Annex 5. WWT Annual Report summaries from 2011 to 2021

Between 2014 and 2021, monthly project reports were compiled for partners, stakeholders and funders. These have been condensed into annual reports (for data analysis and comparison purposes) and presented here. Information from the early years (2011, 2012 and 2013), mostly raw data, has also been collated and is presented.

This Annex is a summary of important information by year, together with additional records and/or observations made by project staff. Each yearly summary follows a standard structure, often in note form or bulleted, under the following headings:

- **Records.** Information on eggs/chick fate (2011 and 2012 only) and deaths.
- **Health.** Body weight, body condition, plumage assessment/moult, lameness and veterinary treatments.
- **Locality.** How the facility was configured and changes made, including bird moves/locations.
- **Social network.** Introductions, departures/deaths, and interactions of the birds.
- **Breeding.** Pairings, outcomes, and egg/chick deaths.
- **Temperature.** Daily temperatures within the facility.
- **Lighting and photoperiod.** Records of light provision.
- **Diet and Nutrition**. Records of food provision.
- **Sanitation.** Cleaning routines, protocols, and biosecurity.
- **Environment provisions and modifications.** Alterations made to the facility to effect temperature, light, space, habitat/substrate, as well as uncommon events.
- **Visitors.** Record of visitors to understand disturbance.

Chapter, section, table and figure headings in Annex 5 are prefixed with an ‘A’ for easier identification and referencing.

A list of all figures and tables in Annex 5 can be found at the end of this document.

A1. 2011 Summary

This annual summary report covers husbandry details from the bird's arrival (11 November) at the WWT Slimbridge Quarantine Station (QS) to 31 December, in their final destination of the WWT Slimbridge Spoon-billed sandpiper Facility (SBS facility). Timeline shown in Table A1.

Table A1 – Location and dates for the movement of eggs and chicks: 2011

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meinypil'gyno village												
Boat on Bering Sea												
Anadyr town (indoors)												
Anadyr town (outdoors)								18				
Moscow Zoo								18			11	
WWT Slim. QS											11	12
WWT Slim. SBS facility												12

Note: Brown = Eggs; Green = chicks

Due to an extremely challenging translocation of eggs and chicks it was not possible to follow which egg belonged to which chick. Therefore, exact relatedness between individuals in this cohort and between future cohorts is unknown. Egg and chick summaries shown in Tables A2 and A3.

Table A2 – Egg and chick status summary: 2011

Egg no.	Date collected from breeding grounds	Date hatched	Egg fate	Deaths
2:1	19 Jun	7 Jul	Hatched in Meinypil'gyno	*
2:2	19 Jun	8 Jul	Hatched on boat	*
2:3	19 Jun	7 Jul	Hatched in Meinypil'gyno	*
2:4	19 Jun	8 Jul	Hatched on boat	*
3:5	20 Jun	10 Jul	Hatched on boat	*
3:6	20 Jun	8 Jul	Hatched on boat	*
3:7	20 Jun	8 Jul	Hatched on boat	Chick died 12 Jul, yolk sac protruded at hatch
3:8	20 Jun	-	Egg left in Meinypil'gyno, no development	-
4:9	29 Jun	9 Jul	Hatched on boat	*
4:10	29 Jun	9 Jul	Hatched on boat	*
4:11	29 Jun	9 Jul	Hatched on boat	*
4:12	29 Jun	9 Jul	Hatched on boat	*
5:13	29 Jun	14 Jul	Hatched in Anadyr	*
5:14	29 Jun	-	Egg broke in Anadyr	-
5:15	29 Jun	-	Egg returned to nest in Meinypil'gyno, hatched 18 Jul	Wild
6:16	29 Jun	14 Jul	Hatched in Anadyr	Chick died 17 Jul

Egg no.	Date collected from breeding grounds	Date hatched	Egg fate	Deaths
6:17	29 Jun	-	Egg left in Meinypil'gyno, half developed embryo	-
6:18	29 Jun	-	Egg left in Meinypil'gyno, half developed embryo	-
1:19	29 Jun	-	Egg left in Meinypil'gyno, no development	-
1:20	29 Jun	7 Jul	Hatched in Meinypil'gyno	*
1:21	29 Jun	7 Jul	Hatched in Meinypil'gyno	*
7:22	3 Jul	5 Jul	Hatched in Meinypil'gyno	*
7:23	3 Jul	5 Jul	Hatched in Meinypil'gyno	*
7:24	3 Jul	5 Jul	Hatched in Meinypil'gyno	*
7:25	3 Jul	5 Jul	Hatched in Meinypil'gyno	*

Note: * Of the asterisked chicks one died in flight collision in Anadyr, the others survived

Table A3 – Egg identification: 2011

SBS ID		
Colour marked in July (Plus, ID in brackets)	Metal ring number (ringed in August)	Deaths
Red Left (RL)	SBS0001	
Blue Left (BlueL)	SBS0002	
White Left (WL)	SBS0003	
-	SBS0004	Died at Moscow Zoo
Green Left (GL)	SBS0005	
Yellow Left (YL)	SBS0006	
Pink Left (PL)	SBS0007	
Black Left (BlackL)	SBS0008	
Red Right (RR)	SBS0009	
-	SBS0010	Died at Moscow Zoo
White Right (WR)	SBS0011	
Blue Right (BlueR)	SBS0012	
Orange Right (OR)	SBS0013	
Green Right (GR)	SBS0014	
Pink Right (PR)	SBS0015	
Black Right (BR)	SBS0016	Died at Moscow Zoo

Note: Egg data does not correlate to chick data in Table A1, relationship not recorded

A1.1 Health

A1.1.1 Mean body weights: All birds male: female

Weights were only recorded once after arrival to WWT Slimbridge in 2011 (whilst in transit from the QS to the SBS facility); Table A4.

Sexes remained unknown until 2012 but are shown here retrospectively. An educated guess could be made at the time based on size and weight of individuals, whereby females are typically heavier than males, however there is known overlap making this method unreliable.

Table A4 – Mean body weights for all birds: 2011

Bird ID	Weight: 12 Dec	Actual sex
PL	36.2	F
RR	28.5	M
WR	29.3	M
BlackL	34.3	M
GR	35.2	F
YL	34.7	F
BlueL	31.5	M

Bird ID	Weight: 12 Dec	Actual sex
OR	37.3	M
RL	32.5	M
PR	32.5	M
WL	33.3	M
GL	29.9	F
BlueR	38.2	M

A1.1.2 Body condition score

Body condition was scored by assessing the musculature, or lack of, around the keel; Table A5. This was used as part of a means to assess health during regular checks in 2011 only.

Table A5 – Body condition score: 2011

Bird ID	Group ID number during quarantine	Body condition score 0-3 scale*					
		11 Nov	21 Nov	23 Nov	25 Nov	28 Nov	12 Dec
PL	2	2.5				2.5	
RR	2	2.0				2.0	
WR	2	2.5				2.75	
BlackL	2	3.0				2.5	
GR	2	3.0				2.75	
YL	3	3.0				3 (very muscular)	
BlueL	3	2.0				2.75	
OR	3	3 (3.5)				3.0	
RL	3	3.0				2.5	2.5
PR	4	3.0				3.0	
WL	4	2.0				2.5	
GL	4	2.5	2.0	2.0	2.0	2.5	
BlueR	4	3.0				3.0	

Note: * 0 = Being emaciated; 3 = Being very muscular

A1.1.3 Plumage assessment

A standardised moult scoring system was not developed until September 2014. However, plumage condition was regularly noted; Table A6.

Table A6 – Plumage assessment: 2011

Date	Bird ID	Notes summarised
19 Nov	WL	Heavily moulting. All birds started moulting
09 Dec	PR, BlueR	Plumage on back a bit greasy and scruffy
10 Dec	PL	Plumage looking greasy/scruffy
10 Dec	PR	Plumage looking greasy and scruffy
	WR	Nearly completely moulted to winter plumage
	GL	Plumage looking greasy/scruffy
12 Dec	GL, PR	Greasy, unkempt plumage
13 Dec	GL, PR, WL	Greasy plumage
14 Dec	GL, PR	Greasy, scruffy plumage
15 Dec caught to examine	GR	No moult on body
	RR	10% moult on body, 1 covert moulted
	PL	Active moult, a few back feathers. No breast or head moult
	WR	No moult
	BlackL	No moult
	BlueL	20% scapula/back, a few head feathers moulted
	YL	10% back feathers moulted
	OR	1 or 2 moulted back feathers only
	RL	40% winter plumage on back. 25% winter plumage on head
	WL	95% moulted
	BlueR	Full juvenile plumage
	PR	Greasy on back, full juvenile plumage
	GL	10% winter plumage on back
26 Dec	RR	Looks small and scruffy, definitely in moult –loose feathers around head
27 Dec	RL, RR	Scruffy plumage, especially around neck
	WR	Particularly scruffy plumage, especially around neck
28 Dec	RR	Quite scruffy around neck. A bit greasy looking

Date	Bird ID	Notes summarised
	RL	Moulted a lot more
29 Dec	RR	Plumage looking especially scruffy, particularly around neck and face

A1.1.4 Lameness data

On arrival to the QS most of the bird's feet were in exceptionally poor condition. This included broken toes, calluses, and lumps on the base of feet, lumps elsewhere on feet and toes, swollen toes and feet, extra-long nails, missing nails, constricted toes, and cracks on the base of feet and toes.

During the first week at the quarantine facility, the birds showed high levels of nervousness which reduced slightly upon transfer to the SBS facility. As a result, any signs of lameness were likely masked, especially considering their existing foot conditions.

A summary of lameness for each month and whether treated or not, is included in Table A7. Of approximately 19 cases of lameness, 16% were treated.

Table A7 – Summary of lameness for each month: 2011

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Nov (from arrival to QS 11 Nov)	13	3	2	17
Dec (to departure of quarantine facility 14 Nov)	13	8	1	28
Dec (from arrival to SBS facility 15 Nov)	13	8		30

Note: * 1 = One day of one lame bird

A1.1.5 Afflictions/treatments

All notable afflictions were treated between the birds' arrival to the quarantine facility at WWT Slimbridge and the end of the year; Table A8.

Table A8 – Individual afflictions/treatments: 2011

Month/ Bird ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
Nov GR	Severe limp	Base of both feet and toes very cracked. Callusing and overgrowth of nodular tissue	Unsuitable substrate and stressors	Caught for examination - feet bathed. Topical antibacterial treatment applied to both feet regularly. Ad hoc anti-inflammatory injectable treatment. Caught regularly for treatment. **Symptoms continued**
Nov WR	Limping, tender on feet	Cracked toes	Unsuitable substrate and stressors	*Unknown*
Nov GL	Limping, sore feet, hunched	White calluses on both feet, also swollen	Unsuitable substrate and stressors	Caught for examination and continued treatment - feet bathed. Course of injections of anti-inflammatory treatment. Caught regularly for treatment. **Symptoms continued**
Nov-Dec OR	No symptoms	Caught for swabbing. Constricted toe, unclear of cause	Unsuitable substrate and stressors	Caught for examination - topical antibacterial treatment applied every few days. **Healed over a couple of weeks, toe came away. However, foot issues continued later**

Month/ Bird ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
Dec RL	Slight limp	Small crack on toe	Unsuitable substrate and stressors	Caught for examination - topical antibacterial treatment applied. **No further treatment required**
Dec WL	No symptoms	End of toe come away. Appears clean	Constriction of toe	Caught for examination- topical antibacterial treatment applied. **No further treatment required**
Dec BlueL	Limping	Constricted toe	Human hair	Caught to remove hair, open wound present- topical antibiotic treatment applied to feet. **No further treatment required**

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A1.2 Locality

A1.2.1 SBS facility configuration

When eggs were being collected in June 2011 the facility had only recently begun construction. It was not finished in its entirety by the time the birds were moved into the facility but enough was in place to house them indoors sufficiently. It comprised of Room #1 and Room #2; Figure A1. Further details in Section 2.1.2.

Notes:
Grey shaded spaces were used to house birds in 2011
Dashed box = Area used for SBS facilities by project end

Figure A1 – SBS facility configuration: 2011

A1.3 Social network

On arrival to the quarantine facility at WWT Slimbridge the birds were split into three groups to utilise the space available (multiple small aviaries). It was not known at the time what the sexes of the birds were so groups were chosen at random. There didn't appear to be any adverse effects of being in small groups.

When re-introduced at the SBS facility they settled well with no adverse social effects observed.

A1.4 Breeding

No breeding behaviours observed between the birds' arrival to the QS or SBS facility to the end of the year. However, none were expected.

A1.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximate temperatures required by the birds depending on time of year and health status. Thermo-hygrometers were used to collect data; Table A9.

Table A9 – Temperature data summary: 2011

Pen 3* (11 Nov-14 Dec) Room #1 (15 Dec onwards)				
Month	Absolute Min ºC	Mean Min ºC	Mean Max ºC	Absolute Max ºC
Nov	11.6	17.9	23.0	26.5
Dec	12.9	19.0	23.2	28.7

Slimbridge (UK)** - temperatures that would be felt in annexes		
Absolute Min ºC	Mean ºC	Absolute Max ºC
3	12	18
1	7	14

Notes:
* Central locality in QS
** Data from timeanddate.com/weather
No mean for Pen 3/Room #1 due to how recordings were taken

A1.6 Lighting and photoperiod

During the birds' 30-day quarantine at the QS the lights were turned on/off manually when staff arrived in the mornings and departed in the evenings. On/off times varied with staff and duties. In addition, the birds were also exposed to the natural light and twilight of the UK photoperiod during that time.

UV lighting was provided from arrival to the QS, UV readings were not taken.

A1.7 Diet and nutrition

Lundi micro was provided wet and dry. Grit was always present, including oyster shell grit. See Table A10.

Table A10 – Food present/absent in diet: 2011

Food item/supplement		Nov	Dec
%ratio	Lundi micro **45**	90	90
	Lundi micro **35**	10	10
Dried freshwater shrimp		✓	✓
Mealworms		✓	✓
Avripro (on dry food)		✓	✓
Avimix (on dry food)		✓	✓
Saltwater		✓	✓

Key
✓ Present in diet

A1.8 Sanitation

A1.8.1 Water systems

- All ponds drained and refreshed regularly.

A1.8.2 Substrates

- Sand in occupied areas partially replaced and/or rinsed with disinfectant periodically.

A1.8.3 Biosecurity

- Occupied areas serviced at least once a day. Faeces-picking, sieving sand, and raking sand.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A1.9 Environment provisions, modifications, and events with consequences

A1.9.1 Climate

- All rooms had fan heaters for ambient heat and heat lamps for basking spots.

A1.9.2 Light

- All rooms had florescent strip lighting and UV light bulbs.

A1.9.3 Enclosure

- Initially housed in one heated indoor space.

A1.9.4 Habitat/substrate

- Initially had very fine gravel substrate only.

A1.9.5 Other

- Commentated feeds took place in December streaming live video of the birds to the cinema in WWT Slimbridge centre.

A1.10 Visitors

Visitors were limited where possible inside the QS and the main facility to allow the birds to settle into their new surroundings.

On 19 December an event was held for VIPs and media to observe the birds from the corridor through one-way glass.

A2. 2012 Summary

Sexes of the 2011 cohort were not known until May 2012, and for the 2012 cohort remained unknown until October 2012 (the 2011 cohort were also sexed again at this time using feathers rather than buccal swabs) so are shown in previous months/years retrospectively. An educated guess could be made at the time based on size and weight, whereby females are typically heavier than males, however there is known overlap making this method unreliable.

Clutch F had a later predicted hatch date than the rest of the eggs collected. Clutch G was collected and taken for the captive population in preference of F and to replace eggs lost during incubation. Clutch F remained in Meinypil'gyno for headstarting. Details in Tables A11 and A12.

Table A11 – Egg/chick status summary and identification: 2012 cohort

Egg ID	Date collected from breeding grounds	Date hatched	Egg fate	Deaths	SBS ID			
					First colour mark[1]	Second colour mark[2]	Metal ring no.[3]	Bird ID (hereby referred to as)
A1	15 Jun	7 Jul			Red Right	Pink	SBS0031	Pink-Red-Right (PRR)
A2	15 Jun	-	Returned to wild nest	Death during hatching Egg was repaired earlier due to small hole	-	-	-	-
A3	15 Jun	6 Jul			White Right	Pink	SBS0017	Pink-White-Right (PWR)
A4	15 Jun	-	Left in Meinypil'gyno	Mid-stage embryo death	-	-	-	-
B5	17 Jun	8 Jul			Light-Green Right	Pink	SBS0022	Pink-Light Green Right (PLGR)
B6	17 Jun	8 Jul			Dark-Green Right	Pink	SBS0032	Pink-Dark Green-Right (PDGR)
B7	17 Jun	8 Jul			Yellow Right	Pink	SBS0033	Pink-Yellow-Right (PYR)
B8	17 Jun	9 Jul			Orange Right	Pink	SBS0028	Pink-Orange-Right (POR)
C9	20 Jun	12 Jul			Red Left	Pink	SBS0029	Pink-Red-Left (PRL)
C10	20 Jun	-	-	Mid-stage embryo death	-	-	-	-
C11	20 Jun	12 Jul			Pink Left	Pink	SBS0030	Pink-Pink-Left (PPL)
D12	20 Jun	12 Jul			Yellow Left	Pink	SBS0023	Pink-Yellow-Left (PYL)
D13	20 Jun	-	Egg cracked in transit during	Late-stage embryo	-	-	-	-

Egg ID	Date collected from breeding grounds	Date hatched	Egg fate	Deaths	SBS ID			
					First colour mark[1]	Second colour mark[2]	Metal ring no.[3]	Bird ID (hereby referred to as)
			security check	death, after internal pip				
D14	20 Jun	12 Jul			Orange L	Pink	SBS0025	Pink-Orange-Left (POL)
E15	22 Jun	4 Jul		Died soon after hatch		-	-	-
E16	22 Jun	4 Jul			Black Right	Pink	SBS0026	Pink-Black-Right (PBlackR)
E17	22 Jun	4 Jul			Blue Right	Pink	SBS0021	Pink-Blue-Right (PBlueR)
E18	22 Jun	4 Jul			Pink Right	Pink	SBS0024	Pink-Pink-Right (PPR)
G22 (2)	22 Jun	10 Jul			Light-Green Left	Pink	SBS0027	Pink-Light Green-Left (PLGL)
G23 (20)	22 Jun	11 Jul			Unringed	Unringed	SBS0018	Unringed (UNR)
G24 (4)	22 Jun	10 Jul			White Left	Pink	SBS0020	Pink-White-Left (PWL)
G25 (19)	22 Jun	10 Jul			Blue Left	Pink	SBS0019	Pink-Blue-Left (PBlueL)

Notes:
Green = hatched; Yellow = Did not hatch; Orange = Died soon after hatch
[1] = 12-19 Jul 2012; [2] = 01 Oct 2012; [3] = 01 Oct 2012

Table A12 – Individual records/deaths (all birds): 2012

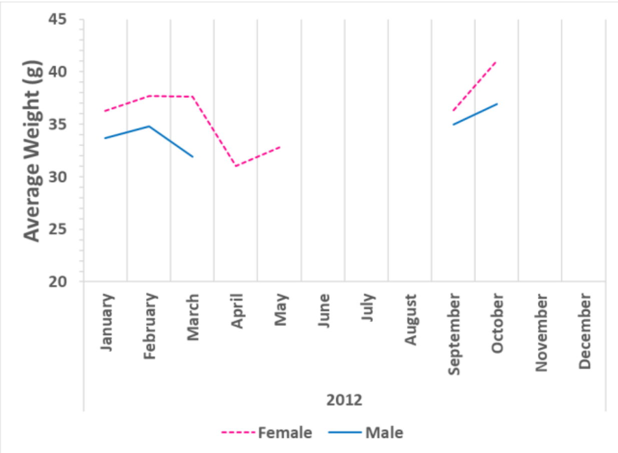
SBS ID	Cohort	Sex	Deaths	Cause
RL	2011	M		
BlueL	2011	M		
WL	2011	M		
GL	2011	F	27 Sep	Amyloidosis
YL	2011	F		
PL	2011	F		
BlackL	2011	M		
RR	2011	M		
WR	2011	M		
BlueR	2011	M		
OR	2011	M		
GR	2011	F	06 Apr	Amyloidosis and chronic pododermatitis
PR	2011	M		
PWR	2012	F		
UNR	2012	M		
PBlueL	2012	M		
PWL	2012	F		
PBlueR	2012	M		
PLGR	2012	M		
PYL	2012	F		
PPR	2012	F		
POL	2012	F		
PBlackR	2012	M		
PLGL	2012	F		
POR	2012	M		
PRL	2012	M		

SBS ID	Cohort	Sex	Deaths	Cause
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		
PYR	2012	M		

A2.1 Health

A2.1.1 Mean body weights: All birds male: female

Not all birds were weighed at each weighing session. In April and May weights were taken from one individual during handling, and no weights were taken in June, July, August or November; Figure A2 and Table A13. The 2011 cohort were not weighed in December.



Note: Includes remote weights and in-hand, excludes death weights

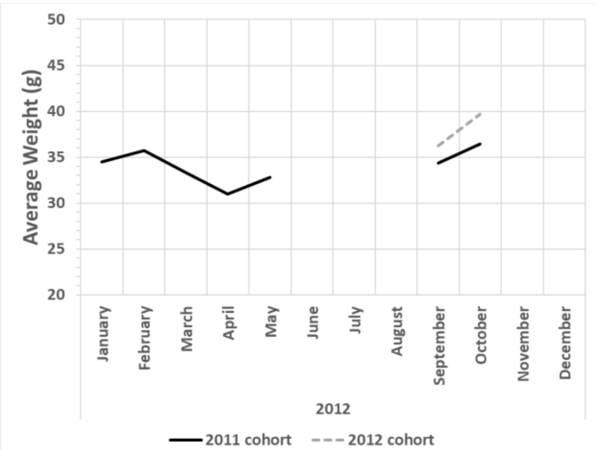
Figure A2 – Mean body weights of all birds: 2012

Table A13 – Number of individuals by sex (end of each month): 2012

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	9	9	9	9	9	9	9	18	18	18	18	18
Females	4	4	3	3	3	3	3	11	10	10	10	10

A2.1.2 Mean body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. In April and May weights were taken from one individual during handling. No weights were taken in June, July and August; Figure A3 and Table A14. The 2011 cohort were not weighed in November and December.



Note: Includes remote weights and in-hand, excludes death weights

Figure A3 – Mean body weights: 2011 and 2012 cohorts: 2012

Table A14 – Number of individuals by cohort (end of each month): 2012

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	13	13	12	12	12	12	12	12	11	11	11	11
2012	-	-	-	-	-	-	-	17	17	17	17	17

A2.1.3 Plumage assessment

A standardised moult scoring system was not developed until September 2014. However, plumage condition was regularly noted by staff, summarised monthly in Tables A15 (2011 cohort) and A16 (2012 cohort). On 31 July an external advisor assessed the 2011 cohort in terms of plumage condition, also included in the same tables.

Table A15 – Summarised plumage related notes: 2011 cohort

<table>
<tr><th>Month</th><th>Summary</th></tr>
<tr><td>Jan</td><td>Two birds were commented as being ‘scruffy’.</td></tr>
<tr><td>Feb</td><td>Of nine birds commented on, four were over 50% into winter plumage. The other five had some winter plumage but less than 50%.</td></tr>
<tr><td>Mar</td><td>Many feathers dropped towards the end of the month. Two birds with gaps in plumage. GL commented as looking scruffy/hunched due to health issues most likely.</td></tr>
<tr><td>Apr</td><td>Some feathers dropped throughout the month. Wing feathers being dropped in first half of month. At least one bird regaining flight (previously feather cut).</td></tr>
<tr><td>May</td><td>Some feathers found throughout the month. Two birds feather cut both sides after collisions seen with heat lamps and walls. Other birds in partial wing moult.</td></tr>
<tr><td>Jun</td><td>Some birds capable of flight early in month, resulting in collisions when spooked. Three birds feather cut mid-month.</td></tr>
<tr><td>Jul</td><td>31 Jul external advisor assessment:
<table>
<tr><th>SBS ID</th><th>% Juvenile plumage</th><th>State of plumage</th><th>Notes</th></tr>
<tr><td>OL</td><td>0</td><td>Good</td><td>‘Full winter body and head plumage looks fresh’</td></tr>
<tr><td>WL</td><td>0</td><td>Good</td><td>‘Full winter body and head plumage looks fresh’</td></tr>
<tr><td>PP</td><td>0</td><td>Good</td><td>‘Full winter body and head plumage looks fresh’</td></tr>
<tr><td>RR</td><td>0</td><td>Good</td><td></td></tr>
<tr><td>WR</td><td>5</td><td>Good</td><td>‘Back feathers scalloped suggesting pseudo-summer plumage’</td></tr>
<tr><td>RL</td><td>10</td><td>OK</td><td>‘One summer plumage covert’</td></tr>
<tr><td>BlackL</td><td>10</td><td>OK</td><td></td></tr>
<tr><td>PL</td><td>50</td><td>Poor</td><td>‘Winter feathers look old’</td></tr>
<tr><td>BlueR</td><td>70</td><td>OK</td><td>‘Most of head and a few scapulars winter plumage’</td></tr>
<tr><td>BlueL</td><td>90</td><td>Feathers look old</td><td>‘Only moult a few scapulars and on head’</td></tr>
<tr><td>GL</td><td>90</td><td>OK</td><td>‘Moulted most of main scapulars’</td></tr>
<tr><td>YL</td><td>95</td><td>Poor</td><td>‘(Bad legs especially right leg not putting a lot of weight on it.)’</td></tr>
</table></td></tr>
<tr><td>Aug</td><td>Feathers dropped throughout the month, body and flight feathers. Wing feather growth noticeable remotely.</td></tr>
<tr><td>Sep</td><td>3 September in-house assessment:
<table>
<tr><th>SBS ID</th><th>% Winter plumage</th><th>Notes</th></tr>
<tr><td>OL</td><td>100</td><td></td></tr>
<tr><td>WL</td><td>100</td><td></td></tr>
<tr><td>PR</td><td>100</td><td></td></tr>
<tr><td>RR</td><td>100</td><td></td></tr>
<tr><td>WR</td><td>100</td><td></td></tr>
<tr><td>RL</td><td>100</td><td></td></tr>
</table></td></tr>
</table>

	BlackL	-	‘Almost winterised’
	PL	100	
	BlueR	75	‘Breast and nape summer’
	BlueL	100	
	GL	-	‘Still a bit brown –summer breast and nape. Scruffy’
	YL	-	‘Close to full winter –breast, head, and nape brownish’
	Some birds dropping feathers throughout the month, body and wing (cut and intact). Some winter feathers dropping. One or two birds with mottled chest feathers.		
Oct	Feathers dropped throughout the month; body and wing. Slowed down towards month end. Two birds noted to have feathers missing.		
Nov	Body feathers found throughout the month; flight feather found through second half of the month. One bird noted as having gaps in plumage.		
Dec	• Body and wing feathers found throughout the month in high quantities, increasing towards end of the month. • Three birds noted to have loose feathers beginning of month (BlackL, BlueL, WR) . • One bird gaining mottled chest (WR). • Two birds looking more mottled with some redness mid-month, and noted to look very red by month end (WR, BlackL). • Some birds with gappy plumage at end of month (RR, RL, BlueR, BlueL).		

Table A16 – Summarised plumage related notes: 2012 cohort

Month	Bird ID	Summary
Aug	-	No plumage/moult notes
Sep	-	No plumage/moult notes
Oct	-	One body feather found
Nov	-	Three body feathers found
Nov	UNR	Loose feather on chest
Dec	BlueL	Trying to fly, crashed into dish. Flapping a lot.

A2.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included in Table A17. Of approximately 76 cases of lameness this year (from both cohorts) 37% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A2.1.5 & Tables A19 and A20.

Table A17 – Summary of lameness for each month: 2012

2011 cohort

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	13	7	4	20
Feb	13	4	3	3
Mar	13/12	10	2	52
Apr	12	9	1	28
May	12	11	3	30
Jun	12	10	8	49
Jul	12	9	2	24
Aug	12	4	2	8
Sep	12/11	3	0	6
Oct	11	2	1	3
Nov	11	2	1	3
Dec	11	1	0	2
				Total: 228

2012 cohort

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	-	-	-	-
Feb	-	-	-	-
Mar	-	-	-	-
Apr	-	-	-	-
May	-	-	-	-
Jun	-	-	-	-
Jul	-	-	-	-
Aug	17	0	-	0
Sep	17	0	-	0
Oct	17	1	0	1
Nov	17	0	-	0
Dec	17	3	1	14
				Total: 15

Note: * 1 = One day of one lame bird

A2.1.5 Afflictions/treatments

General examination included some of the following: foot condition check, body condition check, body weight, plumage condition and moult assessment, and reference photos (feet and plumage); Table A18.

Table A18 – Group health checks/treatments: 2012

Date	Treatment received
04 Jan	All 2011 cohort caught for health check
12 Jan	All 2011 cohort caught for health check
24 Jan	All 2011 cohort caught for health check
07 Feb	All 2011 cohort caught for health check, then moved to Room #2
10 Feb	2 birds caught to check foot condition after changing to finer sand, feet looked ok so deemed unnecessary to catch more
20 Feb	All 2011 cohort caught for health check
26 Mar	All 2011 cohort caught for health check
26 Aug	All 2011 cohort caught for health check
10 Sep	Both 2011 and 2012 cohorts caught, photographed and weighed
01 Oct	Both 2011 and 2012 cohorts caught for health check, feathers taken from 2012 cohort for sexing -many instances of leg flicking in 2012 cohort for several days after being caught
05 Dec	All 2012 cohort caught for health check

Table A19 – Individual afflictions/treatments: 2011 cohort: 2012

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan YL	Limping often, hunched occasionally, often alone, bleeding toe	Calluses/swelling on bottom of feet, cracks on toes, damaged toenail	Unsuitable substrate/conditions during quarantine having a lasting effect	Caught for examination on four occasions (including health check). Warm foot baths to remove debris, topical antibiotic ointment applied. **Symptoms continued**	
Jan WL	Coughing (two instances observed)	Unknown	Suspected from ingesting play sand, though reoccurred two weeks later Local bonfire fumes		No treatment received, continued to monitor.
Mar GR	One instance of 'coughing'. Limping initially, sitting on hocks alone. Unable to stand well after first handling. Condition deteriorated rapidly, not eating of drinking, eyes crusted, panting, struggling to breathe.	Amyloidosis (noted after death)	Stressors	• Day 1: Caught, topical antibiotic applied to feet. Caught the same day for antibiotic injection. Placed in small corral within indoor area. • Day 2: Caught, food supplement administered with gavage. Caught again, food supplement and anti-inflammatory administered with gavage. Caught again, anti-inflammatory injection given. • Day 3: No handling. **Found dead mid-morning.**	
Apr OR	Reluctant to stand on certain leg	Entanglement	Human hair wrapped around feet	Caught, to remove hair. Feet treated with topical antibiotic ointment. Given anti-inflammatory injection. **No further treatment needed**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Apr-Jul GL	Hunched, wings dropping, weak, heavy breathing for several days, scruffy plumage, stiff/not able to use well, weak, squinting Limping (still hunched, wings dropping, weak occasionally, squinting occasionally, being bullied occasionally) Caught to assess moult and foot condition. Still hunched, limping, as in previous months	Unknown Entanglement Long nails, calluses on soles of both feet	Unknown Human hair wrapped around feet Historical foot issues likely from poor substrate	Apr Caught for examination- given anti-inflammatory injection and antibiotic injection. **Symptoms continued** Three-week course of oral antibiotic put into bill; daily catching required. **Symptoms continued** May Course of oral antibiotic put into of bill continued into May. Caught for examination- topical antibiotic ointment applied to feet. One toenail with minor bleed. **Symptoms continued** Caught later in month as leg tangled on artificial Christmas tree thread. Released straight away. Jun Caught, hair removed. Feet look okay but nails trimmed as overgrown. Topical antibiotic ointment applied. **Symptoms continued**	Jul • Caught for examination, nails cut. • Caught later in month, nails cut
May WL	Limping	Cracked foot	Possibly substrate, stressors	Topical antibiotic ointment applied to feet on the second catch	Caught three times for examination. No treatment required for the first catch. Nails trimmed on third catch
Jun YL	Severe limp	Cracked feet, ingrown nail	Possibly substrate, stressors	• Caught for examination- topical anti-inflammatory and topical antibiotic ointment applied. • Caught next day, nails trimmed, topical anti-inflammatory and topical antibiotic ointments applied. **Some improvement after a couple of weeks**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jun OR	Enlarged feet, limping, skin red around nails	Cracked feet, plus possibly poor nail growth/ingrown?	Possibly substrate, stressors	Caught, nails trimmed. Topical anti-inflammatory and topical antibiotic ointments applied. **Improvement seen** Caught two days later, topical anti-inflammatory and topical antibiotic ointments applied. **Improvement seen** Caught one week later, topical anti-inflammatory ointment applied. **Overall limp reduced but foot condition remained poor**	
Sep GL	Prolonged limp. Often alone under heat lamps inside, slow moult, wings dropping, hunched, not interested in live food Conditioned deteriorated quickly over one week	Amyloidosis noted after death	Possibly substrate, stressors	• Caught, warm foot bath then topical antibiotic ointment applied. • Caught three days later, antibiotic injection given in morning. **Found dead a few hours later**	
Oct YL	Swollen outer toes, slightly red, stiff walk, on tiptoes, hunched, legs bent when stood	General poor foot condition	Unsuitable substrate/conditions during quarantine having a lasting effect	Caught regularly for course of anti-inflammatory injections. Topical antibiotic ointment applied to feet each time. Nails trimmed as needed. **Symptoms continued**	
Nov YL	Poor demeanour, odd gait, some pacing, wary of other birds, weak, on tiptoes, wide legged stance, hunched, headshaking, flying to get around, often disinterested in live food	General poor foot condition	Unsuitable substrate/conditions during quarantine having a lasting effect, stressors	Caught regularly for course of anti-inflammatory injections. **Symptoms continued**	
Dec YL	Same as previous month, sometimes bullied by others, quivering, struggles to stand from sitting, right leg occasionally giving way, dropping wings	General poor foot condition	Unsuitable substrate/conditions during quarantine having a lasting effect, stressors		No treatment received, continued to monitor.

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

Table A20 – Individual afflictions/treatments: 2012 cohort: 2012

Month	Symptoms	Affliction	Cause	Treatment received
Dec RL	Limping, swollen sole of foot	Calluses/bumblefoot, possibly infected	Stressors	Caught for examination- given one off antibiotic injection. **Intermittent symptoms into 2013**

Note: From arrival to SBS facility (17 Aug 2012) to 31 Dec 2012

A2.2 Locality

A2.2.1 SBS facility configuration

Temporary aviaries were erected in the annexes so birds could have outside access. They could enter via a pop-hole.

The original annexes were made bird safe by erecting soft nylon net. Once complete the aviary was removed and the birds given access to their larger refurbished annexes; Figure A4. Further details in Section 2.1.2.

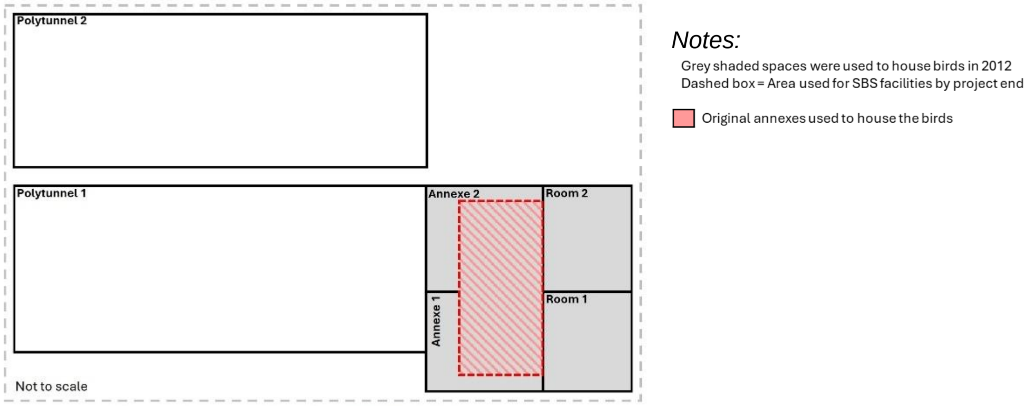


Figure A4 – SBS facility configuration: 2012

A2.2.2 Bird moves

The 2011 cohort had access to Room #1 and Room #2 prior to the arrival of the 2012 cohort. Initially with access to both rooms but soon confined to one at a time and swapped occasionally to be able to refresh substrate and/or for maintenance work; Table A21.

Table A21 – Space occupancy: 2012

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meinypil'gyno village												
WWT Slim. QS							4	17				
Room #1		7	11		14			10 17				***
An#1			* 26	*	* 14	* 24	** 24	10 17		*	*	* until 10
Room #2		7	11		14	24		10				***
An#2					* 14	* 24		10		*	*	* until 10

Notes:

2011 Cohort

2012 Cohort

Date shown of when birds moved/given access to each area

* Daytime only

** Day and night from this point onwards

*** Confined to rooms during days with extremely cold weather

The birds initially had small annexes attached to the rooms, these were extended around the existing panels into permanent fixtures. The original panels were removed, and the birds given access to the new larger annexes from 28 August.

The birds were occasionally shut inside to allow maintenance work to be conducted outside or due to herbicide spraying close by.

A2.3 Social network

A2.3.1 Sexing

Buccal swabs were taken from the 2011 cohort birds early in the year to determine sexes in time for the breeding season, as some small waders breed in their first year. Results may have also influenced the number of eggs collected to form the 2012 cohort, or whether eggs were needed in following years. After initial difficultly extracting DNA from the samples, results were eventually obtained although with some speculation. In October the birds were sexed again this time using feathers from all birds of both the 2011 and 2012 cohorts; Tables A22 and A23.

As SBS are sexually dimorphic (females are generally larger/heavier than males) the birds were ranked by body weight using average weights at the time to give further evidence to possible sexes suggested. However, over time due to behaviour the sexes of some of the birds under speculation became clear.

BlueR, originally sexed as a female showed typical male behaviours during the breeding season throughout life (though again there is overlap with female breeding behaviours) and was confirmed male after death with testes observed during post-mortem.

OR was suspected female initially due to a higher average bodyweight and pending second sexing result, but showed male typical breeding behaviours and was confirmed male at post-mortem.

WL was indeed mis-sexed the first time, with behaviour indicating it was male and testes observed at post-mortem.

PPL although pending a result also behaved as a male, confirmed once again at post-mortem.

POL displayed more female type breeding behaviours and was confirmed a female at post-mortem.

