Seabird Monitoring & Research Project
Isles of Scilly 2022

Manx shearwaters at their burrow on St Helen's, July 2022

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Funded by the Isles of Scilly Area of Outstanding Natural Beauty

Summary of Seabird Monitoring and Research 2022

Monitoring of seabird numbers and productivity on St Agnes and Gugh

- Manx shearwater
    - the breeding population has increased from 22 pairs in 2013 (pre rat eradication) to over 100 pairs in 2022 (post rat eradication), with sub-colony site expansions and newly dug burrows
    - response rate calibration survey conducted for 38 active burrows over 6 days in June – analysis suggests the calibration factor used is too low and our number of breeding pairs on St Agnes & Gugh are higher than previously reported
    - 56 'star-gazing' chicks recorded (29 St Agnes, 27 Gugh); none recorded pre-rat eradication
- Storm petrel
    - recorded breeding on Gugh (first records 2015)
    - continued cat predation (first recorded 2019); minimum 4 adult birds predated over 3 sites (Troytown on St Agnes, Burnt Island & Gugh)
    - No calling chicks recorded
- Lesser black-backed gull
    - colony on Gugh 399 pairs (875 in 2006, but regularly at around 400 since 2012)
    - drone surveys on Gugh for both breeding pairs and fledging chicks
    - high productivity est. 1.35 chicks per pair (using drone footage)
- Oystercatcher
    - Continued increase in nesting pairs with 18 nests on Gugh and 8 on St Agnes

Population monitoring work on Round Island & St Helen's

- Rats discovered 23rd January 2022, incursion response – cleared by April 2022
- Playback survey for storm petrel in July 2022 found only 4 replies – 11 pairs (last visit in 2015 recorded 172 pairs and no rat presence)
- Playback for Manx shearwaters on St Helen's recorded 61 replies indicating a large population attempting to breed each year despite heavy rat presence
- Cameras deployed at shearwater nest sites on St Helen's confirmed extensive rat presence at burrows

Population monitoring work on Annet

- Puffins – 36 birds recorded (50 in 2006, 31 in 2015, 45 in 2021) – relatively stable
- Storm petrel – southern study beach 132 apparently occupied sites
- Shag and greater black-backed gull numbers stable (98 & 188 pairs respectively)
- 'Homes for Shearwaters' Project to provide artificial nesting burrows
    - 35 new boxes installed on Annet March 2022, summer activity but no nesting yet

Productivity monitoring work across the archipelago

- Herring gulls: selected sub-colonies on Samson and in Hugh Town, St Mary's
    - productivity 0.45 chicks per pair on Samson (n = 40)
    - productivity 1.47 chicks per pair in Hugh Town rooftop sub-colony (n = 15)
- Kittiwakes: all sub-colonies
    - total of 11 asynchronous nesting attempts on the east side of Gugh resulting in 4 chicks fledging - 0.36 chicks per pair
- Fulmars: selected sub-colonies Menawethan (n = 35) and Daymark, St Martin's (n = 51)
    - productivity ranging from 0.34 to 0.45 chicks per pair
- Common terns: all sub-colonies
    - very little activity and no breeding attempts recorded in 2022
- Manx shearwaters: selected sub-colonies on Bryher and Peninnis, St Marys
    - no fledging recorded – continued rat presence confirmed

Key Recommendations

- Review current monitoring programme (include Round Island surveys for burrow nesters) and work towards Scilly becoming part of the National Monitoring Scheme
- Update Seabird Conservation Strategy for 2023-28
- Seek funding to complete full SPA survey in 2023 or 24
- Maintain biosecurity vigilance and community support for Seabird Recovery Project St Agnes & Gugh
- Maintain momentum (following Sept 2022 meeting) to reboot 2nd large-scale community led Island Restoration Project for remaining inhabited and uninhabited off-islands of Scilly
- Work with community to deploy GPS tracking collar on domestic cats, deploy trailcams for identification, and seek acceptable intervention to protect storm petrels on St Agnes & Gugh
- Develop seabird demographics programme for Scilly to include colour ringing focusing on key data location gaps and tracking project for Manx shearwaters distribution at sea
- Maintain 'Homes for Shearwaters' nest boxes on Annet and monitor occupancy, deploy infrared cameras
- Contingency Planning for a wider Bird Flu outbreak in Scilly in 2023
- Develop a Research Project Pipeline with priority research project outlines and basic costings
- Review current landing restrictions – red/ amber/ green zonation - for seabird and seal disturbance mitigation – Work with partners to develop an Islands Recreational Strategy

Introduction

This report summarises the results of seabird fieldwork conducted between April and October 2022 and was undertaken by the Isles of Scilly Wildlife Trust, funded by the Isles of Scilly Area of Outstanding Natural Beauty. Scilly's seabird breeding records comprise one of the best long-term environmental data sets we have for the islands and this report adds to the annual productivity data for key seabird species collected at key sites across the islands since 2006. Productivity for the species recorded here were collected using standard methods as set out in *The Seabird Monitoring Handbook* (Walsh *et al*. 1995).

The breeding successes and failures recorded add to the picture in the interim periods between full counts of all the seabirds breeding across the Isles of Scilly. The last full Special Protection Area (SPA) count conducted in 2015/16 confirmed Scilly as supporting a greater diversity of seabirds than any other site in England, with over 8,000 pairs of 13 species of regularly breeding seabird. With internationally important numbers of lesser black-backed gull and storm petrel and nationally important numbers of great black-backed gull (probably the largest colony in the UK), Manx shearwater and shag (possibly the largest colony in the UK), seabirds are a named feature in the SPA and many of the SSSI designations for the area and are a vitally important part of our Natural Heritage. The data collected in Scilly also contributes to national seabird records and allows comparison between different regional populations.

Results: Monitoring of seabird numbers and productivity on St Agnes and Gugh

A full survey of all seabird species breeding on St Agnes and Gugh has been conducted annually since 2012 as part of the long-term monitoring to assess the response to the removal of rats in the winter of 2013/14. The results from this and the two previous SPA counts included in Tables 1 and 2 below. Over this period the number of both herring and lesser black-backed gulls has decreased, with main lesser black-backed gull colony on Gugh falling from 875 pairs in 2006 to 361 in 2012 and remaining relatively stable at that level since. One pair of ringed plover were recorded breeding successfully at Beady Pool in 2022 and the number of Oystercatchers remained high across the two islands.

Kittiwakes first bred on St Agnes at the Turks Head in 2009 following the desertion of a number of sub-colonies elsewhere in the archipelago. After two years of failure at this site a small number of birds returned to breed at their former site on the eastern side of Gugh. After the first year, 2021, when no breeding attempts were recorded in Scilly, 11 pairs nested at the Gugh site in 2022 and although relatively asynchronous raised 4 chicks to fledging.

The largest change since the removal of rats in the winter of 2013/14 has been the increase in breeding numbers, productivity and range of Manx shearwaters and the first recording in living memory of storm petrels breeding on St Agnes since 2015 and on Gugh since 2016.

