

REPORT

2018-2021 Bird Monitoring Report Bacton Bird Breeding Surveys

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1 Introduction

The process to construct the outfall replacements and beach nourishment along the Bacton to Walcott frontage and adjacent areas began in May 2019 and was completed in September 2019. A key consideration during the design and construction of the scheme was the possible impact on breeding bird species along the frontage. The ornithological survey work was discussed in the Construction Environmental Management Plan (CEMP) (Royal HaskoningDHV, 2019¹). The CEMP included the provision of bird surveys both pre- and during construction. The CEMP also detailed the delivery of protocols to



enable an active response to issues that could affect birds on site. The Breeding Bird Survey Report (Royal HaskoningDHV, 2019²) was produced in April of 2019 and established the program for bird survey work throughout the breeding season. The report built on previous survey work undertaken in 2018 by Wild Frontier Ecology, in their Nesting Bird Survey 2018 (Wild Frontier Ecology, 2018). Subsequent survey work, pre- and during construction was provided in accordance with the Breeding Bird Survey Report, whilst allowing for additional surveys as required during the construction process. The overall intent of the survey work was twofold: to establish the impacts of the scheme on bird numbers and behaviour; and to ensure that any potential impacts on birds (and other wildlife) during construction could be avoided/minimised via the provision of prompt responsive measures.

During 2019, 2020 and 2021, further surveys were commissioned to monitor the breeding birds present within the site during the first few years following the beach nourishment works. The objective of the surveys was to monitor the number of birds returning to the site and record their breeding success for the 2019, 2020 and 2021 breeding season.

This report provides an account of the 2018, 2019, 2020 and 2021 survey work with regard to observed bird numbers and behaviour. The four years of surveys are not directly comparable, since the methodologies differed to meet the required objectives. But they do provide a reliable method of recording breeding success for the birds using this area for all four years.

2 Survey Methodologies

2.1 2018

The 2018 survey consisted of two short visits (during May and June) to soft cliff areas of the Bacton frontage to establish an initial baseline in relation to bird species along this area. A key focus of this work was to establish the location of sand martin nests (burrows) since this area is used by the species during their spring/summer breeding period.

The initial 2018 survey sought to establish the location of active burrow areas and broadly determine the scale of sand martin activity in the area. Other species were also considered, specifically ground nesting terns and ringed plover. Both terns and ringed plover nest in pairs (unlike colonial birds such as sand martins), and as such numbers surveyed were expected to be substantially lower.

As outlined above, the 2018 survey sought to establish the degree of sand martin activity and the location of that activity. This task was complicated by the presence of both active and inactive burrows along the frontage. The survey methodology provided was based on recording numbers of burrows (single holes),

collections of burrows (colonies) and number of active/inactive colonies. **Figure 1** provides a simplified account of how this system enabled the frontage to be surveyed.

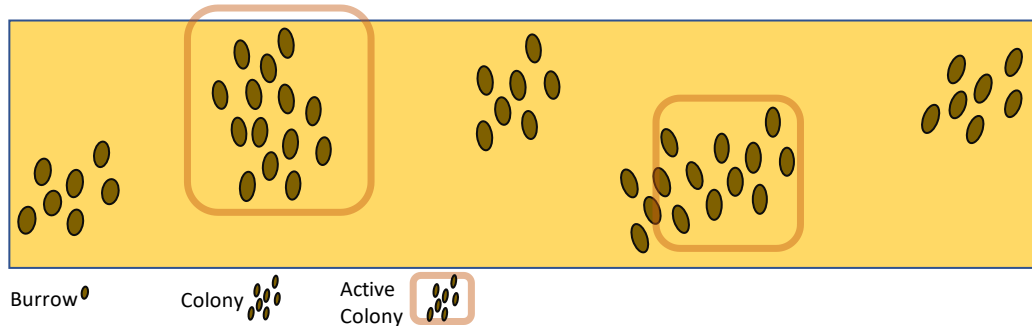


Figure 1 Sand Martin Nest Morphology

2.2 2019, 2020 and 2021

In 2019 the surveys also recorded the number of active burrows per active colony which became the basis of every survey going forward. Due to the intensity of bird activity during exit and entry pulses, bird numbers are not feasible to establish, and therefore the number of active burrows (per colony) is a more accurate and useful metric. This method of estimating numbers is also used by the British Trust for Ornithology (BTO). The BTO observe apparently occupied nest holes along riverbanks for their Waterways Bird Survey (WBS) count data.

In 2019, initial survey work focussed on providing a two hour watch of burrows within the survey area, in order to locate the currently active colonies.

This work developed an understanding of:

- The location of active burrows
- How burrow sets in close proximity operated as a single colony or independently

During all subsequent 2019 survey work, inactive colonies were monitored on survey days for one hour for any signs of habitation, and all active colonies were monitored for 1 hour per colony. Observations of sand martin behaviour and the presence of chicks was also recorded. The 2020 and 2021 surveys followed the same methodology as the 2019 surveys.

Any observations of other breeding birds were recorded with locations and behaviour noted.