Table A22 – Sexing results: 2011 cohort

Bird ID	Buccal swab sex (May 2012)	Feather sample sex (Oct 2012)	Actual*	Average body weight	Body weight rank	Comments
PL	F	F	F	37.9	1	
BlueR	F	Pending	M	37.8	2	Possible female
OR	M	Pending	M	37.0	3	Possible female
YL	F	F	F	36.7	4	
PR	M	M	M	35.7	5	
BlackL	M	M	M	34.8	6	
WL	F	M	M	34.4	7	Possibly mis-sexed first time
RL	M	M	M	32.6	8	
BlueL	M	M	M	32.6	9	
RedR	M	M	M	32.1	10	
WR	M	M	M	30.8	11	

Note: * Confirmed at post-mortem or through breeding

Table A23 – Sexing results: 2012 cohort

Bird ID	Buccal swab sex	Feather sample sex (Oct 2012)	Actual*	Average body weight	Body weight rank	Comments
PPR	N/A	F	F	46.8	1	
PWR	N/A	F	F	46.5	2	
PWL	N/A	F	F	43.4	3	
PLGL	N/A	F	F	43.3	4	
PBlackR	N/A	F	F	42.7	5	
PRR	N/A	F	F	42.1	6	
PYL	N/A	F	F	41.4	7	
PBlueR	N/A	M	M	41.0	8	
PRL	N/A	M	M	38.9	9	
POR	N/A	M	M	37.7	10	
PDGR	N/A	M	M	37.3	11	
PYR	N/A	M	M	37.1	12	
UNR	N/A	M	M	36.5	13	
PBlueL	N/A	M	M	35.9	14	
PPL	N/A	Pending	M	35.8	15	Probably male
POL	N/A	F	F	35.5	16	Possibly a false female
PLGR	N/A	M	M	35.4	17	

Note: * Confirmed at post-mortem or through breeding

A2.3.2 Introductions/departures/interactions

- 2011 cohort remained alone in the SBS facility until mid-August when the 2012 cohort were placed in the adjoining room and annexes. The 2011 cohort were immediately aware of their presence through audible contact only. This appeared to put the 2011 cohort on alert initially, whereas the 2012 cohort appear unfazed at the alarm calls nearby. Though this could be because everything was new to the 2012 cohort having just been moved from the QS.
- The birds only had audible contact for the rest of the year.
- The two deaths within the 2011 cohort did not appear to cause much disturbance to the birds. There was one observation of aggression between two birds the day after one death.
- Adult calls from 2012 cohort heard from mid-November.
- The 2011 cohort began making adult calls from March.

A2.4 Breeding

Limited behaviours associated with breeding were noted this year. Some heightened aggression during the breeding season over resources was seen. This was expected given SBS usually breed at two years of age. There was also a lot of disturbance from the construction of the refurbished annexes and adjoining polytunnels, which was regularly noted to agitate or frighten the birds.

A2.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide temperatures (approximately) required by the birds depending on time of year and health status. Thermo-hydrometers were used to collect data; Table A24.

Table A24 – Temperature data summary: 2012

	Room #1				Slimbridge (UK)* - temperatures that would be felt in annexes		
Month	Absolute Min ºC	Mean Min ºC	Mean Max ºC	Absolute Max ºC	Absolute Min ºC	Mean ºC	Absolute Max ºC
Jan	17.1	20.2	24.6	26.6	-4	7	13
Feb	15.1	19.3	24.5	27.0	-8	6	15
Mar	15.0	18.3	24.1	26.6	-1	11	21
Apr	13.4	16.4	24.9	26.9	1	10	17
May	14.5	18.8	26.0	28.7	4	15	27
Jun	18.0	19.6	25.5	27.8	8	16	24
Jul	16.8	18.7	27.4	30.4	11	18	28
Aug	16.0	17.9	27.0	31.6	10	19	26
Sep	7.6	14.5	21.4	24.8	5	16	25
Oct	9.1	14.1	20.1	21.6	0	12	17
Nov	7.6	12.7	18.1	21.4	0	8	15
Dec	4.8	14.5	17.5	24.6	-5	6	13

Notes:
* Data from timeanddate.com/weather
There is no mean for Room #1 due to how recordings were taken

A2.6 Lighting and photoperiod

Figure A5 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. During spring and autumn where UK photoperiod is longer than what wild SBS encounter, artificial lighting on timers was still provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

Figure A5 graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included and all location photoperiods include twilight.

A2.6.1 Photoperiod experienced by the captive SBS

Initially the birds were on a 12-hour on/off light/dark cycle using artificial lighting whilst housed indoors. In March the birds were given access to outdoor aviaries so the number of daylight hours experienced gradually increased with the Slimbridge (UK) photoperiod from this point. This peaked for one day on summer solstice before gradually decreasing again with the Slimbridge (UK) photoperiod. Artificial lighting took over briefly in August/September, held at 17 hours before again decreasing gradually with the Slimbridge (UK) photoperiod. In December, 11 hours of artificial light per day was provided for the 2012/13 winter period.

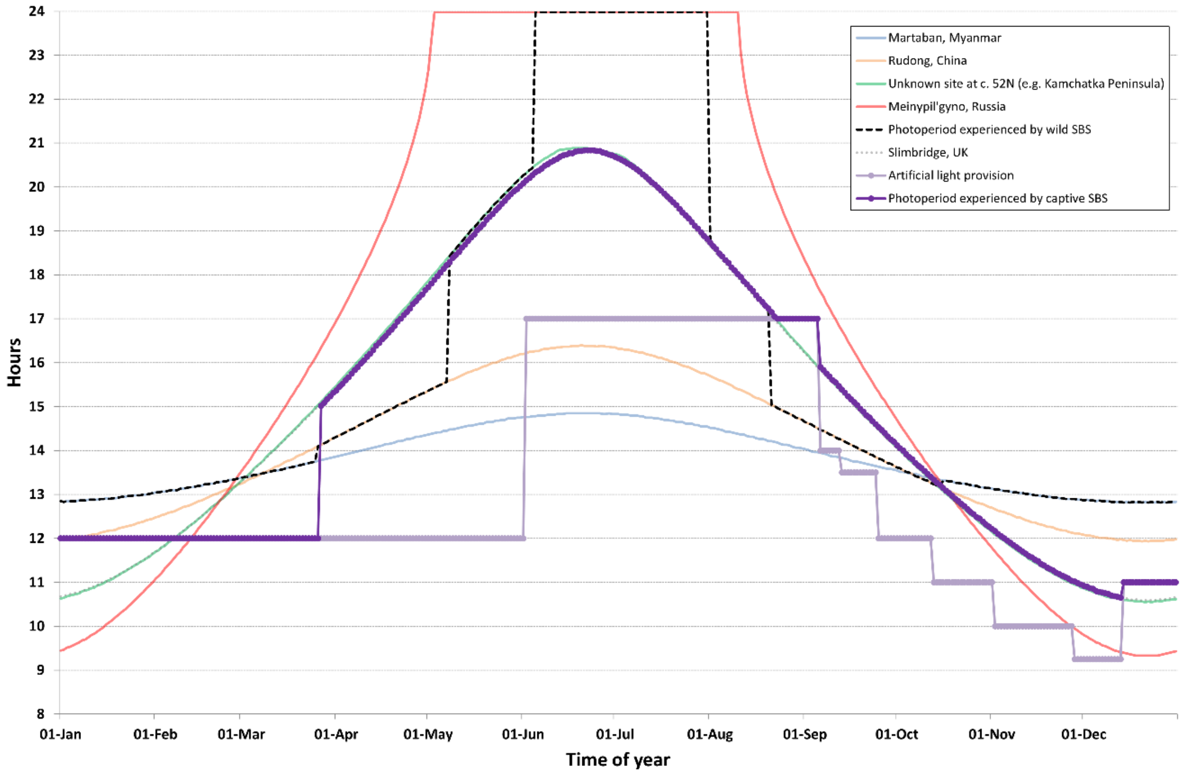


Figure A5 – Photoperiod wild SBS experience during the year based on location: 2012

A2.6.2 Notes

It was decided to increase the number of artificial light hours in line with the breeding season as it was not possible to combat the Slimbridge (UK) photoperiod and not in the birds' benefit to be kept indoors just to provide a certain photoperiod. Exposure to a photoperiod as experienced when migrating to the breeding grounds was not thought to be of detriment to the 2011 cohort because wild SBS have been known to breed in their first year (though usually SBS remain in the south for their first summer). The photoperiod provided also benefited the 2012 cohort on their arrival to the SBS facility, as they would naturally experience a similar light cycle as fledglings in the wild.

Automated light timers were not used initially as the facility was still under construction in early 2012. The sudden changes in number of light hours occur in part to simulate the migration jumps in location wild SBS make, but also in part due to the rudimentary light timers initially installed.

The slight deviation between 'Photoperiod experienced by wild SBS' and 'Photoperiod experienced by captive SBS' is due to the former being calculated on a non-leap year, and 2012 being a leap year.

A2.7 Diet and nutrition

Diet provided was the same for both the 2011 and 2012 cohorts; Table A25. Live foods were fed randomly, not always daily. Lundi micro 45 was phased out of the diet as an unnecessarily high protein food item for fledged birds.

Lundi was provided wet and dry. Grit always present, including oyster shell grit.

Table A25 – Food present/absent in diet: 2012

Food item/supplement*		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **45**	✓	✓	✓	20	X	X	X	X	X	X	X	X
	Lundi micro **35**	✓	✓	✓	80	100	100	100	100	100	100	100	100
Dried freshwater shrimp		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live/frozen Artemia		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live mealworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avripro (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avimix (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live/frozen Daphnia		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X
Live crickets (brown/black)		X	X	X	X	X	X	X	✓	✓	✓	✓	✓
Live fruit Flies		X	X	X	X	X	X	X	X	✓	✓	X	X
Frozen Krill		X	✓	X	X	X	X	X	X	X	X	X	X

Notes:
* Most frequently provided items to least

✓	Present in diet
X	Absent from diet

A2.8 Sanitation

A2.8.1 Water systems

- All ponds drained and refreshed regularly.

A2.8.2 Substrates

- Sand in occupied areas partially replaced and/or rinsed with disinfectant periodically.

A2.8.3 Biosecurity

- Occupied areas serviced at least once a day. Including faeces-picking, sieving sand, and raking sand.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A2.9 Environment provisions, modifications, and events with consequences

A2.9.1 Climate

- All rooms provided with fan heaters for ambient heat and heat lamps for basking spots. All birds shut in on days of severe weather in winter (precipitation and low temperatures).

A2.9.2 Light

- All rooms provided with florescent strip lighting and UV light bulbs. Additional UV bulbs added in May.
- 'Night light' added to Room #1 in October.

A2.9.3 Enclosure

- All birds always had access to one sheltered, heated, room. Access to an outside space was given from March. They had access to an extended area of outdoor space from August.

A2.9.4 Habitat/substrate

- Initially the 2011 cohort had one room of river sand and one room of fine gravel with saltwater ponds which periodically flooded (both intentional and unintentional). At the start of February the gravel was replaced with river sand as it appeared the gravel was constantly sticking to the birds' feet and irritating/damaging them.
- Play sand in trays added to the 2011 cohorts' room but taken away shortly after when one bird appeared distressed after foraging in it; coughing, headshaking, and scratching face. (January).
- Some sedum placed in An#1 temporarily (June).

A2.9.5 Other

- Commentated feeds occurred in January, February, March and April.
- Radio playing in background from March to the end of the year.

A2.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A26.

Table A26 – Number and type of visitor to the breeding facility: 2012

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan				
Feb			1 (internal staff)	1 (electrician)
Mar		1 (VIPs/visitors)		
Apr				
May				
Jun				1 (maintenance working outside annexes)
Jul				1 (maintenance working outside annexes)
Aug				2 (washing machine maintenance, maintenance working outside annexes)
Sep				
Oct			1 (external advisors)	1 (maintenance working outside)
Nov		1 (VIPs/visitors)		
Dec				

A3. 2013 Summary

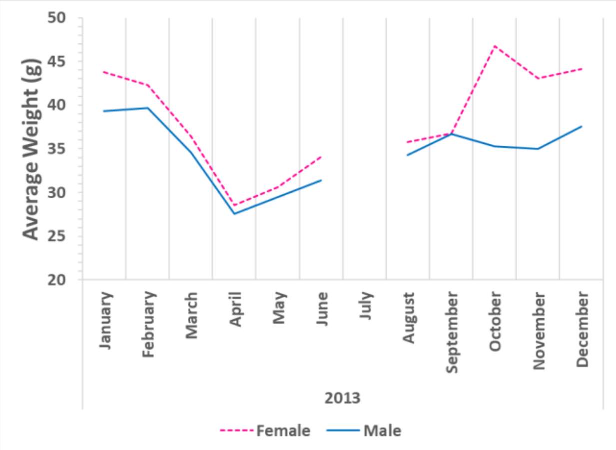
Table A27 – Individual records/deaths (all birds): 2013

SBS ID	Cohort	Sex	Deaths	Cause
RL	**2011**	M		
BlueL	**2011**	M		
WL	**2011**	M		
YL	**2011**	F		
PL	**2011**	F		
BlackL	**2011**	M		
RR	**2011**	M		
WR	**2011**	M		
BlueR	**2011**	M		
OR	**2011**	M		
PR	**2011**	M		
PWR	2012	F		
UNR	2012	M		
PBlueL	2012	M		
PWL	2012	F		
PBlueR	2012	M		
PLGR	2012	M	23 Aug	Euthanised. Severe chronic pododermatitis (bumblefoot)
PYL	2012	F		
PPR	2012	F		
POL	2012	F		
PBlackR	2012	F	13 Aug	Respiratory and pulmonary disease (tracheobronchitis and bronchopneumonia)
PLGL	2012	F		
POR	2012	M		
PRL	2012	M		
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		
PYR	2012	M		

A3.1 Health

A3.1.1 Body weights: all birds

Not all birds were weighed at each weighing session; Figure A6 and Table A28. In July the birds were not weighed to avoid disturbance during the breeding season.



Note: Includes remote weights and in-hand, excludes death weights

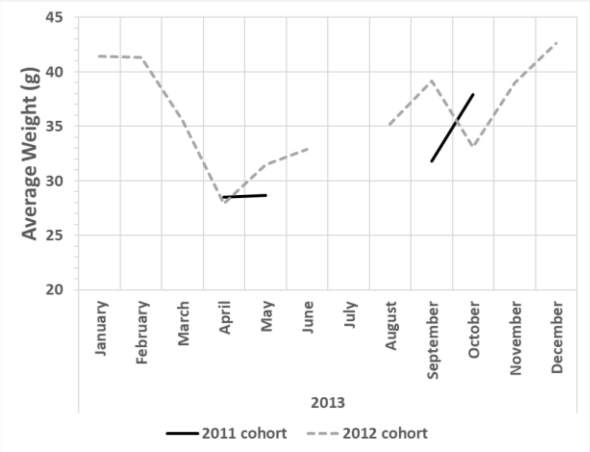
Figure A6 – Mean body weights of all birds: 2013

Table A28 – Number of individuals by sex (end of each month): 2013

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	18	18	18	18	18	18	18	17	17	17	17	17
Females	10	10	10	10	10	10	10	9	9	9	9	9

A3.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session; Figure A7 and Table A29. In July the birds were not weighed to avoid disturbance during the breeding season.



Note: Includes remote weights and in-hand, excludes death weights

Figure A7 – Mean body weights: 2011 and 2012 cohorts: 2013

Table A29 – Number of individuals by cohort (end of each month): 2013

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	11	11	11	11	11	11	11	11	11	11	11	11
2012	17	17	17	17	17	17	17	15	15	15	15	15

A3.1.3 Plumage assessment

A standardised moult scoring system was not developed until September 2014. However, plumage condition was regularly noted by staff, summarised by month in Tables A30 and A31 (separate for 2011 and 2012 cohort).

Table A30 – Summarised plumage related notes: 2011 cohort: 2013

Month	Summary	Plumage*
Jan	Feathers dropped throughout the month, predominantly the first half. Summer plumage starting to show. Loose feathers/gappy plumage noted throughout the month. Wing feathers found through first half of month.	W→S
Feb	Feathers dropped throughout the month. More birds with summer plumage. Continued to have loose/gappy plumage.	W→S
Mar	Feathers dropped throughout the month. Continued to have loose/gappy plumage.	W→S
Apr	Feathers dropped throughout the month. Continued to have loose/gappy plumage. Three birds still in winter plumage at start of month, still one in winter plumage by month end.	W→S some in S
May	Feathers dropped at start and end of month. Continued to have loose/gappy plumage.	W→S some in S
Jun	Feathers found throughout the month, predominantly in the first half of the month. Not all birds in full summer plumage.	W→S most in S
Jul	Feathers dropped at the start and end of the month. One bird noted with winter plumage coming in at the start of the month, more birds by the end of the month. Continued to have loose/gappy plumage.	most in S S→W

Month	Summary	Plumage*
Aug	Feathers found predominantly towards the end of the month. Birds noted to look wintery. Loose/gappy plumage throughout the month.	S→W
Sep	Feathers dropped predominantly towards the end of the month. More coming into winter plumage. Continued to have loose/gappy plumage.	S→W
Oct	Feathers dropped throughout the month. Some birds in winter plumage, some still with summer plumage. Some wing feathers dropped first half of month.	S→W some in W
Nov	A few feathers dropped this month. More birds coming into winter plumage.	S→W some in W
Dec	Feathers found throughout the month. Still generally looking wintery. Noted several times to have loose/gappy plumage.	S→W

Note: * J = juvenile plumage; W = winter plumage; S = summer plumage; → = actively moulting

Table A31 – Summarised plumage related notes: 2012 cohort: 2013

Month	Summary	Plumage*
Jan	Some birds with loose feathers/gappy plumage towards end of month.	J+S
Feb	Feathers dropped throughout the month. New winter plumage showing strongly in some birds from mid-month. Continue to have loose/gappy plumage.	J+S→W
Mar	A lot of feathers being dropped from second week in. Many birds with new winter plumage showing from mid-month. Some going from juvenile, some from summer. Continued to have gappy/loose plumage. Cut wing feathers also found towards end of month.	J+S→W
Apr	Some birds almost with full winter plumage. Feathers found throughout the month, winter feathers included from end of month. Cut wing feathers found this month.	J+S→W
May	Feathers found throughout the month. Some birds with new summer feathers showing from mid-month. Loose/gappy plumage recorded throughout. Cut wing feathers found, at least one bird noted to be flighted.	W→S
Jun	Feathers found throughout the month, predominantly first half. Gappy/loose plumage continued.	S?
Jul	Feathers found at start and end of month. Gappy/loose plumage continued.	S?
Aug	Feathers being dropped throughout month, many from second week in. Gappy/loose plumage continued.	S→W
Sep	Feathers continued to be dropped, many with new winter plumage showing, some still with summer. Gappy/loose plumage continued.	S→W
Oct	Feathers dropped throughout month, some birds still have summer plumage.	S→W
Nov	Feathers continued to be dropped from mid-month, some birds now catching up showing more winter plumage.	S→W
Dec	Feathers dropped throughout the month, birds with some summer plumage progressing into winter. Gappy/loose plumage throughout month. Cut wing feathers found.	S→W

Note: * J = juvenile plumage; W = winter plumage; S = summer plumage; → = actively moulting

A3.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A32. Of approximately 177 cases of lameness this year (from both cohorts) 67% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A3.1.5 & Tables A34 and A35.

Table A32 – Summary of lameness for each month: 2013

2011 cohort

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	11	5	1	3
Feb	11	3	0	2
Mar	11	3	0	1
Apr	11	3	0	3
May	11	3	0	2
Jun	11	1	0	1
Jul	11	0	0	-
Aug	11	1	0	1
Sep	11	8	1	2
Oct	11	12	2	3
Nov	11	1	0	1
Dec	11	13	1	4

Total: 23

2012 cohort

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	17	5	16	27
Feb	17	14	48	85
Mar	17	13	0	125
Apr	17	12	0	55
May	17	6	7	18
Jun	17	4	2	11
Jul	17	11	24	34
Aug	15	12	7	45
Sep	15	13	3	64
Oct	15	14	3	79
Nov	15	11	5	57
Dec	15	9	4	26

Total: 626

Note: * 1 = One day of one lame bird

A3.1.5 Afflictions/treatments

Additional notes:

- Blood found on towels in March in 2012 cohort area over two days, likely bleeding from foot sores present at the time.
- Blood found on inside of door in July of 2012 cohort room, though none seen on birds.
- Green faeces found in August, October and November in the 2012 cohort's areas.
- Blood found on the walls and window of the 2011 cohort room on two separate occasions in September.
- 2012 cohort's foot condition generally poor in October, many birds noted to be struggling to get into salt baths surrounding food dishes, reluctant to go in, or circling around them.
- Green faeces found in December in the 2011 cohort areas.

Table A33 – Group health checks/treatments: 2013

Cohort	Month	Treatment received
2012	Feb-Mar	Oral antibiotic was added to fresh and saltwater dishes, replaced daily, from 13 Feb to 14 Mar due to the high number of chronic foot issues seen. Fresh and saltwater without treatment were given on occasional days.
2012	Feb	All birds in 2012 cohort caught to access moult, as well as examined for health.

Table A34 – Individual afflictions/treatments: 2011 cohort: 2013

Month /ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Oct WL	Parted/missing feathers and dried blood around keel, preening the area often	Surface wound to keel and chest. Also wound on carpal joint	Likely flight collision injury	• Caught for examination -topical anti-inflammatory treatment applied to wounds. Swelling and redness also observed on preen gland. • Caught for examination two weeks later -chest healing well, some redness still. Some ingrown feathers removed from preen gland. Didn't look inflamed or infected. Topical anti-inflammatory ointment applied to preen gland area. Feather cut (non-growing) primaries in case of need to catch again. **Appeared to heal well and new feathers growing. Preen gland improved**	
Oct RL	Limping	Wound to toe	Nail on one toe rubbing on another toe (toe bent from historical cause)	Caught for examination -nail cut, topical anti-inflammatory and topical antibiotic ointment applied. **Limp ceased over two weeks approx.**	
Dec RL	Walking on toes, limping, not weight bearing, disinterested in live food, swelling on top of foot	Unclear, possibly amyloidosis	Possibly due to onset of moult, stressors	Caught for examination -sore skin on sole of foot, though not severe or open. Wound in Nov healed. Antibiotic injection, topical anti-inflammatory and topical antibiotic ointment applied. **Symptoms ceased sometime after treatment**	

Note: **Highlighted green** indicates recovery

Table A35 – Individual afflictions/treatments: 2012 cohort: 2013

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan PBlueR	Severe limp, not weigh bearing	Cracked feet and toes, swollen soles on feet.	Possibly excessive weight, possibly onset of moult, stressors	• Caught for examination -given course of antibiotic injections, and topical antibiotic treatment and/or topical anti-inflammatory ointment applied to feet. **Limp ceased sometime after treatment**	
Jan-Feb PLGR	Slight limp, tender on feet, staying under heat lamp alone, swollen feet, hunched	Calluses on feet,/bumble foot, cracked feet, possibly amyloidosis	Possibly excessive weight, possibly onset of moult, stressors	<u>Jan</u> Caught for examination –given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. Yellow scabs formed over time on soles of feet. **Limited improvement, limping continued** <u>Feb</u> • Caught for examination -fresh cracks on toes, calluses on feet reduced in size. Topical anti-inflammatory ointment applied to feet. • Caught for examination -feet very swollen and hot, skin peeling from top of foot. Area pricked to release purulent content; swab sent to lab. Calluses on both soles of feet. Given antibiotic injection and course of oral antibiotic put in	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
				corner of mouth. Topical anti-inflammatory ointment applied to feet. **Limited improvement, not healing well**	
Jan PPL	Intermittent limp	Cracked feet	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination -given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. Yellow scabs formed over time on soles of feet. **Limp ceased**	
Jan PRL	Slight limp, leg flicking, swollen foot	Calluses/scabs on feet/bumble foot	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination -given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. Yellow scabs formed over time on soles of feet. **Limited improvement, limping continued**	
Jan-Feb PBlackR	Not weight bearing on one leg, swollen foot and toe, cracked feet	Calluses/scabs/bumble foot, scabs opening/lifting, with purulent discharge	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination -given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. Oral antibiotic also given put in corner of mouth. Swabs taken from feet, results unremarkable. **Limp ceased sometime after treatment**	
Feb-Mar PPR	Swollen feet, limping	Calluses/scabs on feet with purulent content	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination -scab removed, flushed with saline on several consecutive days. Given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. **Limp ceased initially** Caught for examination -feet actively healing. Given course of oral antibiotic put in corner of mouth, and topical anti-inflammatory treatment applied to feet. **Intermittent limp into March** Group treatment started; oral antibiotic added to water sources.	
Feb PBlueL	None	Cracked toes, open callus from possible previous infection	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination –one off antibiotic injection and topical anti-inflammatory treatment applied to feet. **No symptoms seen**	
Feb PWR	Limp	Sores on soles of both feet, one appears infected, one appears to have gotten past infection and is healing	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination –given course of antibiotic injections and topical anti-inflammatory ointment applied to feet. Also give course of oral antibiotic put in corner of mouth. **Limp ceased for a while, but reoccurred** Caught for examination- sores healing, some cracks present. Topical anti-inflammatory ointment applied to feet. **Intermittent symptoms**	
Feb PRR	Limping, swollen soles of feet	Calluses on feet, bumble foot	Possibly excessive weight, possibly onset of moult, stressors	Caught for examination -course of oral antibiotic put in corner of mouth, and topical anti-inflammatory ointment applied to feet. **Little improvement, limp continued intermittently**	
Feb	Many new limps towards end of Feb occurred with onset of cold weather (-2ºC) and snow				
May-Aug PLGR	Leg flicking, not weight bearing, limping, swollen sole of foot, swollen ankle,	Small wound inside ankle, severe bumble foot, open cracks on feet	Possibly excessive weight, possibly onset of moult, stressors	May • Caught for examination -one off antibiotic injection and topical anti-inflammatory ointment applied to feet. Course of oral antibiotic administered remotely.	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
	swollen leg, skin peeling from leg Blood stained plumage on one side of body	Surface wound to carpal joint	Flight collision injury	• Caught one week later -colour rings removed. No swelling but calluses still present. Cracks appear worse. Antibiotic injection and topical anti-inflammatory ointment applied to feet. **Limited improvement seen, tender on feet and inactivity developed** <u>Jul</u> • Caught for examination some improvement but feet still in poor condition. Scab removed to relieve purulent content. Course of antibiotic injections and topical anti-inflammatory ointment applied to feet. • Caught for examination -one foot swollen, the other also sore. Course of two oral antibiotics administered remotely. **Some improvement seen, leg flicking continued** Caught for examination during treatment- caustic pen used to treat wound on carpal joint. <u>Aug</u> Condition deteriorated rapidly. Caught for examination- feet very poor. Started course of antibiotic injections and oral antibiotic administer remotely. **Continued to worsen, euthanised**	
Jul YR	Limping, not weight bearing	Cracked feet, swollen sole of foot	Possibly onset of moult, stressors	Caught for examination- one off injection of antibiotic and topical anti-inflammatory ointment applied to feet. **Limp ceased sometime after treatment**	
Jul BlueL	Limping, swollen foot	Cracked toe	Possibly onset of moult, historic poor foot condition, stressors	Caught for examination- course of antibiotic injections and topical anti-inflammatory ointment applied to feet. **Some improvement, intermittent limp after treatment**	
Aug PBlackR	Distressed calling, hunched, eyes closing Generally struggling, gasping, shaking head, scratching head	Unclear. Possible obstruction in throat, possibly amyloidosis Post-mortem and histology results showed respiratory and pulmonary disease, with an Aspergilloma obstruction	Stressors	• Caught for examination- mouth checked, no obvious obstruction. Given hydrating supplement put in corner of mouth. • Caught a day later -appeared better but still gasping a little. Given oral antibiotic put in corner of mouth. • Caught a day later- rattling noise when breathing, brought up some mucus. Gavage/flushed twice with water. Some swallow but most brought back up. Gavage emergency nutritional supplement with an oral antibiotic and anti-inflammatory. • Seen struggling to breath the following morning. **Found dead soon after**	
Sep PLGL	Limping	Deep cracks in toes	Possibly onset of moult, stressors	Caught for examination -oral antibiotic put in corner of mouth and topical anti-inflammatory ointment applied to feet.	

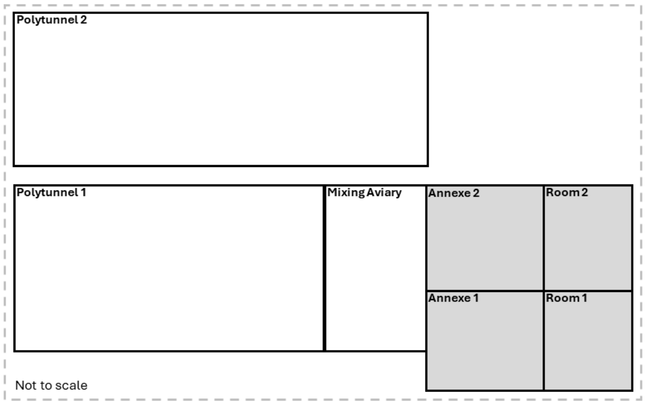
Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
				Caught a day after -feet looking better. Injection of antibiotic, topical anti-inflammatory ointment, and topical antibiotic ointment applied to feet. **Limp ceased sometime after treatment**	
Sep YR	Limping, not weight bearing	Cracked toes, callus on sole of foot	Possibly onset of moult, stressors	Caught for examination- topical anti-inflammatory ointment applied to feet. **Limp ceased**	
Oct BlueL	Limping, quivering, not alert to surroundings, spending time alone, hunched, fluffed feathers, dropping wings	Unclear, possibly amyloidosis	Stressors	• Caught for examination -two doses of antibiotic injections. Body, plumage, and foot condition good. • Symptoms continued with little improvement over next two week approx. • Became more active but limp appeared worse for a short limp. **All symptoms subsided approx. One month after initial symptoms appeared**	
Nov YR	Swelling on foot	Infected callus/bumble foot	Possibly due to excessive weight, and onset of moult, stressors	Caught for examination -swelling on foot lanced to remove purulent content. Course of antibiotic injections. Topical anti-inflammatory and topical antibiotic applied. **Intermittent limp for several weeks after treatment, limp eventually ceased**	
Nov PLGL	Limping, walking on toes	Cracked feet and toes	Possibly due to excessive weight, and onset of moult, stressors	Caught for examination -one off antibiotic injection. Topical anti-inflammatory and topical antibiotic applied. **Limp ceased after treatment**	
Dec PL	Odd gait, walking on toes	Deep cracks on feet	Possibly due to excessive weight, and onset of moult, stressors	Caught for examination -one off antibiotic injection. **Symptoms ceased after treatment**	
Dec YL	None	Old keel injury	Likely flight collision injury		Caught for examination -looked OK, new feathers growing. No treatment given.
Dec YR	None	Calluses/bumble foot	Possibly due to excessive weight, and onset of moult, stressors		Caught for examination -small hard lump on sole of foot, improved since last examined. No treatment given.
Dec PR	Limping	One toe bend near nail, foot swollen and red, cracked feet	Collision injury, in addition possibly due to excessive weight, and onset of moult, stressors	Caught for examination -one off antibiotic injection. Topical anti-inflammatory ointment applied. **Appeared hunched the days following treatment, but all symptoms ceased within a week**	

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A3.2 Locality

A3.2.1 SBS facility configuration

Polytunnels were constructed between July and September 2013; Figure A8. Further details in Section 2.1.2.



Notes:
Grey shaded spaces were used to house birds in 2013
Dashed box = Area used for SBS facilities by project end

Figure A8 – SBS facility configuration: 2013

A3.2.2 Bird moves

January-February

- Each cohort had access to one room each.

March

- 2: Both cohorts were allowed outside in the corresponding annexe for one day to assess their behaviour outside.
- 22: 2012 cohort moved to the QS to be able to fit windows between Room #1 and An#1, fit additional lighting, and conduct electrical work.

April

- 2: 2011 cohort moved to Room #1, walked through pop-hole, to be able to add windows between Room #2 and An#2, fit additional lighting, and conduct electrical work.
- 8: 2012 cohort moved to Room #2 from QS once maintenance work had finished.
- Both cohorts given access to corresponding annexes during the day and shut in at night from 30 April, to monitor the birds before being given access overnight.

May

- Birds given access to annexes overnight from 16 May.

June

- 3: 2011 cohort shut inside temporarily due to disturbance from polytunnels construction.
- 2011 cohort split into two groups occupying Room #1 and An#1 on 19 June. An#1 landscaped to simulate breeding habitat in hope to see some breeding activity. Two birds swapped later that day as they were pacey, and put back together as a flock by end of day as all birds appeared very unsettled.

July

- 10: Both cohorts shut in rooms to cut pop-holes between annexes and MA.

August

- Birds shut in between 13:00-17:00 from 16 to 18 August for live stream to Global Bird Fair.

September

- Cohorts remained in their respective rooms and annexes.

October

- 17: Birds shut in rooms while herbicide was sprayed.
- Short visual barriers in Room #2 to diffuse aggression between some birds. Removed on 29 October, thought to make birds nervous to come inside.
- Birds shut in rooms temporarily for cleaning purposes on 1, 2 and 19 October.

November

- 1: Birds shut in rooms temporarily for cleaning purposes.

December

- Cohorts remained in their respective rooms and annexes.

The occupancy of different rooms is shown in Table A36.

Table A36 – Space occupancy: 2013

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WWT Slim. QS			22	8								
Room #1			22	2	19 NB							
An#1			2 *	30	19 B							
Room #2				2 8								
An#2			2 *	30								

Notes:
* Let out for one day in March

2011 Cohort

B-Breeding:

- Female YL, PL
- Male: BlueL, WR, RL
- Possible female: BlueR

NB-Non-breeding

- Males: WL, PR, BlackL, OR, RR

2012 Cohort

A3.3 Social network

A3.3.1 Sexing

Based on weight, size and behaviour for some of the birds, and differing results from the intuitions used to sex the birds in May 2012 and October 2012, there was still some speculation as to the sex ratio of both cohorts. This was crucial information when it came to deciding how to split the 2011 cohort for their first breeding season, so in the absence of DNA genetic confirmation of sex, educated guesses were made when it came to pairings.

A3.3.2 Introductions/departures/interactions

In March, a short visual barrier was erected in the 2011 cohorts room for refuge as some birds were becoming aggressive. Birds were coming into summer plumage and the increase in such behaviour is likely associated in lead up to the breeding season.

The 2011 cohort were split in two groups for the breeding season. This was in place for only one day as the group housed outside appeared distressed exhibiting excessive pacing. The group was reformed that afternoon. The day after, aggression within the flock appeared heightened. Aggression was observed over resources, and DNA sexed males were showing DNA sexed females notable attention, notably following around the aviaries. This subsided quickly with no other notable breeding behaviours seen.

In October, a short visual barrier was erected in the 2012 cohorts room for refuge as some birds became aggressive. This was removed three days later as birds became increasing spooked by them, most refusing to enter the room.

Both cohorts remained in separate aviaries through the year with only audible contact. No additional birds/cohorts were added to the facility/flocks thereafter unless bred in the facility.

The two deaths within the 2012 cohort did not seem to affect the social structure of the flock in any observable way.

A3.4 Breeding

As the 2011 cohort were of breeding age, two years old/second summer, the birds were split into two smaller groups in an attempt to give the birds an opportunity to breed in the space available. An#1 housed what was suspected to be 3:3, an even sex ratio (actually 4:2), and Room #1 was thought to house 4:1 (actually 5:0).

An#1 was furnished with turf and grasses for places for the birds to nest. One male from each space was swapped shortly after as they were particularly pacey. However, all the outside birds became excessively pacey, so it was decided to reform the cohort giving access to An#1 and Room #1 again.

No birds attempted to breed this year.

A3.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximately temperatures required by the birds depending on time of year and health status. A Thermo-hygrometer was used to collect data; Table A37.

Table A37 – Daily temperatures: 2013

	Room #1				Slimbridge (UK)* - temperatures that would be felt in annexes		
Month	Absolute Min ºC	Mean Min ºC	Mean Max ºC	Absolute Max ºC	Absolute Min ºC	Mean ºC	Absolute Max ºC
Jan	13.2	19.0	21.0	24.2	-4	4	13
Feb	13.0	18.3	20.9	23.4	-4	3	10
Mar	9.7	18.2	21.5	24.4	-7	3	14
Apr	12.2	18.5	23.2	24.6	-5	8	20
May	12.0	15.6	20.5	25.0	0	11	22
Jun	14.0	17.8	22.7	27.2	5	14	24
Jul	12.8	17.6	23.7	28.8	10	19	30
Aug	7.6	15.9	21.1	24.5	9	17	31
Sep	7.6	16.0	21.4	24.7	5	14	27
Oct	11.5	17.2	21.7	24.0	4	13	20
Nov	8.5	12.7	17.3	20.9	-4	6	14
Dec	10.4	14.4	18.4	21.5	-3	7	14

Notes:
No mean for Room #1 due to how recordings were taken
* Data from timeanddate.com/weather

A3.6 Lighting and photoperiod

Figure A9 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

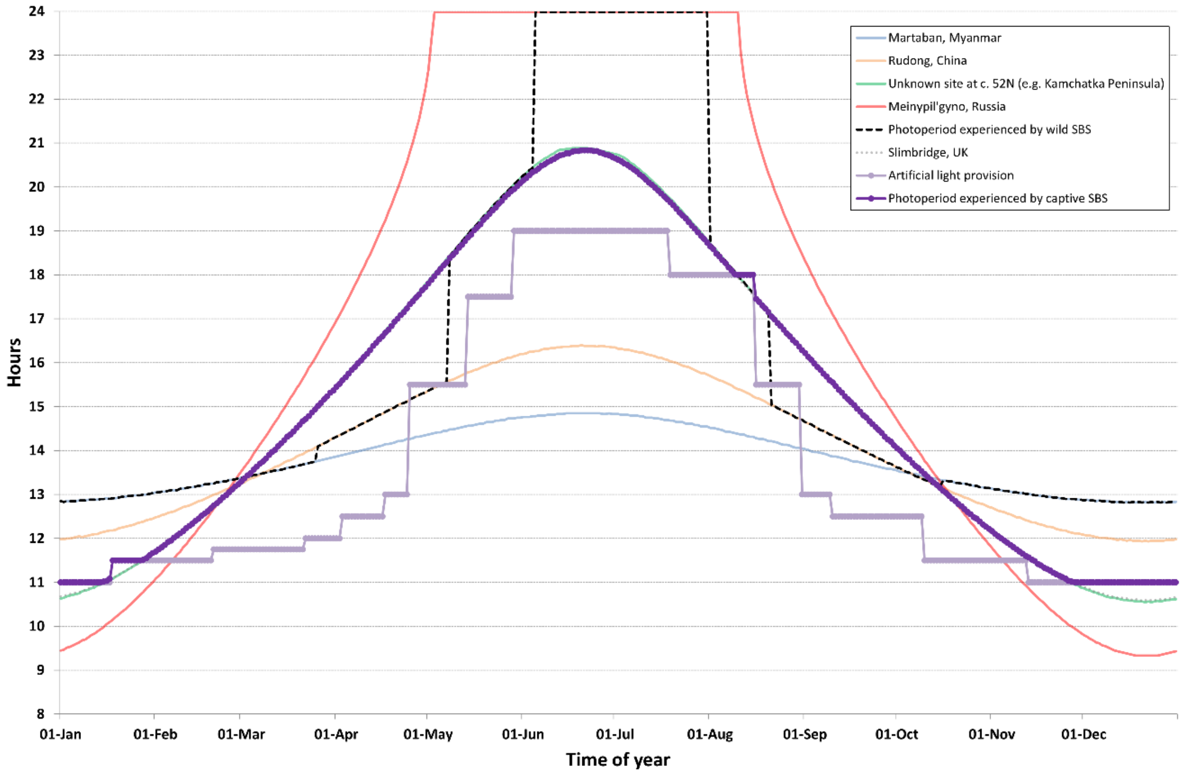


Figure A9 – Photoperiod wild SBS experience during the year based on location: 2013

A3.6.1 Photoperiod experienced by the captive SBS

During winter 2012/13, 11 hours of light per day was provided. This then increased to 11.5 for a short time before the Slimbridge (UK) photoperiod took over in early spring. This peaked for one day on summer solstice before gradually decreasing with the Slimbridge (UK) photoperiod. Artificial lighting held the birds at 18 hours of light in August before decreasing gradually with the Slimbridge (UK) photoperiod again. In early December artificial light took over providing the birds with 11 hours of light once again for winter 2013/14. UVI readings were taken on 12 December; Table A38.