Table 1. Breeding seabirds (pairs) on St Agnes (SH – shag; GBBG – great black-backed gull; LBBG – lesser black-backed gull; HG – herring gull; RAZ – razorbill; FUL – fulmar; KIT – kittiwake; COT – common tern; SP – storm petrel; MX – Manx shearwater; PUF – puffin; OYC – oystercatcher; RPL – ringed plover)

	FUL	MX	SH	LBBG	HG	GBBG	KIT	COT	SP	RPL	OYC	Total
2000	0	5	0	2	25	0	0	3	0	-	-	**35**
2006	0	8	0	0	15	1	0	0	0	-	-	**24**
2012	0	8	0	8	61	0	24	0	-	2	9	**112**
2013	2	5	0	8	32	0	38	0	0	1	8	**94**
Rat Removal												
2014	3	9	0	16	27	1	62	0	0	1	10	**129**
2015	4	12	0	14	11	1	75	0	6	1	7	**131**
2016	6	22	0	15	12	1	5	0	9	2	8	**80**
2017	8	23	0	1	7	0	0	0	11	2	10	**62**
2018	5	23	0	2	7	0	0	0	8	1	7	**53**
2019	6	27	0	1	8	0	0	0	2	0	6	**50**
2020	No count											
2021	9	36	0	0	6	0	0	0	6	1	8	**66**
2022	10	65	0	2	3	0	0	0	0	1	8	**89**

Counts do not include Burnt Island and Tins Walbert (connected to St Agnes at low tide); storm petrel counts relate to only a sample of potential habitat surveyed.

Table 2. Breeding seabirds (pairs) on Gugh

	FUL	MX	SH	LBBG	HG	GBBG	KIT	COT	SP	RPl	OYC	Total
2000	2	22	0	1123	159	3	155	0	0	-	-	**1464**
2006	3	9	0	875	69	4	131	0	0	-	-	**1091**
2012	4	16	2	361	53	10	0	0	-	0	7	**453**
2013	1	17	0	418	51	7	0	0	0	0	10	**504**
Rat Removal												
2014	5	17	0	411	30	5	0	0	0	0	10	**478**
2015	1	45	0	419	30	6	0	0	2	1	5	**509**
2016	1	52	0	400	36	5	0	0	4	0	10	**508**
2017	3	36	2	296	20	2	30	0	5	0	9	**403**
2018	2	41	0	452	28	0	35	0	11	1	9	**579**
2019	2	42	1	422	14	3	20	0	11	0	9	**524**
2020	No count						15	No count				
2021	3	46	0	397	22	2	0	0	7	0	15	**492**
2022	0	80	0	399	31	4	11	0	3	0	18	**531**

Storm petrel counts relate to only a sample of potential habitat surveyed.

The number of fulmars breeding on St Agnes has also notably increased consistently each year since rat eradication. Fulmars are not particularly recognised as a rat limited species but this trend suggests there may be an impact. However, no such increase has been seen on Gugh since removal. Also where fulmar breeding success is recorded elsewhere in the islands there is no consistent difference in fledging success between Menawethan (apparently rat-free) and at the Daymark on St Martins (rats present).

Manx shearwater settlement and productivity St Agnes & Gugh

[2015/16 full SPA count: 523 AOBs on 10 islands, 3-fold increase since 2006; Birds of Conservation Concern (BOCC) Amber Listed]

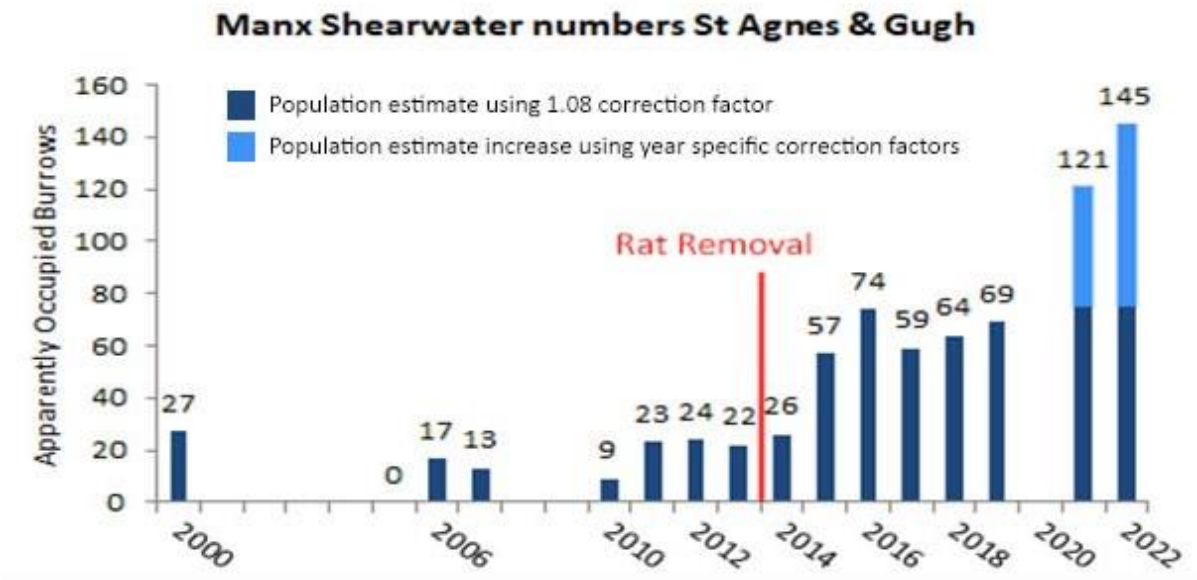
The numbers of apparently occupied Manx shearwater burrows on both St Agnes and Gugh have increased dramatically since the removal of rats in the winter of 2013-4 (islands officially declared 'rat free' in February 2016). In addition to the increase in breeding numbers, new burrows are being occupied year on year, with the sub-colony on Wingletang Down expanding inland since 2019. In particular the expansion of the shearwater sub-colony area on the west side of Wingletang has been away from the flatter grassy areas and up into the rockier slopes, where trampling of burrows (as has been seen lower down) by grazing cows is less of a risk.

Response Rate Calibration survey

Since the Seabird 2000 census in Scilly, we have used the diurnal tape playback census method, following the Seabird Monitoring Handbook (Walsh *et al*. 1995), to record the number of Apparently Occupied Burrows. This method includes the use of a correction factor to account for the number of breeding birds that do not reply to the recording. Researchers have found that this conversion factor can vary between colonies and between years, so that employing a site and survey specific correction factor is preferable wherever possible.

For all Manx shearwater surveys in Scilly up to 2019 we used the correction factor of 1.08 (based on a response rate of 0.93) as recommended in Newton (2004). However, a quick review of the more recent literature suggests that this correction factor is roughly half that found in many of the latest UK shearwater surveys and gives an underestimate of the likely population size. For example, calibration trials on c.100 burrows over 7-10 days on Lundy in 2017 and 2018 obtained correction factors of 2.558 and 2.000 respectively (Booker *et al*. 2019).

The increase in the number of occupied burrows on St Agnes and Gugh since rat removal, now makes a specific calibration plot survey possible. In 2021, a consecutive 5-day survey of 63 potentially occupied burrows on Agnes & Gugh (32 of which solicited at least 1 reply), gave an average response rate of 0.63. A calibration response survey was also conducted in 2022 over 6 days in early June, surveying 75 potentially occupied burrows on St Agnes, 38 of which solicited at least 1 reply. As in 2021 the response rate data was inputted into the *Shiny app* to implement a series of R scripts to calculate the average response rate (Bolton, Padget & Wood *in prep*.) The data from the 2022 survey generated an average response rate of 0.49, which gives a correction factor of 2.04.
This is almost double the correction factor of 1.08 used up until 2019 and suggests that the number of occupied shearwater burrows on St Agnes & Gugh is considerably higher than thought. In the graph below, the columns for 2021 and 2022 present the breeding population estimate using the old correction factor in dark blue and the uplift in light blue resulting from using the year specific correction factors obtained.