2.3 Methodology Comparison

There are similarities and differences in the 2018, 2019, 2020 and 2021 surveys which are identified below in **Table 1**. The differences broadly relate to the different intents: the 2018 survey intended to provide an initial observation of breeding bird locations, and to provide an enhanced understanding of the frontage. The 2019 survey specification was developed to meet the scheme needs, which was then also utilised for the 2020 and 2021 surveys. The 2020 and 2021 surveys had an extended survey area which incorporated the cliffs towards Mundesley as it was apparent that sand martin activity was occurring in this area.

Table 1 2018,2019, 2020 and 2021 survey methodologies

Survey element	2018	2019	2020	2021
Objective	To determine usage of the Bacton frontage by sand martins and ground nesting birds.	To record bird breeding activity within the study area during the coastal management works and to ensure that mitigation was successful to minimise any impact on sand martins and ground nesting birds.	To record bird breeding activity within the study area.	To record bird breeding activity within the study area.
Location	100m south of the access ramp at Seagull Road to 250m north of the BGT boundary	As per 2018	Survey area extended to include from 100m south of the access ramp at Seagull Road to Mundesley.	As per 2020
Duration	2hr survey of frontage length	Initial 2 x 2hr survey of all inactive burrows (to establish lack of activity) Regular (weekly/bi-weekly) 1hr survey of all active burrow colonies and monitoring of inactive burrows for signs of activity.	Initial surveys involved a 1-hour observation of all 2019 burrow colonies that were active in 2019 and any new burrow colonies observed in 2020. Subsequent surveys involved observation of all colonies and 1-hour observation of all active colonies.	Initial surveys involved a 1-hour observation of all 2020 burrow colonies that were active in 2020 and any new burrow colonies observed in 2021. Subsequent surveys involved observation of all colonies and 1-hour observation of all active colonies.
Frequency	2 surveys (of the entire frontage), one on 30th May and one 20th June 2018	20 surveys (of 6 colonies x 1hr) between May and September 2019	6 surveys, undertaken monthly between April and September 2020.	6 surveys, undertaken monthly between April and September 2021.
Total Survey Duration	Approximately 4 survey hours	Approximately 150 survey hours	Approximately 36 survey hours.	Approximately 36 survey hours.
Methodology	Beach walk with 10x42 binoculars and GPS tracker to establish active colonies. All burrows along the frontage counted with an account of the location of active burrow sets (colonies). Estimation of the number of active colonies and birds. No counts were made of the number of active burrows within an active colony Presence of tern and ringed plover species recorded.	Beach walk with 10x42 binoculars and GPS tracker to establish active colonies. A 1hr watch on all active colonies using an image sheet for each colony. In the 1hr of survey, active burrows were marked on the image, giving a final number of active burrows in each colony. During the survey, inactive burrows were examined for any signs of habitation and the frontage examined for the presence of "new" burrow sets. Behaviour was observed for all colonies to assess whether there were any obvious	Beach walk with 10 x 42 binoculars and GPS tracker to confirm location of 2019 burrow colonies and any new burrow colonies. A 1-hour watch of all active burrow colonies. During the 1-hour observation period, active burrows were marked on a printed image of the burrow colony, giving a final number of active burrows in each colony. As with the 2019 surveys, inactive burrows were examined for any signs of habitation and the frontage between the slipway and Mundesley examined for the	Beach walk with 10 x 42 binoculars and GPS tracker to confirm location of 2020 burrow colonies and any new burrow colonies. A 1-hour watch of all active burrow colonies. During the 1-hour observation period, active burrows were marked on a printed image of the burrow colony, giving a final number of active burrows in each colony. As with the 2020 surveys, inactive

Survey element	2018	2019	2020	2021
		<p>impacts and thereby whether (and if so, what) mitigation would be required.</p> <p>Presence and behaviour of tern and ringed plover species recorded.</p>	<p>presence of 'new' burrow colonies.</p> <p>Behaviour was observed for all colonies to assess whether there were any obvious activities affecting the sand martins. The presence of chicks was recorded.</p> <p>Presence and behaviour of little tern and ringed plover species were recorded.</p>	<p>burrows were examined for any signs of habitation and the frontage between the slipway and Mundesley examined for the presence of 'new' burrow colonies.</p> <p>Behaviour was observed for all colonies to assess whether there were any obvious activities affecting the sand martins. The presence of chicks was recorded.</p> <p>Presence and behaviour of ringed plover species were recorded. Any other species were noted if present.</p>

2.3.1 Survey Duration

A key factor when comparing the 2018-2021 data sets relates to the duration of survey. The 2018 survey only provided a brief watch of active colonies and subsequently provided an estimate of bird numbers within the study area. The 2019, 2020 and 2021 surveys provided hour long surveys of all active colonies. Surveys were completed on a regular weekly/bi-weekly basis, across a duration of 20 weeks for 2019, and on a monthly basis for 6 months during 2020 and 2021.