A3.6.2 Notes

The sudden changes in number of hours of artificial light occurred in part to simulate the migratory jumps in location of wild SBS, but also in part due to the rudimentary light timers initially installed. There were some issues experienced with the timers in August and November due to faulty timers and power cuts.

Table A38 – UVI readings : 2013

Room #1		Room #2	
Reading next to light	Reading at floor level	Reading next to light	Reading at floor level
0.02	0.00	0.05	0.00

Note: Readings taken on 12 Dec, 2013

A3.7 Diet and nutrition

Diet provided was the same for both the 2011 and 2012 cohorts; Table A39. However, the diet for the 2012 cohort was reduced to 60% of usual quantity for the first week of January, then increased to 100%. They were also only fed once a day in the afternoon with no food throughout the day for the first two weeks in January. Food quantity was decreased again for the 2012 cohort in February, and again in December. Excessive weight thought to be a significant contributor of ongoing chronic foot issues led to the reduction in food quantity provided.

Aquatic invertebrates were offered to the birds this year to increase variety and gauge appetite. Insectivorous Feast was also introduced. Guardian Angel and Feather-up supplements also added during times of moult.

Lundi micro was provided wet and dry. Grit always present, including oyster shell grit.

Table A39 – Food present/absent in diet: 2013

Food item/supplement*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lundi micro **35**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dried freshwater shrimp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live/frozen bloodworms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avripro (on dry food)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avimix (on dry food)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Guardian Angel supplement	X	X	X	X	X	X	X	X	✓	✓	X	✓
Feather-up supplement	X	X	X	X	X	X	X	X	✓	✓	X	✓
Live/Frozen Artemia	✓	✓	X	X	X	X	X	X	X	X	X	X
Live/frozen Daphnia	X	✓	X	X	X	X	X	X	X	X	X	X
Frozen red plankton	X	✓	X	X	X	X	X	X	X	X	X	X
Insectivorous Feast	X	X	X	X	X	X	X	X	✓	X	X	X
Frozen Brine shrimp	✓	X	X	X	X	X	X	X	X	X	X	X
Frozen Krill	X	✓	X	X	X	X	X	X	X	X	X	X
Live mealworms	✓	✓	X	X	✓	X	✓	X	X	X	X	X

Notes: * Most frequently provided items to least

✓	Present in diet
	Present for 2012 cohort
X	Absent from diet

A3.8 Sanitation

A3.8.1 Water systems

- All water bodies were refreshed as and when needed.

A3.8.2 Substrates

- Due to the birds being in a relatively confined space while the polytunnels were erected, partial changes to the substrate were made almost twice a week to prevent build-up of potential pathogens. All bird occupied areas were swept to remove faeces and raked twice a day, to stop build-up of pathogens and aerate the substrate.
- Sand was treated with disinfectant solution regularly from February after environmental bacterial findings coupled with the extremely poor foot condition of birds at the time.

A3.8.3 Biosecurity

- Occupied areas serviced at least once a day; faeces-picking, sieving sand, and raking sand.
- Towels were used on top of substrates to catch food and faeces where necessary (and to prevent future build up of pathogens) and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A3.8.4 Other

- Air filters were installed and run inside the rooms periodically.

A3.9 Environment provisions, modifications, and events with consequences

A3.9.1 Climate

- Heaters added to Room #1 and Room #2 (March).
- Heat lamps in use in rooms throughout 2013, turned off during hot weather.

A3.9.2 Light

- Windows were added to Room #1 and Room #2 to the wall joining the annexes to allow more natural sunlight (March).
- Luminaires were added to rooms and annexes (March).
- Light fixtures with 20 Watt light bulbs set up in both rooms as luminaires not adequate. Same light fixtures removed from inside and put outside as night light (May).

A3.9.3 Enclosure

- The inner aviary to An#1 was dismantled on completion of the new permanent outer aviary connecting the annexes to the polytunnels (March).
- Wires to open/close hatches between the rooms and annexes removed due to being a flying hazard (April).
- Pipe lagging added to taps in rooms to reduce the risk of collision injuries (October).
- UV filter for annexe ponds found off in October, likely off for some time.
- Guard put on the heat lamp fittings in the rooms (November).

A3.9.4 Habitat/substrate

- Trays of dry sand were added under some heat lamps to give the birds a dry area to roost (September).
- Salt added to room/annexe pond system sump (September, October).
- Began entering An#1 via An#2 (rather than through portal), birds appeared much calmer (September).

A3.9.5 Other

- Ground level CCTV cameras reinstalled (April).
- Bonfires close by caused smoke to linger in facility: 4 July and 24 October (birds shut inside).
- A live camera feed of the 2012 cohort was on air at the Global Bird Fair (August) .
- Talk on SBS in the WWT Slimbridge centre with live feed of 2012 cohort (September and December).

A3.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A40.

Table A40 – Number and type of visitor to the breeding facility: 2013

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan				4 (contractors for polytunnel construction)
Feb		2 (VIPs/visitors)	1 (external advisors)	3 (contractors for window instalment, electricians to look at electric supply)
Mar			1 (internal staff)	12 (contractors for plumbing, window instalment, electricians)
Apr		2 (external advisors, VIPs/visitors)		16 (contractors for window instalment, electricians, plumbers)
May			1 (external advisors)	2 (electricians, internal staff/maintenance)
Jun			1 (external advisors)	8 (contractors for polytunnel construction, electricians)
Jul		1 (VIPs/visitors)	1 (external advisors)	5 (contractors for polytunnel constructions, electricians)
Aug		1 (VIPs/visitors)		2 (contractors for polytunnel constructions, electricians,
Sep		1 (VIPs/visitors)		3 (contractors for polytunnel constructions, electricians)
Oct				
Nov			2 (external advisors)	
Dec		2 (internal staff, VIPs/visitor)	1 (external advisors)	

A4. 2014 Summary

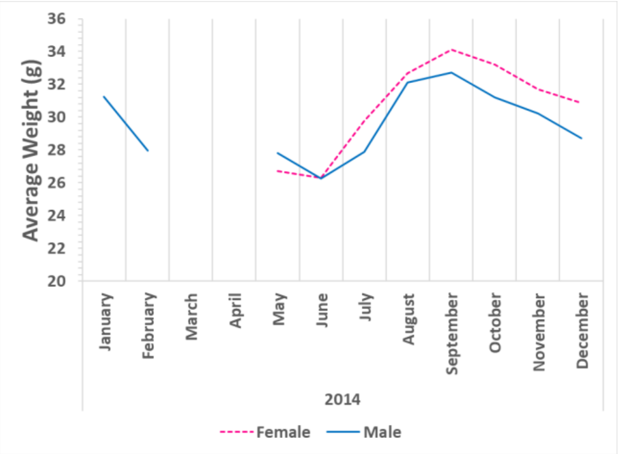
Table A41 – Individual records/deaths (all birds): 2014

SBS ID	Cohort	Sex	Deaths	Cause
RL	2011	M		
BlueL	2011	M		
WL	2011	M		
YL	2011	F		
PL	2011	F		
BlackL	2011	M		
RR	2011	M		
WR	2011	M		
BlueR	2011	M		
OR	2011	M		
PR	2011	M		
PWR	2012	F		
UNR	2012	M		
PBlueL	2012	M	21 Jan	Trauma
PWL	2012	F		
PBlueR	2012	M		
PYL	2012	F		
PPR	2012	F		
POL	2012	F		
PLGL	2012	F		
POR	2012	M		
PRL	2012	M		
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		

A4.1 Health

A4.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. No weights were taken in March or April, and very few weights taken in February; Figure A10 and Table A42. No weights taken from the 2011 cohort from January to April.



Note: Includes remote weights and in-hand, excludes death weights

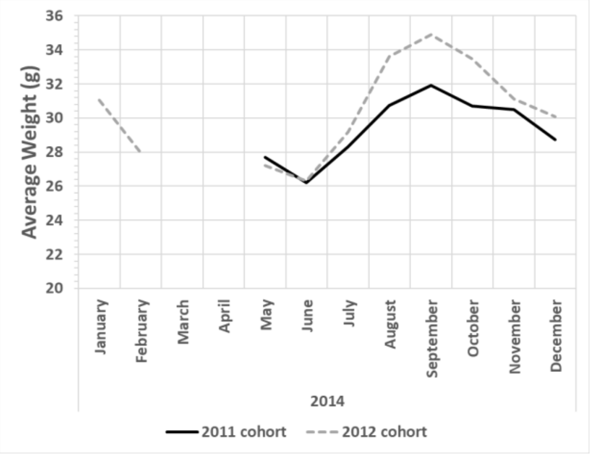
Figure A10 – Mean body weights of all birds: 2014

Table A42 – Number of individuals by sex (end of each month): 2014

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	16	16	16	16	16	16	16	16	16	16	16	16
Females	9	9	9	9	9	9	9	9	9	9	9	9

A4.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. No weights were taken in March or April, and very few weights taken in February; Figure A11 and Table A43. No weights taken from the 2011 cohort from January to April.



Note: Includes remote weights and in-hand, excludes death weights

Figure A11 –Mean body weights: 2011 and 2012 cohorts: 2014

Table A43 – Number of individuals by cohort (end of each month): 2014

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	11	11	11	11	11	11	11	11	11	11	11	11
2012	14	14	14	14	14	14	14	14	14	14	14	14

A4.1.3 Plumage assessment and moult score

A standardised moult scoring system was not developed until September 2014. However, plumage condition was regularly noted by staff between January to August, summarised monthly in Table A44. A moult scoring system (see Section 2.4.4.3 and Table 6) was used from September onwards, Table A45.

Table A44 – Summarised plumage related notes: all birds: 2014

Month	Summary	Plumage*
Jan	Both groups of birds continued to drop feathers throughout January. They remained mostly in winter plumage, with a couple of dark centred feathers coming through on the backs of a few birds, among the 2011 cohort in particular.	W→S
Feb	The birds remained mostly in winter plumage but continued to drop feathers and very slowly started to acquire a few dark-centred summer plumage feathers on their backs.	W→S
Mar	Many feathers dropped by both cohorts at end of the month, including one primary. 2011 cohort generally more advanced into summer plumage. All birds with at least one or two summer feathers.	W→S
Apr	All birds continue to moult into summer plumage. All at varying stages of moult.	W→S some in S
May	The majority of the birds had come in to either full or almost full summer plumage, with all of the birds possessing at least a few summer feathers.	W→S most in S
Jun	Began dropping summer feathers. Non-paired males from 2011 cohort dropping first.	S→W

		most in S
Jul	Feathers continued to be dropped. Winter plumage can be seen in all birds in varying degrees. Some still have a lot of summer plumage.	S→W some close to full W
Aug	Feathers continued to be dropped. Three birds in full winter plumage by the end of the month with most between a quarter to halfway into winter plumage.	S→W some in W

Note: * J = juvenile plumage; W = winter plumage; S = summer plumage; → = actively moulting

Table A45 – Moult scoring (last score of the month): 2014

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Sep (2)	1.0	3.5	6.0	4.0 (3.5:4.5)	3.0 (3.5:3.0)	3.5 (3.5:3.5)	3.5 (4.5:3.0)
Oct (2)	1.0	3.5	5.0	3.5 (3.0:3.5)	3.5 (3.0:3.5)	3.0 (3.0:3.0)	3.5 (3.5:3.5)
Nov (2)	1.0	2.5	4.0	3.0 (2.5:3.0)	2.5 (3.0:2.5)	2.5 (2.5:3.0)	3.0 (3.0:2.5)
Dec (2)	1.0	2.5	4.0	2.5 (2.0:3.0)	2.5 (2.5:2.5)	2.0 (2.0:2.5)	2.5 (3.0:2.5)

Notes:
Rounded to the nearest 0.5
Scores will differ slightly between scorers

A4.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table 46. Of approximately 131 cases of lameness (from both cohorts) none were treated. Those which needed additional care or had other symptoms are included in more detail in Section A4.1.5 & Tables A47 and A48.

Table A46 – Summary of lameness for each month: 2014

2011 cohort

Month	No. of birds: Present	Lame	Treated for lameness	Occurrence*
Jan	11	6		57
Feb	11	0	-	0
Mar	11	0	-	0
Apr	11	0	-	0
May	11	2	0	4
Jun	11	5	0	14
Jul	11	7	0	15
Aug	11	6	0	23
Sep	11	6	0	19
Oct	11	3	0	3
Nov	11	5	0	7
Dec	11	4	0	8
				Total: 150

2012 cohort

Month	No. of birds: Present	Lame	Treated for lameness	Occurrence*
Jan	14	13	0	13
Feb	14	9	0	30
Mar	14	2	0	6
Apr	14	0	-	0
May	14	0	-	0
Jun	14	6	0	9
Jul	14	12	0	24
Aug	14	13	0	55
Sep	14	9	0	24
Oct	14	8	0	28
Nov	14	9	0	27
Dec	14	6	0	11
				Total: 227

Note: * 1 = One day of one lame bird

A4.1.5 Afflictions/treatments

A mist net was used (for the first time) to catch birds being housed in P#2 on 26 June after the breeding season ended. Upon handling, bill lumps on the upper mandibles of three birds were discovered. Two more birds were observed with bill lumps on 28 June, neither of which had been caught with the mist nest. By 30 June, eight birds in total had bills lumps. Two additional birds were identified with bill lumps in July. The lumps remained largely unchanged for all throughout August and September. A new bill lump was discovered in November in a bird who previously exhibited them. The cause was undetermined so disinfection measures were increased to combat possible infection, and an inventory of plant species within the BAs was made and investigated for plants that may have caused the lumps. Eventually the lumps were deemed likely to be caused by trauma. The lumps did not appear to cause any discomfort or hinder the birds in any way. See Table A48 for individual examinations/treatments.

Table A47 – Group health checks/treatments: 2014

Cohort	Month	Treatment received
2012	Jan	All birds caught to check for injuries after PBL found dead unexpectedly after flight collision with a window. All birds weighed and foot condition checked. All birds also feather cut (see individual treatments below Table A48).
-	Jun	Birds in P#2 caught to move back to main flock in MA/P#1. Feet generally in good condition but topical anti-inflammatory and topical antibiotic ointment applied where needed.

Table A48 – Individual afflictions/treatments: 2014

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan PBL	None Found dead unexpectedly	Post-mortem and histology revealed no obvious causes of death. Fatal trauma	CCTV revealed flight collision with a window	**Found dead unexpectedly**	
Jan PPR	Feathers missing from forehead	Abrasion	Flight collision		Caught for examination -no treatment given. **No further symptoms**
Jan-Feb PPL	Blood on breast feathers Scab seen preened off, blood-stained chest, appeared thin, scruffy plumage (blood also found on walls of the room)	Surface wound to keel Prior surface wound to keel re-opening	Flight collision Possibly over preening wound, or further flight collision	Jan Caught for examination- Keel wound healing, scab formed. Given one off injection of antibiotic. Feb • Caught for examination- scab forming on keel. Given one off injection of antibiotic. Topical antibiotic ointment applied to wound site. All primary feathers cut. Also given course of oral antibiotic administered remotely. • Caught one week later for check-up- scab had formed which was removed to reveal dry skin underneath. No infection present. Topical antibiotic ointment applied. **Symptoms subsided**	
Jan PYL	Feathers missing from forehead, large lump on crown, blood on shoulder	Surface wound to keel and head	Flight collision	Caught for examination- Scab formed and removed by staff, skin healing well underneath. Cleaned with antimicrobial skin wash. New feathers growing on head. **Symptoms subsided**	
Jun BlueR BlackL POR	Lumps on upper mandible	Lumps on upper mandible	Unclear		During a catch to move birds, bill lumps were seen once in the hand. They varied in size, two were black as the rest of the bill and hard. One was paler with redness and softer. No treatment given but close observation ensued. Lumps didn't appear to cause any discomfort or inhibit normal behaviour.
Jun PRL RL PYR PDGR PWL	Lumps on upper mandible	Lumps on upper mandible	Unclear		More birds observed with bill lumps in the following day after initial observations. These included birds there were housed in P#1 during the breeding season as well as P#2. No treatment given, continued close observation.
Jul BlackL RR	Lumps on upper mandible	Lumps on upper mandible	Unclear		Caught for examination. Buccal swabs taken. Inside of bills inspected, both looked normal. Lump on bill on BlackL was aspirated and a swab taken. Results came back clear. No treatments given; close monitoring continued.
Jul PL PRR PYL WL BlueL BlueR BlackL OR RL	Lumps on upper mandible	Lumps on upper mandible	Possibly repeated trauma		All caught with a mist net and *caught* to assess bill lumps and investigate cause. All birds were examined thoroughly, and photos and sketches taken. Repeated trauma was deemed the most likely cause of the lumps and no further investigation was taken; birds appeared to remain unaffected by bill lumps. No treatments given and close monitoring continued.
Aug PWR	Reluctant to open eye, squinting	Unclear	Possibly foreign object effecting eye	Caught for examination as no improvement after two days since first symptoms. Third eye lid looked red. Eye flushed with dye to make scratches	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal) / No treatment received
				visible, but no scratches seen. Eye then flushed with saline and antibiotic eye drops given. **Eye appeared normal with no discomfort a few days later**
Sep PYL	Soiled/stained feathers near wing	Abrasions to wing	Likely flight collision	Caught for examination- began bleeding when caught, scab likely knocked off from catching. Antiseptic spray used on wounds. **No further bleeding, no further treatment required**
Oct YL	Closed eye, squinting, feathers distorted around eye	Possibly conjunctivitis	Unclear	Caught for examination- third eye lid appeared red. Eye flushed with dye but no scratches seen. Eye then flushed with saline and antibiotic eye drops given. Slight swelling above eye and abrasion on throat also seen on examination and deemed an old flight collision injury. **Intermittent symptoms**
Oct POR PPL RR	Closed eyes, squinting	Possibly conjunctivitis	Possibly spread from other birds	Similar symptoms to YL. None treated though closely monitored. **Symptoms cleared up over time**
Nov RL	Lump on bill	Unclear	Unclear	Didn't appear to be in any discomfort. No treatment but monitored closely.
Dec OR	White lump seen between inner and middle toe where they join foot, on top of foot	Unclear	Unclear	Lump rather large but didn't appear to cause any discomfort. No treatment or examination. Lump still present two weeks later (end of Dec)

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A4.2 Locality

A4.2.1 SBS facility configuration

Construction on the polytunnels began in early 2014; Figure A12. Further details in Section 2.1.2.

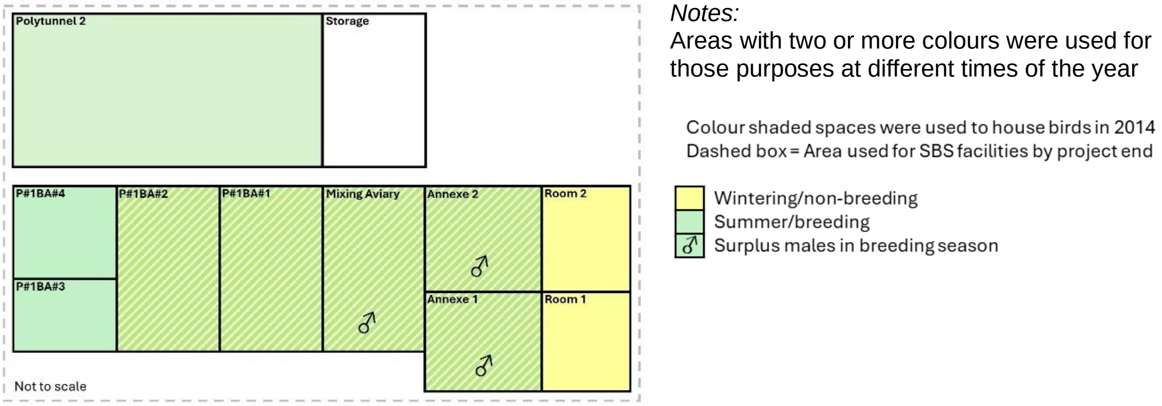


Figure A12 – SBS facility configuration: 2014

A4.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading.

January-February

- Throughout January and February each cohort had access to one room each with their adjoining annexes. 2011 cohort in room/An#1, 2012 cohort in room/An#2.

March

- From early March the cohorts were given access to the MA alternately in addition to the room/annexe they occupied. Occasionally denied access when contractors were working in the polytunnels. At the end of the month both cohorts were let into the MA simultaneously with pop-holes between the rooms opened as well. All birds had access to all these areas during overnights as well.

April

- 22: birds given access to P#1BA#1.
- 24: given access to P#1BA#2.
- 28: given access to P#1BA#3 and BA#4.

May

Following nest scraping by two birds (OR and PR) the birds were moved accordingly:

- 7: OR PR BlueR POL PL in P#1BA#3/4.
- 12: RL PRR in P#1BA#1; BlueL PPR in P#1BA#2; OR PR POL PL in P#1BA#3 and BA#4.
- 14: BlueR POR PDGR in P#2.
- 20: PWR PWL PYL added to P#2; AM WR in P#1BA#3; PM OR and WR in P#1BA#3; PM POL PL PR in P#1BA#4.

Surplus birds had access to the MA and annexes only.

June

- 3:
  - YL and WL moved to An#1.
  - PL moved o P#1BA#3 with OR and WR.

- The pop-hole between P#1BA#1 and BA#2 was opened from approximately 10:00 until 16:30, allowing the two pairs of birds located in those aviaries to mix and explore each other's aviaries.

- 5: BlackL and PLGL were moved to P#2.
- 10: OR was moved from P#1BA#3 and placed in the MA with the surplus males.
- 19: the birds living in P#1 and the annexes were allowed to mix.
- 26: the birds in P#2 were caught and moved to P#1 to join the main flock.

July

- All birds had access to the annexes, MA, and P#1BA#1 and BA#2. On hot days the birds were shut into the MA and annexes i.e. the coolest areas.

August-October

- All birds had access to the rooms, annexes, MA, and P#1BA#1 and BA#2.

November

- All birds had access to the rooms, annexes, MA, and P#1BA#1 and BA#2. Room #1 had an inner tent installed to make it safer for the birds.

December

- All birds had access to the rooms, annexes, MA, and P#1BA#1 and BA#2.

Occupancy of different rooms shown in Table A49.

Table A49 – Space occupancy: 2014

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1					13							
An#1					♂	3-19						
Room #2					13							
An#2					♂							
MA			5 5 25		♂							
P#1BA#1				22	12	19						
P#1BA#2				24	12	19						
P#1BA#3				28	7	19 23						
P#2BA#4				28	7	19 23						
P#2					14	26						

Notes:

2011 Cohort
2012 Cohort
Both cohorts after mixing in May

A4.3 Social network

A4.3.1 Introductions/departures/interactions

The cohorts were introduced to each other in the MA late March. There were a couple of aggressive encounters and some chasing between a few birds but they were also seen flocking together and roosting as one large group. As the breeding season approached, aggressive encounters increased in number and severity, as expected.

It doesn't appear the death of PBL affected the social dynamics of the flock.

A4.4 Breeding

This year the 2012 cohort came of breeding age; two years old/second summer.

Breeding behaviours were observed from early April with singing and increased aggression within the flock; Table A50. Some males began showing at least one female in the flock their attention, following her around the aviaries. Singing increased with males displaying on top of mounds within the BAs. Two nest scrapes were confirmed in early May from males OR and PR in P#1BA#1. The birds were moved into BAs the day after when extremely aggressive encounters were observed. Day light hours extended to 24 hours in line with the move to BAs. Intense fighting between males RL and BlueL was also observed before being separated into BAs. These observations contributed significantly to male selection and timing of pair separation for the breeding season.

Peak season was deemed to be around 16 May. Singing decreased from this point, no further song flights were observed, frog calling also ceased a few days later. Nest scraping was last observed on 20 May.

Recordings of wild SBS singing were played on 5 and 6 June. Some males aware and alert to calls but no other behaviours were induced.

When it was deemed the birds would not breed this year, birds housed in P#1 were allowed to mix from 19 June, and birds from P#2 moved with them on 26 June. High temperatures also played a part in the timing of moving birds, being extremely hot in the polytunnels.

Table A50 – Pairs: 2014

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Eggs	Significant observations/Notes
P#1BA #1	RL	✓	PRR		• Male nest scraping often. • Song flights and 'frog-calling' by male. • Female seen visiting a scrape and responding to males songs. • Pop-hole opened between BA#1 and BA#2 to mix birds to induce territorial behaviours (for one day) • Female seen investigating nest scrape and sitting in it, male observing close by.
P#1BA #2	BlueL	✓	PPR		• Song flights and 'frog-calling' by male. • Female seen in scrape several consecutive days until 16 May ('peak season'). Both seen adding nest material. • Activity decreased though male seen in scrape with females observing. • Pop-hole opened between BA#1 and BA#2 to mix birds to induce territorial behaviours (for one day). Induced some singing from BlueL. • Female seen in nest scrape early Jun.
P#1BA #3	OR (WR)	✓	-		• OR, PR, PL and POL initially housed together (minus WR) in BA#3/4. • WR added then split into a pair and a trio. • PR singing to females but no response. • PL moved to BA#3 to join WR and OR. • OR moved to MA with surplus males early Jun.
P#1BA #4	PR	✓	PL POL		
P#2	(moved in on 14 May): BlueR POR PDGR	✓	(moved in on 20 May): PWR PWL PYL		• Lots of singing from BlueR prior to females being added. • BlackL and PLGL added to P#2. • Recordings singing wild SBS played from the corridor. Males alert in response pacing at

	(moved in on 5 June): BlackL		(moved in on 5 June): PLGL		corridor partition temporarily, though none sang in return.
MA/annexe	WL RR UNR PBlueR PRL PYR YL PPL	WL ✓			• YL and WL shut into An#1, no breeding behaviours observed.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A4.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide the approximate temperatures required by the birds depending on time of year and health status. Thermo-hygrometers were used to collect data; Table A51.

Table A51 – Temperature data summary: 2014

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month	Max recorded in all occupied areas for that month
R1 Jan	13.6	16.0	16.0	17.8	21.0	9.4 (R2)	21.0 (R1)
R1 Feb	11.4	15.2	17.8	19.1	26.1	7.6 (R2)	26.2 (R1)
R1 Mar	9.3	16.8	18.0	20.6	30.4	7.6 (R2)	30.4 (R1)
R1 Apr	8.5	12.3	16.1	19.6	30.8	3.6 (MA)	30.8 (R1)
MA May	2.9	8.6	16.4	23.8	38.9	2.9 (MA)	40.5 (P#2)
MA Jun	7.2	11.2	21.7	31.8	39.4	5.8 (P#2)	48.3 (P#1BA#2)
MA Jul*	13.8	18.2	24.6	35.0	39.3	13.8 (MA)	39.9 (P#1BA#2)
MA Aug	10.2	15.3	19.3	23.4	39.1	10.2 (MA)	40.1 (P#1BA#2)
MA Sep	11.1	13.1	18.4	23.4	28.8	11.0 (An#2)	29.6 (P#1BA#2)
MA Oct	6.6	10.9	14.7	17.4	24.1	6.6 (MA)	24.1 (MA)
MA Nov	2.0	7.7	10.0	11.6	19.2	1.1 (P#1BA#2)	22.7 (An#2) **
MA Dec	-1.7	3.2	6.7	8.1	12.4	-1.8 (P#1BA#2)	12.9 (P#1BA#2) **

Notes:
* Data missing for most of Jul
** Though the birds had access to the rooms in the winter months there were no temperature loggers in these areas
Data used for R! (Room #1) from Jan to Apr and MA from May onwards

A4.6 Lighting and photoperiod

Figure A13 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it’s the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

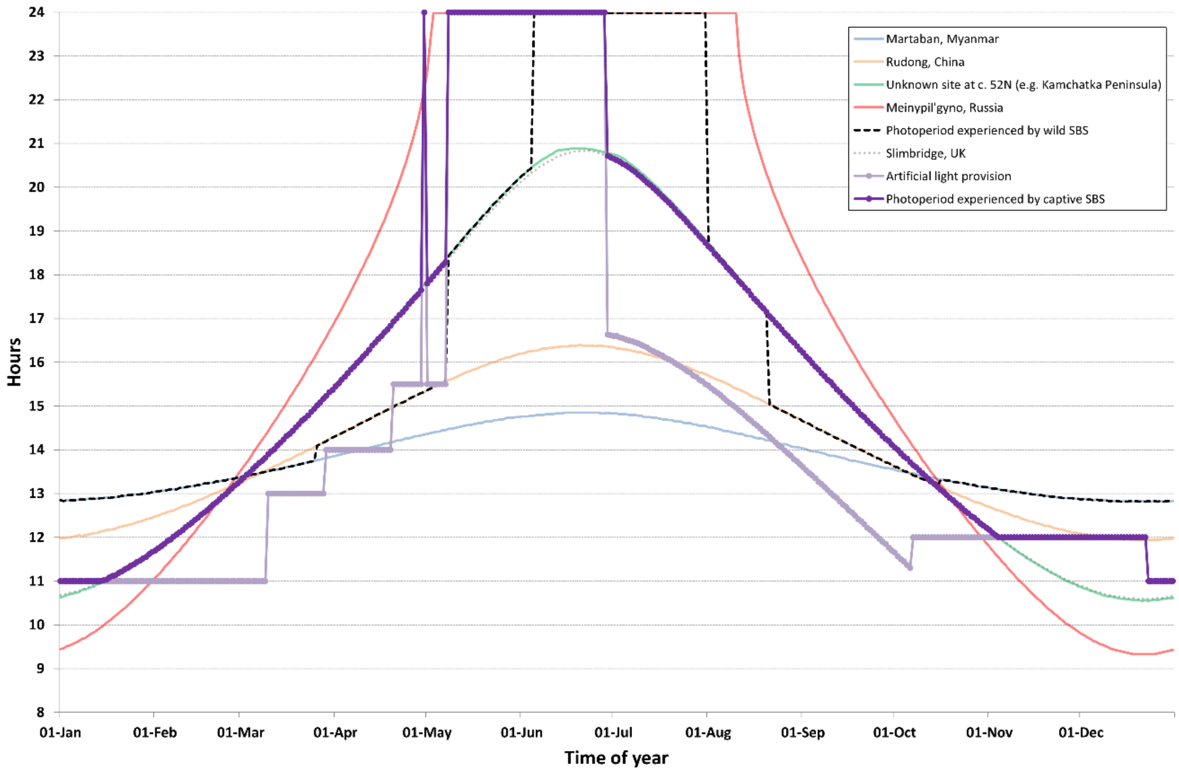


Figure A13 – Photoperiod wild SBS experience during the year based on location: 2014

A4.6.1 Photoperiod experienced by the captive SBS

The photoperiod experienced by the captive SBS largely followed the natural Slimbridge (UK) photoperiod. However, this year for the first time the birds were given 24 hours of light during the breeding season, this light was ambient in the corridor between the polytunnels. Leading up to the breeding season the birds experienced a gradual increase of light with the Slimbridge (UK) photoperiod. Breeding activity began very early this year based on cues from the birds; high aggression, singing, and nest scraping late April/early May, and so light hours were adjusted to this earlier start. This could have been due to UV lights being left on overnight mistakenly late April, triggering the birds into breeding early. Artificial lights were turned on purposefully 24 hours a day from 8 May and throughout the breeding season. The breeding season remained similar in length to that which wild SBS experience (approximately eight weeks) based on the behaviour of the birds, though ended earlier on 28 June given the early start. The photoperiod experienced then gradually decreased with the Slimbridge (UK) photoperiod until early November when they were provided with 12 hours a day of artificial light. This shortened to 11 hours from mid-December.

A4.6.2 Notes

The sudden changes in number of hours of artificial light occurred in part to simulate the migratory jumps in location of wild SBS, but also in part due to the rudimentary light timers initially installed.

A4.7 Diet and nutrition

Dishes were moved from being solely in the rooms to being in all occupied areas from April to encourage the birds to use the space.

Lundi micro 45 was reintroduced to the diet during the breeding season when the birds required a higher fat and protein diet. Insectivorous Feast and various invertebrates were also added during this period. Grit was always present including Oyster shell grit. Lundi micro 20 was introduced at the end of the year replacing in part Lundi micro 35 to lower the overall protein content of the diet over winter. Lundi was provided wet and dry; Table A52.

Table A52 – Food present/absent in diet: 2014

Food item/supplement***		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **35**	✓	✓	✓	75	66.6	60	75	87.5	✓	✓	✓	75
	Lundi micro **45**	X	X	X	25	33.3	40	25	12.5	↓	X	X	X
	Lundi micro **20**	X	X	X	X	X	X	X	X	X	X	X	25
Dried freshwater shrimp		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Live/frozen bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avimix (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avripro (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X**	X
Oyster shell grit		X	X	✓	✓	✓	✓	✓	X	X	X	X	X
Frozen Brine shrimp with spirulina		X	X	✓	✓	✓	✓	X	X	X	X	X	X
Insectivorous Feast		X	X	X	✓	✓	✓	X (to gut-load crickets only)	X	X	X	X	X
Frozen Brine shrimp		X	X	X	X	X	X	✓	X	X	X	X	✓
Live fruit flies		X	X	X	X	✓	✓	X	X	X	X	X	X
Live/frozen Artemia		X	X	X	X	✓	✓	X	X	X	X	X	X
Frozen Rotifers		X	X	X	X	✓	✓	X	X	X	X	X	X
Frozen red plankton		X	X	X	X	✓	✓	X	X	X	X	X	X
Live Daphnia		X	X	X	X	✓	X	X	X	X	X	X	X
Guardian Angel supplement		X	X	to crickets	to crickets	X	X	X	X	X	X	X	X
Feather-up supplement		to crickets	to crickets	to crickets	to crickets	X	X	X	X	X	X	X	X

Notes:
* Salt water only provided in BAs if foot condition was poor
** Removed on nutritionists advice
*** Most frequently provided items to least

✓	Present in diet
↓	Gradually decreasing
	Present for 2012 cohort
X	Absent from diet

A4.8 Sanitation

A4.8.1 Water systems

- When in use, saltwater ponds in each room were cleaned approximately every three days and the annexe ponds once a week. The sump and filter for the room/annexe pond system was cleaned approximately once a fortnight. From first use in March, the MA pond and breeding aviary ponds were cleaned once a day when in use.

A4.8.2 Substrates

- Sand in the rooms and annexes were regularly watered with salt water and disinfectant solution.
- Between January and March patches of sand in the rooms were replaced regularly. It was completely removed in May from rooms to be used for incubation and rearing.
- Sand in the MA pond rinsed through in June, July, and partially replaced in November.
- Sand in An#1 pond was replaced in August and rinsed thoroughly in November.

A4.8.3 Biosecurity

- The rooms were also fogged with disinfectant solution regularly whilst in use.
- Towels in various occupied aviaries were soaked in antiseptic solution when foot issues arose. Any saltwater trays were cleaned approximately once a week.
- Occupied areas were serviced at least once a day.

A4.9 Environment provisions, modifications, and events with consequences

A4.9.1 Climate

- Two heaters were fitted in Room #1 (March).
- Ice and fresh water regularly added to the sump in the polytunnel corridor in an attempt to cool water in the breeding aviary ponds during hot weather (April onwards).
- Once the breeding season was over and the birds mixed in P#1 as a single flock, during times of extremely high temperatures they were confined to the MA and annexes (July onwards).

A4.9.2 Light

- UV lights in aviaries found to be staying on due to faulty timers (April).
- Light added at the near end of the polytunnel corridor leading up to breeding season, and a spotlight added to the far end of the corridor turned. Both turned on/off manually (April).
- UV lights switched off in rooms as thought to be flickering (November).

A4.9.3 Enclosure

- White sticky-back plastic used to cover all windows between rooms and annexes to replace the frosted glass effect in an attempt to remove all light transmission to stop window collisions. Pipe lagging was also added around the edges of the windows to reduce injury risk. This was done soon after PBL was found dead after colliding with a window (January).
- Partitions were erected in P#1 and P#2 to segregate into BAs. Sand and turf were also added to landscape the aviaries and sedum added to mimic breeding habitat (February-April).

- Fine black mesh sewn along edges of each aviary in P#1 including the MA to reduce the risk of flying injuries (July-August).
- The partition between P#1BA#3 and BA#4 was taken down, birds appeared not to settle in this set up (July).
- The P#2 storage area was cleared and surplus items were stored in the Crane shed, so that ponds could be constructed, and panels erected to create an additional breeding aviary (October).
- A tent erected inside Room #1 (only) to make it safer for the birds. Air filters also added to the outside of the tent (November).
- Green shade netting gradually replaced with half-inch nylon netting to improve lighting and airflow (December onwards).

A4.9.4 Substrate/habitat

- Trays filled with dry sand were placed in each of the corners under the heat lamps to provide dry areas to stand and roost (February).
- Turf in MA removed due to snow mould coverage (April).
- Sand and turf added to P#2 and landscaped, sedum also added (April).
- Salt water used in MA pond from early April, at approximately sea water salinity. Salt water in this pond was used periodically through the year when the birds appeared to be having foot issues (April onwards).
- Turf and sedum added to annexes (May).
- Turf and sedum in the annexes was removed and placed in a breeding aviary (July).
- Saltwater trays placed in pop-holes between the MA and the annexes to help foot issues (July).