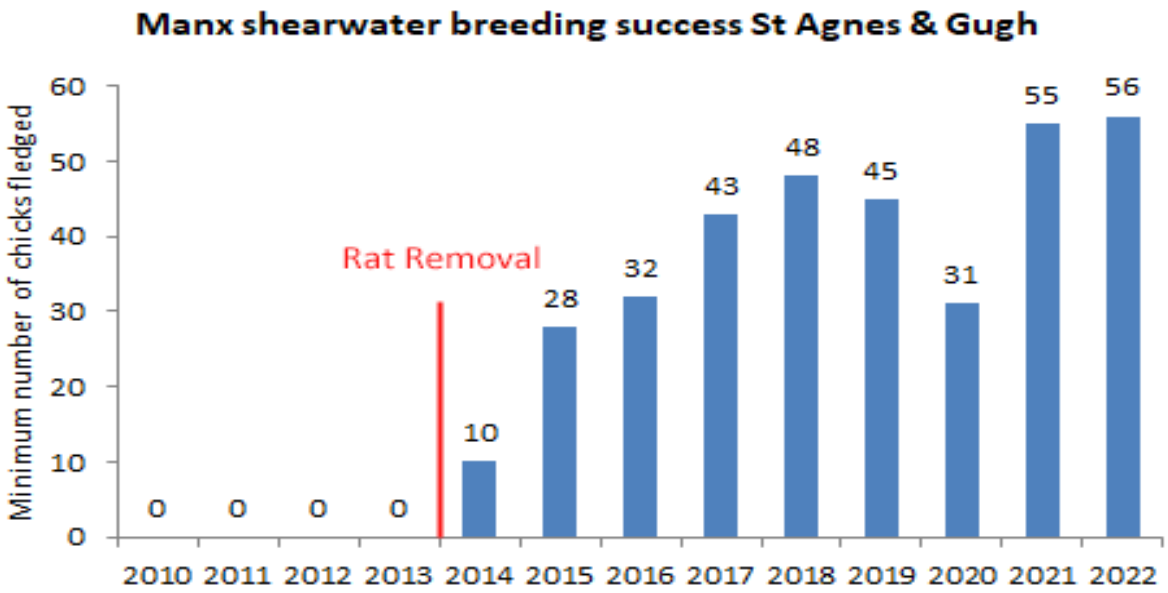


Breeding Success

Without direct access to the nest chamber through an inspection hatch it is not possible to get an accurate measure of breeding success for Manx shearwaters. However, since 2013, evening checks in August and September have been employed across St Agnes and Gugh to get an indication of breeding success for the shearwaters and to help act as a biosecurity monitoring tool. This relies on the 'star-gazing' behaviour of chicks, where in the last 10 days or so before fledging the young birds venture outside their burrow entrances under cover of darkness to stretch their wings and explore for a few hours after night falls (Brooke 1990).

In 2022, evening checks between August and late-September recorded a total of 56 chicks across St Agnes and Gugh (29 on St Agnes and 27 on Gugh), translating to a breeding success of between 0.34 and 0.45 chicks per Apparently Occupied Burrow. This is lower than the breeding success on Lundy after rat removal (0.62 to 0.80 chicks per pair) and the 1986-2019 national average of 0.65 (JNCC 2019), but likely to be an underestimate, reflecting the fact that 'stargazer' counts will likely miss many birds altogether (see below).

Star-gazing behaviour is very much dependent on the amount of ambient light (Brooke 1990). Dark nights with thick cloud and rain or fog are ideal and result in the highest counts. Conversely when the moon is bright and skies clear, chicks rarely venture out from their burrow entrance, as although this would appear to be the best time to actually look at the stars, the ambient light can be enough to allow nocturnal gull predation. When 'bright' nights occur during the star-gazing and fledging window for the shearwater chicks, it appears that they do not spend much time exploring outside the burrow at all and are more likely to leave directly from the burrow to the water. The lower number of chicks encountered in 2020 served to highlight this flaw in the 'stargazer count' method, as the peak fledging period (late August/ early September) coincided with a full moon and a long string of clear skies which was likely to have led to a reduced number of chicks encountered on the ground. Discussions with Greg Morgan, Warden on Ramsey Island, revealed that in 2020, although his chick ringing totals (from ringing chicks found on the ground after dark) were well down on the usual numbers, the shearwater breeding success, recorded from study burrows with direct access, was no lower than average.



Manx shearwaters elsewhere across the islands

In 2015/16 the total number of Manx shearwaters breeding across the Isles of Scilly was estimated at 523 pairs, with many of these birds attempting to breed at sites with continued rat presence. A number of evening checks were made at two of these sites, Shipman Head, Bryher and Peninnis, St Mary's in August and September 2022. As in previous years, no fledglings were recorded and much rat activity was seen around the burrows at Shipman Head. Although the occasional chick may survive from these nesting attempts (as seen in 2019 at Peninnis), it seems likely that these populations are only being maintained at a low level by immigration, either from other rat free islands in Scilly or further afield. No playback survey was conducted on Round Island for breeding Manx shearwaters in 2022.

Population monitoring work on Round Island & St Helen's

As part of the winter rodent surveys carried out in early 2022 (Pearson 2022) a significant population of rats were discovered on Round Island on the 23rd January 2022. A rapid multi-agency incursion response was put in place and the rats were cleared by early April 2022. It is not clear how long the rats had been present on Round Island and they could have established a breeding population anytime since the last visit in 2015 when no rat presence was recorded.

Although no survey was conducted for Manx shearwaters in 2022, a diurnal playback survey for storm petrels on 22nd July 2022 elicited only 4 replies from apparently occupied storm petrel sites. With the correction factor of 2.86 (Ratcliffe *et al.* 1998) this gives an estimate of just 11 breeding pairs; a 94% decline.