Data collection for the 2019, 2020 and 2021 surveys focused on the number of active burrows in each colony, and the behaviour at that time. Whereas the 2018 surveys were very much a snapshot of nesting bird activity, which provided the basis to sharpen the specification of the 2019, and subsequently the 2020 and 2021 surveys. The 2019, 2020 and 2021 surveys were more detailed and extensive and enabled time to count active burrows and observe bird behaviour.

2.3.2 Colonies

As described above, a further key factor in considering the four data sets relates to how sets of burrows in close proximity are clustered and considered to be a single colony.

Based on the two-hour surveys of 2018, it was not possible to establish the degree to which burrows in close proximity operated as a single colony. However, based on repeated surveys in 2019, 2020 and 2021, understanding of the colonies along the frontage was enhanced enabling analysis based on clusters of burrows that operated as colonies along the frontage. Colonies for 2019, 2020 and 2021 are summarised in **Table 2** below and shown on **Figure 2**.

Table 2 Number of active colonies for 2019, 2020 and 2021

Year	Number of active colonies along the frontage	Comments
2019	6	Burrow areas 1 to 6 with burrow area 7 recorded but not included within the count study area
2020	11	Burrow areas N1 to N9 and 3 and 7 (from the 2019 survey period)
2021	8	Burrow Areas 21-1, 21-2, 21-3, 21-4, 21-4a, 21-4b, 21-5 and 21-6

2019 Colonies

In the 2019 survey, Colonies 2 and 3 were located in close proximity but behaved as two distinct colonies (in terms of group activity). To the north, Colonies 4 and 5 were also located in close proximity, but again group activity (entry and exit of burrows and other behavioural aspects) displayed what appeared to be two distinct colonies. Colony 6 burrows were located immediately adjacent to Colony 5; however, Colony 6 was treated as a new colony based on the excavation of those burrows later in the year (Colony 6 was first recorded on the 22nd May 2019). In summary, the 2019 survey was able to consider bird numbers and activity based on observed patterns of colony behaviour over an entire breeding season, with weekly/bi-weekly survey intervals.

2020 Colonies

Of the new colonies observed during 2020 (named with a 'N' followed by a number), N1-N7 were all located in very close proximity to each other, along an approximately 200 m stretch of cliff. However, the bird activity observed along this stretch appeared to show 7 distinct colonies, albeit comprised of low burrow numbers. Colony 7, which was first excavated towards the end of the 2019 season (but was outside of the survey study area at the time) was also active in the 2020 season and was included in the survey study area in 2020. Colony 7 had an 'upper' and a 'lower' section, and these were treated as parts of the same colony, based on them being excavated around the same time and on the behaviour of sand martins observed during the surveys. This burrow area did experience some erosion towards the end of the breeding season within the lower section.

2021 Colonies

In 2021, the new colonies (named with a '21-' followed by a number), 21-1 to 21-4b were all located in close proximity to each other, along an approximately 250m stretch of cliff. However, the bird activity observed along this stretch appeared to show six distinct colonies. Located further north-west along the coast, Colony 21-5 was observed to be active during the 2021 survey season. Colony 7, mentioned in the '2020 Colonies' section above, was also active in the 2021 season, and has been named Colony 21-6 for the 2021 surveys. Colony 21-6 had an 'upper' and a 'lower' section, and these continued to be treated as part of the same colony. In 2021, Colony 21-6 was far less active despite this being the highest recorded Colony site in 2020 (a peak of 103 active burrows across the 2020 survey season compared to a peak of 15 active burrows in 2021 survey season). As outlined above, erosion was evident on the lower section of Colony 21-6 towards the end of the breeding season in 2020 which could be an explanation for the lower number of active burrows in 2021 compared to 2020.

Although erosion is evident along the cliff frontage in 2021, this does not seem to have impacted the overall number of sand martin present across the survey season compared to 2020.



Figure 2 Locations of Active Burrows during 2021 with Burrow Locations shown for 2018, 2019 and 2020

3 Sand Martin Activity

A direct comparison of the 2018 and 2019/2020/2021 data is not appropriate for the reasons stated in **Section 2** above, however when taken as four datasets (2018, 2019, 2020 and 2021), some key facts are evident relating to sand martin behaviour along the frontage.

3.1 Total number of colonies or burrow areas

Table 3 provides an account of the number of sand martin colonies recorded during 2018, 2019, 2020 and 2021. In 2018, 7 active burrow areas were identified although not enough survey time (in the 2018 surveys) was spent to determine whether they were 7 distinct colonies. The location of the active burrow areas in 2018 align with active colonies identified at the start of the 2019 survey series so it is likely that some of the 7 burrow areas from 2018 would merge to give either 5 or 6 colonies in total. In 2018, every 'burrow' within the active burrow areas was counted (whether active or inactive) but not the specific number of 'active' burrows. It is unlikely that all of the burrows counted during 2018 were active (which is why a maximum number is given in the table below), whereas during 2019, 2020 and 2021 only burrows that were observed as active within each burrow area were included in the counts.

During the monitoring in 2019, two additional colonies were excavated, one of which was inside the survey area (colony 6) and one approximately 250m to the north of the survey area (which became colony 7 but was not included in the count summaries due to it being outside of the survey area).

