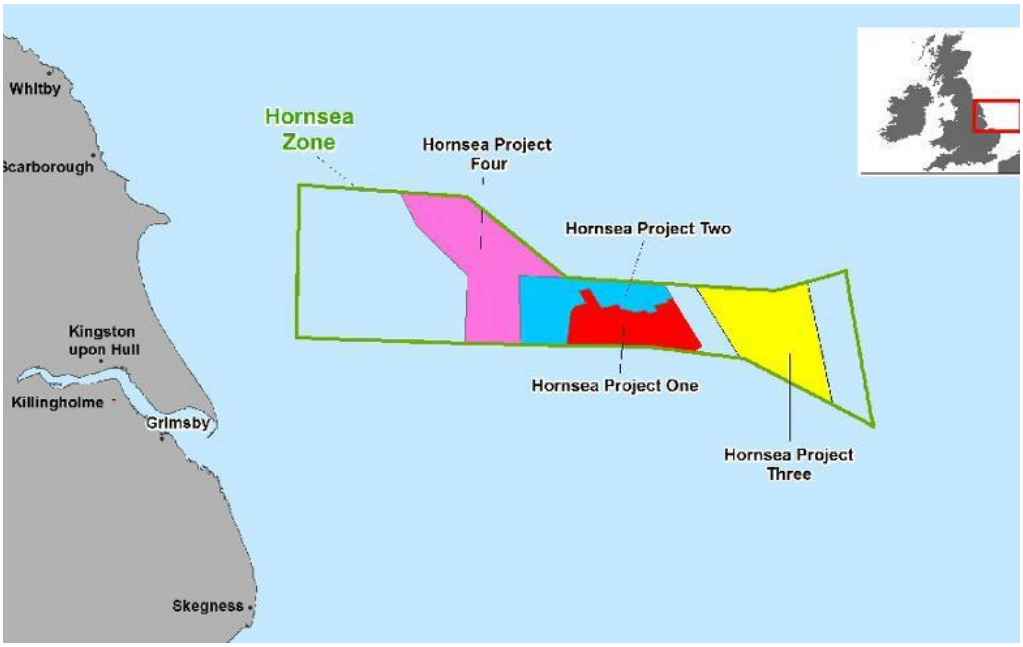

Figure 15: The Hornsea Wind Farm project area. Source: Ørsted (UK) Limited

The 2018 Monitoring Season

After the abortive whole colony count in the summer of 2016 and the successful colony count in 2017 (Clarkson et. al. 2018) it was a relief to be able to focus on the core monitoring programme in 2018, but the Bempton Cliffs Seabird Research team also kept busy supporting the RSPB Conservation Science seabird tracking project and helping to start a new Black-legged Kittiwake colour ringing project at Flamborough Head to track year-to-year adult survivorship. The new colour ringing project should help us develop our understanding of the current state of the Kittiwake population in the SPA.

Taken together with the successful colony count last year, the results of the monitoring programme this season continue to paint a mixed picture of the state of the colony. While there was a welcome recovery in Razorbill productivity in 2018, Common Guillemot productivity remained lower than the 10-year average. Unpicking the possible effects of plot specific factors such as localised predation or prospecting Northern Gannets remains a challenge. Gannets themselves continue to do well and over the coming years it will be interesting to see whether the rate of recent population increases slows. While the apparent increase in the number of European Herring Gull nests on our monitoring plots is encouraging, productivity remains low and without information on the number and productivity of urban breeding gulls in the local area it is difficult to fully understand the local population trends. Black-legged Kittiwake productivity remains worryingly low for the third consecutive year and our study plot counts suggest that some birds skipped breeding this year.

One matter of concern in long-lived species like seabirds is that low productivity not be reflected in the population for a number of years. If the productivity of our seabirds, which has, in many cases, dropped in recent years, stays at current low rates, then the long-term prospects for the SPA are of concern. From c.1981 to 1997 the Black-legged Kittiwake population of Shetland declined by 50%, probably as a result of low productivity due to overfishing of sandeels (Heubeck et. al. 1999; Heubeck 2004). As highlighted by the MSc students working on auk diet this year, the temperature of the North Sea rises in a changing climate the range of key prey species may change, making it harder or impossible for our seabirds to feed their chicks. Modelling a theoretical Black-legged Kittiwake population for the next 25 years with the demographic rates set out in Horswill and Robinson (2015) but setting annual productivity at 0.75, our average Black-legged Kittiwake productivity over the last 10 years of seabird monitoring, projects a stable, if not increasing, population. However, if productivity is set at 0.64, our average productivity for the last five years, then a steady population decline is projected.