A4.9.5 Other

- Smoke lingering in aviaries up to seven days after bonfires in nearby horticultural areas: 14 January, 15 March, 12 July and 1 August.
- Mouse activity in P#2 (January).
- New hairnets used from April.
- CCTV cameras fitted (April).
- Heavy storm caused gutter water to enter facility, affected area treated with disinfectant solution (August).
- Poison mouse excrement found in bird occupied areas. All poison and bait boxes removed from nearby areas and staff vigilant for further contamination (October).
- Gulls pecking holes in roofing polythene. Scare-kite put up to deter them (October).

A4.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A53.

Table A53 – Number and type of visitor to the breeding facility: 2014

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan	1 (VIPs/visitors)	1 (sponsors)	1 (VIPs/visitors)	
Feb	1 (VIPs/visitors)	2 (external advisors)		
Mar				4 (contractors fitting cables, sumps, and heaters)
Apr	2 (VIPs/visitors)		1 (external advisors)	4 (maintenance/contractors fitting CCTV, and replacement pond)
May		3 (VIPs/visitors)	1 (external advisors)	2 (contractors fixing light timers, installing fire alarms)
Jun		1 (internal staff)	4 (external advisors, internal staff)	2 (contractors installing fire alarms)
Jul			1 (internal staff)	2 (contractors checking fire alarms, fixing timer switches, quote for fitting ceiling fans in polytunnels)
Aug	1 (external advisors)	2 (VIPS/visitors)	2 (internal staff)	1 (contractors to quote for new light fittings)
Sep			2 (internal staff, external advisors)	4 (contractors to quote for new light fittings, developing inside tent, developing light setup, and maintenance checking fire alarms)
Oct		2 (internal staff, external advisor)		
Nov	2 (external advisors, VIPS/visitor)			2 (contractors to discuss lighting)
Dec		1 (external advisors)	1 (external advisors)	

A5. 2015 Summary

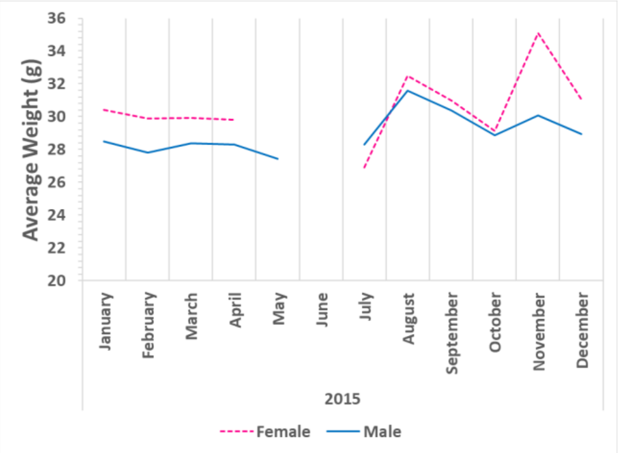
Table A54 – Individual records/deaths (all birds): 2015

SBS ID	Cohort	Sex	Deaths	Cause
RL	**2011**	M		
BlueL	**2011**	M		
WL	**2011**	M		
YL	**2011**	F	27 Oct	Trauma
PL	**2011**	F		
BlackL	**2011**	M		
RR	**2011**	M		
WR	**2011**	M		
BlueR	**2011**	M		
OR	**2011**	M		
PR	**2011**	M		
PWR	2012	F		
UNR	2012	M		
PWL	2012	F		
PBlueR	2012	M		
PYL	2012	F	21 Jan	Possible trauma
PPR	2012	F		
POL	2012	F		
PLGL	2012	F		
POR	2012	M		
PRL	2012	M		
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		
PYR	2012	M		

A5.1 Health

A5.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. Few weights were taken in May and none in June to avoid disturbance during the breeding season; Figure A14 and Table A55.



Note: Includes remote weights and in-hand, excludes death weights

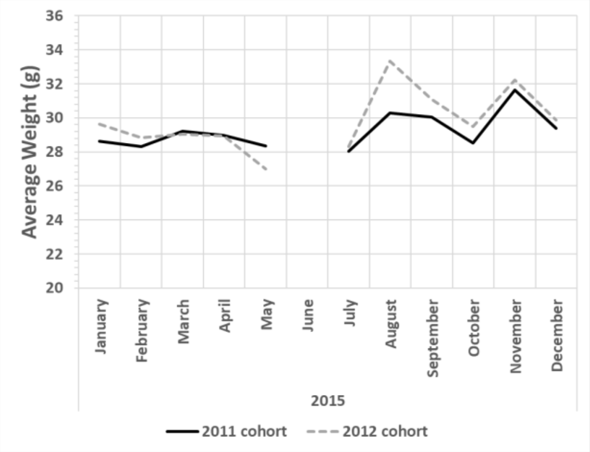
Figure A14 –Mean body weights of all birds: 2015

Table A55 – Number of individuals by sex (end of each month): 2015

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	16	16	16	16	16	16	16	16	16	16	16	16
Females	8	8	8	8	8	8	8	8	8	7	7	7

A5.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. Few weights were taken in May and none in June to avoid disturbance during the breeding season; Figure A15 and Table A56.



Note: Includes remote weights and in-hand, excludes death weights

Figure A15 – Mean body weights: 2011 and 2012 cohorts: 2015

Table A56 – Number of individuals by cohort (end of each month): 2015

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	11	11	11	11	11	11	11	11	11	10	10	10
2012	13	13	13	13	13	13	13	13	13	13	13	13

A5.1.3 Moult scoring

Assessment of moult scores; Table A57.

Table A57 – Moult scoring (last score of the month): 2015

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Jan (2)	1.0	2.5	4.0	2.5 (2.0:3.0)	2.5 (3.0:2.5)	2.0 (2.0:3.0)	2.5 (3.0:2.5)
Feb (2)	1.0	2.5	4.0	2.5 (2.0:3.0)	2.5 (3.0:2.5)	2.0 (2.0:3.0)	2.5 (3.0:2.5)
Mar (3)	1.0	2.5	3.5	2.5 (2.5:2.5)	2.5 (2.5:2.5)	2.5 (2.5:2.5)	2.5 (2.5:2.5)
Apr (4)	2.0	4.0	6.0	4.5 (5.0:3.5)	3.5 (4.5:3.5)	5.0 (5.0:4.5)	3.5 (3.5:3.5)
May (4*)	3.0	5.5	7.0	6.0 (6.5:5.0)	5.0 (6.0:5.0)	6.5 (6.5:6.0)	5.0 (5.0:5.0)
Jun (2**)	-	-	-	-	-	-	-
Jul (2)	3.0	4.5	6.0	5.0 (5.5:4.5)	4.0 (4.5:3.5)	5.0 (5.5:4.5)	4.0 (4.5:3.5)
Aug (5)	1.0	3.5	5.0	4.0 (3.5:4.0)	2.5 (3.0:2.5)	3.5 (3.5:3.0)	3.0 (4.0:2.5)
Sep (4)	1.0	2.5	5.5	3.0 (2.5:4.0)	1.5 (2.0:1.5)	2.5 (2.5:2.0)	3.0 (4.0:1.5)
Oct (4)	1.0	2.0	4.5	2.5 (2.0:3.5)	1.5 (1.5:1.5)	2.0 (2.0:1.5)	2.5 (3.5:1.5)
Nov (5)	1.0	1.5	3.0	2.0 (1.5:2.0)	1.5 (1.0:1.5)	1.5 (1.5:1.0)	1.5 (2.0:1.5)
Dec (4)	1.0	1.5	3.0	1.5 (1.5:1.5)	1.0 (1.0:1.0)	1.5 (1.5:1.0)	1.5 (1.5:1.0)

Notes:
* The birds in BAs were only moult scored once in May, this score was used for averages in May
** Moult scores were only taken for surplus males so averages not calculated
Some variation between score takers
Rounded to the nearest 0.5

A5.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A58. Of approximately 111 cases of lameness this year 5% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A5.1.5 and Table A59.

Table A58 – Summary of lameness for each month: 2015

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	24-25	11	0	32
Feb	24	15	1	43
Mar	24	8	1	31
Apr	24	9	0	22
May	24	6	0	13
Jun	24	9	0	23
Jul	24	17	0	53
Aug	24	8	0	26
Sep	24	11	1	25
Oct	23-24	6	1	23
Nov	23	4	1	38
Dec	23	7	1	22
				Total: 351

Note: * 1 = One day of one lame bird

A5.1.5 Afflictions/treatments

- Some green faeces observed in May.
- Some blood found on wall/substrate in November likely from a flight collision.

Table A59 – Individual afflictions/treatments: 2015

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan OR	White lump on top of foot Large facial injury close to eye, possibly eye damage	Infection turned granuloma Trauma	Unclear Likely flight collision injury	Caught for examination -lump first seen in Dec 2014, no improvement seen. Lump squeezed, swab and slide samples taken. Laboratory results showed it was likely to have been an infection which settled into a granuloma. Small lump also found of bottom on foot. Given injection of antibiotic, antiseptic spray and topical antibiotic applied. **Symptoms subsided** Caught for examination -significant weight loss from previous day. Large cut at back of eye displacing eyelid across back of eye. Eye was present but unclear what damage had been done. Appeared able to move eye in socket and blink eyelid to some extent. Wound flushed with saline and antibiotic eye drops applied. Given injection of anti-inflammatory and antibiotic, also started on course of oral anti-inflammatory administered remotely. **Symptoms subsided**	
Jan WL	Preen gland appears to be causing discomfort	Infected preen gland	Unclear	Caught for examination -preen gland very swollen, some feathers around it removed. Purulent content squeezed from the gland, likely crystalised preen oil. Given an injection of antibiotic. **Symptoms continued** Started course of oral antibiotic administered remotely. **Symptoms subsided**	
Jan-Feb YL	Closing eye for prolonged periods, squinting, head shaking	Possibly conjunctivitis	Unclear	Jan Caught for examination -Ophthalmoscope used to exam eye, no scratches, ulcers, or redness seen. Appeared tender around eye area. Swab and faecal sample taken, both came back clear. Eye flushed with saline and antibiotic eye drops applied. **Symptoms continued** Started on course of oral anti-inflammatory administered remotely. **Symptoms continued** Feb Started a course of oral antibiotic administered remotely. **Symptoms continued** Course of a different oral antibiotic and oral anti-inflammatory started, administered remotely. **Symptoms continued then worsened** Treatment ceased for a few days then another course of oral anti-inflammatory administered remotely. **Symptoms lessened but still present**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal) / No treatment received
Jan PYL	Found dead unexpectedly	Post-mortem, microbiology and histology were unable to identify cause of death. Suspected fatal trauma	-	**Found dead unexpectedly.** Found on her back with lots of sand on head/face. Trauma was most likely the cause.
Feb-Apr PYR	Intermittent worsening limp	Open cracks on feet and toes	Unclear, possibly stressors, possibly amyloidosis	Feb Caught for examination -cracks treated with topical antibiotic and anti-inflammatory ointment. **Symptoms continued** Mar Caught for examination -large open crack still present and callus also present. Topical antibiotic and anti-inflammatory ointment applied and given antibiotic injection. **Intermittent symptoms** Apr Couse of oral antibiotic injected into Waxworms administered remotely. **Intermittent symptoms**
Feb POL	Blood-stained feathers on one side of body	Growing feather quill damaged	Likely flight collision	Caught for examination -topical antibiotic ointment applied to wound. **No further treatment needed**
Feb WR	Greasy un-kempt plumage	Infected preen gland	Unclear	Caught for examination -several feathers plucked from gland area. Gland generally looked less swollen and inflamed than when previously caught. Given an antibiotic injection. **Intermittent symptoms**
Apr PRL	Small cut seen underneath eye, third eye lid partially covering eye	Small facial cut	Likely flight collision	Caught for examination -face swollen around wound, washed with saline. Given antibiotic injection and oral anti-inflammatory given in corner of mouth. **Wound fully healed within a few days**
Apr PWL	None	Swollen/bulbous toe	Possible infection	During the birds catch to move PWL into a BA her swollen toes were noticed. Nail was missing with possible purulent content. Given an antibiotic injection. **No symptoms seen but continued to monitor**
May PWL	Blood-stained feathers on side of body	Damaged primaries	Likely flight collision	Caught for examination -outer two primaries damaged, cleaned with antimicrobial cleanser and surgical spirit. **No further symptoms**
May PR	Yellow material observed inside nostrils	Unclear	Unclear	No treatment given, continued monitoring. Saltwater bath given in hope to clear nares
Jul YL	Damp/matted feathers around eye, squinting often	Unclear	Unclear	Caught for examination -eye weeping excessively, possible swelling/lump seen close to eye visible when blinking. Eye flushed with saline, injected with an anti-inflammatory. **Symptoms continued**

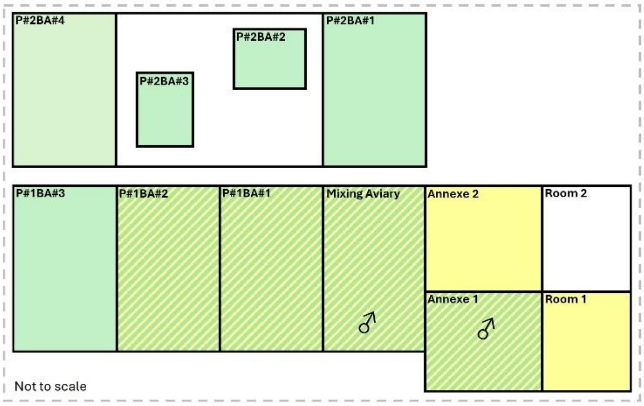
Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Aug PYR	Bill lump observed on upper mandible	Unclear	Unclear		Lump appeared pale in centre, didn't appear to be causing any discomfort. No treatment given, monitored closely.
Aug UNR	Severe limp	Unclear. Possibly historical foot issues, possibly amyloidosis	Unclear, possibly stressors		Severe limp thought to be due to old affliction (white lump on top on foot had since subsided partly). No treatment given, monitored closely.
Sep PLGL	Severe limp, cracks on feet visible remotely	Cracked feet	Unclear, possibly stressors	Given course of oral antibiotic and oral anti-inflammatory administered remotely. **Symptoms ceased by treatment end**	
Oct PYR	Severe limp, swelling on sole of foot visible, odd gait	Calluses/bumble foot	Unclear, possibly stressors	Caught for examination -callus appeared red and possibly infected, also felt warm. Deep cracks but healed. Lots of furrowing and thickening on sole of foot. Given antibiotic injection and anti-inflammatory injection. Topical anti-inflammatory ointment and anti-septic spray applied to feet. **Symptoms subsided**	
Oct YL	None. Found dead unexpectedly	Post-mortem and histology revealed no obvious causes of death. Suspected fatal trauma	It was not possible to see any collision incident using CCTV footage, however, prior to death (approx. 02:00) she appeared very uncoordinated and could be seen convulsing in the same position she was found in	**Found dead unexpectedly**	
Nov WL	Extremely swollen leg joint and foot, not weight bearing Limping, swollen toe joint, discomfort when walking	Unclear, possibly amyloidosis Severe cracks on toes	Possibly connected to moult, stressors	Nov • Caught for examination -in addition to swelling a small wound was found behind metal ring. Given antibiotic injection and anti-inflammatory injection. Also started course of oral anti-inflammatory treatment administered remotely. • After **little improvement observed** he was started on a course of two different oral antibiotic treatments administered remotely. **Intermittent symptoms** Dec Caught for examination -middle toes came off when caught, appeared another toe would come away soon as well. Cracks looked clean. Silver nitrate pen used to seal wounds. Given antibiotic injection and started course of oral antibiotic and oral anti-inflammatory administered remotely. **Symptoms intermittent, most toes now missing**	

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A5.2 Locality

A5.2.1 SBS facility configuration

See Figure A16. Further details in Section 2.1.2.



Notes:

- P#2 aviary labels vary annually
- Areas with two or more colours were used for those purposes at different times of the year

Colour shaded spaces were used to house birds in 2015
Dashed box = Area used for SBS facilities by project end

Wintering/non-breeding
Summer/breeding
♂ Surplus males in breeding season

Figure A16 – SBS facility configuration: 2015

A5.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A60.

January

- Continued to have access to Room #1, An#1, MA and P#1BA#1 and BA#2. 16-22 January birds shut out of P#1BA#1 and BA#2 due to back flow of ground water through the drains into the breeding aviary water system sump.
- Birds shut out of An#2 and Room #2 on 27 January following the death of PYL thought to have died from a flight collision and the serious facial injury obtained by OR also thought to have been from a flight collision. As well as reducing flight collision risk this was done to also encourage the birds to use the warmer room.

February

- Birds shut out of BA#2 so partition between BA#2 and BA#3 could be re-hung to allow both pop-holes to be used. Continued to have access to Room #1, An#1, MA and P#1BA#1.

March

- Bird continued to live in Room #1, An#1, MA and P#1BA#1.
- From the 11 to 14 March the birds were shut out of BA#1 to allow a ceiling fan to be fitted, and the net to be sewn back together.

April

- 29: Nine birds caught to move in BAs of P#2:
    - P#2BA#1 PR PWL POL.
    - P#2BA#2 BlueR PWR.
    - P#2BA#3 RR YL.
    - P#2BA#4 PDGR PLGL.
- 30 : Rest of birds walked into aviaries:
    - P#1BA#1 RL PRR.
    - P#1BA#2 BlueL PPR.
    - P#1BA#3 BlackL PL.

- MA/An#1 surplus males.

May

- 5: PWL moved from trio in P#2BA#1 to MA/An#1 with the surplus males. It was suspected that she was likely disrupting the pair that remained, they were displaying flock-like behaviours until this point, so she was removed (no other BAs available to form another pair using her).

June

- PRR swapped with POL on 22 June. PRR thought to be in better condition so swapped to be with the male with highest activity.

July

- 8: All birds put back in the wintering areas comprising An#1, MA and P#1BA#1.

August

- All birds had access to An#1, MA, and P#1BA#1. Birds shut out of P#1BA#1 temporarily while cleaning and vegetation management took place.

September

- All birds had access to An#1, MA, and P#1BA#1. Given access to P#1BA#2 on 29 September and denied access to An#1 and MA from 30 September while LED flood lights were installed in the MA.

October

- All birds initially had access to An#1, MA, P#1BA#1, and BA#2. The birds were denied access from An#1 between 14 and 16 October for lights to be fitted here. They were shut out of P#1BA#2 on 20 October and BA#1 on 22 October.

November

- All birds had access to the MA and An#1. On 8 November they were given access to Room #1.

December

- All birds had access to the MA, An#1 and Room #1.

Table A60 – Space occupancy: 2015

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1											8	
An#1				♂	♂	♂	8					
Room #2												
An#2	27											
MA				♂	♂	♂	8					
P#1BA#1				30			8			22		
P#1BA#2		10		30			8		29	20		
P#1BA#3				30			8					
P#2BA#1				29			8					
P#2BA#2				29			8					
P#2BA#3				29			8					
P#2BA#4				29			8					

Notes:

Wintering/non-breeding

Summer/breeding

A5.3 Social network

A5.3.1 Introductions/departures/interactions

It is unclear whether the deaths within the flock affected the social dynamics when they occurred. No observable interactions were noted.

A5.4 Breeding

Breeding activity appeared to begin slowly with a few songs in late April; Table A61.

The birds were moved into BAs on 29 and 30 April. Most observation work was conducted through the CCTV cameras installed in the aviaries, so although there were many songs it was not possible to identify from which individual. The CCTV meant staff could also note breeding activity which occurred outside of usual working hours. Pairs with high activity could be gauged approximately and the location of nest scrapes determined without disturbance. Staff presence/disturbance in aviaries was reduced to an absolute minimum.

There was no consistency to time of day that highest activity occurred. Peak season was deemed to be around the end of May with activity dropping gradually soon after.

No eggs were laid this year. All activity appeared to cease mid-June.

Table A61 – Pairs: 2015

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Significant observations/Notes
P#1BA#1	RL	2	PRR (POL)	• Some initial singing from RL, also seen chasing PRR though no response observed. • PRR swapped with POL on 22 Jun. PRR thought to be in better condition so swapped to be with male with highest activity.
P#1BA#2	BlueL	2	PPR	• Appeared to actively choose to be close to PPR prior to being moved to the BAs. • PPR appeared to have sustained a keel injury, likely from a flight collision. • Nest scrape found on 26 May.
P#1BA#3	BlackL		PL	• PL didn't appear to settle well in the BA initially, though settled down after a few days. • BlackL seen chasing PL off a food resource (bloodworms fed once a day), seen feeding together at a different resource later. • PL acting in a secretive manor, running away in tall grass and alongside of aviary in early Jun.
P#2BA#1	PR	5	POL (PWL) (PRR)	• PWL moved to MA/An#1 on 5 May, the less suitable female. • PR aggressively chasing POL away from a food resource (crickets fed once a day). • Nest scrapes found 30 May and 13 Jun. • PR continued singing after most other males ceased. • PRR swapped with POL on 22 Jun. PRR thought to be in better condition so swapped to be with male with highest activity.
P#2BA#2	BlueR		PWR	• PWR has some foot issues causing discomfort prior to being moved into a breeding aviary. • BlueR seen frog calling end of May. • PWR possibly sustained a keel injury end of May, likely from a flight collision.

P#2BA#3	RR	1	YL	• No noted breeding behaviours from this pair.
P#2BA#4	PDGR		PLGL	• PDGR seen singing soon after moving into a BA, though little definite activity through the rest of the season. • Pair seen roosting together mid-May. • Possible flight collision injury for PLGL end of May.
MA	POR PPL PRL WR UNR PYR WL OR PBlueR		PWL	• POR dominant bird early in season while housed with other surplus males, lots of aggression over resources and singing. • Some aggressive behaviour from PPL. • Possible flight collision injury for PWL end of May.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A5.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide the approximate temperatures required by the birds depending on time of year and health status; Table A62. From January to October a thermo-hygrometer was used to collect the data, and from November onwards a temperature logger button used. Data is from the MA (most frequently occupied aviary).

Table A62 – Temperature data summary: 2015

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month	Max recorded in all occupied areas for that month
Jan	-0.9	3.1	6.1	8.1	12.4	-2.7 (P#1BA#2)	16.0 (Room #1)
Feb	0.2	2.5	5.7	7.2	11.7	0.0 (An#1, P#1BA#1/2)	16.2 (Room #1)
Mar	3.3	5.8	8.8	11.3	15.5	3.1 (An#1)	16.2 (Room #1)
Apr	2.8	7.8	13.5	19.1	25.1	2.8 (MA)	25.1 (MA)
May	8.7	11.9	16.4	20.8	27.5	7.2 (P#1BA#1)	32.9 (P#2)
Jun	10.4	14.2	20.1	24.5	33.5	10.0 (MA)	42.0 (P#2)
Jul	11.6	16.0	21.2	22.0	33.5	11.9 (An#1)	39.8 (MA)
Aug	10.1	14.3	18.6	21.7	31.2	10.1 (MA)	31.5 (MA)
Sep	7.0	11.0	15.9	21.1	24.3	7.0 (MA and P#1BA#1)	25.2 (P#1BA#1)
Oct	4.1	9.5	13.9	17.3	23.5	4.1 (MA)	22.8 (MA)
Nov*	0.5	5.3	7.6	10.9	15.5	1.0 (MA, An#1)	17.4 (MA)***
Dec**	4.0	7.8	10.0	12.3	22.0	3.0 (An#1)	14.2 (An#1)***

Notes:
* 4-30 Nov
** 1-25 Dec
*** Birds had access to Room #1 in Nov and Dec but no temperature loggers were placed here

A5.6 Lighting and photoperiod

Figure A17 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

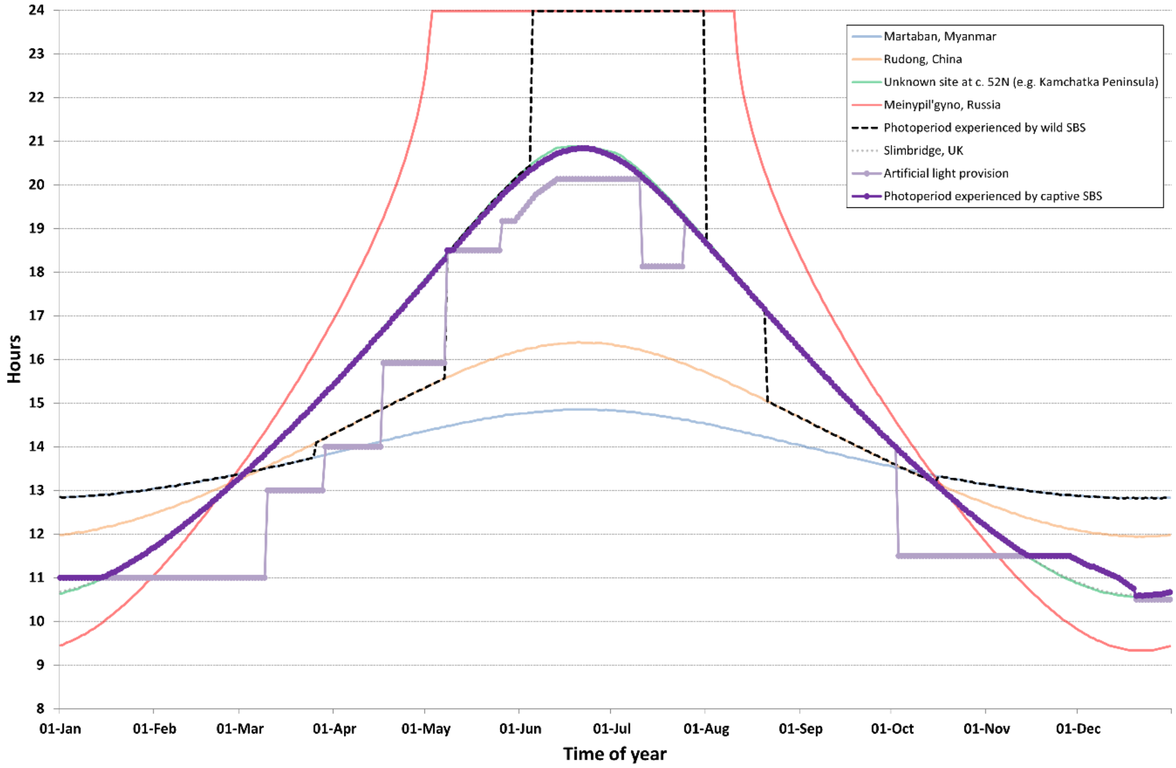


Figure A17 – Photoperiod wild SBS experience during the year based on location: 2015

A5.6.1 Photoperiod experienced by the captive SBS

This year the birds experienced a photoperiod more or less equivalent to Slimbridge (UK). They were not given 24 hours of light during the breeding season (Section A5.6.2) as they received in 2014. Number of light hours peaked again for one day at summer solstice and gradually decreased again with the Slimbridge (UK) photoperiod. In November they were briefly held at 11.5 hours of artificial lighting before gradually decreasing until reaching the Slimbridge (UK) photoperiod.

A5.6.2 Notes

The sudden changes in number of hours of artificial light occurred in part to simulate the migratory jumps in location of wild SBS, but also in part due to the rudimentary light timers initially installed. New computer controlled light timers and information cables were installed in October 2015 which allowed transitions of light hours to be much smoother where appropriate. These were also capable of fading the lights on and off rather than a sudden switch.

Unfortunately (see also for 2017) no evidence could be found to confirm that the 24-hour light was turned on for the breeding season. Hence, Figure A17 represents photoperiod provided by other lights in the facility; if the 24-hour light was indeed turned on, the pale and dark purple lines would follow the black dashed line (photoperiod experienced by wild SBS).

A5.7 Diet and nutrition

In January, dried shrimp was reduced as the birds were not eating it. Lundi micro 35 was increased and Lundi micro 20 decreased because the birds were eating less but not maintaining weight in the cold weather. Lundi micro 45 was reintroduced soon after and throughout the breeding season; Table A63.

An experiment was also conducted to see if the birds had a preference and could tell the difference between Lundi micro 35 and Lundi micro 25. The conclusion was that generally they had no preference.

Dried shrimp was reduced again in February to try and reduce ‘treat’ foods prior to the breeding season in order to give them a boost as they enter the breeding season a few weeks’ later. The milder weather allowed this change without concerns of birds losing condition.

Lundi was provided dry only. Grit always present, oyster shell grit in breeding season only.

Table A63 – Food present/absent in diet: 2015

Food item/supplement**		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **45**	50	80	60	50	50	66	50	↑	100	100	100	100
	Lundi micro **35**	X	X	40	50	50	33	50	↓	0	0	0	0
	Lundi micro **20**	50	20	0	0	0	0	0	0	0	0	0	0
Dried freshwater shrimp		↓	↓	↑	✓	↓	↓	↑	✓	↑	✓	✓	✓
Live crickets (brown/black)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live/frozen bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avimix (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oyster shell grit		X	X	X	✓	✓	✓	X	X	X	X	X	X
Frozen Brine shrimp		✓	X	X	X	X	X	✓	X	X	X	X	✓
Insectivorous Feast		X	X	X	✓	X	X	X	X	X	X	X	X
Avripro (on dry food)		X	✓	X	X	X	X	X	X	X	X	X	X
Live Wax worms		X	X	X	✓ for meds	X	X	X	X	X	X	X	X
Live mealworms		✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds	✓ for meds

Notes:
* Salt water only provided in BAs if foot condition is poor
** Most frequently provided items to least

✓	Present in diet
↑	Increasing that month
↓	Decreasing that month
	Present for certain birds
X	Absent from diet

A5.8 Sanitation

A5.8.1 Water systems

- Both sumps and filters for the pond systems within the facility were cleaned approximately once a fortnight. The MA pond and P#1 ponds were cleaned approximately every other day and the annexe ponds were cleaned approximately once a week from January-May, then every 4-5 days from April, every three days from December. The small saltwater ponds in the MA were cleaned approximately once a fortnight from January-May, then once a week from April.
- Small ponds in BAs not cleaned when birds were paired for the breeding season.

A5.8.2 Substrates

- Sand changed in small breeding aviary ponds in February and July.
- Sand in the MA pond was replaced in July.
- Sand in An#1 pond replaced in August and October.

A5.8.3 Biosecurity

- Air filters in Room #1 were cleaned regularly.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.
- During replacement of annexe lights, inner netting was vacuumed to remove as much accumulated dust/debris as possible (October).

A5.9 Environment provisions, modifications, and events with consequences

A5.9.1 Climate

- Two heaters and soil cables under the sand were added to Room #1 due to cold weather (January).
- All original green shade cloth fitted internally and externally of the facility replaced with 19mm knotted nylon mesh for better air flow, light transmission and to allow natural weather in. Note this cloth was not accessible to birds (January).
- All ceiling fans installed in P#1 (March).
- Ice and fresh water regularly added to the sump in the polytunnel corridor in an attempt to cool water in BA ponds during periods of hot weather (April onwards).

A5.9.2 Light

- Philips luminaires containing 'Truelight' bulbs fitted above all BAs (except P#2BA#2 due to lack of places to hang the fitting) and Philips floodlights fitted in the MA (April).
- The lights in the MA, An#1 and inside Room #1 were all connected via information cables which fed into the computer meaning they could be put on an accurate time schedule, capable of fading on/off. This was possible from 17 October.

A5.9.3 Enclosure

- Erected small fruit cages to act as aviaries in P#2 (January-April).
- Partition between P#1BA#2 and BA#3 replaced with one that had functional pop-holes (February).

- New ponds installed in P#2BA#1 and connected to the existing polytunnel pond system (March).
- Construction began on a new BA external of the SBS facility (October).
- A tent in Room #1 was installed and sand added and disinfected (October).
- 'Pigeon spikes' were added to the predator proof fencing outside of the MA to prevent the resident Sparrowhawk *Accipiter Nisus* perching and spooking the birds (October).

A5.9.4 Substrate/habitat

- More turf and sedum added to BAs, some replaced (March-April).
- Watercress grown in BA ponds during summer for added filtration.

A5.9.5 Other

- Smoke lingering in aviaries up to seven days after bonfires in nearby horticultural areas (23 October).

A5.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A64.

Table A64 – Number and type of visitor to the breeding facility: 2015

Month	Occurrences (minimum)			No. of days
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors inside the facility
Jan				
Feb				
Mar		4 (VIP/visitors)	1 (media filming SBS)	
Apr		1 (VIP/visitors)	1 (external advisors)	
May				1 (contractors checking circuit boards)
Jun				
Jul				
Aug			1 (SPOONIEVISION)	
Sep				
Oct			1 (external advisor)	4 (contractors fitting lights/timers)
Nov	1 (VIP/visitors)			
Dec				

A6. 2016 Summary

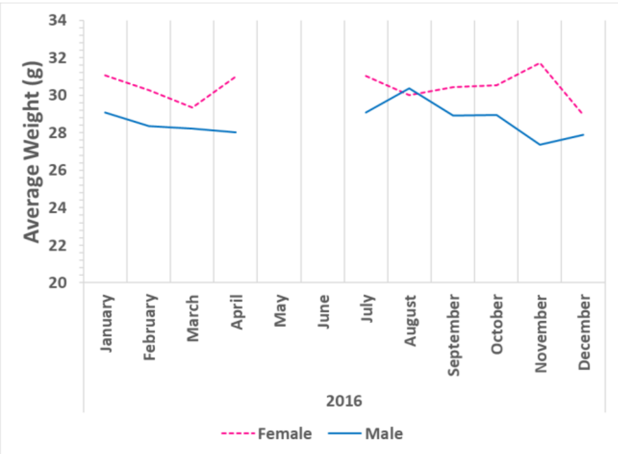
Table A65 – Individual records/deaths (all birds): 2016

SBS ID	Cohort	Sex	Deaths	Cause
RL	2011	M		
BlueL	2011	M		
WL	2011	M	11 Jul	Amyloidosis and chronic limb and foot issues
PL	2011	F		
BlackL	2011	M		
RR	2011	M		
WR	2011	M		
BlueR	2011	M		
OR	2011	M		
PR	2011	M		
PWR	2012	F		
UNR	2012	M		
PWL	2012	F		
PBlueR	2012	M		
PPR	2012	F		
POL	2012	F		
PLGL	2012	F		
POR	2012	M		
PRL	2012	M		
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		
PYR	2012	M		
Chick 1:2	2016	UNK	04 Jul	Osteopenia
Chick 2:4	2016	UNK	05 Jul	Yolk sac infection and osteopenia

A6.1 Health

A6.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. No weights were taken in May and June to avoid disturbance during the breeding season; Figure A18 and Table A66.



Note: Includes remote weights and in-hand, excludes death weights

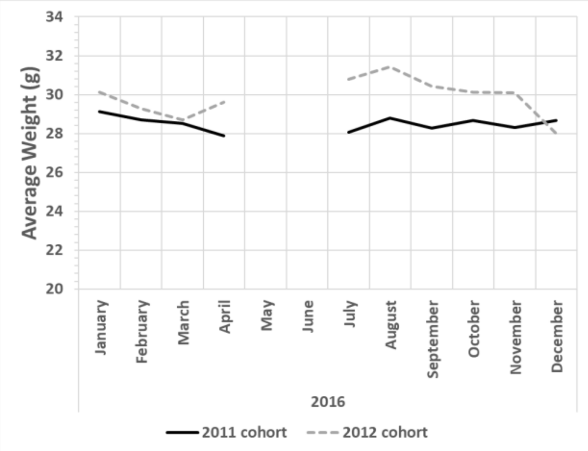
Figure A18 – Mean body weights of all birds: 2016

Table A66 – Number of individuals by sex (end of each month): 2016

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	16	16	16	16	16	16	17	17	17	17	17	17
Females	7	7	7	7	7	7	7	7	7	7	7	7

A6.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. No weights were taken in May and June to avoid disturbance during the breeding season; Figure A19 and Table A67.



Note: Includes remote weights and in-hand, excludes death weights

Figure A19 –Mean body weights: 2011 and 2012 cohorts: 2016

Table A67 – Number of individuals by cohort (end of each month): 2016

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	10	10	10	10	10	10	9	9	9	9	9	9
2012	13	13	13	13	13	13	13	13	13	13	13	13

A6.1.3 Moult scoring

Assessment of moult scores; Table A68.

Table A68 – Moult scoring (last score of the month): 2016

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Jan (4)	1.0	1.5	3.0	2.0 (2.0:2.0)	1.0 (1.0:1.0)	1.5 (2.0:1.0)	1.5 (2.0:1.0)
Feb (4)	1.0	2.0	3.0	2.0 (2.0:2.0)	1.5 (2.0:1.5)	2.0 (2.0:2.0)	1.5 (2.0:1.5)
Mar (3)	1.0	2.0	3.0	2.0 (2.5:2.0)	2.0 (3.0:2.0)	2.5 (2.5:3.0)	2.0 (2.0:2.0)
Apr (4)	3.0	5.0	7.0	5.5 (5.5:4.5)	5.0 (6.5:4.5)	6.0 (5.5:6.5)	4.5 (4.5:4.5)
May* (4)	4.0	6.0	7.0	6.0 (6.5:5.5)	5.5 (7.0:5.0)	6.5 (6.5:7.0)	5.5 (5.5:5.0)
Jun** (0)	-	-	-	-	-	-	-
Jul (4)	3.0	4.5	6.0	5.0 (5.0:4.5)	4.0 (4.5:3.5)	5.0 (5.0:4.5)	4.0 (4.5:3.5)
Aug (4)	2.0	3.5	5.0	4.0 (3.5:4.0)	2.5 (3.0:2.5)	3.5 (3.5:3.0)	3.5 (4.0:2.5)
Sep (4)	1.0	2.5	5.0	3.0 (2.5:4.0)	1.5 (1.0:1.5)	2.0 (2.5:1.0)	2.5 (4.0:1.5)
Oct (5)	1.0	2.0	5.0	2.5 (2.0:3.5)	1.5 (1.0:1.5)	2.0 (2.0:1.0)	2.5 (3.5:1.5)
Nov (2)	1.0	1.5	3.0	1.5 (1.5:1.5)	1.0 (1.0:1.0)	1.5 (1.5:1.0)	1.5 (1.5:1.0)
Dec (1)	1.0	1.5	3.0	2.0 (2.0:2.0)	1.5 (1.0:1.5)	1.5 (2.0:1.0)	1.5 (2.0:1.5)

Notes:
* The final moult score of May was spread over two days, the scores were combined for averages (only one score from each bird)
** No moult scores although moult photos were taken
Some variation between score takers
Rounded to the nearest 0.5

A6.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included in Table A69. Of approximately 59 cases of limping this year 22% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A6.1.5 and Table A70.