Table 3 Sand Martin Colony/Burrow Area Numbers 2018-21

Sand Martin Activity	2018	2019	2020	2021
Total number of active burrow areas at the start of the breeding cycle (early May) ⁽¹⁾	7 burrow areas	5 colonies	1 colony	6 colonies
Total number of new colonies (excavated and inhabited during the breeding season) within the survey area	None-recorded	2 colonies	10 colonies	2 colonies
Total number of active burrow areas/colonies within the survey area (at the conclusion of the survey (June in 2018/September in 2019, 2020 and 2021) ⁽¹⁾	7 burrow areas	7 colonies	11 colonies	8 colonies
Peak number of active burrows per survey within survey area ⁽²⁾	135- 269 Max ⁽²⁾	195	125	173

1 –With one of the colonies outside of the survey area in 2019(approximately 250m to the north of the survey area). 2 –Note that the total number of burrows (active and inactive) were counted for each active burrow area (giving a total of 269 burrows) not active burrows during the 2018 survey. Estimates suggest that 50% occupancy may be a precautionary figure for active burrows which would give 135 active burrows.

Two groups of burrows identified in 2018 (see **Figure 2**) were subsequently covered prior to the start of the breeding season for sand martins in early 2019 to prevent nesting in areas of the frontage which would be directly impacted by the beach nourishment during construction. Netting was maintained on the lower levels of the cliff face. Burrows were still therefore available in the upper areas of the cliff. The location of the netting for these lower burrows would appear to correlate with the reduced number of active colonies at the start of the 2019 breeding season (5 active colonies) as compared to the number observed in 2018 (7 active colonies) although the number of active burrows cannot be compared as the 2018 survey did not record whether burrows were active. Two areas of netting were removed early on in the breeding season and the burrow areas were then used for nesting (sites 2 and 3) with additional mitigation measures in place to reduce disturbance to these areas (such as buffers left around the burrow entrances where no sand was placed initially and minimisation of disturbance through placement of fencing in front of the active burrows).

As can be seen in **Table 3**, at the beginning of the 2020 breeding season, there was only one active colony noted during the April survey. The creation of other colonies increased rapidly after this survey however and by the May survey there were 8 active colonies, with 11 in total during the breeding season. Overall, there were higher numbers of active colonies than during the 2019 season, although the number of active burrows in 2020 was less when compared to the 2019 data. It may be that the colony numbers are just reflecting the availability of suitable substrate within each burrow area rather than the number of distinct groups of birds. Comparison of the 2020 data with the 2018 and 2019 data shows a higher number of active burrow areas, noting that the study area was larger in 2020 which could account for this (colonies N8, N9 and 7 from 2020 were outside of the study area in 2018 and 2019).

As stated above, some degree of caution must be exercised in drawing conclusions relating to colony movement and development. In 2019 the netted areas were clearly inactive, but the previously inactive burrows to the north (from 2018) then became the busiest active colonies that year (colonies 4 and 5) together with the new colony (6). It is considered likely that the birds simply moved northwards in response to the netted burrows, as intended.

Over the summer of 2019, two additional (new) colonies were identified; one at the northern edge of the survey area (colony 6), and one approximately 250m further to the north of the survey area towards Mundesley (named colony 7 but not included in the counts). During 2020 several new burrow areas were excavated (N1-N9). This behaviour would align with the response of sand martins who return each year and then find some burrows have been lost (e.g. due to landslides or erosion) or not habitable, requiring the excavation of new burrows. This report recognises that there could be a range of influences that could cause fluctuations in sand martin populations in the survey area.

Table 3 shows that at the beginning of the 2021 breeding season, there were six active colonies noted during the April 2021 survey, with two more colonies excavated between the April and May surveys. All eight colonies were observed as active from May to August 2021. Much like 2020, no colonies were observed to be active during the September 2021 survey.

Overall, there were fewer active colonies than the 2020 season (which had a total of 11 active colonies throughout the season). However, the number of active sand martin burrows was higher overall in 2021 when compared to the 2020 data as discussed in **Section 3.2**.

Comparison of the 2021 data with the 2018 and 2019 data shows a slightly higher number of active burrows, noting that the study area was larger in 2020 and 2021 which could account for this (colonies 21-5 and 21-6 were outside of the study area in 2018 and 2019).

3.2 Active Burrow Numbers

Direct comparison of active burrow numbers as shown in **Table 3** is not possible with the 2018 data as the count was of the total number of active and inactive burrows in each burrow area in 2018 (as per the survey objective at the time). The surveyors from the 2018 survey (Wild Frontier Ecology) suggested that “A precautionary estimate of 50% occupancy within the active colonies gives a population well in excess of 100 pairs for the survey area”. This would indicate that at 50% occupancy the number of active holes could be approximately 135 active burrows, closer to the numbers in other years.