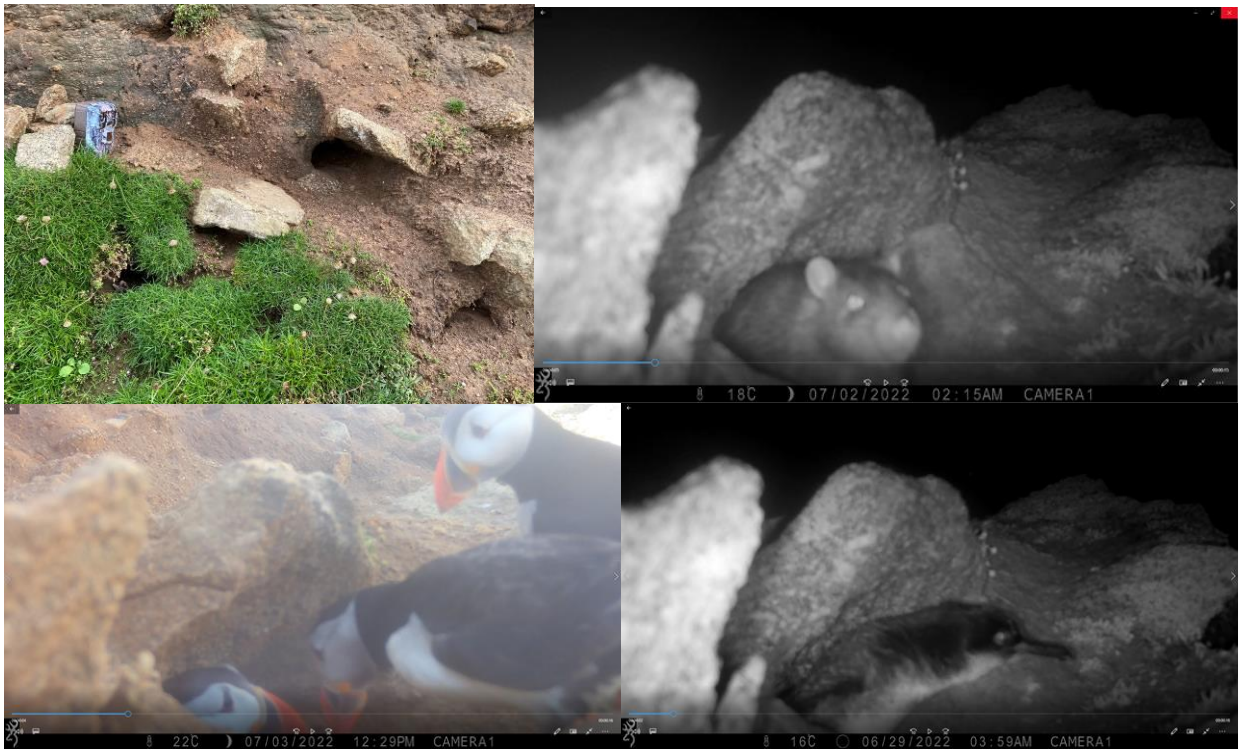
Table 3. Storm petrel number of apparently occupied sites on Round Island

Island	2000	2006	2015	2022
Round Island	183	251	172	11

St Helen's has been shown to be an important island for Manx shearwaters with previous estimates of up to 56 apparently occupied sites in 2019 but extensive evidence of heavy rat presence and predation of chicks (copious feathers in burrow entrances in late summer).

A diurnal playback survey on 17th June 2022 elicited 61 replies from incubating adult shearwaters, indicating a population of over 100 birds attempting to breed here each year. Cameras were deployed at shearwater nest sites on St Helen's over the summer in 2022 and confirmed extensive rat presence at burrows. In particular, burrows which showed regular visits and change overs from adult shearwaters, in all cases also recorded visits by rats by both day and night. These visits became more frequent as the season progressed and eventually at the 3 main burrows studied the adult birds stopped visiting altogether and no chicks were ever seen emerging.

Burrow 1 in the coastal ram St Helens – visits recorded from puffins, shearwaters and rats.



Burrow 2 in the coastal ram St Helens – visits recorded from puffins, gulls and peregrine.

Storm petrel settlement and productivity St Agnes & Gugh

[2015/16 full SPA count: 1,335 AOSs on 14 islands, Stable; BOCC Amber Listed]

Storm petrels were first recorded as a breeding bird to St Agnes & Gugh in 2015 following rat removal. Between 2015 and 2019 the number of breeding birds increased to approximately 20 pairs (apparently occupied sites) within the study plots on St Agnes and Gugh. However, since 2019 there has been an issue with cat predation of adult storm petrels at the three main breeding sites on Kittern Hill, Gugh, Burnt Island and at Troytown, St Agnes. A large number of adult birds have now been predated across these relatively wide-ranging sites (from wings left behind minimum 38 birds in 2019, 17 in 2021 and 4 in 2022).

Diurnal playback response survey elicited only one response on Gugh and none on St Agnes in 2022 and no evidence of successful breeding (indicated from hearing fledglings calling from nest sites after dark Aug – Oct) was found. Cameras did however record multiple storm petrel adults in flight at night at the Troytown and on Burnt Island sub-colony sites in July and August.

Trail cameras were again deployed in 2022 from June to October and although brief footage was obtained of a cat on Burnt Island in early July 2022, the best footage to date remains that obtained in 2019 (see below). Efforts to establish the identity of the cat and to work with St Agnes residents around the issues of responsible cat ownership are ongoing.

Lesser black-backed gull settlement and productivity on Gugh

[2015/16 full SPA count: 2,485 AOSs on 30 islands, 26% decline since 2006; BOCC Amber Listed]

The number of lesser black-backed gulls breeding in Scilly has fallen dramatically in recent years, with a decline of 26% between 2006 and 2015 to just under 2,500 breeding pairs (Heaney & St Pierre 2017). The majority of the birds in Scilly now breed in three main sub-colonies; Samson, St Helen's and Gugh. Since 2012 the numbers and productivity at the Gugh sub-colony have been recorded annually.

The method used for counting gull nests across Gugh (and for all gull nests across Scilly) has been the traditional 'walk-through'; where a line of observers a metre or two apart systematically cover all the ground in the colony and count the active nests (fully formed nests with or without eggs). Although effective, it is a relatively invasive technique that creates quite a bit of temporary disturbance and there is potential for error with missed or double counted nests.

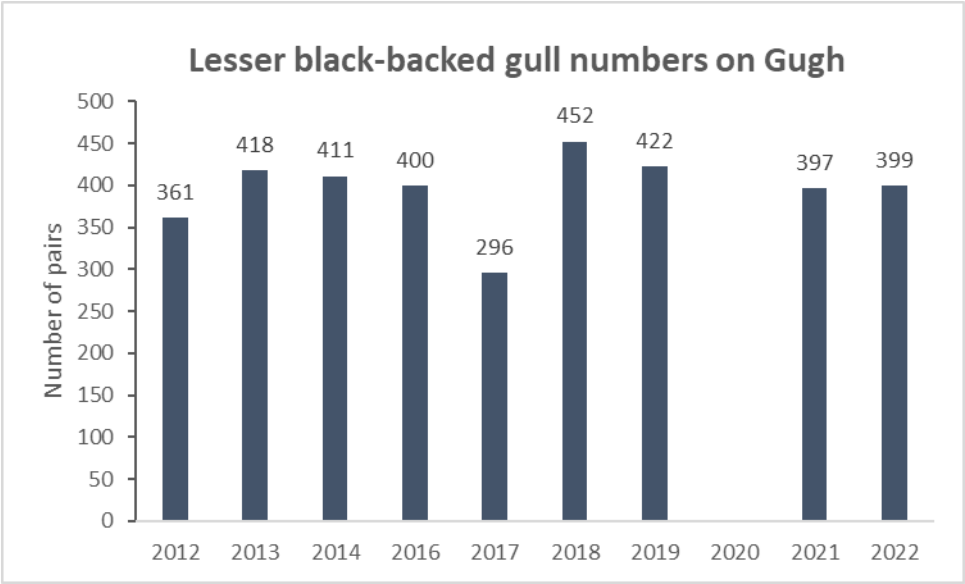
In 2021 the use of drone technology to assist with gull counts was trialled. As well as potentially reducing disturbance the use of UAVs (Unpiloted Aerial Vehicles) or drones offers an advantage for accessing nests found around clear patches or rocks deep within thick brambly vegetation. In 2022 local drone pilot – Gareth Tibbs from Bryher – was again contracted to help with the survey. This overcomes the issues of drone-flying skills and knowledge of regulations (e.g., in Scilly drone use is restricted over much of the islands by the Civil Aviation Authority) that are needed as well as the cost of the drone itself.