The potential effect from a relatively small change in productivity, whatever the cause, highlights the need for continued monitoring of productivity in the SPA, together with regular population counts and continued tracking work. All are vital to maintain and develop a better understanding of the state of the SPA. At the time of Seabird 2000, the last UK national seabird census carried out from 1998 to 2000, the SPA held 11.2% of the UK population of Black-legged Kittiwake (Heubeck 2004). If the current Seabirds Count national seabird census shows that the SPA supports a more stable population of seabirds than some of the UKs other colonies, then it also becomes a potential reservoir to support repopulation of declining sites, which also magnifies the internationally important status of this colony.

The RSPB's seabird monitoring programme continues to provide important data and evidence to inform future policy and advocacy work within the RSPB, as well as informing government and other policymakers. Ongoing support for this monitoring programme should be maintained as a priority for the reserve.

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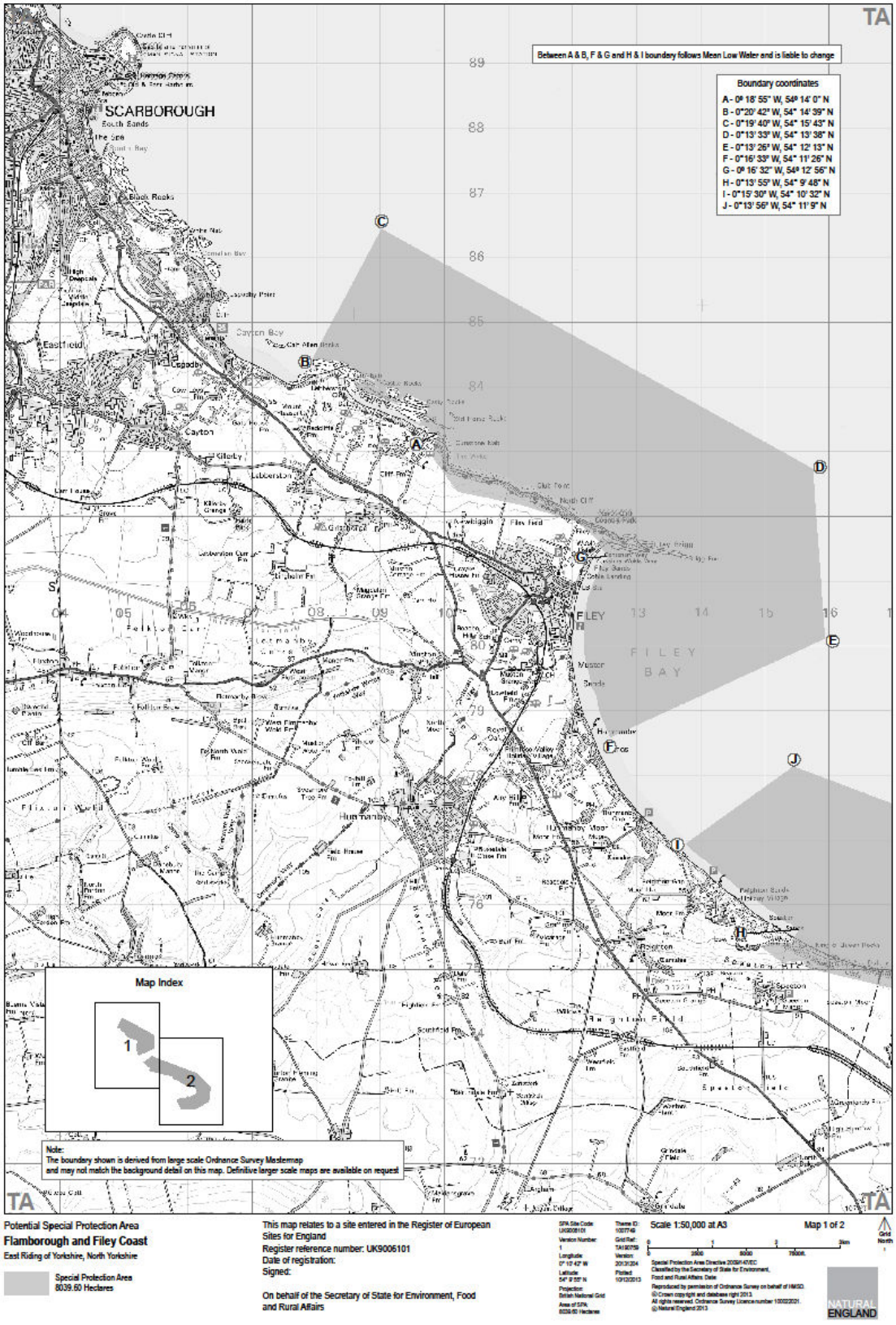
Blue Dolphin Holiday Park at Filey for allowing access to reach important sections of the colony for essential monitoring works. And last but not least, the owners and management at Thornwick Bay Holiday Village at Flamborough for providing invaluable parking permits for North Landing car park.