The number of active burrows per survey for 2019 is recorded at a maximum of 195 burrows (**Figure 3**), with a peak of 125 during 2020 (**Figure 4**) and 173 in 2021 (**Figure 5**). The numbers in 2019 were therefore higher than the estimated numbers during 2018 as well as 2020 and 2021. The 2019 survey also did not count the new active burrows to the north towards Mundesley in the regular counts, since this was outside the survey area. One count for Colony 21-6 was however provided when the colony was first identified on

27th July 2019; this counted 36 active burrows. Adding in the new colony observed to the north of the survey site would suggest that sand martin activity in 2019 could have been up to 231 active burrows although it is most likely that the additional 36 active burrows were just relocated birds from other active burrow areas. As above, caution should be exercised in comparing the two datasets.

The new colony that was observed towards the end of the 2019 season (colony 7) was also the busiest colony of the 2020 season. As also mentioned above, the peak number of active burrows per survey during the 2020 surveys (125) was lower than in 2019 (195), even though there was a higher number of active colonies recorded in 2020 (11) than in 2019 (7). This peak count of 195 occurred during one count only (as shown in **Figure 3**) and as the surveys were undertaken more frequently in 2019 it is possible that a peak count was missed during the 2018 and 2020 counts. The levels more generally appeared to fluctuate between 121 and 154 which would correlate with the numbers counted in 2018 and 2020.

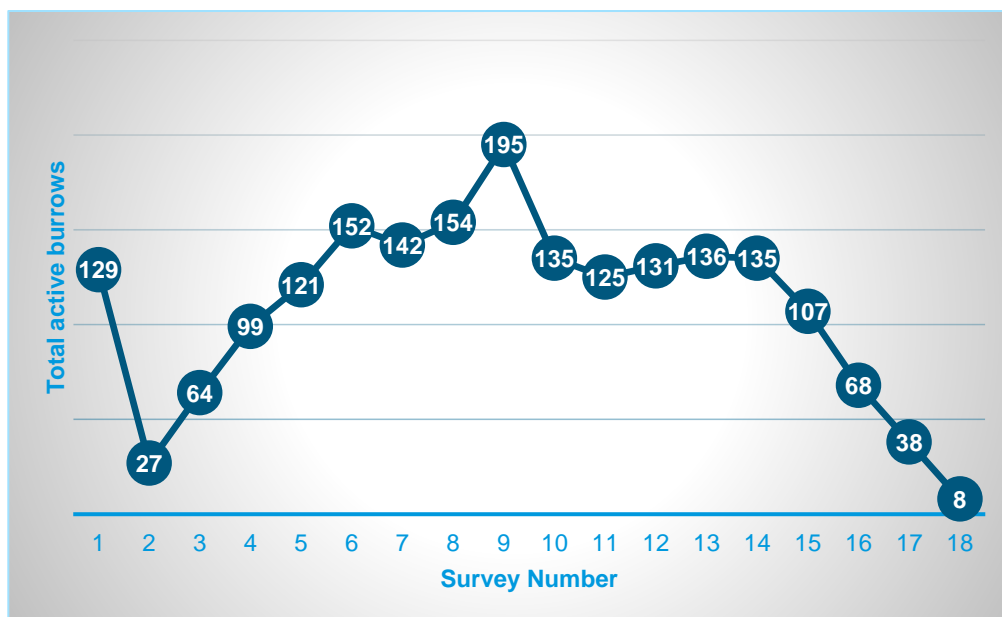
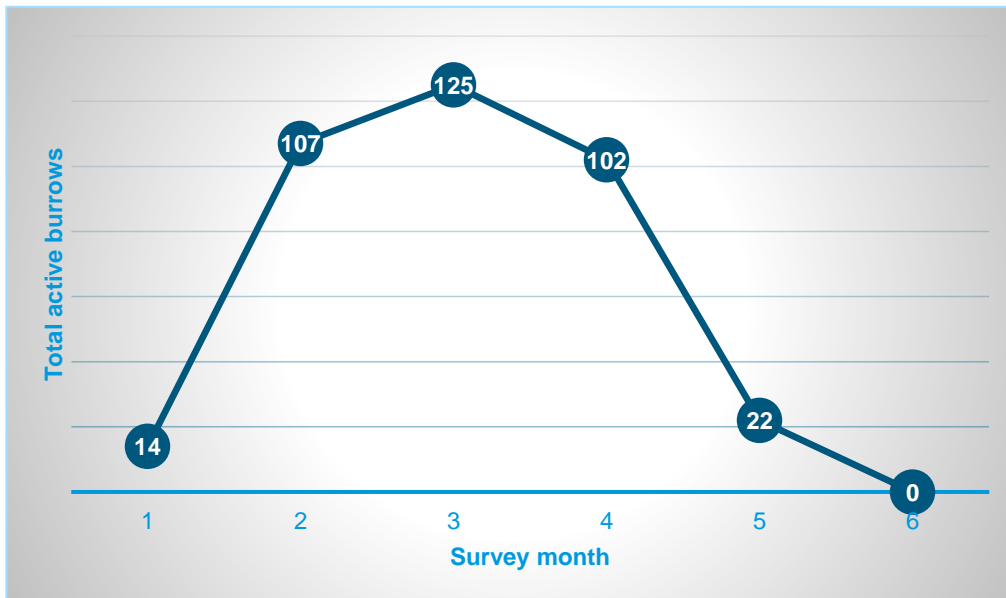


Figure 3 Total active burrows per survey for 2019. Note: high peak for one survey only.