Informed by the protocol detailed in Rush *et al.* (2018) using drones to produce high resolution images for later analysis of lesser black backed gull colonies on Skokholm Island (1,400 breeding pairs), we again used a Mavic 2 Pro drone as follows:

- A smooth flyover at 40 m above the sub-colony from a take-off site approximately 20m to the side of the sub-colony, allowing the birds to become comfortable with the UAV.
- The altitude of the UAV was lowered to 30m whilst in motion to the side of the sub-colony – this elicited little to no reaction from the breeding birds.
- A transect was flown at a speed of 4mph providing image overlap of approximately 20% over the sub-colony with images captured at 2 second intervals to ensure a similar overlap between images. This resulted in @780 high resolution images.

The high-resolution images collected in early June were then uploaded onto *Dronedeploy.com* which meshed them together to produce an orthomosaic of the sub-colony – effectively a large top-down image of the whole site for analysis. Using the online software to zoom in and click on birds apparently incubating birds produced an estimate of 399 (top colony 364, lower rocks 32, East coast 3) pairs of Lesser black-backed gull breeding on Gugh.

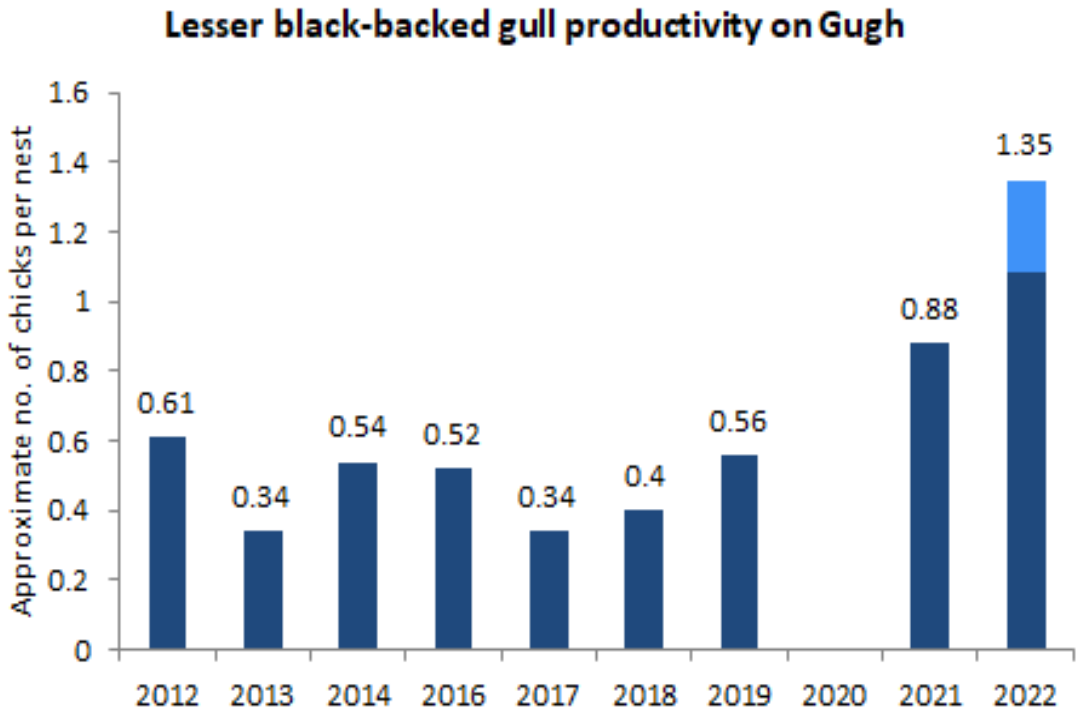
A sub-section of the main Gugh colony was selected for comparison between the new drone survey and the previous walk-through method. The area, marked on the following photograph with a light blue border, was counted on foot and produced an estimate of 107 occupied nests. For this same area the drone survey count was 101 nests, this difference is presumably due to top-down drone footage missing nests tucked under vegetation edges. However, the drone orthomosaic was extremely useful in locating outlying nesting pairs and nests further back in the dense bracken and bramble and overall is thought to have produced a reliable estimate.



Drone footage was also used to estimate productivity at the Gugh colony in 2022. Previous studies employing drone footage in gull surveys, e.g., for glaucous and Iceland gulls, have recorded as much as 50% more chicks using UAVs than with ground counts (Brisson-Curadeau *et al*. 2017).

In previous years on Gugh fledging success has been estimated by observing nests and the total number of large chicks in mid-July from a vantage point above the colony. In 2022 this method gave an estimate of 395 chicks from the 364 nests in the top sub-colony – a higher than average breeding success of 1.09 chicks per pair. Using the drone to identify chicks however, gave a significantly higher count again, of 493 chicks – 1.35 chicks per pair. The photo overleaf was taken on Gugh in mid-July and shows the potential for counting lesser black-backed gull chicks.

The graph below shows in a lighter blue the uplift in fledging success estimated from using the drone footage.



Drone orthomosaic with occupied nests mapped, 12.06.2022. Green marked area - section where foot count and drone count compared.

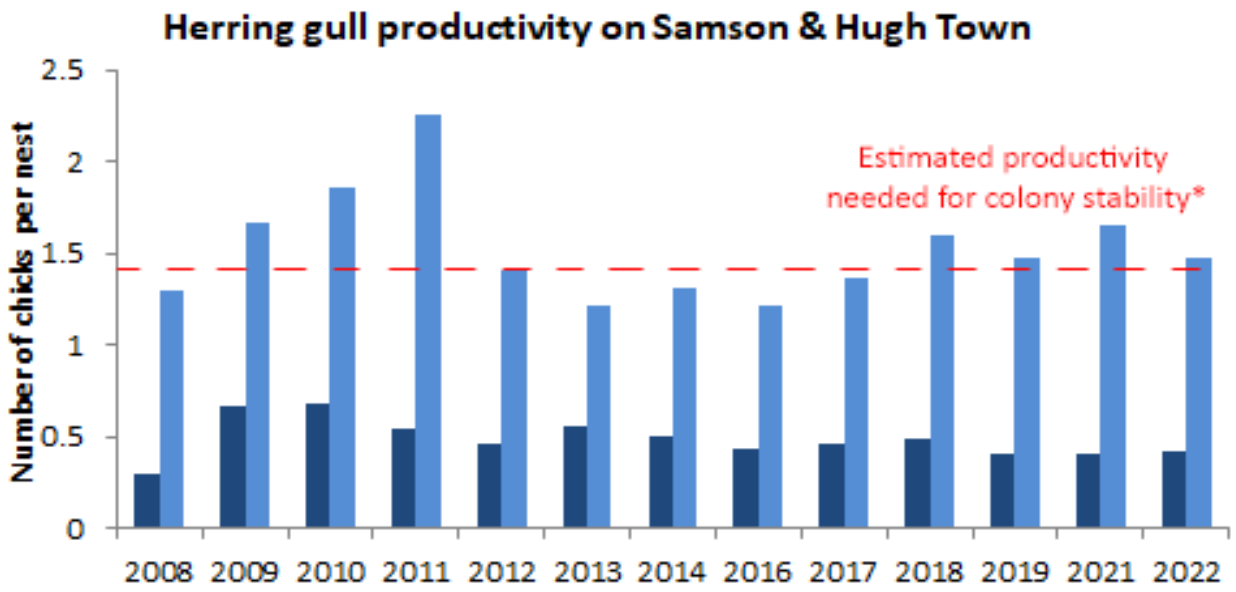
Drone photograph of lesser black backed gull colony on Gugh mid-July – chicks circled

Herring gull settlement and productivity

[2015/16 full SPA count: 556 AONs on 47 islands, 22% decline since 2006; BOCC Red Listed]

In 2015 herring gulls were red-listed as a species of conservation concern due to recent declines in numbers nationally (estimated 47% loss of abundance, natural nesters only, 2000-2018, JNCC 2019). Breeding numbers across Scilly of this species have also been falling at a rapid rate with a decline of 22% between 2006 and 2015/6 to just 556 pairs (Heaney & St Pierre 2017). Since 2008 the productivity of herring gulls at three sub-colonies on St Mary's, Tresco (deserted since 2014) and Samson has been recorded by observing minimum fledging success at mapped nests.