Without all of the aforementioned, the Flamborough and Filey Coast seabird monitoring programme would not be the success that it is.

Appendix 1: Flamborough and Filey Coast SPA maps

North



South


TA
TA
Between P & Q boundary follows Mean Low Water and is liable to change
Boundary coordinates
K- 0°4' 56" W, 54° 9' 1" N
L - 0°2' 27" W, 54° 7' 23" N
M - 0°2' 53" W, 54° 5' 52" N
N - 0°5' 41" W, 54° 4' 57" N
O - 0°8' 21" W, 54° 5' 1" N
P - 0°9' 2" W, 54° 6' 3" N
Q - 0°7' 9" W, 54° 6' 10" N
Flamborough
FLAMBOROUGH HEAD
BRIDLINGTON
B R I D L I N G T O N
Map Index
1
2
Note:
The boundary shown is derived from large scale Ordnance Survey Mastermap
and may not match the background detail on this map. Definitive larger scale maps are available on request
Potential Special Protection Area
Flamborough and Filey Coast
East Riding of Yorkshire, North Yorkshire
Special Protection Area
8039.60 Hectares
This map relates to a site entered in the Register of European Sites for England
Register reference number: UK9006101
Date of registration:
Signed:
On behalf of the Secretary of State for Environment, Food and Rural Affairs
Scale 1:50,000 at A3
Map 2 of 2
NATURAL ENGLAND

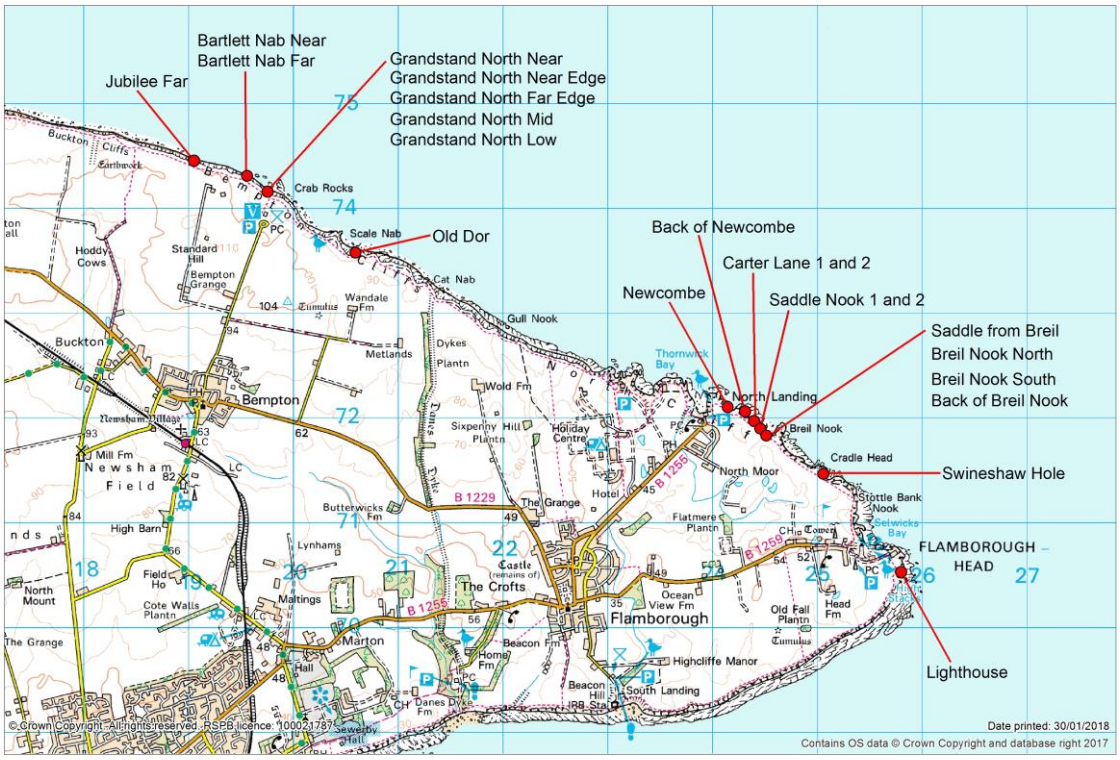
Appendix 2 - Productivity plot locations

Northern Fulmar productivity plots

Northern Gannet productivity plots

European Herring Gull productivity plots

Black-legged Kittiwake productivity plots – Flamborough and Bempton



Black-legged Kittiwake productivity plots – Filey

Common Guillemot productivity plots

Razorbill productivity plots

Appendix 3 – Study-plot locations

Black-legged Kittiwake study-plot locations

Common Guillemot study-plot locations

Razorbill study-plot locations