A high level of cliff erosion was observed during the 2020 survey period at some of the previous burrow colonies from the 2019 season (namely colonies 1, 4, 5 and 6), which would also reduce the attractiveness of these colonies to returning sand martin populations. Erosion was also observed throughout the 2020 season at some of the active burrows, which may have caused the reduction in active burrow numbers, however this is difficult to confirm due to the temporal variability between surveys throughout the breeding season. Namely colonies 7, N5, N6 and N7 had some burrows eroded away throughout the 2020 season.

Figure 4 Total active burrows per survey month (April to September) for 2020.



Overall, there were fewer active colonies in 2021 (8 active colonies) compared to 2020 (11 active colonies). However, the peak number of total active burrows within each colony during the 2021 survey season (April to September) was much higher than 2020 (173 compared to 125 active burrows respectively (**Figure 5**).

Cliff erosion was observed during the 2021 survey at Colony 21-6 (previously Colony 7 from 2020 surveys). The number of active burrows at Colony 21-6 in 2021 was less than the total number of active burrows recorded at the same site in 2020. Cliff erosion to the lower section of Colony 21-6 in the latter part of 2020, would reduce the attractiveness of the colony to returning sand martin populations. It is worth noting that erosion was observed at this colony during the 2020 survey season.

Both 2020 and 2021 survey results show a peak in month 3 of surveys (June) (**Figure 6**). This is the period when the chicks are starting to hatch. It was observed in both years that the June survey offered the most suitable weather conditions with moderate to medium winds, warm and dry with more than 50% cloud cover. The number of active colonies per survey is influenced by the weather and predation. It is worth noting that the weather across the 2021 surveys was fairly consistent compared to the 2020 surveys. The weather was generally warm and dry, with mild to moderate wind conditions and >50% cloud cover. Sand martin activity was also impacted by predation. It was observed that fewer sand martin were present when birds of prey such as a hobby (*Falco subbuteo*) or kestrel (*Falco tinnunculus*) were observed flying over the beach or above the cliffs. Sand martin numbers then start to decline following June and all sand martin had left the burrow areas by September.

Chicks were occasionally observed within the mouth of the burrows during feeding periods during June, July and August, with at times 3 or 4 chicks observed in the mouth of one burrow. Mostly however, there was either one or two chicks observed per burrow.

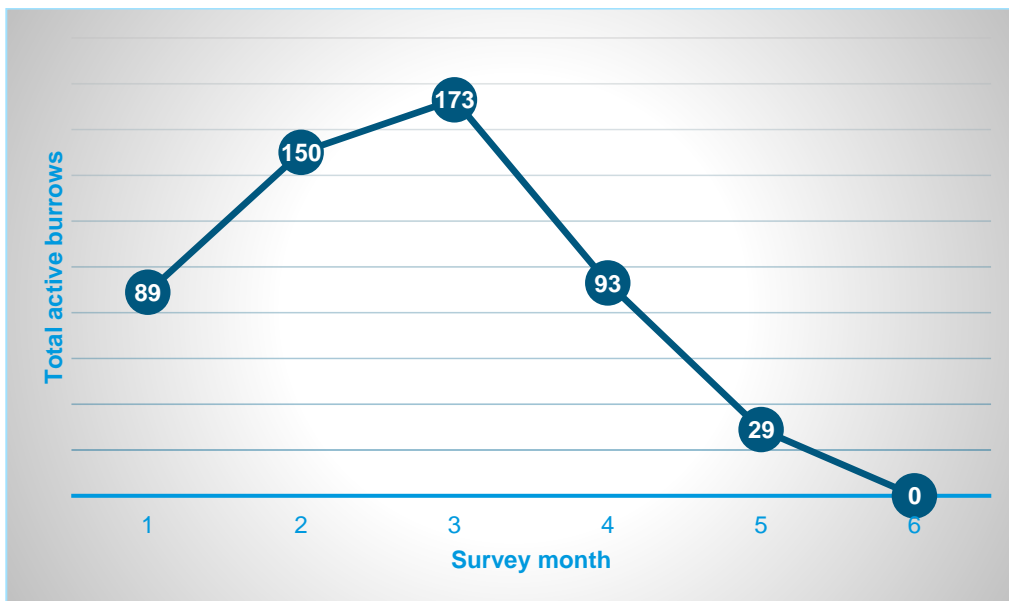


Figure 5 Total active burrows per survey month (April to September) for 2021.