In 2022, 40 nests were recorded on the Northern beaches of Samson and fledged a minimum of 18 chicks. The birds on St Mary's fledged a minimum of 22 chicks from 15 nests. Over the years of this study the small roof-top colony in Hugh Town, which presumably relies on more anthropogenic food sources, has fared consistently better than the birds on Samson. With fledging success well above that needed for colony stability, the fact that the Hugh Town sub-colony has not increased beyond 20 pairs presumably reflects the limited amount of suitable undisturbed roof space available.



KEY: Samson dark blue; Hugh Town light blue. No productivity recorded in 2015 or 2020.

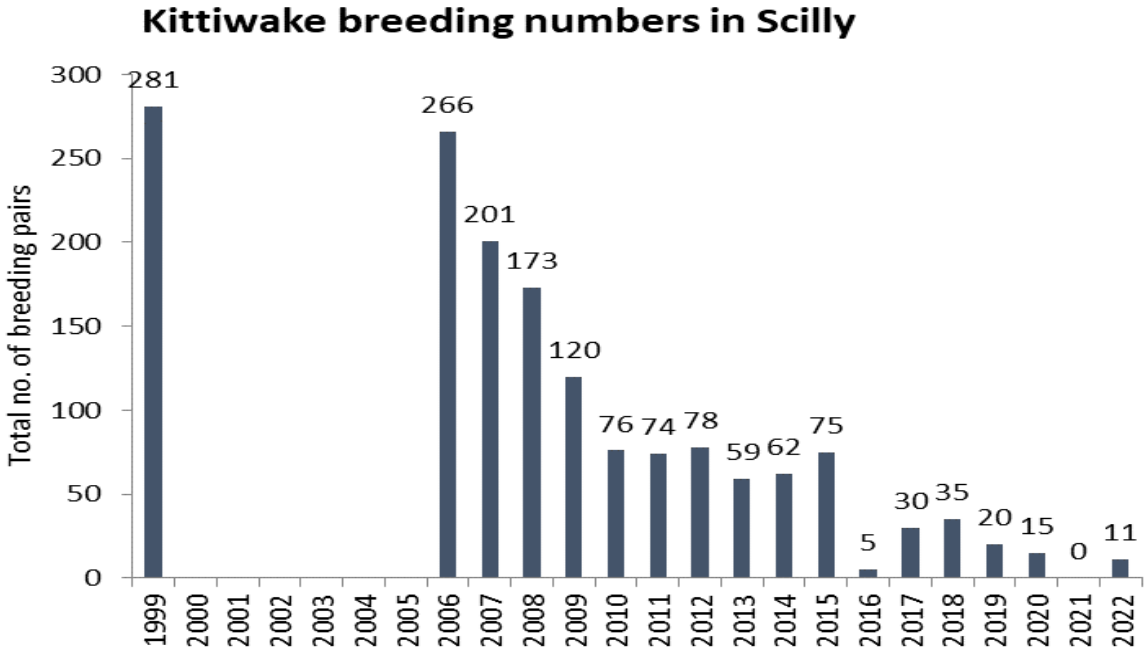
*Cook and Robinson (2010) estimate that an average productivity of 1.3-1.5 chicks per pair per year is needed for colony stability.

Kittiwakes across Scilly

[2015/16 full SPA count: 75 AOSs on 1 island, Rapid decline; BOCC Red Listed]

All kittiwake sub-colonies across Scilly have been counted annually since 2006. Over this period dramatic declines have been recorded, with the loss of 5 sub-colonies and total breeding failure in 9 of the last 16 years. In the last 9 years only one sub-colony site has been occupied by all of the remaining birds (below the Turk's Head at St Agnes 2014-16 and then Gugh 2017-22). At no time in this study has the productivity of the kittiwakes in Scilly approached the level of 1.5

chicks per pair per year, estimated to be needed for colony stability (Cook & Robinson 2010). Following the first year in recent memory where no kittiwakes bred in Scilly, a small number of birds returned to the eastern Gugh site in 2022. 11 nesting pairs were recorded in total with significant asynchrony and late nesting attempts, raising just 4 chicks to fledging.



* Breeding numbers not recorded in the years 2000 to 2005.

Fulmar productivity

[2015/16 full SPA count: 287 AOSs on 18 islands, Stable; BOCC Amber Listed]

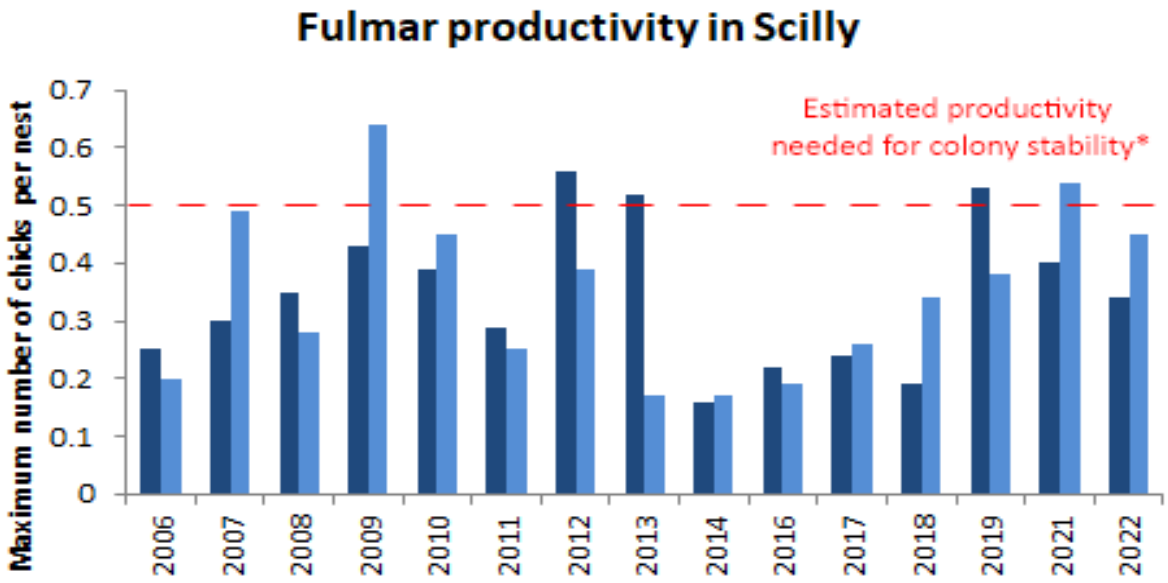
Since 2006 two of the main discrete cliff-side fulmar sub-colonies, those on Menawethan and the Daymark, St Martin's, have been monitored from the sea. The numbers settling at the two sites have been fairly consistent over this time but the fledging success quite variable (see Table 3). In general, productivity has been lower than the level needed to sustain the population (Cook & Robinson 2010) and this will go some way to explaining the recent slowing of population growth across Scilly. However, there is some evidence of a reversal of this trend with fledging success starting to increase again from an overall low in 2014. Across the UK the mean productivity recorded for fulmars between 1986 and 2008 was 0.39 chicks per pair per year, declining at a rate of 0.005 ch/pr/yr.