Table A69 – Summary of lameness for each month: 2016

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	23	6	0	15
Feb	23	7	2	25
Mar	23	8	2	39
Apr	23	6	2	21
May	23	2	1	15
Jun	23	4	1	10
Jul	22	4	1	14
Aug	22	4	1	10
Sep	22	4	0	28
Oct	22	3	1	23
Nov	22	6	1	27
Dec	22	5	1	30
				Total: 257

Note: * 1 = One day of one lame bird

A6.1.5 Afflictions/treatments

Blood seen on towels/walls in January and November, possibly from cracked feet or collision injury.

Table A70 – Individual afflictions/treatments: 2016

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan PWL	Soiled/damp feathers around eye, squinting, head shaking	Unclear	Possible trauma injury	Caught for examination -no obvious wound visible, some feathers missing around ear and eye. Eye flushed with saline and antibiotic eye drops given. Also given an anti-inflammatory injection. **Symptoms subsided within a few weeks**	
Feb PL	Feathers missing around eye, damp feathers around eye, eye half closed, eye watering	Unclear	Possible trauma injury	Caught for examination -no obvious wounds. Given a course of oral antibiotic and oral anti-inflammatory treatment administered remotely. **Intermittent symptoms**	
Feb-Mar PYR	Recurring limp	Unclear, possibly amyloidosis	Possibly related to moult, stressors	Feb Put on course of two oral antibiotics and an oral anti-inflammatory administered remotely. **Limp persisted** Mar Caught for examination -toes nails extremely long, likely unworn due to limp/gait. Nails were trimmed. Large cracks present on feet, antiseptic spray and topical anti-inflammatory ointment applied. Given antibiotic injection. **Symptoms lessened** Caught to check feet -appeared to be responsive to previous topical anti-inflammatory treatment so caught to apply more. Also given another injection of antibiotic.	
Mar-Apr POL	Limping, visible constricted toe	Constricted toe	Unclear	Mar Caught for examination -unclear what had caused the constriction, not able to remove from the toe. No obvious sign of infection though was bleeding. Antiseptic spray applied. Given an injection of antibiotic. Also given a course of anti-inflammatory administered remotely. **Condition worsened, not using foot/leg.** Caught again, toe still attached but not very well. Appeared to be healing around constriction site although some redness, also bleeding upon catch. Topical treatment was used on constriction site. **Improvement but some discomfort** Apr Course of oral anti-inflammatory treatment administered remotely. **Symptoms subsided**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Mar WL	Greasy plumage, hunched, less bright	Infected preen gland	Unclear, possibly stressors, possibly amyloidosis	Caught for examination -purulent content visible. Preen gland squeezed to remove, some feathers also removed from the area. Given an antibiotic injection. **Intermittent symptoms, continued to monitor**	
Apr PL	Head shaking, damp feathers behind eye, preening eye often (opposite side seen in Feb)	Unclear	Possible trauma injury		Upon remote examination eye appeared unaffected. No treatment given, continued to monitor closely. **Intermittent symptoms**
Apr-Jul WL	Persistent limp Poor condition and demeanour	Unclear, possibly amyloidosis Post-mortem results revealed amyloidosis as main cause of death	Possibly related to moult, stressors Stress of multiple afflictions	Apr-May Caught for examination -feet in good condition. Given antibiotic injection, and course of oral anti-inflammatory administered remotely. **Intermittent symptoms** Jun Given a course of oral anti-inflammatory administered remotely. **Symptoms continued** Jul Caught for examination -lower than average weight. Large sores and calluses on feet. Preen gland looked okay. Given two different antibiotic injections, topical anti-inflammatory applied to feet. **Found dead later the same day**	
Jul PPR	Lump on top of foot	Possible dislocation	Possible trauma injury		Caught for examination- lump appeared to be healing fracture, appeared swollen. No treatment given, monitored closely
Aug PLGL	Severe limp	Unclear, possibly amyloidosis	Possibly related to moult, stressors	Caught for examination -feet look in good condition. Given a course of oral anti-inflammatory administered remotely. **Symptoms subsided shortly after treatment**	
Sep WR	Excessively preening chest and belly, looking down at ground between legs, stamping feet whilst turning in circles	Unclear (assumed discomfort around stomach area), possibly amyloidosis	Unclear, possibly stressors	Given two courses of oral antibiotic administered remotely. Faecal samples collected, results showed nothing unusual. **Symptoms subsided within a few weeks**	
Oct PYR	Limping	Unclear, possibly amyloidosis	Possibly related to moult, historic foot issues, stressors	Given a course of oral antibiotics administered remotely. **Intermittent symptoms**	
Nov PWL	Severe limp, hardly weight bearing	Unclear, possibly amyloidosis	Possibly related to moult, stressors	Given a course of oral anti-inflammatory administered remotely. **Symptoms subsided within a week of occurrence**	
Dec OR	Unusual erratic behaviour, feathers missing on head, eye appears misshapen	Trauma injuries	Possible flight collision	Caught for examination -low weight, some blood coming from nostril, and small keel wound. Given an antibiotic injection and given a course of oral anti-inflammatory treatment administered remotely. **Symptoms subsided within a week, no further treatment required**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Dec PYR	Persistent recurring limp	Unclear, possibly amyloidosis	Possibly moult related, historic foot issues, stressors	Given several courses of oral antibiotics and oral anti-inflammatories administered remotely. **Little improvement seen** Caught for examination -extremely long nails, cracked feet though mostly healed but some fresh. Faecal stained feet and small callus on sole of foot. Swab taken from one deep crack in foot, results unremarkable. Nails trimmed, feet cleaned with antimicrobial skin wash and topical antibiotic ointment and topical anti-inflammatory ointment applied. **Continued treatment into January 2017**	

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A6.2 Locality

A6.2.1 SBS facility configuration

See Figure A20. Further details in Section 2.1.2.

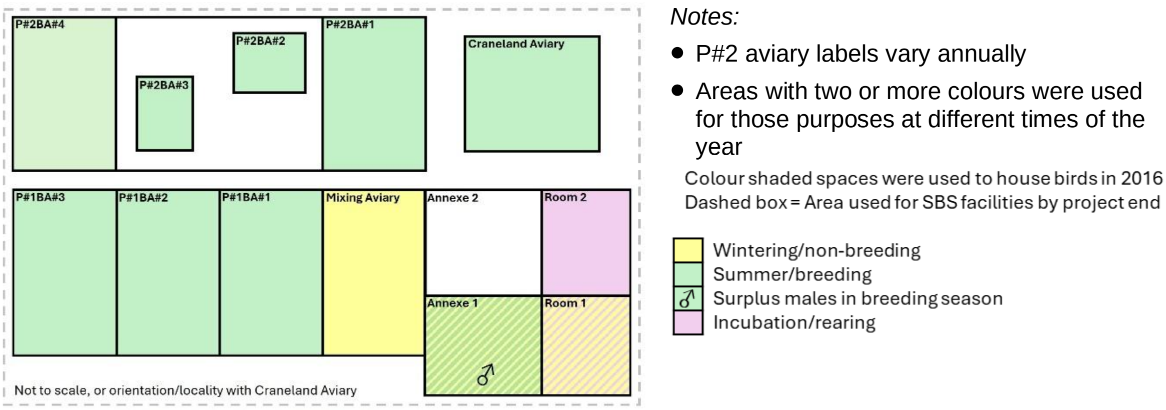


Figure A20 – SBS facility configuration: 2016

A6.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A71.

<u>January-February</u>

- Birds continued to occupy Room #1, An#1 and the MA.

<u>March</u>

- 16: The birds were given access to P#1BA#1, as well as Room #1, An#1 and the MA. On 28 March they were given access to P#1BA#2.

<u>April</u>

- 5: The birds were shut out of Room #1.
- 7: The birds were given access to P#1BA#3.
- 28: The birds were shut out of An#1.

<u>May</u>

- 17: The following birds were caught/moved to BAs in P#1 and P#2 (the rest were placed in An#1):
  - P#1BA#1/BA#2- PDGR, PYR, BlueR, RL.
  - P#1BA#3- PRR, PL, PLGL.
  - P#2BA#1- PR, PWR.
  - P#2BA#2- BlackL, POL.
  - P#2BA#3- BlueL, PPR.
  - P#2BA#4- RR, PWL.
- 18: Two birds were moved to the Craneland Aviary: RL, PRR.
- 19: Birds in P#1 were re-arranged:
  - P#1BA#1 BlueR, PLGL.
  - P#1BA#3- PDGR, PL.
  - An#1- PYR
- 24: The pop-holes between P#1BA#1 (BlueR,PLGL) and BA#2 (empty) were opened.

- 25: BlackL was found in the space between P#2BA#2 and BA#3. He was caught and returned to P#2BA#2.
- 26: PBlueR and POR were added to P#1BA#1/BA#2 (BlueR,PLGL).
- 27:
    - Morning - PBlueR was isolated in P#1BA#1.
    - Morning - POR was moved to An#1 with surplus males.
    - Morning - BlueR and PLGL were confined to P#1BA#2.
    - Afternoon - pop-holes opened between P#1BA#1 and BA#2 mixing BlueR, PLGL, and PBlueR.
- 31:
    - BlueR moved to MA/An#1.
    - PBlueR and PLGL confined to P#1BA#1.

June

- 1: PBlueR moved to An#1 from P#1BA#1; POR added to P#1BA#1 with PLGL.
- 2: BlueR added to P#1BA#3 (PDGR, PL); POR moved to An#1 from P#1BA#1.
- 3: Males in P#1 swapped; (BlueR to P#1BA#3 with PL, PDGR to P#1BA#1 with PLGL).
- 14: WR added to P#1BA#3 (BlueR, PL) from An#1; OR added to P#1BA#1 (PDGR, PLGL) from An#1.
- 15: OR and WR swapped: P#1BA#1- PDGR, PLGL, WR; P#1BA#3- BlueR, PL, OR.
- 16: Females in P#1 moved into P#1BA#2 together, leaving males in P#1BA#1 and BA#3 behind.
- 17: PLGL moved back to P#1BA#1 (PDGR, WR); PL moved back to P#1BA#3 (BlueR, OR).
- 18: WR moved to An#1 from P#1BA#1 (PDGR, PLGR); OR moved to An#1 from P#1BA#3 (BlueR, PL).
- 30: Breeding pairs remained in their aviaries whilst all other in the SBS facility were moved back in main flock in MA and An#1.

July

- 5: BlueL and PPR moved to An#1 and MA from P#2BA#3; PR and PWR moved to An#1 and MA from P#2BA#1.
- 21: RL and PRR moved to An#1 and MA from Craneland Aviary (extended period due to disease screening compliance).

August-October

- All birds continued to occupy An#1, and the MA.

November

- All birds continued to occupy An#1, and the MA. On 28 November they were also given access to Room #1.
- All birds shut out of the MA on 30 November due to extremely cold weather freezing the MA pond.

December

- All birds continued to occupy Room #1, An#1 and the MA. The birds were shut out of Room #1 between 12-16 December for the room to be thoroughly cleaned and disinfected following the presence of Pseudomonas in faecal samples.

Table A71 – Space occupancy: 2016

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1				5							28	
Room #2					17 ♂	30 ♂						
An#1												
An#2												
MA					17	30						
P#1BA#1					17	30						
P#1BA#2					17	30						
P#1BA#3					17	30						
P#2BA#1					17		5					
P#2BA#2					17	30						
P#2BA#3					17		5					
P#2BA#4					17	30						
Craneland Aviary					18		21					

Note:

- Wintering/non-breeding
- Summer/breeding
- ♂ Surplus males in breeding season
- Incubation /rearing

A6.3 Social network

A6.3.1 Introductions/departures/interactions

There were no introductions of new birds to the flock this year. It was not noted if the chicks being hatched/reared in the rooms could be heard by the adults, or vice versa.

It is unclear whether the death of WL affected the social dynamics when it occurred. No observable behaviours recorded.

A6.4 Breeding

Singing and increased aggression began early April prior to moving into BAs.

The birds were arranged into their breeding pairs between 17-19 May; Table A72. Those in P#2 and Craneland Aviary were put in pairs in BAs where they remained throughout the breeding season. Those in P#1 were initially put in aviaries in single sexes, two days later they were put into pairs to simulate males arriving to the breeding grounds prior to the females as they would in the wild. In the following days several moves and introductions and removal of surplus males was conducted (Section A6.2.2) to test/assess compatibility and incite breeding with male competition. No moves occurred between 3-14 June. Swapping/addition and removal of males (both paired and surplus in P#1) started again with little to no signs of breeding. Peak season was approximately late May.

Generally, breeding activity began decreasing at the start of June with a couple of instances of high activity. Activity ceased mid-to-late June. Some birds began dropping feathers early July.

Table A72 – Pairs: 2016

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Significant observations/Notes
P#1BA#1	BlueR		PLGL	• Various bird moves between P#1BA#1, #2, #3 and An#1 (Section A6.2.2). • BlueR appeared interested in PLGL when housed together though she wasn't apparently receptive of him. • PLGL sustained an injury early in the season likely from a flight collision which may have impacted her health and therefore breeding status. • PBlueR initially housed in An#1 with surplus birds. Very active throughout the season. • POR also singing often, quite dominant when in An#1 with surplus birds. • Some singing and displaying from PDGR to PL when housed together but PL didn't appear receptive.
P#1BA#1/2	PBlueR POR (PYR)		(PRR)	
P#1BA#3	PDGR		PL	
P#2BA#1	PR	3	PWR	• PR slow to start singing (and not the most frequent through the season) though pair appeared compatible early on, standing together and following each other, female receptive and reciprocated advances. • Copulations between the pair were first witnessed 2 Jun. • First egg was found 5 Jun, second on 7 Jun (in a different scrape to the first egg), third egg found on 8 Jun (in same scrape as second egg), and fourth egg on 11 Jun (in same scrape as second and third).
P#2BA#2	BlackL		POL	• BlackL singing as soon as out into aviary though this was very short lived.
P#2BA#3	BlueL	2	PPR	• BlueL singing as soon as put into the aviary. • Copulations between the pair first witnessed 1 Jun. • First egg found on 5 Jun, second egg on 6 Jun, third egg on the 8 Jun (thin shelled and 'dumped' in pond).
P#2BA#4	RR		PWL	• RR singing as soon as put into aviary though sang infrequently thereafter. • The pair were seen together often but little breeding activity observed, particularly from PWL.
Craneland	RL		PRR	• Singing by RL intermittent through the season with some initial response by PRR. Appeared settled but very little activity perhaps due to very high temperatures.
MA/annexe	PRL PYR UNR OR PPL WL WR			• Some singing and aggression between surplus males housed together.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A6.4.1 Eggs

Eggs were produced from two pairs housed in P#2; Figures A21 and A22 & Table A73.

No second clutches were produced. Though female PWR appeared heavy for two days following removal of dummy eggs used to replace the first clutch.

No egg repairs were conducted in 2016.

Refer to Section 2.5 for egg collection, storage, incubation/hatching and rearing details.

A21a. Egg 1:1 (2016)

A21b. Egg 1:2 (right) with dummy egg (left) replaced with 1:1 (2016)

A21c. Egg 1:3 found ‘dumped’ in pond (2016)

(All photographs credit: WWT)

Figure A21 – Photographs of eggs in clutch one from 2016 breeding season

A22a. Egg 1:1 (top) and Egg 2:1 (right) (2016)

A22b. Egg 2:2 (top) with dummy egg (bottom) replaced with 2:1 (2016)

A22c. Egg 2:3 (bottom) with two dummies (2016)

(All photographs credit: WWT)

Figure A22 – Photographs of eggs in clutch two from 2016 breeding season

Table A73 – Egg/chick status summary: 2016

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
BlueL PPR P#2BA#3	1:1	Chalky appearance; looked as though it was missing the waxy eggshell cuticle. Judged to be thin-shelled.	5 Jun Put in cold storage (approx. 15ºC) until 8 Jun, then set in incubator	Day 0+ 75+% RH Day 6 wrapped in cling film due to rapid weight loss	Assessed by candling on Day 13. No obvious development seen. Further analysis found early to mid-stage development .	Did not hatch (53% average weight loss)
	1:2	Chalky appearance; looked as though it was missing the waxy eggshell cuticle. Judged to be thin-shelled.	6 Jun Put in cold storage (approx. 15ºC) until 8 Jun, then set in incubator	Day 0+ 75+% RH	Assessed by candling on Day 13. Clear signs of embryonic development.	Day 23 Internally pipped 1 Jul 2016 Day 24 Hatched 2 Jul 2016 (21.2% average weight loss) Died 5 Jul 2016
	1:3	Soft shelled, layering not complete. 'Dumped' in pond. Completely collapsed within a few hours of collection	8 Jun	Not incubated	Analysis revealed sperm cells on the surface of the egg yolk, indicating likely fertility.	Egg spilt open and collapsed within two hours of collection
PR PWR P#2BA#1	2:1	Normal	5 Jun Put in cold storage (approx. 15ºC) until 8 Jun, then set in incubator	Day 10 water removed from incubator LOW RH	Assessed by candling on Day 13. No obvious development seen. Further analysis found early to mid-stage development.	Did not hatch (11.6% average weight loss)
	2:2	Normal	7 Jun Put in cold storage (approx. 15ºC) until 8 Jun, then set in incubator	Day 10 water removed from incubator LOW RH	Assessed by candling on Day 13. No obvious development seen. Further analysis found early to mid-stage development.	Did not hatch (11.5% average weight loss)
	2:3	Normal	8 Jun Started incubation shortly after collection (no cold storage)	Day 4 moved to HIGH RH incubator	Assessed by candling on Day 13. No obvious development seen. Further analysis found early to mid-stage development.	Did not hatch (16.7% average weight loss)
	2:4	Normal	11 Jun Started incubation shortly after collection	Day 7 water removed from incubator LOW RH Day 12 water added to incubator approx. 55% RH	Assessed by candling on Day 13. Clear signs of embryonic development.	Day 20 appeared to be pushing against airspace. Day 22 Hatched 3 Jul 2016

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
			(no cold storage)			(11.5% average weight loss) Died 4 Jul 2016

A6.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide the approximate temperatures required by the birds depending on time of year and health status; Table A74. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary).

Table A74 – Daily temperatures for the Mixing Aviary: 2016

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan*	2.5	5.9	8.8	12.6	15.0	2.5 (MA)	24.5 (MA)
Feb**	-3.5	2.3	5.8	10.9	16.5	-3.5(MA)	16.5 (MA)
Mar	-1.5	2.9	7.2	14.7	27.0	-1.5 (MA)	27.0 (MA)
Apr	0.0	4.7	9.3	17.6	27.5	0.0 (MA)	28.5 (P#1BA#1)
May	2.0	9.2	13.7	21.1	29.0	1.0 (P#1BA#1)	37.5 (P#1BA#1)
Jun	8.5	13.1	16.8	23.0	30.5	8.0 (P#2, Craneland)	42.5 (Craneland)
Jul***	10.5	14.8	19.6	27.8	39.0	9.5 (Craneland)	46.5 (Craneland)
Aug	10.5	15.1	19.3	26.5	32.0	9.5 (An#1)	32.0 (MA)
Sep	10.5	14.2	17.6	22.8	28.5	8.5 (An#1)	28.5 (MA)
Oct	4.5	8.9	11.8	16.3	21.0	4.0 (An#1)	22.9 (MA)
Nov	-3.0	4.3	7.0	10.3	15.5	-3.0 (MA)	17.5 (MA)
Dec	-2.5	4.5	6.8	9.5	15.0	-2.5 (An#1)	16.5 (MA)

Notes:
* 21-28 Jan
** 4-29 Feb
*** 1-10, 18-31 Jul

A6.6 Lighting and photoperiod

Figure A23 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

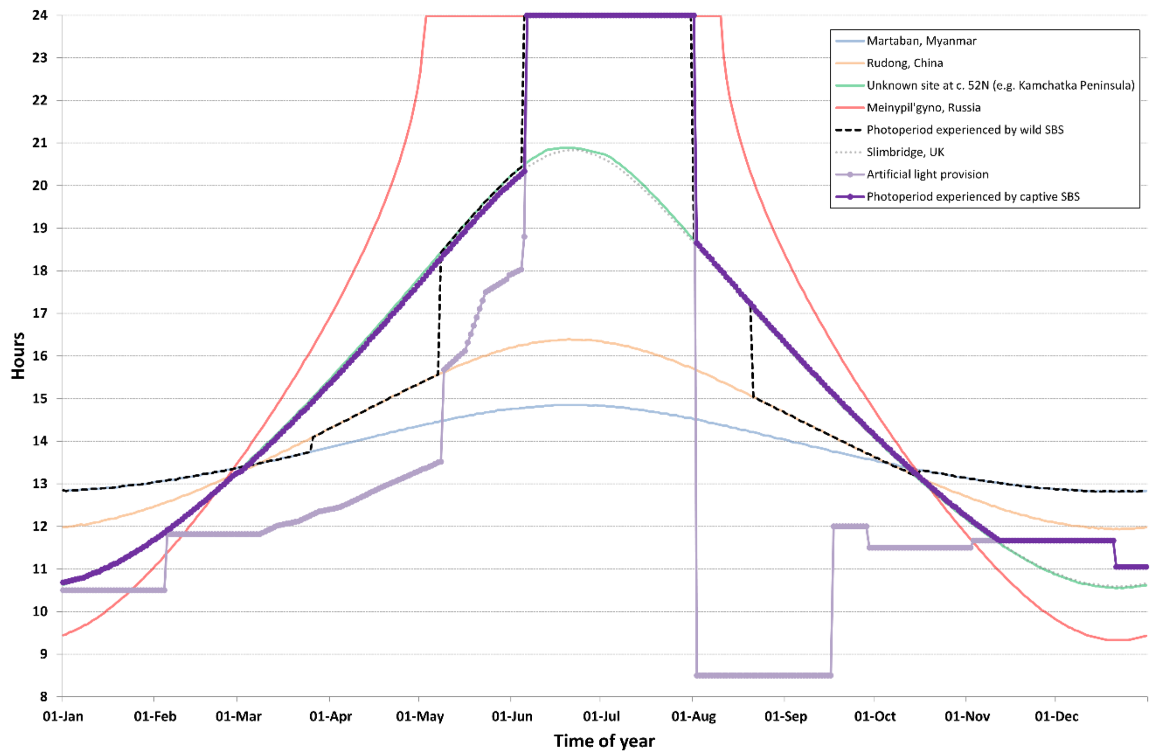


Figure A23 – Photoperiod wild SBS experience during the year based on location: 2016

A6.6.1 Photoperiod experienced by the captive SBS

The birds continued to experience the Slimbridge (UK) photoperiod from winter 2015/16 into late spring. They were given 24 hours of artificial light from 5 June to 31 July replicating exactly what they would encounter in the wild. Number of light hours then dropped/jumped to the Slimbridge (UK) photoperiod experiencing a gradual decrease in hours until October. With artificial lighting they were held between 11 and 12 hours of light per day into winter 2016/17.

A6.6.2 Notes

The light timer system installed in October 2015 failed in autumn 2016 after water damage to the information cables of the light fittings. In the meantime, staff manually turned lights on/off in line with their work day (approximately 08:00-16:30 equally 8.5 hours). The faulty timers were replaced with manual input light timers which could provide gradual increases and decreases in daily light provision but were unable to fade on and off. These were used from mid-September. To avoid the birds being plunged into sudden darkness due to the lack of fade capability, the on/off times for the various lights in use were staggered with about one minute between each.

The sudden changes in number of hours of artificial light occurred to simulate the migratory jumps in location of wild SBS, except the drop from 24 hours to 8.5 hours.

Note the slight deviation between 'Photoperiod experienced by wild SBS' and 'Photoperiod experienced by captive SBS' in Figure A23 is due to the former being calculated on a non-leap year, and 2016 being a leap year.

A6.7 Diet and nutrition

Lundi micro 45 was provided during the breeding season only to increase fat and protein content for high energy demands. Freshwater shrimp was reduced before the breeding season and increased at the start of the breeding season for a more dramatic change in diet/protein content to stimulate breeding.

Lundi was provided dry only. Grit always present, oyster shell grit added during breeding season only; Table A75.

Table A75 – Food present/absent in diet: 2016

Food item/supplement****	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio Lundi micro **45**	100	100	↓	60	60	60	↑	100	100	100	100	100
Lundi micro **35**	0	0	↑	40	40	40	↓	0	0	0	0	0
Live/frozen bloodworms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avimix (on dry food)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓*	✓
Saltwater*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dried freshwater shrimp	✓	✓	✓	↓	✓	X	✓	↑	✓	✓	✓	✓
Avipro (on dry food)	X	X	X	X	✓	X	X	X	✓	✓	X	✓
Frozen Red plankton	✓	✓	✓	✓	X	X	X	X	X	X	X	x
Nutrobal (on dry food)	X	X	X	X	X	✓	✓	X	X	X	✓***	✓
Oyster shell grit	X	X	X	X	✓	✓	X	X	X	X	X	X
Frozen Brine shrimp plus Spirulina	X	✓	X	X	X	X	X	X	X	X	X	X
Frozen Brine shrimp	✓	X	X	X	X	X	X	X	X	X	X	X
Live fruit flies	X	X	X	X	X	X	✓	X	X	X	X	X
Live mealworms	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp

Note:
* Five days a week that Nutrobal wasn't used
** Salt water only provided in BAs if foot condition was poor
*** Twice a week
**** Most frequently provided items to least

✓	Present in diet
↑	Increased that month
↓	Decreased that month
	Present for 2012 cohort
X	Absent from diet

A6.8 Sanitation

A6.8.1 Water systems

- Both sumps and filters for the pond systems within the facility were cleaned approximately once a week. The MA pond was cleaned approximately every other day, and from April it was cleaned every day. The annexe pond was cleaned approximately every four days when in use.
- Any saltwater ponds/trays were cleaned approximately once a week or as necessary.

A6.8.2 Substrates

- Occupied areas were serviced at least once a day to sweep up any faeces, rake/aerate the sand.
- Sand in the MA pond was replaced in March and May.
- Sand in An#1 pond was replaced in November.

A6.8.3 Biosecurity

- A new disinfection regime was developed in December after Pseudomonas was found in faecal samples. All sand was disinfected thoroughly, using F10 solution, every day for five consecutive days between 12 and 16 December. The small saltwater ponds in the MA were removed on 12 December to prevent them as acting as reservoirs for re-infection of Pseudomonas. Disinfection of all sand, in all aviaries continued twice per week for two weeks, following this initial five-day treatment, then once per week for the final week. Upon completion of this treatment regime, the vets also recommended that further faecal samples be sent to the lab to test again for Pseudomonas Sp. All artificial Christmas tree branches were also replaced, cleaned, and disinfected before adding to the aviaries.
- Following a confirmed positive result for avian influenza on the Slimbridge reserve, an additional disinfectant footbath was placed outside the entrance of the SBS facility. The aviculture staff were also split so that members of staff feeding other species on site did not feed the SBS.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A6.9 Environment provisions, modifications, and events with consequences

A6.9.1 Climate

- Ice and fresh water regularly added to sump in polytunnel corridor in attempt to cool water in BA ponds during hot weather (April onwards).

A6.9.2 Light

- A scaffolding tower fitted with luminaires was put in between P#2BA#2 and BA#3 to provide those aviaries with additional lighting (April).

A6.9.3 Enclosure

- A new aviary was created external to the main SBS facility, the ‘Craneland Aviary’. Pond system installed and set up with sand and disinfected. Aviary landscaped with turf and sedum and soaked with disinfectant (October 2015-May 2016).
- Partition between P#1BA#2 and BA#3 realigned due to slack top wire (March).
- Stand-alone wide angle cameras were placed in BAs regularly to take video recordings to assess activity during the breeding season (May-June).
- A tent used in Room #1 when birds were given access over winter (November).

A6.9.4 Substrate/habitat

- Swamp areas added to some BAs using soaker hose and butyl in low areas of the aviary (April).

A6.9.5 Other

- Black-tailed godwit eggs were collected from Germany to hatch and rear at WWT Slimbridge, close to the SBS facility (May-August).
- Smoke lingering in aviaries up to seven days after bonfires in nearby horticultural areas from 7 December.

A6.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A76.

Table A76 – Number and type of visitor to the breeding facility: 2016

Month	Occurrences (minimum)			No. of days contractors inside the facility
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	
Jan			2 (external advisor, set up of electroreception experiment)	
Feb			2 (electroreception experiment, external advisor)	
Mar	1 (filming birds from outside)			
Apr			1 (external advisor)	
May				
Jun		2 (external advisors)		
Jul		3 (photographers to photograph chicks, external stakeholder)		
Aug	1 (external advisors)			
Sep				1 (electrician fitting new light timers)
Oct				2 (checking fire alarms, CCTV repairs)
Nov	1 (VIP/visitors)			
Dec				

A7. 2017 Summary

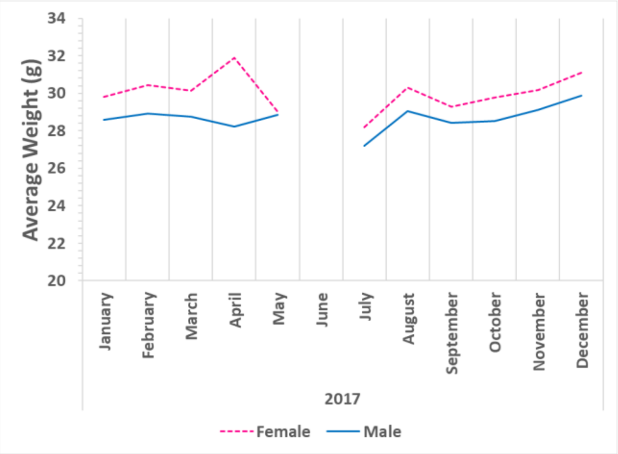
Table A77 – Individual records/deaths: 2017

SBS ID	Cohort	Sex	Deaths	Cause
BlueR	2011	M		
BlueL	2011	M	29 Jan	Gout and secondary renal disease
RR	2011	M		
RL	2011	M		
PL	2011	F		
BlackL	2011	M		
OR	2011	M		
WR	2011	M		
PR	2011	M	03 May	Trauma
PPL	2012	M		
PPR	2012	F		
PBlueR	2012	M		
PYR	2012	M	19 Jan	Renal disease, chronic pododermatitis (bumblefoot) and potential stress
PRL	2012	M		
PRR	2012	F		
POL	2012	F		
POR	2012	M		
PWL	2012	F		
PWR	2012	F		
PLGL	2012	F		
PDGR	2012	M		
UNR	2012	M		
PPL	2012	M		
PRR	2012	F		
PDGR	2012	M		
PYR	2012	M		

A7.1 Health

A7.1.1 Body weights: all birds

No weights were taken in June to avoid disturbance during the breeding season. Few weights were taken in May and June; Figure A24 and Table A78.



Note: Includes remote weights and in-hand, excludes death weights

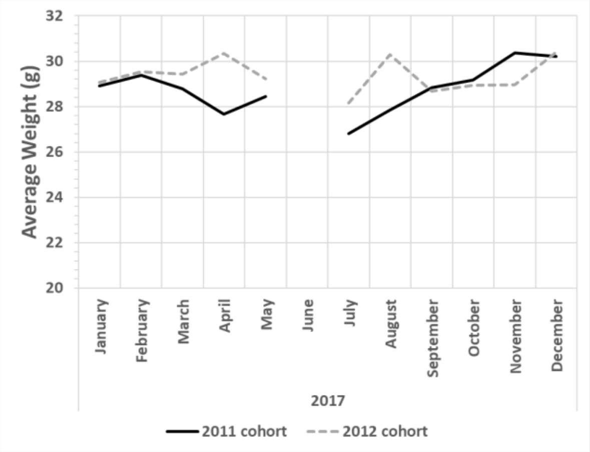
Figure A24 – Mean body weights of all birds: 2017

Table A78 – Number of individuals by sex (end of each month): 2017

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	13	13	13	13	12	12	12	12	12	12	12	12
Females	7	7	7	7	7	7	7	7	7	7	7	7

A7.1.2 Body weights: 2011 and 2012 cohorts

No weights were taken in June to avoid disturbance during the breeding season. Few weights were taken in May and June; Figure A25 and Table A79.



Note: Includes remote weights and in-hand, excludes death weights

Figure A25 – Mean body weights: 2011 and 2012 cohorts: 2017

Table A79 – Number of individuals by cohort (end of each month): 2017

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	8	8	8	8	7	7	7	7	7	7	7	7
2012	12	12	12	12	12	12	12	12	12	12	12	12

A7.1.3 Moult scoring

Assessment of moult scores; Table A80.

Table A80 – Moult scoring (last score of the month): 2017

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Jan (2)	1.0	2.0	3.0	2.0 (2.0:2.0)	1.5 (1.5:1.5)	2.0 (2.0:1.5)	2.0 (2.0:1.5)
Feb (4)	1.0	2.0	3.0	2.0 (2.0:2.5)	2.0 (2.5:1.5)	2.0 (2.0:2.5)	2.0 (2.5:1.5)
Mar (3)	1.0	2.5	4.5	3.0 (3.5:2.5)	2.5 (3.5:2.5)	3.5 (3.5:3.5)	2.0 (2.5:2.0)
Apr (2)	2.0	4.5	6.0	4.5 (5.0:3.5)	4.5 (5.5:4.0)	5.0 (5.0:5.5)	4.0 (3.5:4.0)
May (2)	3.5	5.5	7.0	5.5 (6.0:5.0)	5.5 (6.5:5.5)	6.0 (6.0:6.5)	5.5 (5.0:5.5)
Jun (1)	3.0	6.0	7.0	6.0 (6.5:6.0)	6.0 (7.0:6.0)	6.5 (6.5:7.0)	6.0 (6.0:6.0)
Jul (2)	3.0	5.5	6.0	5.5 (5.5:5.0)	5.0 (6.0:5.0)	5.5 (5.5:6.0)	5.0 (5.0:5.0)
Aug (2)	2.0	3.5	5.0	4.0 (4.0:4.0)	3.0 (3.0:3.0)	4.0 (4.0:3.0)	3.5 (4.0:3.0)
Sep (3)	1.0	2.0	5.0	2.5 (2.0:2.5)	1.5 (1.0:1.5)	2.0 (2.0:1.0)	2.0 (2.5:1.5)
Oct (3)	1.0	2.0	4.0	2.0 (2.0:2.5)	1.0 (1.0:1.5)	2.0 (2.0:1.0)	2.0 (2.5:1.5)
Nov (4)	1.0	2.0	3.0	2.0 (2.0:2.0)	1.5 (1.0:1.5)	1.5 (2.0:1.0)	2.0 (2.0:1.5)
Dec (3)	1.0	2.0	3.5	2.0 (2.0:2.0)	1.5 (1.0:1.5)	2.0 (2.0:1.0)	1.5 (2.0:1.5)

Notes:
Rounded to the nearest 0.5.
Scores will differ slightly between assessors

A7.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A81. Of approximately 15 cases of lameness this year 33% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A7.1.5 and Table A82.

Table A81 – Summary of lameness for each month: 2017

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	22/20	2	2	6
Feb	20	3	1	28
Mar	20	1	1	27
Apr	20	1	0	1
May	20/19	0	-	0
Jun	19	0	-	0
Jul	19	1	0	1
Aug	19	0	-	0
Sep	19	2	1	8
Oct	19	0	-	0
Nov	19	1	0	2
Dec	19	5	0	6

Total: 79

Note: * 1 = One day of one lame bird

A7.1.5 Afflictions/treatments

- Birds seen eating small white worms in August. Collected for examination and deemed to be small earthworms.
- Some dark green faeces found in December.

Table A82 – Individual afflictions/treatments: 2017

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal) / No treatment received
Jan PYR	Recurring limp	Severely cracked feet, sores present	Undetermined, stressors, possibly amyloidosis	• Caught twice ten days apart for medication. • Feet cleaned and disinfected. Received topical treatment on the feet and started on anti-inflammatory and antibiotic treatment (injectable). **Found dead later that day**
Jan BlueL	Severe limp	Had large crack on bottom of one toe when examined. (Gout observed after death)	Rapid increase of high protein food item in diet	Caught- treated topically for crack on toe. Topical treatment applied on feet. **Found dead the day after treatment**
Feb PRR	Severe limp, not weigh bearing	Possibly gout	Rapid increase of high protein food item in diet	• Received various courses of a xanthine oxidase inhibitor to treat gout, as well as anti-inflammatory and antibiotic oral treatment administered remotely. • Shut in Room #1 alone overnight for a short period for rest. Spent one night confined to a small box to reduce movement (caught to move here). **Full recovery made during this period**
Feb RL	Limping	Undetermined, possibly amyloidosis	Undetermined, possibly stressors	Close monitoring but no treatment. **Recovered within a day.**
Feb WR	Limping	Undetermined, possibly amyloidosis	Undetermined, possibly stressors	Close monitoring but no treatment **Recovered within a day.**
May PR	None. Found dead unexpectedly	Fatal trauma	Based on CCTV footage, appeared to collide with aviary netting	**Found dead unexpectedly**
Jun OR	N.A.	Scrape on forehead	Likely a flying injury	Close monitoring but no treatment. Wound dry and clean. **Recovered.**
Jun PL	N.A.	Slightly swollen eye	Flying injury or foreign body	Close monitoring but no treatment. **Recovered within a day**
Sep PWL	Limping	Undetermined, possibly amyloidosis	Undetermined, possibly stressors,	Course of oral anti-inflammatory treatment plus fluids administered remotely. **Recovered**
Oct BlueR UNR	Lumps on bills	Undetermined	Possibly collision	Close monitoring but no treatment. **Lumps gradually subsided**

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A7.2 Locality

A7.2.1 SBS facility configuration

See Figure A26. Further details in Section 2.1.2.

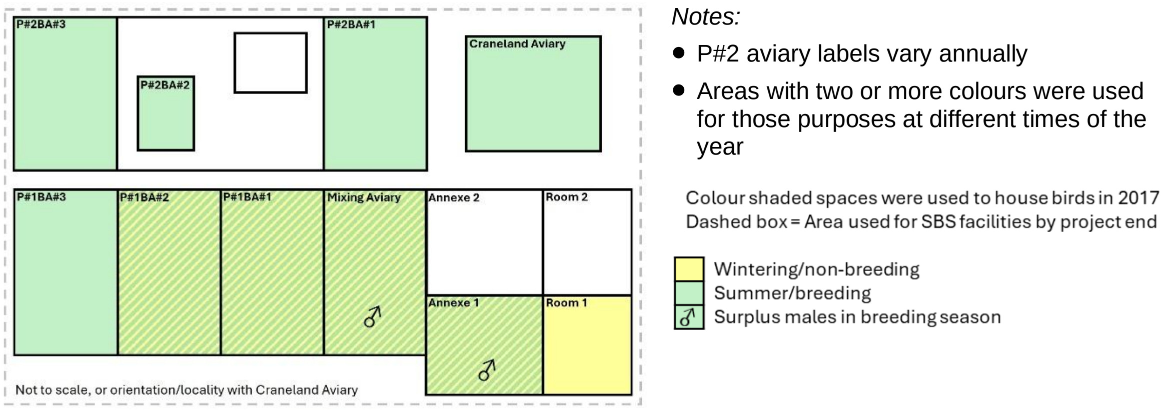


Figure A26 – SBS facility configuration: 2017

A7.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A83.