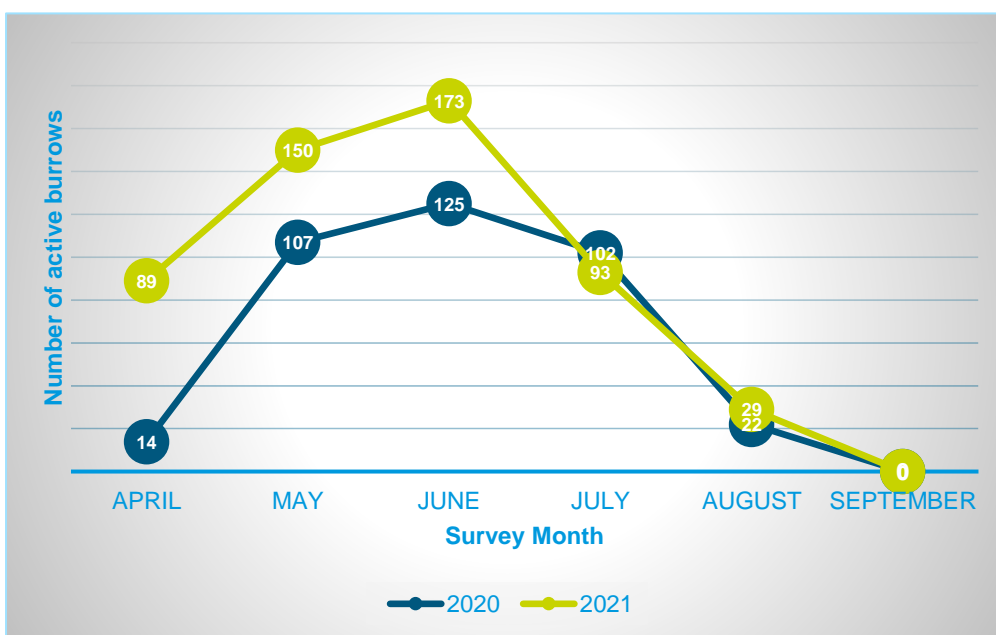


Figure 6 Comparison of total active burrows per survey month (April to September) for 2020 and 2021

3.3 Other Considerations

The British Trust for Ornithology (BTO) provide long term data for sand martin (<https://www.bto.org/birdtrends2010/wcrsanma.shtml>) and they recognise that it is unusually difficult to monitor sand martin numbers as the active and inactive nest holes are difficult to distinguish and because whole colonies frequently disperse or shift to new locations as suitable sand cliffs are created and destroyed. Observations at Bacton, as outlined above, show that some of the sand martin do relocate to adjacent areas. The BTO conclude (following review of long-term data up to and including the 2009 dataset that the Wetland Bird Survey (WBS) counts (of active colonies) “suggest a stable or shallowly increasing population, with

wide fluctuations, although the ongoing decrease since the late 1990s has been steep enough to raise BTO alerts". Breeding Bird Survey (BBS) counts, which are of birds seen, show clearly that large year-to-year changes occur, but do not yet reveal a clear long-term trend. Fluctuations do occur on a yearly basis and it is suggested that rainfall in the feeding grounds (in Africa) has an influence on abundance.

For the Bacton monitoring, no sick or injured sand martins were recorded in the survey area during 2019 and 2020. One dead chick was found during the surveys in 2021. Based on a colony observation during 2019, it would appear that the two areas where previously used burrows were netted during the construction phase were replaced with new burrow areas elsewhere on the frontage. Based on this, and the four survey datasets from 2018 to 2021, it can be said that there are no obvious signs of adverse impacts on sand martins due to the coastal management construction works, new beach profile and the higher level of sand at the base of the cliffs. Although numbers were lower in 2020 than the previous two years, numbers increased again in 2021. The lower counts recorded in 2020 could have been due to:

- Missing the peak count due to lower frequency of monitoring during 2020 and 2018
- Natural variability within the sand martin population
- Cliff face (erosion) during the breeding season and/or standard error inherent in estimating bird numbers

Based on the 2019 survey period, it was concluded that the mitigation provided during construction was successful in avoiding any disturbance to the breeding cycle of this species.

It is worth noting that, in addition to the sand martin activity along the coastal frontage around the Bacton Gas Terminals, there were also two large breeding colonies located at Happisburgh and Ostend during the 2020 and 2021 breeding season and one large breeding colony located at Mundesley during the 2021 breeding season.

4 Other Breeding Bird Activity

4.1 Ringed Plover

No correlation can be drawn across the 2018, 2019 and 2020 surveys for the observations of ringed plover; the actual numbers are too low and the survey area itself has been so changeable for the three survey periods. The pre-construction beach offered only limited areas above high tide. During construction there was a high level of activity on the beach. During 2020 and 2021 there was much more suitable habitat for ground nesting coastal birds.