The winter rodent surveys carried out as part of the Biosecurity for Life Project in early 2022 confirmed that no rats were present on Menawethan (despite being present on other Eastern Isles, Great Ganilly and Nornour – Pearson 2022) – it is interesting to note that this does not appear to confer any significant advantage to the birds nesting there over those on St Martins where rats are present.

Table 4. Fulmar productivity estimates

	Menawethan	Daymark	Total
2006	0.25 (*n* = 44)	0.20 (*n* = 46)	90
2007	0.30 (*n* = 41)	0.49 (*n* = 45)	86
2008	0.35 (*n* = 37)	0.28 (*n* = 46)	83
2009	0.43 (*n* = 33)	0.64 (*n* = 36)	69
2010	0.39 (*n* = 30)	0.45 (*n* = 51)	81
2011	0.29 (*n* = 24)	0.25 (*n* = 49)	73
2012	0.56 (*n* = 25)	0.39 (*n* = 59)	84
2013	0.52 (*n* = 27)	0.17 (*n* = 54)	81
2014	0.16 (*n* = 44)	0.17 (*n* = 52)	96
2015*	(n = 43)	(n = 46)	89
2016	0.22 (*n* = 45)	0.19 (*n* = 57)	102
2017	0.24 (*n* = 34)	0.26 (*n* = 54)	98
2018	0.19 (*n* = 33)	0.34 (*n* = 50)	83
2019	0.53 (*n* = 34)	0.38 (*n* = 53)	87
2020	-	-	-
2021	0.40 (*n* = 43)	0.54 (*n* = 46)	87
2022	0.34 (*n* = 35)	0.45 (*n* = 51)	86

*Productivity not recorded in 2015 or 2020



KEY: Dark blue Menawethan, light blue Daymark.

*Cook and Robinson (2010) estimate that an average productivity of 0.5 chicks per pair per year is needed for colony stability in fulmars.

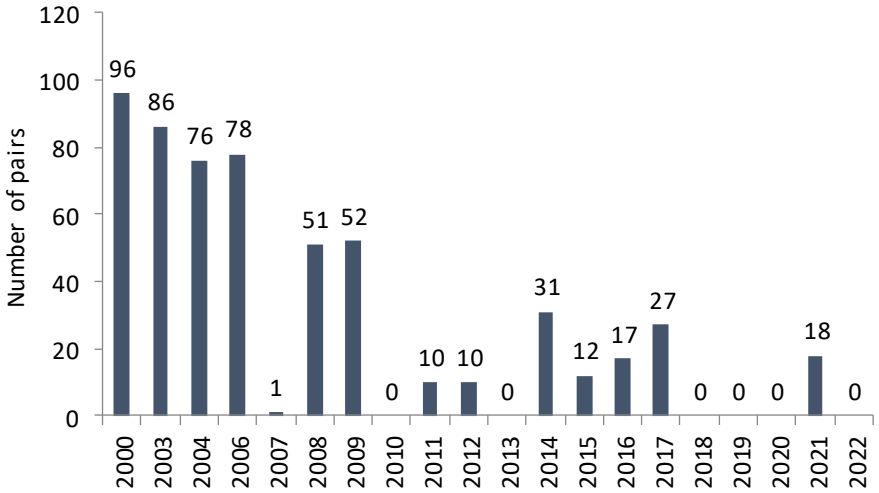
Common tern breeding numbers and productivity

[2015/16 full SPA count: 12 AONs on 2 islands, Precipitous decline; BOCC Amber Listed]

Following a maximum count of 210 breeding pairs in 1983, the number of common terns breeding in Scilly has been in rapid decline (Heaney & St Pierre 2017). Alongside this steep decline in numbers of terns returning to breed each year, the birds have suffered repeated low success or total breeding failure. In a number of seasons this has been due to their repeated choice of the low-lying Green Island, where high tides often swamp the colony resulting in egg and chick loss.

In recent years the terns have been very late to return to the islands and show interest in breeding, with hatching observed well into July in both 2016 and 2017. This late settlement may indicate that the birds are first-time breeders or have already made a failed attempt elsewhere earlier in the season. Although in both these 2016 and 2017 a few chicks fledged, numbers were low and the lateness is likely to have adversely affected post-fledging survival. Despite a welcome return of 18 pairs nesting on Annet in 2021, 2022 again saw no recorded breeding in Scilly.

Common tern breeding numbers in Scilly



Annual count of breeding seabirds on Annet

(One of 7 SSSIs in Scilly listed specifically for its seabird interest features)

A count of the seabirds breeding on Annet has been made in most years since 2000 (see Table 4 – no counts were made in 2001, 2005 or 2020). These regular counts document an overall decline in the number of shags nesting on Annet which is mirrored across the rest of the islands (Heaney & St Pierre 2017). However, data from the last few years suggest a slight reversal of this trend. As elsewhere the number of small gulls has declined. In particular, the sub-colony of lesser black-backed gulls which numbered 517 in 2000 is now deserted. The number of great black-backed gulls, although high as a percentage of the overall assemblage on Annet, is still less than half the peak (of around 400 pairs) recorded for this species on the island before they were controlled by JNCC in the late 1970s.

Table 5. Breeding seabirds (pairs) on Annet; a dash indicates that no count was made.

Year	SH	GBBG	LBBG	HG	RAZ	FUL	COT	SP*	MX*	PUF	OYC	RPL
2000	209	137	517	42	4	21	1	938	123	47	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	171	215	7	4	-	-	-	-	-	-	-
2003	150	164	18	17	0	45	0	-	-	-	-	-
2004	159	197	7	32	2	44	0	-	-	-	5	0
2005	-	-	-	-	-	-	-	-	-	-	-	-
2006	177	187	281	24	4	37	0	788	89	50	-	-
2007	140	88	0	5	1	37	0	-	-	-	5	0
2008	164	47	(5)	4	3	48	0	-	-	-	6	0
2009	154	168	54	7	7	43	0	-	-	-	6	0
2010	198	213	76	11	2	40	0	-	-	-	7	1
2011	115	180	27	5	4	37	0	-	-	-	4	2
2012	107	177	32	8	2	49	0	-	-	-	-	-
2013	99	208	6	4	1	36	0	-	-	-	5	0
2014	96	205	10	5	1	38	0	-	-	-	9	1
2015	85	235	1	20	5	57	2	778	229	31	6	0
2016	86	215	1	16	6	41	14	(106)	-	-	4	1
2017	74	222	7	12	5	41	27	(132)	-	-	7	1
2018	81	170	6	19	0	46	0	(175)	(30)	43	8	0
2019	103	199	19	10	2	46	0	(338)	(30)	42	4	0
2020	-	-	-	-	-	-	-	-	-	-	-	-
2021	106	184	7	8	1	39	18	-	(29)	45	1	0
2022	98	188	5	17	4	37	0	(132)	-	36	11	0

**Counts in brackets represent only a sample of the total breeding population on Annet.*

'Homes for Shearwaters' Project

Since rat eradication on St Agnes and Gugh, breeding numbers of shearwaters have increased dramatically and there is evidence of competition for nesting sites as the sub-colonies expand. Although shearwaters can dig their own new nest burrow (as has been seen on Gugh in recent years), they will also take over an existing shearwater, puffin or rabbit burrow. Burrow take-overs from other birds will usually result in breeding failure for the ousted pair as their egg is turfed out.