January

- Throughout the month the birds were housed in the MA, An#1 and Room #1.

February

- 1: Birds were given access to P#1BA#1.
- 19: Access given to P#1BA#2.

March-April

- 14: Birds were given access to P#1BA#3.
- 21: Shut out of Room #1. They had access to An#1, the MA, and P#1BA#1 to BA#3 for the rest of the month.

May

- The birds were shut into the wintering areas during the second week of May for maintenance work.
- 16: The birds were moved into BAs:
  - P#1BA#2 and BA#3 PRL, WR, RL, BlackL, PLGL, PRR, and PL.
  - P#2BA#1 BlueR and PWR.
  - P#2BA#2 PDGR and PPR.
  - P#2BA#3 RR and PWL.
  - Craneland Aviary OR and POL.
  - PPL, POR, and UNR were housed as surplus males in the MA and An#1.
- 17: The birds in P#1 were split into pairs:
  - P#1BA#1 PRL, WR and PLGL.
  - P#1BA#2 RL and PRR.
  - P#1BA#3 BlackL and PL.

- 20: The surplus male WR of the trio in P#1BA#1 was moved in with other surplus males. Putting an additional male with a pair was to incite competition and stimulate breeding.

June

- 14: PBlueR was added to P#1BA#1 with the occupying pair to stimulate further activity.
- 16: The pair housed in Craneland Aviary were moved back to the main facility.

July

- The pair from P#1BA#1 was moved in with the surplus males on the 1 July. These birds were then all given access to P#1BA#1 in addition to An#1 and the MA.
- 11: Pairs from P#2 were moved back with the main flock. Additionally, all pop-holes in P#1 were opened allowing the remaining pairs to join the main flock.
- 16: They were shut out of P#1BA#1 and BA#2 to allow staff to manage the vegetation.

August-September

- Throughout the month the birds had access to the MA, An#1, P#1BA#1 and BA#2.

October

- The birds were shut out of P#1BA#1 and BA#2 between 19 and 20 October when snow mould was found, this was cleared and the area disinfected.

November

- Throughout the month the birds had access to MA and An#1 and P#1BA#1, where they spent most of their time.

December

- The birds were given access to Room #1 on 9 December, where they spent most nights thereafter. Following this the birds were nervous to enter the MA, this lasted the remainder of the month but no longer.

Table A83 – Space occupancy: 2017

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1			21									9
Room #2												
An#1					♂	♂	♂					
An#2												
MA					♂	♂	♂					
P#1BA#1		1										
P#1BA#2		19										
P#1BA#3			14				1					
P#2BA#1					16		16					
P#2BA#2					16		16					
P#2BA#3					16		16					
P#2BA#4												
Craneland Aviary					16	16						

Notes:

Wintering/non-breeding
Summer/breeding
♂ Surplus males in breeding season

A7.3 Social network

A7.3.1 Departures

It is unclear whether the three deaths that occurred this year affected the social dynamics of the wintering flock when they occurred. However, two of the deceased birds were both male partners to the laying females of 2016. Consequently, new pairings were made with these females, which is likely a contributing factor for them not producing eggs this year, given they tend to remain in the same pairings in the wild. The new males behaved appropriately but the females were not responsive.

A7.4 Breeding

Breeding activity began in mid-May with heightened aggression and the occasional song; Table A84. Activity appeared to peak around the start of June with one possible copulation observed and regular singing by multiple birds. Activity slowed gradually and appeared to cease by the end of June.

Only one male is believed to have made nest scrapes. No eggs were laid this year.

Some birds began dropping feathers from early-mid June.

At the end of August, 7-8 weeks after the birds were put together as a wintering flock, one male was seen to visit an existing nest scrape and perform nest scraping and associated displays.

Frequent singing was heard for a few days at the start of September, and the start of October. Two days prior, on both occurrences the lights were mistakenly left on overnight.

Table A84 – Pairs: 2017

Aviary	Male(s)	Nest scrapes	Female(s)	Notes
P#1BA#1	PRL (WR) (PBlueR)	0	PLGL	• All birds in P#1BAs initially housed together in BA#2 and BA#3, moved on 16 May, then separated 1 day later. • WR was moved from P#1BA#1 to the MA on 20 May to allow the pair to breed. • Some singing from PRL early to mid-Jun. • On 14 Jun PBlueR was added to P#1BA#1 to stimulate territorial behaviours in the resident pair.
P#1BA#2	RL	8	PRR	• All birds in P#1BAs initially housed together in BA#2 and BA#3, moved on 16 May, then separated 1 day later. • Nest scrapes from RL at the end of May, with PRR following him into the scrapes. RL singing throughout the rest of the month and into Jun, PRR staying close by him. • RL seen gardening a scrape in early Jun. • Possible copulation between RL and PPR early Jun, nest scraping and singing continued. • Mid-Jun RL became quitter, much fewer songs and displays. PRR still staying close to RL.
P#1BA#3	BlackL	0	PL	• All birds in P#1BAs initially housed together in BA#2 and BA#3, moved on 16 May, then separated 1 day later. • Some singing from PL end of May.
P#2BA#1	BlueR	0	PWR	• BlueR chasing PWR a lot mid-May, PWR flying to get away, appears tired often. • PDGR and PPR pacing occasionally in May. Often sitting on UV light frame, appearing unsettled. • Some singing from PDGR early Jun. • BlueR sitting on top of UV light frame mid-Jun. • RR, PPR and PWL appeared nervous early-mid Jun.
P#2BA#2	PDGR	0	PPR	
P#2BA#3	RR	0	PWL	

Craneland Aviary	OR	0	POL	• Some singing from OR early Jun. • Apparent injury to face early Jun, didn't require any intervention, seen singing soon after.
MA/An#1	POR UNR PBlueR WR PPL	0		• PBlueR was moved from the MA to P#1BA#1 on 14 Jun to incite competition and stimulate breeding behaviours. This provoked PRL to display/sing intensively.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A7.5 Temperature

Temperature recording devices were not always present in the occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximately temperatures required by the birds depending on time of year and health status; Table A85. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary).

Table A85 – Temperature data summary: 2017

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan	-1.0	3.0	5.0	7.5	11.0	-2 (An#1)	13 (An#1)
Feb	0.5	5.5	7.0	10.0	13.5	0 (An#1)	14 (MA)
Mar**	3.0	6.5	9.5	14.0	18.5	2 (An#1)	20 (P#1BA#1)
Apr	-*	-*	-*	-*	-*	1 (An#1, P#1BA#1)	29 (P#1BA#1)
May	-*	-*	-*	-*	-*	1 (P#1BA#1, P#2)	38 (P#1BA#1, P#2)
Jun	-*	-*	-*	-*	-*	7 (P#2)	40 (P#1BA#1)
Jul	-*	-*	-*	-*	-*	10 (P#2)	33 (P#2)
Aug	15.5	17.5	19.5	22.0	25.0	16 (MA, P#1BA#1)	27 (P#1BA#1)
Sep	7.0	13.5	16.0	20.5	23.0	6 (An#1)	27 (P#1BA#1)
Oct	3.5	11.0	14.0	18.0	21.5	3 (An#1)	22 (MA, P#1BA#1)
Nov	1.5	5.5	8.5	11.5	17.0	1 (An#1)	18 (P#1BA#1)
Dec	1.5	3.5	6.0	8.5	12.0	-2 (MA, An#1, P#1BA#1)	23 (P#1BA#1)

Notes:
* No temperatures due to equipment failure
** Data missing for 30 Mar

A7.6 Lighting and photoperiod

Figure A27 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

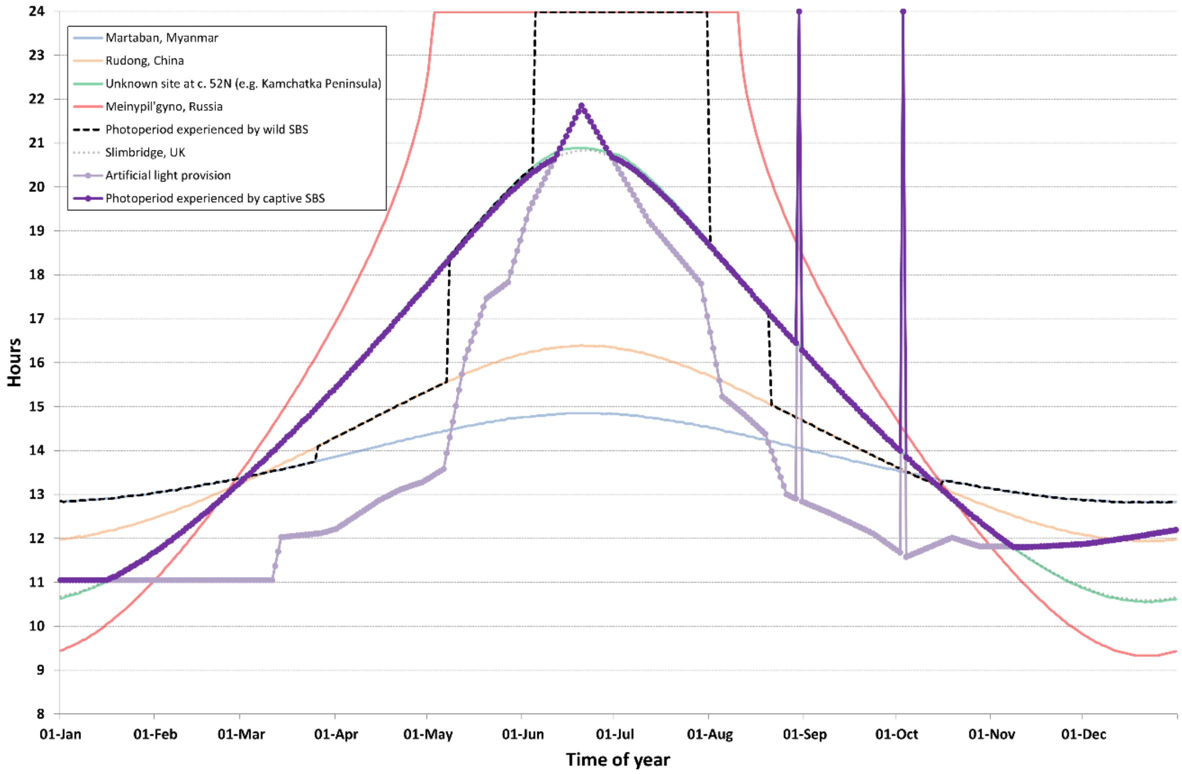


Figure A27 – Photoperiod wild SBS experience during the year based on location: 2017

A7.6.1 Photoperiod experienced by the captive SBS

The birds were held on 11 hours of artificial light for winter 2016/17 into early spring. They then followed the gradual increase of light with the Slimbridge (UK) photoperiod. Artificial light took over briefly during the breeding season, peaking for one day at 22 hours approximately (Section A7.6.2), before gradually decreasing to meet the Slimbridge (UK) photoperiod.

There were two occurrences in late summer/early autumn where artificial lights were left on overnight, once in September and once in October. This appeared to influence the birds as soon after these occurrences, multiple birds were heard singing over the next few days.

They followed the Slimbridge (UK) photoperiod until November when artificial lighting took over. Rather than holding the birds on a set number of light hours for winter, the photoperiod began to gradually increase. This was done as the first step towards 'time shifting' the birds to enable them to breed earlier the following year in the cooler months in spring. This also made their winter period shorter this year.

A7.6.2 Notes

The sudden changes in number of hours of artificial light occurred to simulate the migratory jumps made by wild SBS; Table A86.

Unfortunately (as for 2015) no evidence could be found to confirm that the 24-hour light was turned on for this breeding season. Hence, the Figure A27 represents photoperiod provided by other lights in the facility; if the 24-hour light was indeed turned on, the pale and dark purple lines would follow the black dashed line (photoperiod experienced by wild SBS).

It was noticed in December that the lights were going on/off in the incorrect order, due to the clocks timers' not being synchronized. It was not substantial enough to affect the birds and was soon corrected going forward.

To avoid the birds being plunged into sudden darkness the on/off times for the various lights in use were staggered with about one minute between each.

Table A86 – Mean monthly UVI readings from accessible light units: 2017

UV Unit* ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MA#1			1.9						1.7	1.2	1.2	1.2
MA#2											1.6	3.2
An#1			2.2						2.6	2.1	2.5	2.6
Room #1												4.9
P#1BA#1										1.4	2.4	3.1

Notes:
* Not all UV units were accessible at any one time i.e. one unit in each BA during the breeding season
UVI readings were taken approx. once a week. Averages shown here are from under the centre of the unit

A7.7 Diet and nutrition

In January the birds increased appetite for dried shrimp was accommodated with a large increase in what was provided. This unfortunately led to gout in at least two birds, one of which died. Dried shrimp was phased out in February once it was determined that this was the cause of the gout and replaced with Insectivorous Feast. Lundi micro 20 was also used to partially replace Lundi micro 35 (until the breeding season where high protein is required) to decrease the overall level of protein the birds were receiving. Nutrogrub was also stopped being fed to the crickets. Calcium carbonate was added to the dry food during the breeding season after the calcium related issues seen in the eggs and chicks in 2016.

Lundi was provided dry only. Grit, including oyster shall grit was present year-round; Table A87.

Table A87 – Food present/absent in diet: 2017

Food item/supplement**		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **35**	100	↓	50	↑	100	100	50	↓	0	0	0	0
	Lundi micro **20**	0	↑	50	↓	0	0	50	↑	100	100	100	100
Live crickets (brown/black)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live/frozen bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓ not eating
Oyster shell grit		↑	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Insectivorous Feast		X	↑	✓	✓	✓	✓	✓	✓	✓	↓ not eating	↓ not eating	↓ not eating
Frozen Brine shrimp+ omega3 and spirulina		X	X	✓	✓	✓	✓	✓	✓	↓	X	X	X
Frozen red plankton		X	X	X	✓	✓	✓	✓	✓	↓	X	X	X
Calcium carbonate (on dry food)		X	X	X	✓	✓	✓	↓	X	X	X	X	X
Dried fresh water shrimp		↑ appetite	↓	X	X	X	X	X	X	X	X	X	X
Nutrogrub (on crickets)		✓	X	X	X	X	X	X	X	X	X	X	X
Avripro (on dry food)		↑	X	X	X	X	X	X	X	✓	X	X	X
Avimix (on dry food)		✓	X	X	X	X	X	X	X	X	X	X	X
Live mealworms		For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds	For Meds

Notes:
* Salt water only provided in BAs if foot condition is poor
** Most frequently provided items to least

✓	Present in diet
↑	Gradually increasing
↓	Gradually decreasing
	Present for certain birds
X	Absent from diet

A7.8 Sanitation

A7.8.1 Water systems

- The annexe pond sump and filter were cleaned approximately once a fortnight. The MA pond was cleaned every day and the annexe pond was cleaned approximately every four days when in use.

A7.8.2 Substrates

- Sand in the MA pond was replaced in March.
- Sand in An#1, including sand in the pond, was replaced in September.
- Sections of sand in the MA, and all the sand in the pond, was replaced in October.
- Snow mould was found in the BAs in October, this was cleared/replaced, and the areas disinfected.

A7.8.3 Biosecurity

- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A7.9 Environment provisions, modifications, and events with consequences

A7.9.1 Climate

- When occupied, Room #1 was heated using an oil radiator.
- Ice was added to the sump for the BA ponds when summer temperatures were high.

A7.9.2 Light

- Ultraviolet lights were added to the pop-holes between MA and An#1, and An#1 and Room #1, being concentrated areas for traffic. Readings were approximately 2.2 UVI. Food dishes were also placed under these lights for additional exposure. UV light units were also added to most of the BAs and Room #1 (March).
- An additional UV unit was added to the MA where it could be placed lower to give a reading of 4 UVI (November).
- Already installed UV light units were lowered to give a higher UVI reading of at least 4 UVI (December).
- Heated soil cables were also added to UV light units under the substrate in hope to encourage the birds to roost here over winter (November).
- The artificial photoperiod began being altered from 'normal' (a simulation of that which wild birds experience) to be able to shift the breeding season 6 weeks earlier than normal in an attempt to breed the birds in the cooler spring weather and possibly enable double-clutching. Winter of 2017/2018 was shortened by increasing the day length more rapidly through manipulation of the lights on/off timing (October).

A7.9.3 Substrate/habitat

- Whole artificial Christmas trees added to Room #1 and An#1 to break up the landscape (December).

A7.9.4 Other

- Water backing up in the sumps from drain in February.
- Small birds (Sparrow *Passer sp.*, Wren *Troglodytes troglodytes*) in the facility (June, July and December).
- Live stream of SBS for Severn Wader Festival (September).
- Mouse faeces and activity found in facility, including bird occupied areas (October).

A7.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A88.

Table A88 – Number and type of visitor to the breeding facility: 2017

Month	Occurrences (could be individuals or larger groups)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan	1 (external advisor)			
Feb				
Mar		1 (external advisor)		2 (maintenance fitting UV units)
Apr				1 (contractor to PAT test electronics)
May				
Jun				
Jul				
Aug				
Sep				2 (contractors checking fire alarms, and quoting for lighting work)
Oct	1 (VIP/visitor)			
Nov	3 (VIP/visitor)			
Dec	1 (external advisor)			

A8. 2018 Summary

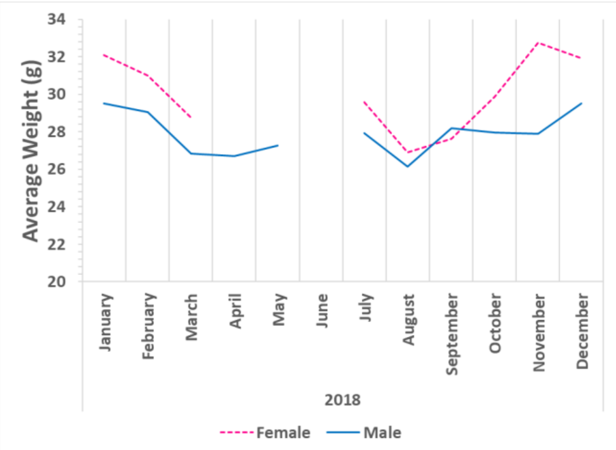
Table A89 – Individual records/deaths: 2018

SBS ID	Cohort	Sex	Deaths	Cause
BlueR	2011	M		
RR	2011	M		
RL	2011	M		
PL	2011	F		
BlackL	2011	M	07 Dec	Candidiasis
OR	2011	M		
WR	2011	M		
PPL	2012	M		
PPR	2012	F		
PBlueR	2012	M		
PRL	2012	M		
PRR	2012	F		
POL	2012	F		
POR	2012	M		
PWL	2012	F		
PWR	2012	F		
PLGL	2012	F		
PDGR	2012	M		
UNR	2012	M		
Chick 2:4	2018	UNK		Yolk sac infection
Chick 2:2	2018	F		Flight collision/fatal trauma

A8.1 Health

A8.1.1 Body weights: all birds

No weights taking in June to avoid disturbance during the breeding season. Very few weights were taken in April and May; Figure A28 and Table A90.



Note: Includes remote weights and in-hand, excludes death weights

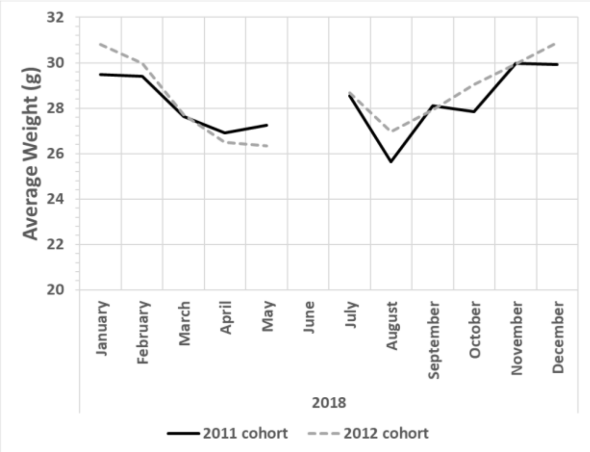
Figure A28 – Mean body weights of all birds: 2018

Table A90 – Number of individuals by sex (end of each month): 2018

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	12	12	12	12	12	12	12	12	12	12	12	11
Females	7	7	7	7	7	7	7	7	7	7	7	7

A8.1.2 Body weights: 2011 and 2012 cohorts

No weights taking in June to avoid disturbance during the breeding season. Very few weights were taken in April and May; Figure A29 and Table A91.



Note: Includes remote weights and in-hand, excludes death weights

Figure A29 – Mean body weights: 2011 and 2012 cohorts: 2018

Table A91 – Number of individuals by cohort (end of each month): 2018

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	7	7	7	7	7	7	7	7	7	7	7	6
2012	12	12	12	12	12	12	12	12	12	12	12	12

A8.1.3 Moult scoring

Assessment of moult scores; Table A92.

Table A92 – Moult scoring (last score of the month): 2018

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Jan (3)	1.0	3.0	5.0	3.5 (3.5:3.0)	2.5 (3.0:2.0)	3.5 (3.5:3.0)	2.5 (3.0:2.0)
Feb (4)	2.0	5.5	6.5	5.5 (5.5:5.0)	5.5 (6.0:5.0)	5.5 (5.5:6.0)	5.0 (5.0:5.0)
Mar (1)	2.0	5.0	6.5	5.0 (5.5:5.0)	5.0 (6.0:5.0)	5.5 (5.5:6.0)	5.0 (5.0:5.0)
Apr (1)	3.5	6.0	7.0	6.5 (6.5:6.5)	6.0 (7.0:6.0)	6.5 (6.5:7.0)	6.0 (6.5:6.0)
May (1)	4.0	6.5	7.0	6.5 (6.5:6.5)	6.0 (7.0:6.0)	6.5 (6.5:7.0)	6.0 (6.5:6.0)
Jun (3)	2.0	4.0	6.0	4.0 (4.5:4.0)	4.5 (5.0:4.0)	4.5 (4.5:5.0)	4.0 (4.0:4.0)
Jul (4)	1.0	2.5	6.0	3.0 (2.0:4.0)	2.0 (2.0:2.0)	2.0 (2.0:2.0)	3.0 (4.0:2.0)
Aug (3)	1.0	1.5	6.0	1.5 (1.0:2.0)	2.0 (1.0:2.0)	1.0 (1.0:1.0)	2.0 (2.0:2.0)
Sep (2)	1.0	1.5	4.0	1.5 (1.0:1.5)	2.0 (1.0:2.0)	1.0 (1.0:1.0)	1.5 (1.5:2.0)
Oct (3)	1.0	1.5	3.0	1.5 (1.0:2.0)	1.0 (1.0:1.0)	1.0 (1.0:1.0)	1.5 (2.0:1.0)
Nov (0*)	1.0	1.5	3.0	1.5 (1.0:2.0)	1.0 (1.0:1.0)	1.0 (1.0:1.0)	1.5 (2.0:1.0)
Dec (2)	1.0	1.5	2.0	1.5 (1.0:1.5)	1.0 (1.0:1.5)	1.0 (1.0:1.0)	1.5 (1.5:1.5)

Notes:
* No moult scores as no change in plumage since end of October
Some variation between score takers
Rounded to the nearest 0.5

A8.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A93. Of approximately 55 cases of lameness this year 40% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A8.1.5 & Tables A94 and A95.

Table A93 – Summary of lameness for each month: 2018

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	19	0	0	0
Feb	19	6	0	11
Mar	19	3	1	16
Apr	19	1	1	3
May	19	2	0	5
Jun	19 (+1)	5	1	14
Jul	19 (+1)	5	1	20
Aug	19	6	1	25
Sep	19	3	1	11
Oct	19	5	2	25
Nov	19	12	10	105
Dec	19-18	7	4	53
				Total: 288

Note: * 1 = One day of one lame bird

A8.1.5 Afflictions/treatments

In September numerous green faeces were found throughout the bird accessible areas. Additionally in the same month, some faeces containing undigested bloodworms were also found which continued in higher quantities into October, with some instances noted in November. Runny brown faeces were also found in November. It is unclear which individuals these belonged to.

Table A94 – Group health checks/treatments: 2018

Month	Treatment received
Oct-Nov	All birds put on a course anti-fungal treatment (Nystatin).

Table A95 – Individual afflictions/treatments: 2018

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Mar-Apr PWL	Severe limp	Possibly amyloidosis	Moult, stressors	Course of oral anti-inflammatory treatment plus fluids administered remotely. **Symptoms gradually subsided** Course of oral anti-inflammatory treatment plus fluids administered remotely. **Symptoms subsided**	
Apr POR	Lump on bill, skin appears stretched here. Bill slightly bent	Trauma related swelling	Flight collision		Large lump on top of upper mandible. No treatment given, continued to monitor **Swelling gradually reduced**
May POR	Cloudy/grey eye, head shaking and scratching eye. Impaired vision, distressed and disorientated	Eye injury	Likely from flight collision	Given an oral anti-inflammatory treatment plus fluids administered remotely. Following day one eye appeared red with some swelling. Started a course of oral anti-inflammatory and antibiotic treatment plus fluids, administered remotely. **Superficially recovered within a couple of weeks**	
Jun-Sep PWL	Severe limp. Not weight bearing, holding leg up (not tucked to body)	Cracked feet, infected nail bed. Possibly amyloidosis	Stress of breeding season, moult, additional stressors	Jun Course of oral anti-inflammatory administered remotely. Improvement seen. Caught to move from BA to main flock- treated topically. Looked hunched the day after, given one more day of anti-inflammatory treatment. **Intermittent symptoms** Jul Course of oral anti-inflammatory administered remotely. **Intermittent symptoms**	Limping again later in the month which was not treated. **Intermittent symptoms**
				Aug Given two short courses of oral anti-inflammatory administered remotely. **Intermittent symptoms** Sep Short course of oral anti-inflammatory administered remotely. **Symptoms subsided**	
Jun Chick 2:2 aka Tyrion	Found dead unexpectedly	Fatal trauma	Flight collision	**Found dead unexpectedly**. Aged 49 days. Known to be flying from at least 25 days. CCTV did not show any collision, only the bird crawling on floor before death.	
Sep-Oct WR	Taps feet and stares at them when stood still, looks uncomfortable. Issues with preening/maintaining plumage	Crystallised preen gland	Unclear, possibly stressors, possibly amyloidosis	Caught for examination -gland cleaned and fluid removed (swabs taken beforehand). Course of oral anti-inflammatory and antibiotic administered remotely. An alternative antibiotic course started after little improvement seen. **Symptoms subsided**	
Sep-Oct OR	Upper and lower mandible no longer	Mandibles misaligned	Likely from flight collision	Course of anti-inflammatory administered remotely. **Intermittent symptoms**	

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal) / No treatment received
	meeting. Eye being squinted occasionally			
Oct PLGL	Prolonged limp	Possibly amyloidosis	Moult, other stressors	Course of anti-inflammatory administered remotely. **Symptoms subsided**
Oct BlackL	Gasping, frantic foraging, struggling to swallow crickets	Possibly Candidiasis	Stressors, underlying health conditions, possibly amyloidosis	Caught multiple times -course of antifungal treatment (Itraconazole) administered via gavage with food supplement. Switched to remotely feeding when it began too difficult to catch the bird. **Intermittent symptoms**
Oct PPR	Hunched, squinting, alarm calling often, fluffed feathers, lethargic	Possibly Candidiasis	Stressors, underlying health conditions, possibly amyloidosis	Course of antifungal administered remotely. **Symptoms subsided**
Oct PWL	Intermittent symptoms: Closed eye, appeared damp/greasy around eye, feather possibly obscuring eye	Unclear	Possibly flight collision	Caught for examination -eye flushed with saline. No other treatment given, continued to monitor. **Intermittent symptoms**
Oct PBlueR	Fluffed feathers initially, decrease in interest in live food Condition deteriorated overnight, wings dropped	Possibly Candidiasis	Stressors, underlying health issues	Course of antifungal administered remotely. **Intermittent symptoms**
Oct-Nov POL	Limping, switching legs, not weight bearing	Possibly amyloidosis	Moult, other stressors	Course of anti-inflammatory administered remotely. **Intermittent symptoms**
Nov PPL PLGL RR POR PWL PRL PDGR	Began limping within a few days of each other, switching legs	Possibly amyloidosis		All started a course of anti-inflammatory administered remotely. **Symptoms continued** Treatments stopped due to fear of long-term effects of medication, and with knowledge that limps often clear on their own Some birds put back on treatment after a week with no improvement without treatment. **Intermittent symptoms**
Nov-Dec BlackL	Prolonged low weight, tame, frantic behaviours, appeared very hungry Poor condition, difficulty swallowing, gasping. Sudden rapid deterioration	Possibly Candidiasis	Stressors, underlying conditions	Nov Food supplement administered remotely throughout Nov. **Symptoms continued** Dec Continued to be remotely fed food supplement injected into mealworms. Caught to examine, extremely thin, no abnormalities in mouth or throat, feathers around vent soiled. Gavage antibiotic and food supplement. Very lethargic and weak once put back with flock. **Died shortly after handling**

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Nov PBlueR	Low weight	Possibly Candidiasis	Stressors	Food supplement administered remotely over two days. **Weight increased**	
Dec PWL	Severe limp. Eye irritation, damp and rubbing it	Feathers growing into eye	Past collision injury	Course of anti-inflammatory administered remotely. **Intermittent symptoms**	
Dec PGDR	Severe limp	Possibly amyloidosis	Moult, other stressors	Course of anti-inflammatory administered remotely. **Symptoms subsided**	
Dec PLGL	Limping. Toe bent in odd direction with swelling	Cracked feet and possible fractured toe	Stressors, and possible trauma, possibly amyloidosis	Caught for examination -courses of anti-inflammatory and course of antibiotic administered remotely. Topical treatment also applied, and nails trimmed. **Symptoms continued**	
Dec UNR	Stiff walk, developed into limp	Possibly amyloidosis	Moult, other stressors	Course of anti-inflammatory administered remotely. **Intermittent symptoms**	
Dec OR	Gasping, and open-mouth breathing. Tameness, frantic foraging	Possibly Candidiasis (exhibiting same behaviours as BlackL)	Stressors, underlying health issues, possibly amyloidosis	Course of antifungal administered remotely. **Intermittent symptoms**	
Dec PBlueR	Rapid weight loss, disinterested in live food, inactive, hunched	Possibly Candidiasis	Stressors, underlying health conditions, possibly amyloidosis	Course of antifungal administered remotely. **Symptoms continued**	

Notes:

Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death

'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A8.2 Locality

A8.2.1 SBS facility configuration

See Figure A30. Further details in Section 2.1.2.

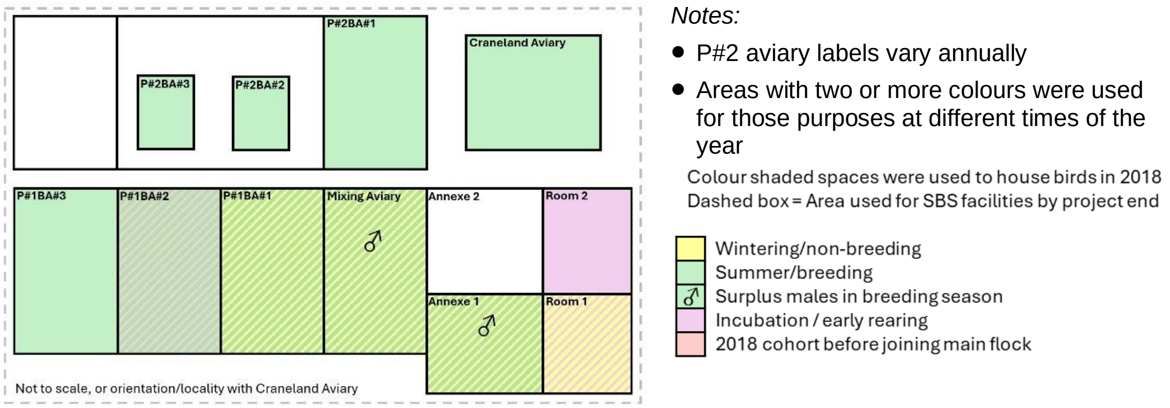


Figure A30 – SBS facility configuration: 2018

A8.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A96.

January

- The birds had access to Room #1, An#1, MA and P#1BA#1 until 4 January when they were confined to Room #1 and An#1 while netting work took place in P#1. They regained access to the MA on 19 January and P#1BA#1 on 22 January. They were also denied access to An#1 and Room #1 on 30 and 31 January whilst sand was replaced, and lightbulb changed.

February

- Throughout the month the birds had access to Room #1, An#1, MA, P#1BA#1 and BA#2.

March

- The birds were shut into Room #1 and An#1 on the 1 March due to extremely cold weather freezing the MA and breeding aviary ponds. They regained access to the MA, P#1BA#1 and BA#2 in March as temperatures rose.
- Most pairs were moved to BAs in March:
  - 9: POR and PL were moved to P#1BA#3; PDGR and PRR were moved to P#1BA#2.
  - 14: RL and PPR were moved to P#2BA#3; PPL and PWL were moved to P#2BA#2; BlueR and PWR were moved to P#2BA#1; PRL and PLGL were moved to P#1BA#1.

April

- 4: BlackL and POL were moved to the Craneland Aviary. The remaining pairs and surplus males remained in their areas.

May

- All pairs and surplus males remained in their designated aviaries throughout May.

June

- 4: The pair from P#2BA#2 were moved in with the surplus males due to PWL's persisting limp.

- 6: The pair from P#1BA#3 were moved to join the pair in P#1BA#1 in order to prepare the aviary to house the chick hatched on 30 May.
- 11: All birds occupying An#1, MA, P#1BA#1 and BA#2 were mixed and then confined to An#1, MA and P#1BA#1.
- 12: The pairs from P#2BA#1 and P#2BA#3 were moved to join the rest of the flock.
- From 30 May to 7 June, chick 2:2 was reared in Room #1. Moved to P#1BA#3 within a brooder on 7 June. Given access to whole of P#1BA#2 on 16 June, with access to whole of P#1BA#3 on 24 June.

July

- Chick 2:2 shut in P#1BA#2 on 3 July and the pair from Craneland Aviary were moved to P#1BA#3, then the pop-hole opened to P#1BA#2 introducing them to the chick. The pop-hole to the MA was opened on 5 July allowing them to join the main flock. The flock were then shut out of P#1BA#3, allowing them access to An#1, MA, P#1BA#1 and P#1BA#2 for the remainder of the month.

August

- Birds continued to have access to An#1, MA and P#1BA#1 throughout August.

September

- Birds continued to have access to An#1, MA and P#1BA#1 throughout September.

October

- Birds continued to have access to An#1, MA and P#1BA#1 throughout October. They were given access to Room #1 on 20 October. Earlier than usual due to many birds in sub-optimal condition.

November

- Birds continued to have access to Room #1, An#1, MAa and P#1BA#1 throughout November.

December

- Birds continued to have access to Room #1, An#1, MA and P#1BA#1 throughout December.
- 7: Birds were shut into Room #1 and An#1 to limit the movement of a particularly sick bird (BlackL).

Table A96 – Space occupancy: 2018

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1			14							20		
Room #2												
An#1			♂	♂	♂	♂						
An#2												
MA			♂	♂	♂	♂						
P#1BA#1			9									
P#1BA#2	30	28	9			11						
P#1BA#3			7			6	Pair + chick IN 3 Out 5					
P#2BA#1			14			12						
P#2BA#2			14			4						
P#2BA#3			14			12						
P#2BA#4												
Craneland Aviary				4			3					

Notes:

- Wintering/non-breeding
- Summer/breeding
- ♂ Surplus males in breeding season
- Incubation/early rearing

A8.3 Social network

A8.3.1 Introductions/departures/interactions

One bird was introduced to the flock this year. The breeding season yielded one fledgling hatched on 30 May. It was reared indoors initially away from the adults with its sibling, though this chick died shortly after hatching. It's possible the adults could hear it but not confirmed. At eight days old the chick was moved to a BA in P#1 where it could be heard by the adults. At 32 days old the chick was observed contact calling to the adults. At 34 days old an adult male and adult female joined the chick in its aviary. Little interaction was observed, and no obvious aggression was noted by any bird. At 36 days all pop-holes were opened in P#1 allowing all birds to mix. One adult male, particularly dominant within the flock, pushed the chick around a little but otherwise no aggression was observed. The chick appeared to mix well with the flock, sleeping and resting with them. It was noted on 12 July, 43 days old, the chick spent a considerable amount of time with the parent male.

It is worth noting the chick did not appear to suffer adversely of any significance being reared alone.

It is unclear whether the deaths within the flock affected the social dynamics when they occurred.

A8.4 Breeding

Some songs were heard through January and March mostly from BlackL. On 4 March breeding behaviours intensified rapidly after snowfall entered the aviaries via the netting. Resource guarding and defending of patches of snow was seen in both males and females. Singing and displaying followed; Table A97.

Activity peaked towards the end of April/start of May and quickly subsided. Almost no activity was recorded from the end of May.

Activity was considerably lower on days with high temperature.

Table A97 – Pairs: 2018

Aviary	Male(s)	Nest scrapes	Female(s)	Eggs	Notes
P#1BA#1	PRL	1	PLGL	3	• The first scrape was found on 6 Apr. PRL seen making second scrape on 19 Apr, and third on 23 Apr, PLGL spending time in them. • First egg laid on 28 Apr, thin shelled with a hole and dent. Second egg on 30 Apr, Copulation attempts seen before second egg laid. Third egg found on 2 May. All eggs were collected as soon as found. • PRL chasing PLGL often on 3 and 4 May. • On 4 May the nest was 'scrapped' as it appeared there would be no forth egg, done to stimulate a second clutch. • PRL seen nest scraping on 5 May and copulation observed on 7 May. • PRL continued to sing and scrape until 21 May.
P#1BA#2	PDGR	2	PRR	4	• First scrape found on 23 Apr, both often attending nest. • 28 and 30 Apr PRR frequently chasing PDGR. • Seen visiting nest scrape often, and possible copulations also observed between 1 and 4 May. • First egg found on 5 May, second on 7 May, third egg on 8 May, and fourth on 10 May. All eggs taken as soon as found. PRR seen incubating from 10 May. • Nest was scrapped on 11 May. • PDGR continued singing and observed scraping on 21 May with PRR following him to the scrape. Both observed gardening the scrape. • Breeding behaviours continued until the end of the month. • A dummy egg was added to the scrape on 1 Jun with hope to incite laying, but neither showed interest in it and was removed on 9 Jun.
P#1BA#3	POR	0	PL	0	• POR was moved to P#1BA#3 one day ahead of PL (7 and 8 Apr), this was to simulate the males arrival and establishment of territory ahead of the females arrival as wild SBS do.
P#2BA#1	BlueR	0	PWR	0	• BlueR spending lots of time on top on UV unit netting 1.5m from ground, often singing there. • First nest scrape found 14 Apr.
P#2BA#2	PPL	0	PWL	0	Very little breeding behaviour observed throughout the season.
P#2BA#3	RL	1	PPR	0	Observed singing end of May.
Craneland Aviary	BlackL	0	POL	0	This pair were moved to the Craneland Aviary on 4 Apr and moved out on 3 Jul. They then entered an empty aviary with the only fledged chicks as a soft introduction before being let with the rest of the flock.
MA/An#1	OR RR WR PBlueR UNR	0	-	-	All males were observed singing.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A8.4.1 Eggs

Details of eggs laid in 2018 in Figure A31 and Table A98.