As documented in the series of Survey Reports for the 2019, 2020 and 2021 surveys, the foreshore was monitored for nesting activity. During 2019, the monitoring identified an active ringed plover nest at the centre of the construction site. It was considered that this site could have been selected by the ringed plover because of the reduced access to the site and that particular area of beach during construction, particularly for people walking dogs. In 2020, a pair of ringed plover were observed to have successfully nested and hatched chicks. The two chicks were observed moving around on the nourished beach and down by the waterside during the May 2020 survey. Additional pairs of ringed plover were also observed and appeared to be nesting, but no other chicks were observed. It is possible that there were additional chicks but that they hatched between surveys as once hatched they do move away from the scrape within a few days. During 2021 observations of up to 4 adult ringed plover were seen on the upper beach area at any one time. They were observed sitting on what could have been scrapes but no chicks were observed. Again, this could have been due to the chicks hatching between surveys and moving away from the area.

For 2020 and 2021, to provide protection for ringed plover nesting on this section of the beach, signs informing the public to keep their dogs on a short leash due to the potential for ground nesting birds were placed by NNDC, and an area of beach to the east of the access ramp was cordoned off, with the Norfolk Coast Path diverted to the lower section of the beach to minimise disturbance from human activity. Additional signs were also placed at both ends of this cordoned off area informing the public of the diversion to the coastal path and the reasons for diversion. NNDC also placed a temporary ban on any maintenance vehicles driving along the beach.

Observed numbers of ringed plover in 2020 and 2021 are summarised in **Table 4** below.

Table 4 Number of ringed plover observed during 2020 and 2021 surveys

	Date of Survey	April	May	June	July	August	September
2020	Adults	3	3	2	2	2	2
	Chicks	0	2	0	0	0	0
2021	Adults	4	2	2	4	0	12
	Chicks	0	0	0	0	0	0

In 2021, twelve ringed plover were observed during the September survey. One group of 7 individuals and one group of 5 individuals were both observed at 9:30 and 13:00. Most were foraging at the water's edge. As discussed above, generally, there were up to four ringed plover on the upper beach area at any one time.

4.2 Other Breeding Bird Species

There were no sightings of terns or other breeding birds in the area during the April to September 2021 surveys.

5 Conclusions

At this stage there are four broad data sets for sand martins based on survey work in 2018, 2019, 2020 and 2021 which (as outlined in this report) were based on very different survey aims and approaches (duration and scale), with the 2019, 2020 and 2021 surveys adopting a similar methodology but with a different frequency of surveys. A simple exercise in projecting or extrapolating the data is not appropriate, but a considered use of all four datasets, in addition to the narrative provided here, does highlight some likely factors with regard to sand martin activity.

Overall, there were fewer active colonies observed in 2021 (8 colonies) compared to the 2020 survey period (11 colonies), however the number of active burrows increased in 2021 when compared to the 2020 data. It may be that the colony numbers are reflecting the better availability of suitable substrate within each burrow area rather than the number of distinct groups of birds.

Comparison of the 2020 and 2021 data with the 2018 and 2019 data shows a higher number of active burrow areas noting that the study areas was larger in 2020 and 2021 which could account for this as some of the burrow areas counted in 2020 and 2021 were outside of the study area in 2018 and 2019.

Based on the number of colonies and the number of active burrows present along the frontage it would appear unlikely that the construction works for the Bacton to Walcott Coastal Management Scheme had any significant impacts on sand martins. The netting used as mitigation in 2019 successfully prevented the sand

martins from nesting in areas directly within the placement area (where the netting remained in place) and led to a successful relocation of the displaced sand martin colonies. The observation of new burrows in 2019, just outside the scheme area, suggests that the birds created new burrow sets in nearby areas. This would align with the natural pattern of sand martin behaviour where burrows are lost due to the fragile nature of the soft cliffs in which the burrows are created and suggests that the intended effect of the netting was achieved. This is further supported by the findings of the 2020 and 2021 surveys, which showed that high numbers of sand martin returned to the site again in 2020 and 2021 and successfully bred and reared young within existing or newly excavated burrows. There were clear signs of erosion evident in some of the colonies between the 2019, 2020 and 2021 breeding seasons. Newly excavated burrow areas were observed in 2021 along various sections of cliff (Colonies 21-4a and 21-4b), both along the stretch of beach that was subject to nourishment (below the Bacton Gas Terminal) and also along the stretch of beach where works were not carried out (towards Mundesley).

Ringed plover were again recorded from the site in 2021 in the same area as in 2020 (and close to the area where one pair were nesting in 2019) where the created beach area provides an ideal habitat for these ground nesting species. Generally, there were up to four ringed plover on the upper beach area at any one time. Chicks were not observed during 2021 so it was uncertain as to whether or not they had successfully nested and hatched chicks during 2021. However, it is worth noting that chicks could have hatched and left the nesting area between surveys.

The habitat created by the Bacton to Walcott Coastal Management Scheme provides good conditions for breeding ground nesting birds and the measures put in place by NNDC to control levels of disturbance were clearly effective.

6 References

Royal HaskoningDHV 2018 Statement	Bacton to Walcott Coastal Management Scheme Environmental
Royal HaskoningDHV 2019 ¹	Bacton Gas Terminal Construction Environmental Management Plan
Royal HaskoningDHV 2019 ²	Bird Survey Report (Bacton Gas Terminal Construction)
Wild Frontier Ecology 2018	Bacton Nesting Bird Survey