As populations increase competition for burrows is likely to increase and with new burrows being hard to dig in the compacted ram habitat found round much of the islands we are seeing evidence of this. On at least 5 occasions in recent years intact shearwater eggs have been found outside the entrance to burrows, presumably kicked out by burrow usurpers and fights at burrow entrances have been recorded (see photos below). The calibration study conducted in

2021 found that just over 50% of the apparently suitable burrows surveyed on St Agnes and Gugh contained active nests (on Lundy the figure was only 23%, Booker *et al.* 2019.) In an attempt to try and alleviate this pressure the Homes for Shearwaters Project was developed to provide artificial nesting burrows to help reduce competition and potentially facilitate recruitment of our 'home-grown' chicks.

Displaced shearwater egg, Round Island 2022.

Shearwaters fighting at burrow entrance, St Helens 2022.

Initial plans were to deploy boxes on St Agnes and Gugh (where competition for burrows appears high) however, due to complications with Scheduled Ancient Monument disturbance and cattle grazing, Annet was chosen as the first site for deployment. In February and March 2022 35 wooden nest boxes were deployed along the Eastern coast. The boxes were assembled by the IOSWT Rangers with the help of volunteers following a design developed for fluttering shearwaters in New Zealand and used successfully on Ramsey Island among other places.

Much help and advice on materials, construction and deployment was gratefully received from Wardens Greg Ramsey, Dean Jones and Leighton Newman (Ramsey, Lundy and Skomer respectively). As well as a Homes for Shearwaters fundraising appeal the project engaged with Tevi (Cornish for 'grow') an EU-funded venture led by the University of Exeter, and delivered in partnership with the Cornwall Wildlife Trust and Cornwall Council. Through Tevi we collaborated with technology company VerFacil to install solar panels and mini cameras down 5 of the boxes on Annet.

Nocturnal activity and the long and convoluted burrows at natural sites make it very hard to measure breeding success. Once occupied, these nest boxes should allow us to easily and safely access the breeding chamber to directly measure nest phenology, chick growth and fledging, and to access fledging chicks and breeding adults for future ringing and tracking projects. In addition, the infrared cameras should allow real-time monitoring of breeding activity and provisioning, as well as live-streaming of burrow and chick activity.

Manx shearwaters are one of our most important species in Scilly, but their nocturnal behaviour and underground nesting means they are not widely known or engaged with. Through this project we hope to make them more visible and highlight the important work that the IoSWT and the community of St Agnes are doing to support and enhance this iconic species with global importance to the UK.

Boxes in place at North-East Par on Annet, March 2022.

It will take time for the burrows to be occupied. A visit in mid-September 2022, although curtailed to limit disturbance to pupping grey seals, showed that in this first season a number of the boxes had been investigated by birds with feathers, evidence of extra digging (the boxes lack a wooden base or back wall) and one abandoned storm petrel egg.

Discussion

The productivity monitoring and breeding numbers presented in this report show mixed fortunes for the seabirds of Scilly. A number of complex and in many cases inter-related factors are likely to be contributing to the breeding successes and failures recorded. The number of burrow nesters on St Agnes and Gugh continues to increase year on year since rat removal; spreading to new breeding areas and with the highest number of fledging chicks to date recorded there in 2022, further demonstrating the positive impact of island restoration for these birds. The fulmar and herring gull sub-colonies studied elsewhere in the islands this year appear to have had a reasonably productive season, as particularly did the lesser black-backed gulls studied on Gugh. In addition, a small number of kittiwakes returned to breed on Gugh after a total absence in 2021, but there were no common tern breeding attempts at all. The use of drones to count the gulls on Gugh was again successful, particularly for fledging success estimation, although problems were again encountered on Samson where the birds were much less happy with the drone.

The 35 nest boxes deployed on Annet for Manx shearwaters have bedded in well and it is hoped that at least some may be occupied by breeding pairs in 2023 allowing live-stream camera footage. With the planned development of floating wind in the Celtic Sea in the near future, there is a pressing need to find out where our seabirds go to feed and to document any potential overlap or impact on travel routes. Being able to access breeding shearwater adults in these boxes to attach GPS trackers will be very useful. We will also plan to start ringing Manx shearwater chicks in 2023 and potentially adults too where possible. Island ringer Jim Askins is keen to help with this and to train ringers.

The need to address the issue of cat predation of storm petrels on St Agnes and Gugh is ongoing and difficult. GPS collars have been purchased and are being trialled with cat owners on St Agnes to see where their pets go. In addition, more footage is needed to definitively identify the cat, feral or owned, and to work with the community and cat-owners to find a way forward.

The 2015/16 full SPA survey revealed that up to a third of shearwaters that breed in Scilly do so at sites with rat presence. The continued records of low to no breeding success recorded on Bryher and St Mary's contrast starkly to the results seen on St Agnes and Gugh. The survey in 2022 also identified a substantial population of shearwaters attempting to breed on St Helens each year too and a strong argument could be made for control of the rats on there to protect this sub-colony but also to further protect Round Island from further disastrous re-incursion. The discovery of rats on Round Island in January 2022 emphasises the need to stay vigilant and maintain biosecurity on presumed rat-free islands. With so many birds in Scilly still suffering the impact of rat predation, the impetus for extending the Seabird Recovery work in Scilly to Bryher, Tresco, St Martin's and their associated uninhabited islands, is convincing. A meeting of key stakeholders in September 2022 proved positive regarding the impetus to reboot the Seabird Recovery Process.

The last full SPA survey was in 2015/16 and according the 6 yearly SPA monitoring cycle it is due again. Initial meetings to look at funding and scheduling this for 2023 have been positive and it is hoped that the count can go ahead if not in 2023 then definitely in 2024. This data will be an important update of trends and could act as a baseline for breeding numbers pre-rat eradication of the wider archipelago. It will also be important to help understand the potential impacts of bird flu on the islands. In 2022, although bird flu was prevalent and decimated many

seabird breeding colonies in the North and East of the UK, it arrived to the South coast relatively late in the season when many breeding colonies had dispersed. As a result it had the biggest impact on our nearest gannet colonies in Wales and the Channel Islands as they are present in large numbers at their colonies later in the summer than most seabirds. Dead and sick gannets started washing up in Scillonian waters in early June with numbers increasing through July and August. Where possible sick birds have been collected from accessible beaches to try and limit the risk to human health and also in an attempt to limit the spread to our scavenging birds. It is possible that we will see a significant outbreak in our breeding seabirds in the 2023 season and we will need to be vigilant.

The current Isles of Scilly Seabird Conservation Strategy which runs from 2018-23 is due for revision. The strategy looks at ways to address the declines we have seen in seabirds across the islands and following discussions at the Annual Seabird Meeting in October 2022 this document will be reviewed and updated in partnership with prioritised actions for 2023-2028.

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