A31a. Egg 1:1

A31b. Eggs 2:1 to 2:4 (no particular order)

(All photographs credit: WWT)

Figure A31 – Selection of egg photographs from the 2018 breeding season

A8.4.2 Chick deaths

The first death was chick 2:4; Table A98. It hatched 2 June and died 6 June. It had a longer hatch period than chick 2:2. It also rested/slept more than expected following hatch. It was moved to a brooder on 3 June but moved back due to lethargy. Moved again to brooder that evening and observed eating and drinking. It was still eating and drinking on 4 June but was very vocal, though settled more when adult contact call recordings were played. On 5 June morning the chick appeared lethargic and not interested in live food, though perked up that afternoon and seen eating. It was noted that the chicks right wing was dropping and was often scratching its belly and looking between its legs. That evening the chick was sleeping often, it was quiet and appeared weak. The chick died on 6 June at 00:52.

The second death was chick 2:2; Table A98. Hatched 30 May and died 18 July aged 49 days. The chick was hatched and reared successfully with no complications. It was also introduced to the adult flock with no issues. The chick was found dead unexpectedly one morning in P#1BA#1 with a very swollen left eye. It was thought to have died from collision with the aviary overnight, possibly spooked into flight. CCTV did not show the collision but the chick was observed crawling along the floor before it died.

Table A98 – Egg/chick status summary: 2018

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
PRL (M) PLGL (F) P#1BA#1	1:1	Thin shelled with a small hole and small dent. Hole covered with paper towel and Germolene New Skin. Wrapped in cling film due to rapid weight loss.	28 Apr 2018 03 May 2018	Day 0-7 70+% RH	Inconclusive results from external lab analysis	No signs of development. Removed from incubator Day 7: 10 May 2018. (Rapid unrecoverable weight loss in incubation)
	1:2	Very small hole fixed with Germolene New Skin.	30 Apr 2018 03 May 2018	Day 0-8 55%RH Day 8-22 <30%RH Silica gel packets added to incubator Day 13	Inconclusive results from external lab analysis	No signs of development. Removed from incubator Day 22: 25 May 2018. (11.2% average weight loss)

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
	1:3	Appeared normal	02 May 2018 03 May 2018	Day 0-8 55%RH Day 8-22 <30%RH Silica gel packets added to incubator Day 13	Candled Day 11, solid floating mass Inconclusive results from external lab analysis	No signs of development. Removed from incubator Day 22: 25 May 2018 (10.6% average weight loss)
PDGR (M) PRR (F) P#1BA#2	2:1	Appeared normal	05 May 2018 07 May 2018	Day 0-2 55%RH Day 3-25 <30% RH Silica gel packets added to incubator Day 9	Candled Day 7, no development seen Inconclusive results from external lab analysis	No signs of development. Removed from incubator Day 25: 02 Jun 2018. (7.4% average weight loss)
	2:2	Appeared normal	07 May 2018 07 May 2018	Day 0-4 55% RH Day 5-19 <30% RH Day 19-23 >70% RH Silica gel packets added to incubator Day 9-18	Candled Day 7, development observable	Externally pipped 29 May 2018. (11.3% average weight loss) **Hatched 30 May 2018** **Died 18 Jul 2018**
	2:3	Appeared normal	08 May 2018 10 May 2018	Day 0-4 55% RH Day 5-19 <30% RH Day 19-23 >70% RH Silica gel packets added to incubator Day 6-18	Candled Day 7, development observable	Early embryo death (approx. 5-6 days). Removed from incubator Day 23: 02 Jun 2018. (11.2% average weight loss)
	2:4	Appeared normal	10 May 2018 10 May 2018	Day 0-4 55% RH Day 5-15 45% RH Day 16-18 50% RH Day 19-20 60% RH Day 21-23 >70%RH Silica gel packets added to incubator Day 6-16	Candled Day 8, development observable	Externally pipped 01/06/18. (13.9% average weight loss) **Hatched 02 Jun 2018** **Died 06 Jun 2018**

A8.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximately temperatures required by the birds depending on time of year and health status; Table A99. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary)

Table A99 – Temperature data summary: 2018

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan	-1.0	4.0	6.5	9.5	12.0	14.0 (A#1, P#1BA#1)	-1.0 (MA, P#1BA#1)
Feb	-2.0	2.5	5.0	9.0	13.5	18.0 (P#1BA#1)	-4.0 (P#1BA#1)
Mar	-2.5	4.0	6.0	10.0	17.0	25.0 (P#1BA#3)	-4.0 (P#2BA#1)
Apr	4.5	8.5	11.5	16.0	28.0	44.0 (Craneland)	3.0 (Craneland)
May	5.0	11.0	15.5	23.0	30.5	45.0 (Craneland)	1.5 (Craneland)
Jun	10.5	14.5	19.0	27.0	33.0	49.5 (Craneland)	7.5 (Craneland, P#1BA#3)
Jul*	15.0	17.0	21.5	30.0	35.5	50.5 (Craneland)	11.5 (Craneland)
Aug**	11.0	16.0	20.5	28.0	36.0	36.5 (P#1BA#1)	9.0 (An#1)
Sep	5.5	12.0	15.5	21.6	28.0	31.0 (P#1BA#1)	3.5 (An#1, MA, P#1BA#1)
Oct	1.5	9.0	12.0	16.5	24.0	27.5 (P#1BA#1)	-1.0 (MA)
Nov	2.0	7.5	9.5	12.0	15.5	20.0 (MA)	0.0 (An#1)
Dec	2.0	7.0	8.5	10.5	14.5	25.5 (An#1)	0.5 (MA)

Notes:
* Data missing between 6 and 12 July
** Data until 24 August only

A8.6 Lighting and photoperiod

Figure A32 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

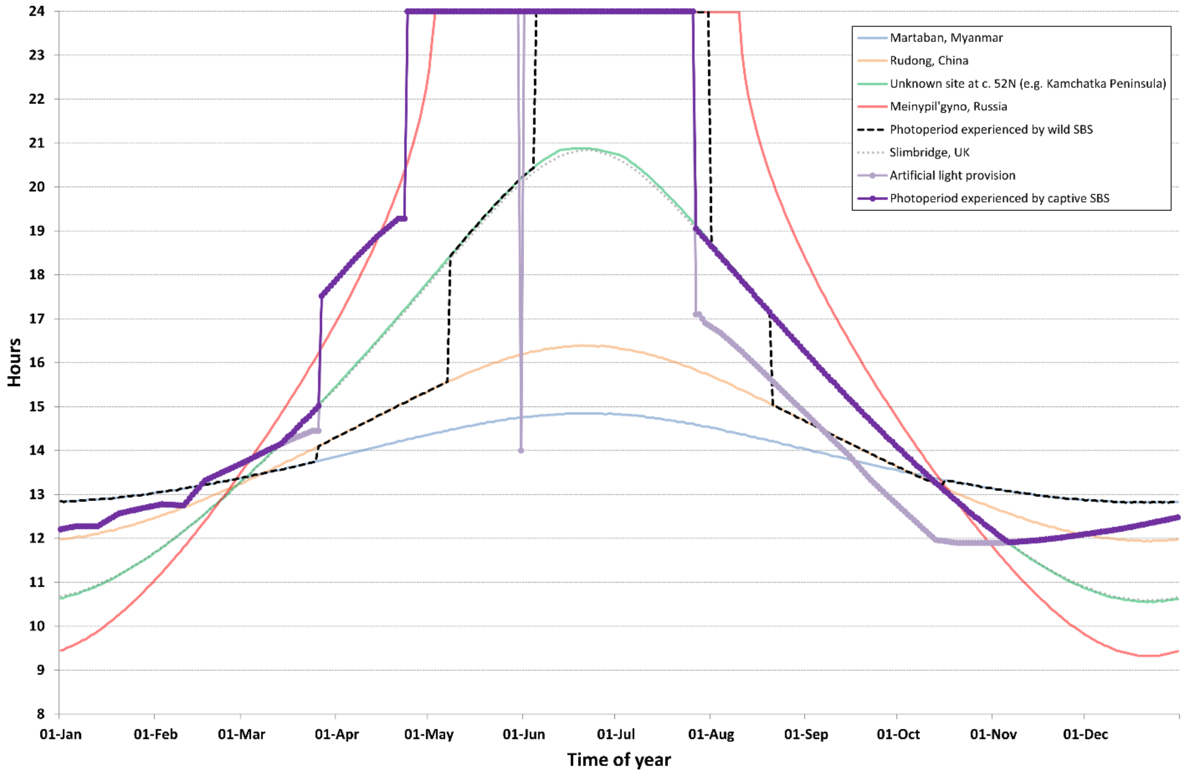


Figure A32 – Photoperiod wild SBS experience during the year based on location: 2018

A8.6.1 Photoperiod experienced by the captive SBS

For the first half of the year the captive birds experienced a photoperiod roughly similar to that of wild SBS. This was in part due to the time shift which began late 2017, shortening their 2017/18 winter to be able to bring the breeding season forward by six weeks, to encourage them to breed in the cooler months of spring. As the season was brought forward, the Slimbridge (UK) photoperiod no longer affected the spring photoperiod, so they experienced the migratory jumps in location/photoperiod that wild SBS experience. They received 24 hours of light exactly six weeks earlier than wild SBS typically experience. This was additionally extended beyond the usual eight-week breeding season by another five weeks and five days in hope to encourage additional first and second clutches. On 26 July the birds jumped in photoperiod from 24 hours to meet the Slimbridge (UK) photoperiod. They followed the gradual decline until November when artificial lighting took over. From here photoperiod gradually increased again, rather than being held between 11 and 12 hours for winter, to incorporate and additional two-week time shift bringing the following breeding season forward by a total of eight weeks. This again meant a short 2018/19 winter. UVI readings shown in Table A100.

A8.6.2 Notes

On 31 May there was a power cut between 11:00 and 21:00, this is reflected on Figure A32 by a dip to 14 hours of daylight hours for artificial lighting. As this occurred during light hours this did not affect the photoperiod experienced by the SBS.

To avoid the birds being plunged into sudden darkness the on/off times for the various lights in use were staggered with about one minute between each.

Table A100 – Mean monthly UVI readings from accessible light units: 2018

UV Unit* ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MA large										5.8	4.9	5.2
MA small	4.0											
An#1 large	2.4	4.1	3.9	4.2	4.0	4.1	3.5	3.6	4.5	4.8	4.2	4.6
An#1 small		3.2	3.1	2.9	3.5	OFF		2.7	2.9	3.3	3.9	3.7
Room #1	4.3	4.2	4.1							6.4	5.6	5.2
P#1BA#1 small	4.5											
P#1BA#1 large		5.1	5.5	5.2	4.9	4.7	4.5	4.7	5.2	5.5	4.8	4.4
P#1BA#2		6.5	6.7	4.8	4.7	4.6	4.4					
P#1BA#3			6.8	4.8	4.5	OFF**						
P#2BA#1				4.7	4.5	4.6						
P#2BA#2				5.0	4.8	4.6						
P#2BA#3				5.0	4.9	4.8						
Craneland				4.8	5.2	5.4	5.4					

Notes:
* Not all UV units were accessible at any one time i.e. one unit in each breeding aviary during the breeding season
** Switched off due to eye injury in one birds and suspected sensitivity to light
UVI readings were taken approximately once a week outside of the breeding season. Bulbs were replaced as and when needed

A8.7 Diet and nutrition

Two new food items high in calcium were tested on the birds in 2018 in hope to improve female condition and egg quality the following breeding season. The birds showed very little interest in the live calci worms, some picking them up in their bill but dropping them immediately while most did not attempt at all. The cultured woodlice seemed to appeal to some birds, pecking persistently until in a state to be eaten. Live Tubiflex worms were also given which the birds ate readily.

Lundi was provided dry only. Grit, including oyster shell grit, was present year-round; Table A101.

Table A101 – Food present/absent in diet: 2018

Food item/supplement^		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **35**	X	12.5	50	50	50	50	↑	0	0	0	0	0
	Lundi micro **20**	100	87.5	50	50	50	50	↓	100	100	100 *	100*	100*
Insectivorous Feast		✓	✓	✓	✓	✓	↓	✓	✓	↑	↑	✓	✓
Live/frozen bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oyster shell grit		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Salt water**		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calci-dust (on dry food)		X	✓	✓	↑	↓	↓	X	X	X	X	X	X
Frozen Brine shrimp+ omega3		X	✓	✓	✓	↓	↓	X	X	X	X	X	***
Frozen red plankton		X	✓	✓	✓	↓	↓	X	X	X	X	X	***
Avripro (on dry food)		X	X	X	X	X	X	X	X	✓	✓	✓	✓
Live Tubiflex worms		X	X	X	X	X	X	X	X	X	✓	X	✓
Live calci worms		X	X	X	X	X	X	X	X	X	X	✓	X
Live cultured woodlice		X	X	X	X	X	X	X	X	X	X	X	✓
Live mealworms		✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds	✓ For Meds

Notes:
* Lundi micro 20 partially crushed to assist BlackL in swallowing (utilised by all birds)
** Salt water only provided in BAs if foot condition was poor
*** Offered to BlackL in poor health
^Most frequently provided items to least

✓	Present in diet
↑	Increasing that month
↓	Decreasing that month
	Present for certain birds
X	Absent from diet

A8.8 Sanitation

A8.8.1 Water system

- The annexe and polytunnel ponds sumps and filters were cleaned approximately once a fortnight. The annexe pond was emptied and refilled daily and the filter sent to waste for approximately half an hour. The MA pond was cleaned daily with fresh water and salt added.

A8.8.2 Substrates

- Sand topped up in the MA in August.
- Sand replaced in the MA pond in July. Sand rinsed through in November.
- Sand in An#1 topped up in December.
- Sand replaced in An#1 pond in July.

A8.8.3 Biosecurity

- Following environmental sampling which demonstrated Pseudomonas on 5 July, the sand in the MA, An#1 and P#1BA#1 was soaked with F10 every few days for the remainder of the month. The daily excrement-picking routine was increased from twice daily to three times per day for the month.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A8.9 Environment provisions, modifications, and events with consequences

A8.9.1 Climate

- Heat lamps were added to each side of the UV light units in an attempt to encourage the birds to stand near them (January).
- Plastic 'D' ends of each polytunnel replaced with nylon mesh in hope to release hot air and increase airflow (March).
- Photoperiod altered to start the breeding season six weeks earlier than normal (i.e. what wild counterparts experience) in hope to commence breeding during the cooler temperatures of spring. The birds began moving to BAs 10 weeks earlier than the previous year.
- A paddling pool with a water fountain was placed in the corridor between the polytunnels in an attempt to reduce air temperature by evaporation (May).
- Room #1 heated using an oil radiator (October-March).
- Ice was added to the sump for the BA ponds when summer temperatures were high (April-August approximately).

A8.9.2 Light

- In late 2017 the artificial photoperiod the birds normally experience (i.e. a simulation of what wild SBS experience) was altered, shortening the 2017/18 winter by increasing the day length more rapidly to be able to stimulate the birds to breed earlier in the cooler UK spring climate, rather than the heat of summer. Through gradual changes to the photoperiod the breeding season was shifted six weeks (42 days) earlier. Not only did this 'time-shift' occur but the breeding season was also extended, also by manipulating the photoperiod holding them in the breeding grounds with 24 hours of light. Early signs indicated the time-shift had the desirable effect, including moulting into breeding plumage earlier than in previous years. However, extending the breeding season yielded no additional clutches.
- The polytunnel rooves were cleaned in hope to allow more sunlight into the aviaries (January).
- A large UV unit was added to P#1BA#1 with heat lamps either side to encourage the birds to roost here (February).
- A scaffolding tower with luminaires attached was placed in the corridor between the polytunnels, these lights were on 24 hours a day throughout the breeding season. Luminaires above the BAs were also on 24 hours a day. Lights in MA, annexe and UV/side lamps on 20 hours approximately (April-June).
- On 31 May there was a power cut between 11:00 and 21:00, lights and fans remained off throughout this period (a power generator was used for incubators and rearing unit heat and UV light for chicks) (May).

A8.9.3 Enclosure

- All inner netting of P#1 replaced. Long side panel replaced with micromesh (January).
- The 'D' end sections of both polytunnel rooves were removed for better airflow (March).
- BlackL found stuck in 19mm woven nylon netting in the Craneland Aviary. Freed itself when staff entered aviary, no adverse effects, likely not stuck there long. No changes made to aviary (April).
- The inner ceiling netting and the long far side inner netting of P#2 were removed (September). Their replacement (with micromesh) started in November and finished in December.
- Small aviaries in P#2 dismantled and stored (October).
- Roof and MA-side netting replaced in An#1. New sticky-back plastic added to windows of An#1/Room #1 (October).

A8.9.4 Substrate/habitat

- Additional shrubs, grasses, heather, and turf were planted in the BAs to create further shade, shelter and visual barriers. Extra pipes covered with sand and turf were also added to the BAs to give additional look out/display areas for the birds, as well as shade, shelter and visual barriers (January).
- Saltwater baths added due to poor foot condition in some birds (October).

A8.9.5 Other

- Wren *Troglodytes troglodytes* occasionally present in the facility, including in SBS occupied areas. Birds spooked by it (February).
- Live feeds (i.e. extra live food given) broadcast in WWTs cinema for the Severn Wader Festival (September).

- Back flow of water into annexe sump due to high ground water. Annexe pump, sump and filter not used until issue sorted and pumps and sumps cleaned (November).

A8.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A102.

Table A102 – Number and type of visitor to the breeding facility: 2018

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan				
Feb				
Mar				4 (to add new sockets in polytunnel corridor and fix entrance door)
Apr				
May				
Jun		3 (VIP/external)	2 (media team filming 2018 chick)	
Jul			1 (externals filming the chick)	
Aug		2 (internal staff, VIP/externals)		
Sep		1 (VIP/externals)		1 (checking fire alarms)
Oct	1 (VIP/externals)			
Nov				1 (electricians looking at fuse boxes)
Dec				

A9. 2019 Summary

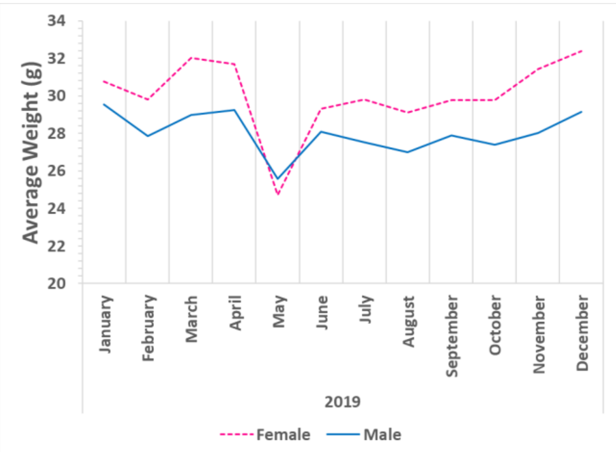
Table A103 – Individual records/deaths: 2019

SBS ID	Cohort	Sex	Deaths	Cause
BlueR	2011	M		
RR	2011	M		
RL	2011	M		
PL	2011	F	27 May	Amyloidosis, Candidiasis
OR	2011	M	20 Feb	Amyloidosis, Candidiasis
WR	2011	M	06 Nov	Amyloidosis, Candidiasis
PPL	2012	M	02 May	Candidiasis
PPR	2012	F	03 Jun	Amyloidosis, Candidiasis
PBlueR	2012	M		
PRL	2012	M		
PRR	2012	F		
POL	2012	F		
POR	2012	M		
PWL	2012	F		
PWR	2012	F		
PLGL	2012	F		
PDGR	2012	M		
UNR	2012	M	25 Aug	Amyloidosis, Candidiasis
LBDGL 1:2 (Light Blue Dark Green Left)	2019	M		
LBRL 1:1 (Light Blue Red Left)	2019	M		
Chick 1:3	2019	U	30 May	Yolk sac infection

A9.1 Health

A9.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. In May and June of 2019 only sick birds were weighed, the rest were not weighed to avoid disturbance during the breeding season; Figure A33 and Table A104.



Note: Includes remote weights and in-hand, excludes death weights and 2019 cohort weights

Figure A33 – Mean body weights of all birds: 2019

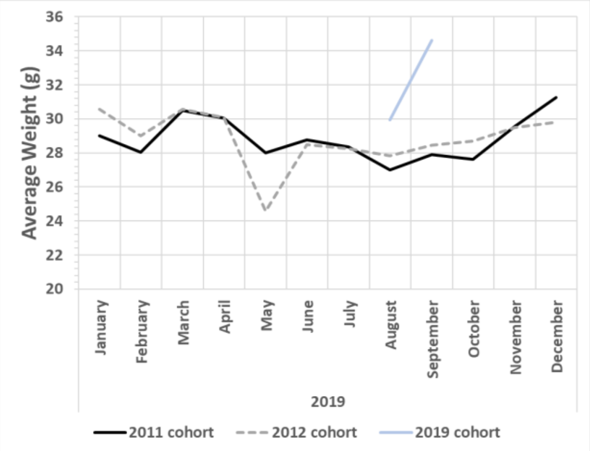
Table A104 – Number of individuals by sex (end of each month): 2019

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	11	10	10	10	9	9	9	8	8	8	7	7
Females	7	7	7	7	6	5	5	5	5	5	5	5

Note: Excludes two males from 2019 cohort

A9.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. In May and June of 2019 only sick birds were weighed, the rest were not weighed to avoid disturbance during the breeding season; Figure A34 and Table A105.



Note: Includes remote weights and in-hand, excludes death weights

Figure A34 – Mean body weights: 2011, 2012 and 2019 cohorts: 2019

Table A105 – Number of individuals by cohort (end of each month): 2019

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	6	5	5	5	4	4	4	4	4	4	3	3
2012	12	12	12	12	11	10	10	9	9	9	9	9
2019	-	-	-	-	2	2	2	2	2	2	2	2

A9.1.3 Moult scoring

The 2019 cohort maintained juvenile plumage until December when they started moulting in some first winter feathers. Their flight feathers were cut once they had finished growing in consideration of the death of the fledged chick in 2018 after a flight collision; Table A106. No sex comparison was made in the 2011 cohort from June onwards due to no 2011 females remained. The last female from the 2011 cohort died in May therefore no subsequent comparison for average female between cohorts, or average 2011 cohort between sexes could be made.

Table A106 – Moult scoring: 2011 and 2012 cohorts (last score of month): 2019

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male (+ av. scores of 2011:2012 cohorts)	Average female (+ av. scores of 2011:2012 cohorts)	Average 2011 cohort (+ av. scores of sexes)	Average 2012 cohort (+ av. scores of sexes)
Jan (3)	1.0	1.5	3.0	1.5 (1.5:2.0)	1.0 (1.0:1.0)	1.5 (1.5:1.0)	1.5 (2.0:1.0)
Feb (5)	1.0	2.0	3.5	2.5 (3.0:2.0)	1.5 (2.0:1.5)	3.0 (3.0:2.0)	1.5 (2.0:1.5)
Mar (5)	1.0	4.5	6.5	5.0 (6.0:4.0)	4.5 (5.5:4.0)	6.0 (6.0:5.5)	4.0 (4.0:4.0)
Apr (3)	4.0	6.0	7.0	6.5 (7.0:6.0)	6.0 (6.5:6.0)	6.5 (7.0:6.5)	6.0 (6.0:6.0)
May (0*)	-	-	-	-	-	-	-
Jun (2)	3.0	5.5	6.5	5.5 (6.0:5.0)	5.0	6.0	5.0 (5.0:5.0)
Jul (2)	2.5	4.0	5.0	4.0 (4.5:4.0)	3.5	4.5	3.5 (4.0:3.5)
Aug (2)	2.0	2.5	4.0	3.0 (3.0:3.0)	2.0	3.0	2.5 (3.0:2.5)
Sep (4)	1.0	2.0	4.0	2.0 (2.0:1.5)	2.0	2.0	1.5 (1.5:2.0)
Oct (4)	1.0	1.0	2.0	1.5 (1.5:1.0)	1.0	1.5	1.0 (1.0:1.0)
Nov (3)	1.0	1.5	2.0	1.5 (1.5:1.5)	1.0	1.5	1.0 (1.5:1.5)
Dec (2)	1.0	2.0	3.5	2.0 (2.5:2.0)	2.0	No data	2.0 (2.0:2.5)

Notes:
* No moult scores to avoid disturbing the birds in the breeding season
Some variation between score takers
Rounded to the nearest 0.5

A9.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A107. Of approximately 94 cases of lameness this year 22% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A9.1.5 & Tables 108 and A109.

Data from the 2019 cohort was included from May.

Table A107 – Summary of lameness for each month: 2019

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	18	15	4	114
Feb	18-17	10	0	50
Mar	17	8	2	36
Apr	17	3	1	3
May	19-17	10	2	18
Jun	17-16	13	4	35
Jul	16-15	4	0	24
Aug	15	8	1	46
Sep	15	9	4	79
Oct	15	7	0	42
Nov	15-14	4	2	39
Dec	14	3	1	34

Total: 520

Note: * 1 = One day of one lame bird

A9.1.5 Afflictions/treatments

- Faeces with undigested bloodworms were found throughout January, and some in November.
- Some faeces containing blood were found on one occasion in February.
- Some green faeces found in July.

Table A108 – Group health checks/treatments: 2019

Month	Treatment received
Jan	The 2011 and 2012 cohorts received 21-day course of oral antifungal administered remotely after repeated positive results for *Candida* in faecal samples in Dec 2018, in attempt to reduce infection levels in the birds. (Done in conjunction with frequent disinfection of their aviaries).

Table A109 – Individual afflictions/treatments: 2019

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan PBlueR	Rapid weight loss, disinterested in live food, inactive, hunched	Possibly Candidiasis	Stressors, underlying health conditions, possibly amyloidosis	Continued course of antifungal treatment administered remotely. **Intermittent symptoms**	
Jan OR	None	Entanglement of foot/toes with human hair	-		Caught to remove hair. Tips of toes appeared pink. No other concerns.
Jan PLGL	Swelling on toe, severe limp/not weight bearing	Suspected fractured toe	Possibly collision incident	Course of oral antibiotic injected into crickets and administered remotely. **Symptoms continued** Course of oral anti-inflammatory administered remotely. **Symptoms continued**	
Jan PWL	Severe limp, holding leg up when walking (not tucked to body), flying to move around aviaries	Unclear, possibly amyloidosis	Possibly going into moult, stressors	Course of oral anti-inflammatory administered remotely. **Recovered by end of treatment**	(Caught day after course finished to remove vegetation tangled around foot, foot condition was good)
Jan PRR	Severe limp, little weight bearing	Deep crack on toe visible remotely	Cracked feet, stressors	Course of oral anti-inflammatory treatment administered remotely. **Intermittent symptoms**	
Feb-May PPL	Breast feathers wet and parted	Keel injury/abrasion Post-mortem and histology revealed Candidiasis and amyloidosis	Collision injury Stressors	• Caught for examination, wound cleaned with antimicrobial cleanser and a germicidal barrier ointment applied. Also given dose of injectable antibiotic. • Following day started a course of oral antibiotic administered remotely. • Caught three days after initial examination, wound healing well and more ointment applied. • Caught six days after initial treatment, wound had re-opened so was cleaned and more ointment applied. A course of a different oral antibiotic as administered remotely. **Treatment ongoing, recurring wound** Mar Caught to examine keel injury. Healing well, germicidal barrier ointment applied, some also applied to cracked feet. **Some improvement, keel continued to appear wet/parted, preening it often** Apr Caught for examination. Wound appeared to still be healing. Course of oral anti-inflammatory administered remotely. **Wound continued to heal** May **Found dead**	
Feb OR	Stiff walk, unbalanced, loss of appetite	Suspected Candidiasis and amyloidosis, confirmed in post-mortem and histology results	Stressors, existing poor health	Caught for examination. Very thin, prominent keel, very low weight. Nutritional supplement, oral antibiotic and oral antifungal treatment given via gavage. **Found dead the following day**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Feb-Mar WR	Swollen leg, inflammation between metal and colour rings	Constriction or abrasion	Rings possibly wedged on leg	• Caught to remove rings (remains known as WR). Germicidal barrier ointment applied. No long-term damage visible. (Preen gland also examined which appeared healthy). Put on course of oral antibiotic and oral anti-inflammatory administered remotely. • Symptoms persisted so started another course of oral antibiotic and a course of anti-inflammatory also administered remotely. **Recovered fully three days after treatment end**	
Feb-Mar PL	Tame, very hungry, dull eyes	Likely Candidiasis	Stressors including moult, possibly amyloidosis	Course of two different oral antifungals administered remotely. Went into heavy moult during this period. **Symptoms continued**	
Feb PPR	Hunched, squinting, loss of appetite	Likely Candidiasis	Stressors, possibly amyloidosis	Course of two different oral antifungals administered remotely. **Intermittent symptoms**	
Mar UNR	Severe limp, not weight bearing	Unclear, possibly amyloidosis	Possibly moult, other stressors	Course of oral anti-inflammatory administered remotely. **Intermittent symptoms**	
Apr BlueR	Unbalanced, weak	Possible collision injury	High winds	Given hydrating supplement administered remotely. **Recovered the following day**	
Apr UNR	Overgrown bill tip	-	Not being worn down, overgrowth due to nutritional imbalance		No treatment or intervention.
Apr PLGL	Long toe nail	-	Likely overgrown not being worn down due reduced use		Nails trimmed; no treatment given.
May-Jun PPR	Hunched, feathers fluffed-up, dropping wings, squinting	Post-mortem and histology revealed Candidiasis, amyloidosis	Stressors	• Given hydrating supplement and began course of oral antibiotic administered remotely. • Caught following day for examination. Started course of oral antifungal administered remotely. **Intermittent symptoms** • Deteriorated after treatments stopped. Given course of oral antifungal administered remotely. She began refusing live food and condition deteriorated rapidly, resting on hocks with eyes closed. Caught for examination. Given injection of antibiotics and fluids, and a different antifungal with hydrating supplement via gavage. • Caught next two days to give for same treatment but replacing hydrating supplement with nutritional supplement. Staff continued to target feed hydrating supplement between times. **Found dead 22 days after initially appearing unwell**	
May PBlueR	Tame, feathers fluffed-up	Likely Candidiasis	Stressors, possibly amyloidosis	May Course of oral antifungal and hydrating supplement, administered remotely. **Symptoms continued** Given another course administered remotely.	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
				June Course of oral antifungal administered remotely. **Symptoms continued**	
May BlueR	Lame	Unclear, possibly amyloidosis	Possibly moult	May Course of oral anti-inflammatory administered remotely. No improvement during course, so additional course of oral antibiotic administered remotely. **Symptoms continued** June Given another course of oral anti-inflammatory administered remotely. **Recovered before end of course**	
May PL	Found dead unexpectedly Two days prior noted to be hunched Four days prior noted to be tame and hungry	Post-mortem and histology revealed Candidiasis, amyloidosis and heart disease	Stressors	**Found dead**	
May RR	Staggering around aviary, producing urates but no solids	Likely Candidiasis	Stressors, possibly amyloidosis		No treatment given. Faecal sample sent off for analysis, but no *Candida* reported in sample **Symptoms subsided**
May WR	Drenched plumage after misting system use	Ongoing preen gland issues	Unclear		No treatment given, continued to monitor.
June PLGL	Severe limp, swollen toe joint Lethargy, slow reactions, feathers fluffed-up, hunched	Same area of suspected fracture Likely Candidiasis	Collision Stressors, possibly amyloidosis	Course of oral anti-inflammatory administered remotely. **Recovered by end of treatment** Started course of oral antifungal administered remotely. **Symptoms subsided**	
June POL	Unbalanced, subdued	Likely Candidiasis	Stressors, possibly amyloidosis	Course of oral antifungal administered remotely. **Intermittent symptoms**	
June RL	Lethargic, squinting	Likely Candidiasis	Stressors, possibly amyloidosis	Course of oral antifungal administered remotely. **Intermittent symptoms**	
June PDGR	Lethargic, hunched, uninterested in live food	Likely Candidiasis	Stressors, moult, possibly amyloidosis	Course of oral antifungal administered remotely. Course finished sooner than planned as thought his demeanour may be due to moult, appears lethargic this time of year generally. **Symptoms continued**	
June PWL	Severe limp	Unclear, possibly amyloidosis	Possibly due to moult	Course of oral anti-inflammatory administered remotely. **Intermittent symptoms**	
June POR	Severe limp	Unclear, possibly amyloidosis	Possibly due to moult	Course of oral anti-inflammatory administered remotely. **Symptoms continued**	
June UNR	Subdued, lethargic, tame	Likely Candidiasis	Stressors, possibly amyloidosis	Course of oral antifungal administered remotely. **Intermittent symptoms**	

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
July POL, RL, PLGL, UNR, RR, PBlueP, POR, PGDR	Symptoms include subdued, lethargic, unbalanced, squinting, slow, disinterested in live food, decreased appetite, tame, pacing	Likely Candidiasis	Stressors, possibly amyloidosis	All received a course of oral antifungal administered remotely. **Some improvement seen in:** POL, RL, PLGL, RR, PBlueR, POR **Little improvement seen in:** UNR, PDGR Birds with symptoms shut in An#1 with food dishes removed before treatment given due to decreased appetite. This also gave them access to more food and less competition.	
July UNR	Swollen hind toe	Constriction, plant material tightly wrapped around hind toe	-		Plant material removed, swollen but no redness or bleeding. No treatment given.
Aug PBlueR, POR, PDGR, UNR	Symptoms include: subdued, tame, loss of appetite, pacing, hunched, dull eyes, spending time alone, hunched, fluffed, squinting, vomiting	Likely Candidiasis	Stressors, possibly amyloidosis	All given a course of oral antifungal administered remotely. **Some improvement seen in:** POR, PDGR **Little improvement seen in:** PBlueR (second course given after deterioration soon after finishing first course along with hydrating supplement) UNR (caught to treat via gavage, also given hydrating supplement. **UNR died that evening**	
Aug PWL	Limping, not weight bearing	Unclear, possibly amyloidosis	Possibly due to moult	Course of anti-inflammatory administered remotely. **Intermittent symptoms**	
Aug RL	Swollen toe, tripping	Entanglement of foot/toes with human hair	-		Hair removed; one toe swollen. Walked normally once released. No treatment given.
Sep RL	Lethargic, fluffed Limping periodically	Likely Candidiasis Infected nail bed	Stressors Historic foot issues	Course of oral antifungal administered remotely. **Intermittent symptoms** Caught for examination. Nails cut, and germicidal barrier ointment applied to swollen nail bed. Feet had old healed cracks. **Intermittent symptoms**	
Sep PBlueR	Lethargy, tame, decreased appetite	Likely Candidiasis	Stressors, possibly amyloidosis	Course of oral antifungal administered remotely. **Symptoms continued**	
Sep-Dec RR	Squinting or eye closed often	Possible eye infection	Possibly flight collision injury, possibly foreign body	Oct Course of oral antibiotic administered remotely. **Symptoms continued** Nov Caught for examination. Some dry discharge removed, possibly sand as well. (swab taken for culture, no significant results). Antibiotic eye drops administered. **Improvement seen through November, eye occasionally still causing discomfort** Dec Caught for examination. Eye appeared ok. Eye washed with warm water and antibiotic eye drops administered.	Sep Monitored but no treatment given.

Month/ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Sep PWL	Limping, not weight bearing. Limp switched between legs	Unclear, possibly amyloidosis	Possibly due to moult	Course of oral anti-inflammatory administered remotely. **Symptoms continued**	
Sep PLGL	Limping	Unclear, possibly amyloidosis	Possibly from old fracture	Course of oral anti-inflammatory administered remotely. Little improvement seen. Caught to examine. Nails trimmed as very long. One joint on toe swollen, same joint with previously suspected fracture. Felt solid rather than fleshy. **Intermittent symptoms**	
Sep POR	Limping	Unclear, possibly amyloidosis	Possibly due to moult	Course of oral anti-inflammatory administered remotely. **Symptoms continued**	
Sep PRL	Tripping	Entanglement of foot/toes with human hair	-		Caught. Hair removed, walking normally once released. No treatment given.
Oct POR	Coughing periodically	Unclear	Unclear		Monitored but no treatment received.
Oct PLGL	Limping	Entanglement of foot/toes with human hair	-		Caught. Hair removed, a little sensitive on feet after release but no limping. No treatment given.
Oct-Nov WR	Plumage not water resistant, lethargic, disinterested in live food,	Historical preen gland issue Post-mortem and histology revealed Candidiasis and amyloidosis	Unclear	Nov Caught for examination. Preen gland swollen with purulent discharge, small incisions made either side to drain. Preen gland then flushed with antiseptic solution. Some bleeding occurred, also appeared to be painful. Unable to walk when released using wings to travel. Placed on a towel in Room #1 but deteriorated quickly. Placed in a box for peace. **Died soon after treatment**	Oct Monitored but no treatment received
Nov PLGL	Limping, not weight bearing	Unclear, possibly amyloidosis	Possibly from old fracture, stressors	Course of oral pain relief administered remotely. **Symptoms continued**	
Dec PBlueR	Low body weight, tame, limping	Likely Candidiasis	Stressors, possibly amyloidosis	Daily nutritional supplement administered remotely. **Symptoms continued**, appeared method of treatment for Candidiasis ineffective. Trialled catching daily to give course of two oral antifungals put into mouth/throat. Feather cut to enable catching. Cracks appeared on feet and germicidal barrier ointment applied. **Symptoms continued, weight continued to fluctuate**	
Dec RR	Hunched, lethargic, squinting, tame, sneezing, head shaking, discomfort while eating, weight loss	Likely Candidiasis, and upper respiratory tract infection	Stressors, possibly amyloidosis	Given nutritional supplement administered remotely. Caught for examination. Nasal discharge observed. Course of oral antibiotic and two antifungal treatments given via gavage. Feather cut to enable catching. **Symptoms continued** (Died early January)	

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual

A9.2 Locality

A9.2.1 SBS facility configuration

See Figure A35. Further details in Section 2.1.2.

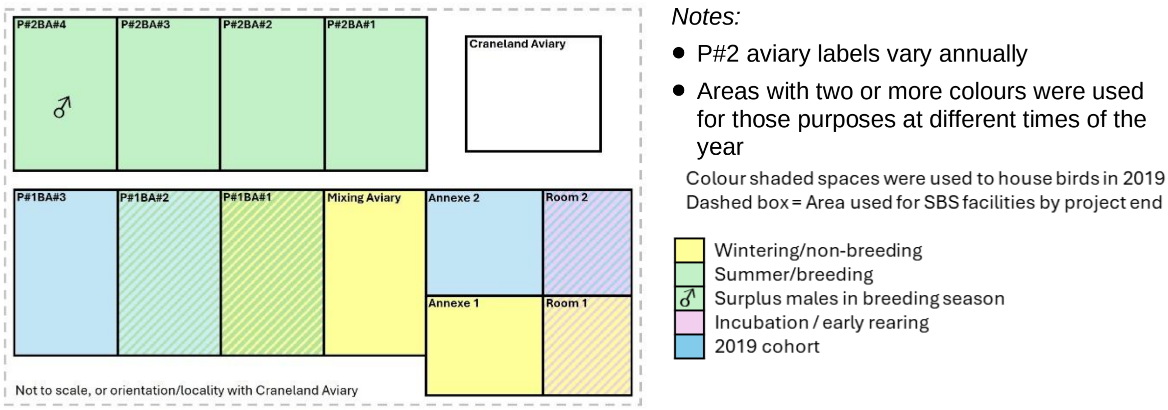


Figure A35 – SBS facility configuration: 2019

A9.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A110.

January

- For the duration of the month the birds had access to the P#1BA#1, MA, An#1 and Room #1.
- 16: Birds were shut out of P#1BA#1 to allow an overhead misting system to be installed in the polytunnels.

February

- The birds continued to have access to P#1BA#1, MA, An#1 and Room #1. They were shut in Room #1 temporarily on 12 and 16 February to develop An#1 and the MA into BAs. The birds were shut out of Room #1 from the 28 February.

March

- The birds continued to have access to An#1, MA, and P#1BA#1. They were shut out of P#1BA#1 temporarily on 21 March to continue installing the misting system. They were then confined the P#1BA#1 and BA#2 on 29 March to replace the sand in the MA pond.

April

- The birds were moved to their BAs on 1 April:
  - An#1 RR and PWL.
  - MA POR and PL.
  - P#1BA#1 PRL and PLGL.
  - P#1BA#2 PDGR and PRR.
  - P#2BA#1 PBlueR and PWR.
  - P#2BA#2 BlueR and POL.
  - P#2BA#3 RL and PPR.
  - P#2BA#4 UNR, WR, and PPL.

- This year the MA and An#1 were also converted into BAs creating seven useable BAs in the coolest locations in the facility.

May

- 3: Females PWR and POL were swapped to be paired with BlueR and PBlueR respectively in hope they may make more suitable pairings. There had been aggression between POL and BlueR, and little breeding behaviours seen between PBlueR and PWR.
- 25: The pop-hole between P#2B3 and P#2BA#4 opened, to allow mixing between the surplus males and RL and PPR, with the hope that it might stimulate some breeding behaviour (e.g. territoriality) within the pair. However, no breeding behaviours were observed and WR and UNR were observed pacing, so a decision was made to separate the groups on 27 May.
- Following PL's death on 27 May, her partner POR was mixed with RR and PWL who were adjacent in An#1. These three birds thus had access to the MA and An#1.

June

- 3: RL was moved from P#2BA#3 to P#2BA#4 with the rest of the surplus males after the death of his partner PPR.
- The 2019 cohort were introduced to P#1BA#3 (empty breeding aviary) on 6 June, then moved to P#1BA#2 on 14 June.
- 12: All the main flock (2011 and 2012 cohorts) were mixed in the MA and An#1.

July

- For the duration of the month all of the main flock were housed in the MA and An#1. They also had access to P#1BA#1 from 6 July. The 2019 cohort were housed in P#1BA#2 for the duration of July.

August

- For the duration of the month all of the main flock were housed in the MA and An#1 and the 2019 cohort housed in P#1BA#2.

September

- For the duration of the month, the main flock were housed in the MA and An#1. They also had access to P#1BA#1 until 25 September and given access to Room #1 from 22 September. The 2019 cohort were housed in P#1BA#2 throughout the month.

October-November

- The main flock were housed in the MA, An#1 and Room #1. The 2019 cohort were housed in P#1BA#2.

December

- For the whole of the month all of the main flock were housed in the MA, An#1 and Room #1. The 2019 cohort moved from P#1BA#2 to Room #2 and A#2 on the 3 December where they remained for the rest of the month.

Table A110 – Space occupancy: 2019

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1		28							22			
Room #2												3
An#1				1		12						
An#2												3
MA				1		12						
P#1BA#1				1		6	6		25			
P#1BA#2			29 only	1		14						3
P#1BA#3						6-14						
P#2BA#1				1		12						
P#2BA#2				1		12						
P#2BA#3				1	3							
P#2BA#4				1		12						
Craneland Aviary												

Notes:
In cases where multiple spaces are occupied within a month, date indicates move

- Wintering/non-breeding
- Summer/breeding
- ♂ Surplus males in breeding season
- Incubation/early rearing
- 2019 cohort

A9.3 Social network

A9.3.1 Sexing

- The 2019 cohort were caught in September to collect feathers for DNA sexing. LBRL came back as male and LBDGL yielded ‘no result’.
- Feathers were taken again in October from LBDGL for sexing, the results returned as male.

A9.3.2 Introductions/departures/interactions

The 2019 cohort were kept physically separate from the main flock, but audible contact could be established. Limited visual contact could be made in adjoining aviaries when birds were stood on tall mounds. Other than both the 2019 cohort and the main flock reacting to each other’s alarm calls when startled, little observations were made of them reacting to the others’ presence.

It is unclear whether the deaths within the flock affected the social dynamics when they occurred, partly because they were housed as breeding pairs when several deaths occurred. POR appeared very nervous the morning his partner PL was found dead. He was moved in with another pair and his nervous behaviour appeared to affect them as well.

UNR was seen to deteriorate during the day despite efforts to restore his health. It was clear that other birds were bullying UNR during this time. WR also deteriorated during the day when observable, though he did not appear to be bullied. The majority of deaths occur overnight so behaviour of other birds towards seriously unwell birds is not well documented.

A9.4 Breeding

The first breeding behaviours were noted on 8 March. Resource guarding and other interactions between the birds became increasingly aggressive; Table A111.

Breeding behaviour declined in May with few songs from 21 May onwards. On 26 and 27 May recordings of songs and displaying birds from the wild were played back in an attempt to encourage breeding behaviour. WR, PDGR, POR, BlueR responded with songs, frog calls, and following behaviours.

Breeding behaviours ceased towards the end of May and pairs returned to the MA and An#1 on 12 June.

Activity was considerably lower on days of high temperatures. In April a pair of Black-tailed godwits usually housed adjacent to the SBS facility 15m away were placed in an aviary at the rear of the SBS facility approximately 5m away from the closest BA. This was done in hope to encourage the SBS to breed making the area appear suitable for breeding with other breeding waders close by.

Refer to Section 2.5 for egg collection, storage, incubation/hatching and rearing details.

Table A111 – Pairs: 2019

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Eggs	Notes
P#1BA#1	PRL	1	PLGL	0	• PRL very active, high intensity of songs, ground displays, and nest scraping. PLGL often responding. Aggressive chasing observed throughout Apr too. First scrape found 28 Apr. • Some aggressive behaviour towards each other mid-May, but very little else seen in May.
P#1BA#2	PDGR	1	PRR	3	• Pair singing in unison or song reciprocation and contact calling throughout the season. • PDGR frog calling 21 Apr. • PDGR nest scraping 23 Apr with PRR following him to scrape. • PRR appeared heavy 26 Apr, however swelling reduced the following day with no egg found. • First known egg found 28 Apr, second on 30 Apr, and third on 2 May. No fourth egg was found and PRR was seen incubating (dummies) from the 4 May. • The nest was scrapped by staff at 10:00 on 5 May. Following this PDGR was seen chasing PRR. On 10 May contact calling occasionally and new material was found in the same scrape. Little breeding behaviour was observed after this event.
P#2BA#1	PBlueR	0	PWR (POL)	0	• Aggression between POL and BlueR following his ground displays and singing 6 Apr. Aggression escalated into a fight with both birds pinning each other to the ground. BlueR pacing following the fight. Chasing observed to a lesser degree throughout Apr. • POL swapped with female PWR on 3 May in hope to give more compatible pairs. • BlueR reacted immediately on PWRs arrival with ground displays, singing, frog calls, and following behaviours. On 18 May a nest scrape song was heard possibly coming from their aviary. Staff also noted PWR looking heavy on 22 May but no eggs were found.
P#2BA#2	BlueR	(1)	POL (PWR)	0	

P#2BA#3	RL	3	PPR	0	• PPR often seen responding to RL breeding behaviours; contact calling, ground displays, and nest scrape displays through Apr. First nest scrape found 22 Apr. • Behaviours subsided so pop-hole to surplus males (P#1BA#4) opened to try to stimulate territorial/breeding behaviours. None observed and pop-hole shut again with same configuration of birds as WR and UNR were pacing. • On 6 and 9 May nest scrapes songs were heard from P#2BA#3. RL was singing frequently and following PPR on 10 May. The following day a nest scrape was discovered. Ground displays and reciprocal singing was noted on the 18 May but no significant behaviours hereafter.
P#2BA#4	PPL UNR WR		-	-	
MA	POR	0	PL	0	• Some singing by males in MA and An#1. • PL died on 27 May, POR was mixed with RR and PWL in adjoining An#1.
An#1	RR	0	PWL	0	

Note:

Highest				Lowest	None	:Observed breeding activity overall

A9.4.1 Eggs

No egg shell repairs were necessary this year. Details of eggs laid in 2019 in Figure A36 and Table A112.

Figure A36 – Photograph of eggs 1:1, 1:2 and 1:3 (2019)

Eggs shown in the order stated

(Credit: WWT)

Table A112 – Egg/chick status summary: 2019

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
PDGR (M) PRR (F) P#1BA#2	1:1	Normal, possibly thin shelled	28 Apr 2019 (03:00) 04 May 2019	Days 0-2 45% RH Days 2-6 70% RH Days 6-9 45% RH Days 9-20 25-35% RH	Fertile	Externally pipped 24 May 2019. (13.0% average weight loss before external pip) **Hatched approx. 10:00 27 May 2019.**
	1:2	Normal, possibly thin shelled	30 Apr 2019 (10:30) 4 May 2019	Days 0-9 45% RH Days 9-20 35% RH Dent at pointed end of shell noticed towards end of incubation; not repaired.	Fertile	Externally pipped 24 May 2019. Assisted by staff in final stages of hatching. (11.6% average weight loss before external pip) **Hatched between 18:00 and 20:00 27 May 2019.**

	1:3	Normal, possibly thin shelled	2 May 2019 4 May 2019	Days 0-2 45% RH Days 2-20 70% RH Dent at blunt end of shell noticed towards end of incubation; not repaired.	Fertile	Externally pipped 27 May 2019. (17.8% average weight loss before external pip) **Hatched between 18:00 and 20:00 27 May 2019.** **Died 30 May 2019.**

A9.4.2 Chick deaths

Upon hatching, chick 1:3 had bent toes, curled inwards. It was given several drinks throughout the night and moved to a small table-top brooder in Room #1 at 14:00 the following day (28 May), joining its two siblings. It was seen on its feet and pecking at feast at 23:30. It appeared to be behaving normally and in good health until 06:30 on 30 May when it was noticed drooping its wings. By 08:30 it was shallow breathing and appeared very lethargic, and at 08:30 it died.

The chicks were left unringed until 17 September when feathers were also taken to DNA sex them. There were observable differences between the chicks for identification purposes.

A9.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximate temperatures required by the birds depending on time of year and health status; Table A113. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary).

Table A113 – Temperature data summary: 2019

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan	-1.0	4.0	6.0	8.0	11.5	-3.0 (An#1)	12.5 (P#1BA#1)
Feb	-0.5	5.0	7.5	12.0	17.0	-2.5 (An#1)	17.0 (MA and An#1)
Mar	4.5	7.5	10.0	15.0	20.0	1.5 (MA)	23.5 (P#1BA#1)
Apr	4.0	8.5	12.0	18.5	27.5	0.5 (An#1)	31.5 (P#2BA#3)
May	6.5	11.0	15.5	22.5	30.5	2.5 (P#2BA#3)	36.5 (P#1BA#2)
Jun	10.5	13.5	17.0	22.5	33.0	5.0 (P#2BA#3)	46.5 (P#2BA#3)
Jul	12.5	16.6	21.0	28.5	35.5	10.5 (An#1)	43.5 (P#1BA#2)
Aug	12.0	16.0	20.0	27.5	33.5	9.0 (An#1)	40.5 (P#1BA#1)
Sep	9.5	13.5	17.0	22.5	27.5	7.0 (An#1)	34.5 (P#1BA#1, P#1BA#2)
Oct	5.5	10.0	12.5	15.5	22.0	4.0 (P#1BA#2)	27.0 (P#1BA#2)
Nov	3.5	7.0	8.5	10.5	14.0	1.0 (An#1)	18.0 (Room #1)
Dec	1.5	6.0	7.5	9.5	12.5	-0.5 (An#1)	18.0 (Room #2)

A9.6 Lighting and photoperiod

Figure A37 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

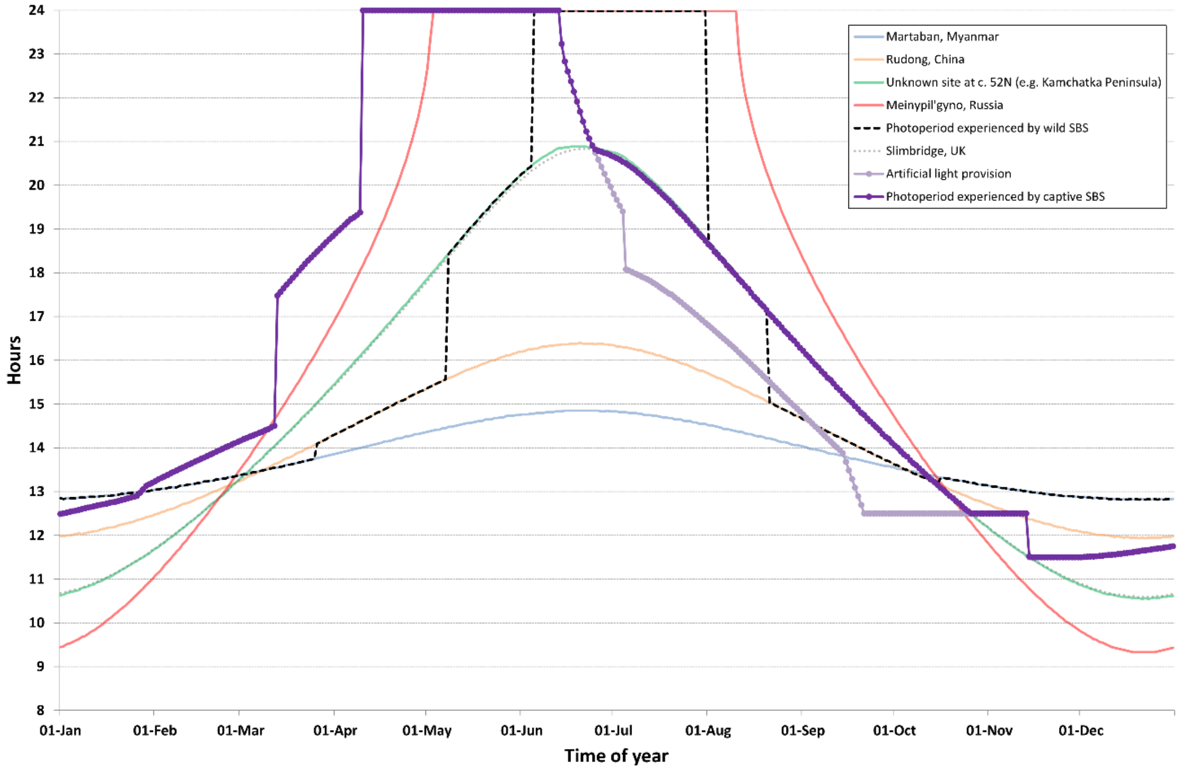


Figure A37 – Photoperiod wild SBS experience during the year based on location: 2019

A9.6.1 Photoperiod experienced by the captive SBS

For the first half of the year the captive birds experienced a photoperiod roughly similar to that experienced by SBS. The time shift to bring the breeding season forward eight weeks meant the Slimbridge (UK) photoperiod didn't compromise what would ideally be provided. Winter 2018/19 was relatively short to accommodate the time shift (extended from six weeks to eight weeks) and the extended breeding season in 2018. The photoperiod gradually increased before a first small jump in January (simulating a migratory jump from Myanmar to China), gradually increasing again before a second larger jump in March (simulating a migratory jump from China to Kamchatka, Russia). It increased gradually again before the final spring jump (from Kamchatka, Russia to Meiynypil'gyno, Russia) to 24 hours of light hours on 10 April, eight weeks earlier than wild SBS typically experience. The breeding season with 24 hours of light hours was extended again this year by one week and two days, with photoperiod beginning to decrease from 14 June. From here light hours decreased rapidly with a jump on 5 July where the Slimbridge (UK) photoperiod took over. Photoperiod decreased gradually until late October when artificial lights were held at 12.5 hours decreasing to 11.5 hours. The birds were able to have a winter more of a usual length this year, though the photoperiod did begin to increase gradually from mid-December. UVI readings shown in Table A114.

A9.6.2 Notes

To avoid the birds being plunged into sudden darkness the on/off times for the various lights in use were staggered with about one minute between each.

Table A114 – Mean monthly UVI readings from accessible light units: 2019

UV Unit* ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MA large	4.8	4.1	5.0				5.2	4.8	4.7	4.6	4.2	3.6
An#1 large	4.3	4.2	4.3				3.9	3.9	4.8	4.5	3.9	4.5
An#1 small	3.3	3.6	4.3				3.1	3.5	3.6	3.4	4.1	3.6
Room #1	4.9	4.6							4.5	3.0	4.1	3.7
Room #2												4.0
An#2												3.8
P#1BA#1 small	4.2		4.6					4.1	4.1			
P#1BA#1 large							4.4	4.6	4.5	4.4	4.9	
P#1BA#2							4.4					
P#2BA#1				3.8								
P#2BA#2				4.8								
P#2BA#3				3.7								
P#2BA#4 small				4.9								

Notes:
* Not all UV units were accessible at any one time i.e. one unit in each BA during the breeding season
UVI readings were taken approx. once a week outside of the breeding season

A9.7 Diet and nutrition

Lundi micro 35, and aquatic invertebrates, were introduced in winter largely due to the time shift to bring the breeding season forward. They were removed at the end of the breeding season.

Zolcal-D was introduced to the diet for the breeding season to aid birds in calcium (and phosphorus) regulation. Rat tail bones were provided for an additional calcium source.

Lundi was provided dry for the most part. Some wet lundi (lundi presented in tap water) was given occasionally to assist birds who had difficulty swallowing. Grit, including oyster shell grit, was present year-round; Table A115.

2019 cohort diet can be found in rearing section A10.7.

Table A115 – Food present/absent in diet: 2019

Food item/supplement^		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **35**	33	42	50	50	50	50	17	8	0	0	0	0
	Lundi micro **20**	66	58	50	50	50	50	83	92	100	100	100	100
Insectivorous Feast		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Frozen bloodworms		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avripro (on dry food)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oyster shell grit		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Salt water*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Frozen Brine shrimp+ omega3		✓	✓	✓	✓	✓	✓	↓	✓	X	X	X	X
Frozen red plankton		✓	✓	✓	✓	✓	✓	↓	✓	X	X	X	X
Live fruit flies		X	X	X	✓	✓	✓	✓	✓**	X	X	X	X
Zolcal-D***		X	✓	✓	✓	✓	X	X	X	X	X	X	X
Rat tail bones (autoclaved)		X	X	X	✓	✓	X	X	X	X	X	X	X
Calci-dust (on dry food)		X	✓	✓	X	X	X	X	X	X	X	X	X
Feather-up supplement		X	X	X	X	X	✓	✓	✓	X	X	X	X
Live cultured wood lice		X	X	X	X	✓****	X	X	X	X	X	X	X
Live mealworms		X	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp

Notes:
* Salt water only provided in BAs if foot condition was poor
** Fed to build those with decreased appetite
*** Females daily, males every other day
**** Fed but didn't eat
^ Most frequently provided items to least

✓	Present in diet
↓	Decreasing that month
	Present for certain birds
X	Absent from diet

A9.8 Sanitation

A9.8.1 Water systems

- Outside of the breeding season, the annexe and polytunnel ponds, sumps and filters were cleaned approximately once a fortnight. The annexe pond was emptied and refilled, and the filter set to drain the water completely every few days. The MA pond was cleaned daily with fresh water and salt added.
- During the breeding season cleaning was restricted depending on breeding activity. Ponds cleaned of algae regularly.

A9.8.2 Substrates

- Sand disinfected regularly with F10 throughout the year.
- Sand replaced in MA pond in January, and in July.
- Sand replaced in annexe pond in March.

A9.8.3 Biosecurity

- P#1BA#3 prepared for use by the 2019 cohort. Vegetation cut, cleaned thoroughly, and disinfected. All ponds in P#1 emptied and disinfected throughout the pond/sump system

and clean sand added to ponds also disinfected. Small ponds that main flock had access to also covered up to stop use. All done to minimise cross contamination between the main flock and 2019 cohort in respect of ongoing *Candida* infection.
- The Virkon foot dips were replaced with Safe4 on 2 December; Safe4 has a lower environmental impact than Virkon and it was thought that the use of both Virkon and Safe4 may be contributing to staff members' coughing in the SBS Facility.
- Towels were used on top of substrates to catch food and faeces where necessary and soaked in antiseptic solution beforehand when foot issues in the birds were prevalent.

A9.9 Environment provisions, modifications, and events with consequences

A9.9.1 Climate

- An underfloor cooling system was set up in P#2BA#2 and P#2BA#3 to trial during the breeding season, with the hope that it may provide cooler areas of sand for the birds in their BAs. A pump set up in the corridor sent water through a water cooler and then coils of piping laid on the sand in the BAs. A thin layer of sand was laid over the piping, creating a mound which the birds could stand on (March).
- An overhead misting system was also set up in both polytunnels extending along all of the BAs (with the exception of the MA and annexe). The misting system installed was an adapted greenhouse cooling system. Due to the low water pressure at the facility during the daytime, an Intermediate Bulk Container (a.k.a. IBC) was filled overnight and cooled to around 4°C by a large water cooler. When the system is in use a pressurised pump delivers the chilled water through pipes attached to the apex of the polytunnels and then through low flow fogging nozzles positioned at regular intervals along the piping. With the average droplet size being around 70 microns the idea was that when in use in hot temperatures, most of the water expelled will evaporate before reaching the ground, thereby lowering the dry air temperature. The cooled air should therefore sink to the ground where the birds reside, with any additional mist that reaches the ground potentially having a cooling effect if any of the birds choose to stand beneath it (March).
- Industrial air conditioning unit hired and set up from 26 April in corridor between polytunnels in hope it would help cool aviaries on hot days (April). This was returned on 4 July.
- Ceiling fans in P#2 not working between 16 and 21 May until an electrician replaced the fuses.
- Ice was added to the sump for the BA ponds plus empty P#1BA#3 when summer temperatures were high (April-August approximately).
- The Phillips LED bulbs were removed from the light fitting in P#1BA#2 on 15 October, and replaced with dull emitter heat lamp bulbs to provide a source of heat for the 2019 cohort.

A9.9.2 Light

- Polytunnel rooves cleaned (January).
- UV light unit from Craneland Aviary installed in P#2BA#4 (January).
- Heat lamps next to UV units replaced with LED lights to increase the spectrum birds are exposed to (February).
- Two luminaire lights were placed on the scaffolding tower in the corridor, to provide ambient 'moon' light during the almost 24-hour daylight period (March).

A9.9.3 Enclosure

- The ponds in P#1BA#1 were covered with butyl to prevent the main flock having access to the same water system as the 2019 cohort, in an attempt to minimise cross-contamination between the main flock and 2019 cohort. An area of lower ground lined with butyl was filled with water on a daily basis to provide fresh water in P#1BA#1 (June).

A9.9.4 Substrate/habitat

- Plants from Craneland Aviary moved to SBS facility and disinfected for use in BAs (January).
- Artificial snow was purchased from Snow Business in Stroud on 24 January and added to the wintering areas. The birds showed great interest in the snow and foraged in it for insects scattered over the surface. This was a trial to determine whether snow could be added to the BAs later in the year, simulating the birds' arrival on the breeding grounds. However, a natural snow event occurred in March eliminating the need for artificial snow.
- Additional mounds, tunnels and turf added to BAs (February).
- MA and An#1 converted in BAs using turf tunnels and plants. Though to be more suitable for nervous birds, additionally they were cooler than the BAs in summer despite not having the overhead misting system (March).
- On 31 March the leaky hose in P#2 was reinstated to provide the birds with marshy areas in their BAs (March).
- All turf and plants removed from MA and An#1, any black sand replaced, and both aviaries treated with disinfectant before the birds moved back in for winter (June).

A9.9.5 Other

- Sparrowhawk *Accipiter Nisus* perching on fence surrounding facility spooked birds significantly (January).
- A pair of Black-tailed godwits was moved to an aviary to the rear of the SBS facility in hope this would encourage the SBS to breed (April-August).
- A High Efficiency Particular Air (a.k.a HEPA) filter was set up in the kitchen on 23 October to try and purify the air and reduce staff coughing in the SBS facility (October).
- Small birds (Sparrow *Passer sp*., Wren *Troglodytes troglodytes*) inside the facility (January, July, August and October).
- A Shrew seen in the facility, traps set but none caught and not seen again (November).

A9.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A116.

Table A116 – Number and type of visitor to the breeding facility: 2019

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan	2 (external advisors, VIPs/visitors)		1 (internal staff/media)	
Feb	1 (VIPs/visitors)		1 (VIPs/visitors)	
Mar				1 (electrical work)
Apr				1 (fire alarm check)
May		1 (internal staff)		3 (electrical work)
Jun	3 (internal staff, VIPs/visitors)	2 (external advisors, external media)		2 (electrician fixing timer switches)
Jul			1 (internal media)	7 (pick up of air conditioning unit, electrician to fix light timers, general facility maintenance, internal staff)
Aug	2 (VIPs/visitors)	2 (VIPs/visitors)		1 (ladder checks)
Sep			1 (Media)	1 (checking fire alarms and sensors)
Oct				
Nov	2 (VIPs/visitors)	1 (VIPs/visitors)		1 (testing fire alarm sensors)
Dec		3 (VIPs/visitors, external advisors, air quality testing)		

A10. 2020 Summary

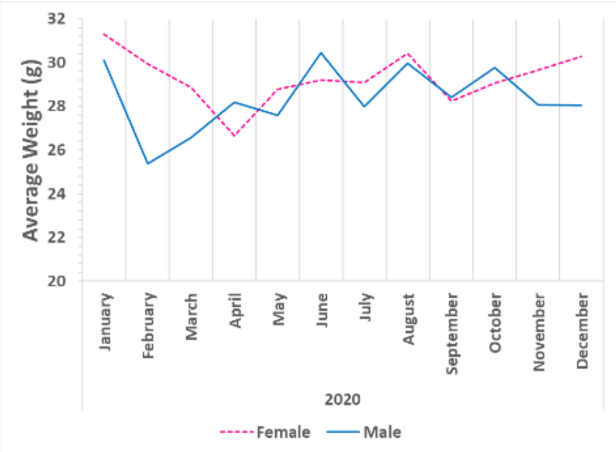
Table A117 – Individual records/deaths: 2020

SBS ID	Cohort	Sex	Deaths	Cause
BlueR	**2011**	M	27 Apr	Inconclusive. Likely Candidiasis
RR	**2011**	M	02 Jan	Amyloidosis, Candidiasis
RL	**2011**	M		
PBlueR	2012	M	04 Mar	Euthanised. amyloidosis, Candidiasis, Renal gout
PRL	2012	M	17 May	Amyloidosis, Candidiasis
PRR	2012	F	02 Apr	Amyloidosis, Candidiasis, enteritis
POL	2012	F	28 Feb	Candidiasis
POR	2012	M		
PWL	2012	F		
PWR	2012	F		
PLGL	2012	F		
PDGR	2012	M		
LBDGL	2019	M		
LBRL	2019	M		

A10.1 Health

A10.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. Very few weights were taken in April. Birds in poor health and subsequently low body weights are included in Figure A38 and Table A118.



Note: Includes remote weights and in-hand, excludes death weights and 2019 cohort weights

Figure A38 – Mean body weights of all birds: 2020

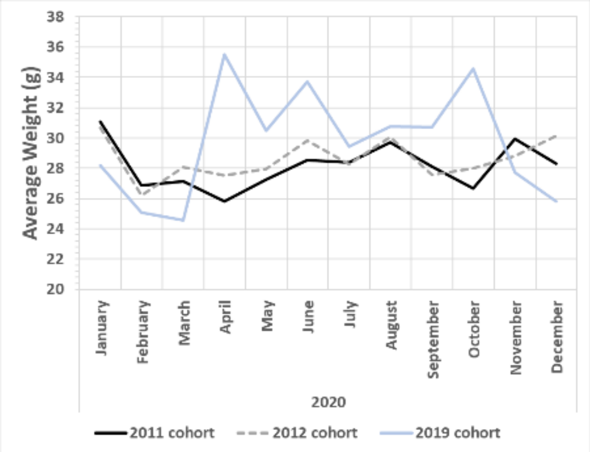
Table A118 – Number of individuals by sex: 2020

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	6	6	5	4	3	3	3	3	3	3	3	3
Females	5	4	4	3	3	3	3	3	3	3	3	3

Note: End of each month, excludes two males from 2019 cohort

A10.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. Very few weights were taken in April. Birds in poor health and subsequently low body weights are included in Figure A39 and Table A119.



Note: Includes remote weights and in-hand, excludes death weights

Figure A39 – Mean body weights: 2011, 2012 and 2019 cohorts: 2020

Table A119 – Number of individuals by cohort (end of each month): 2020

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	2	2	2	1	1	1	1	1	1	1	1	1
2012	9	8	7	6	5	5	5	5	5	5	5	5
2019	2	2	2	2	2	2	2	2	2	2	2	2

A10.1.3 Moult scoring

Assessment of moult scores and records; Tables A120 and A121. There were only two males from the 2011 cohort at the start of the year, only one from April onwards. Therefore, no cohort comparison for sex, or sex comparison for the 2011 cohort is possible.

Table A120 – Moult scoring: 2011 and 2012 cohorts (last score of month): 2020

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male	Average female	Average 2011 cohort	Average 2012 cohort (+ av. scores of sexes)
Jan (3)	1.0	1.5	2.5	1.5	1.5	1.5	1.5 (1.5:1.5)
Feb (4)	1.0	2.0	3.5	2.0	2.0	1.5	2.0 (2.0:2.0)
Mar (3)	1.0	3.0	4.5	3.0	3.0	3.0	3.0 (3.0:3.0)
Apr (2)	4.0	6.0	7.0	6.0	5.5	7.0	5.5 (5.0:5.5)
May (1)	4.0	5.5	6.5	5.0	6.0	5.0	5.5 (5.5:6.0)
Jun (3)	3.5	5.0	6.0	4.0	5.5	4.0	5.0 (4:5.5.0)
Jul (3)	2.0	2.5	3.0	2.0	2.5	2.0	2.5 (2.0:2.5)
Aug (4)	1.0	1.5	2.0	1.0	2.0	1.0	1.5 (1.0:2.0)
Sep (3)	1.0	1.0	2.0	1.0	1.5	1.0	1.0 (1.0:1.5)
Oct (4)	1.0	1.5	2.5	1.0	1.5	1.0	1.5 (1.0:1.5)
Nov (2)	1.0	1.5	3.0	1.0	1.5	1.0	1.5 (1.0:1.5)
Dec (2)	1.0	1.5	3.0	1.0	1.5	1.0	1.5 (1.0:1.5)

Notes:
Some variation between score takers
Rounded to the nearest 0.5

Table A121 – Moult records: 2019 cohort (last notes of the month): 2020

Month	PLGDL	LBRL
Jan	15% into first winter, plus a couple of first summer feathers grown in Dec.	15% into first winter.
Feb	75% into first winter plumage, plus a couple of first summer feathers grown in Dec. Began wing moult.	75% into first winter plumage. Began wing moult.
Mar	Early Mar was mostly in first winter. Mid-late Mar began moulting in summer plumage. End of Mar started dropping first winter feathers.	100% first winter plumage by month end.
Apr	One row of first winter scapulas dropped on each side of body and replaced with new winter feathers. Some summer feathers dropped, and some retained. Wing moult almost complete.	No change in body plumage. Wing moult almost complete.
May	No change. Winter plumage with a few retained summer feathers.	No change. Full winter plumage
Jun	Wing feathers cut after bill lump seen on LBRL. Dropping feathers, including retained summer feathers. Also dropping wing feathers.	Wing feathers cut after bill lump seen on LBRL. Dropping feathers. Also dropping wing feathers.
Jul	Continued dropping wing feathers, had limited flight ability. Body feathers dropping in first half of month.	Remains flightless, not dropped any more wing feathers. Body feathers dropping in first half of month.
Aug	Some new feathers moulted in?	No change.
Sep	Primary moult complete, secondaries being replaced.	Began dropping body feathers at the end of the month. Wing feathers remained the same since being cut in Jun.
Oct	No change. No feathers dropped.	Began to drop some first winter feathers, replacing with adult winter. Wind feathers remain the same.
Nov	Dropped several primaries and secondaries at start of the month. Was feather-cut mid-month (found on other side of aviary barrier).	Continued to drop first winter body feathers, replacing with adult winter feathers. Potentially dropped secondaries end of month.
Dec	Began dropping body feathers and moulting in summer plumage. Ceased dropping feathers and moulting new in when moved to adult flock. Wing feathers already cut in Nov.	Continued to drop body and wing feathers. Ceased dropping feathers and moulting new in when moved to adult flock. Had wing feathers cut during transfer.

A10.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A122. Of approximately 63 cases of lameness this year 21% were treated. Those which needed additional care or had other symptoms are included in more detail in Tables A123 and A124.

Table A122 – Summary of lameness for each month: 2020

Month	No. of birds			Occurrence*
	Present	Lame	Treated for lameness	
Jan	14-13	8	1	66
Feb	13-12	8	1	51
Mar	12-11	5	0	26
Apr	11-9	4	0	15
May	9-8	5	1	10
Jun	8	3	2	31
Jul	8	6	1	31
Aug	8	5	0	21
Sep	8	5	1	26
Oct	8	2	1	12
Nov	8	5	2	60
Dec	8	7	3	47
				Total: 396

Note: * 1 = One day of one lame bird

A10.1.5 Afflictions/treatments

Table A123 – Group health checks/treatments: 2020

Month	Treatment received
Jun-Sep	The 2011 and 2012 cohorts started a course of oral antifungal treatment administered remotely. They were also all given a nutritional supplement injected into crickets and target fed to aid with kidney function whilst on medication. Initially decided to continue until moult into winter plumage (Jul), then re-evaluated and then kept on treatment for the foreseeable future (Aug). As time went on it was decided to stop the antifungal treatment to give them a break from medication, being on it for 98 days. Close monitoring continued and no adverse effects were seen in the following weeks after medication ceased. They continued to receive nutritional supplement as the weather cooled and winter set in (Sep).
Oct onwards	Birds continued to receive nutritional supplement when deemed necessary (Oct onwards).

Table A124 – Individual afflictions/treatments: 2020

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
Jan-Mar PBlueR	Fluctuating weight, hunched, sitting on hock, tame, limping	Likely Candidiasis, cracked feet	Stressors, underlying health issues, possibly amyloidosis	Jan Continued treatment from Dec. Caught twice a day to give two oral antifungal treatments into mouth/throat. Given a nutritional supplement in addition at each handling with a gavage tube. Whilst in the hand his feet were treated on one occasion when cracks on his feet were bleeding, germicidal barrier ointment was applied. **Symptoms persisted** Given a nutritional supplement administered remotely daily. Feb Caught for treatment, started a new anti-fungal (at precautionary dose) dripped into back of mouth. Isolated in Room #1 with RL after 2 days of treatment (going into to clean environment with lower *Candida* burden in theory). He was also given a nutritional supplement via gavage daily initially, then twice a day toward end of month. His feet were also in poor condition so were bathed and had germicidal barrier ointment applied whilst in the hand. Mar Continued to deteriorate. Extremely low weight. **Euthanised**	
Jan RR	Hunched, lethargic, squinting, tame, sneezing, head shaking, discomfort while eating, weight loss Unsteady, soiled feathers around cloaca	Likely Candidiasis, and upper respiratory tract infection Post-mortem and histology revealed Candidiasis and amyloidosis to be the primary causes of death	Stressors, underlying health issues	Continued treatment from Dec, course of oral antibiotic and two antifungal treatments given via gavage plus nutritional supplement administered remotely. **Found dead one morning**	
Jan-Feb LBDGL	Weight loss, faecal positive for *Candida*	*Candida* infection	Stressors, underlying health issues, possibly amyloidosis	Jan During *handling* for feather collection (for sexing) it was found he had lost a significant amount of weight. Both birds of the 2019 cohort particularly stressed around staff since polytunnel roofing was replaced. Given a nutritional supplement administered remotely. Feb Both birds of the 2019 cohort underwent weight loss from around 35g to 25g which coincided with multiple events, including facility roof replacement, positive *Candida* results, start of first moult. Continued to receive a nutritional supplement administered remotely. His weight continued to fluctuate but remained low for an average male SBS (note from long-term records of both birds of the 2019 cohort weight and appearance, it appears they were both smaller than the average male captive SBS). Mar	

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
				Maintained consistent weight. Gradually weaned off nutritional supplement. **No other symptoms**	
Feb-Mar LBRL	Weight loss	Likely *Candida* infection	Stressors, underlying health issues, possibly amyloidosis	Feb Both birds of the 2019 cohort underwent weight loss from around 35g to 25g which coincided with multiple events, including facility roof replacement, positive *Candida* results, start of first moult. LBRL was given nutritional supplement administered remotely but his weight remained worryingly low. He was then caught daily and given the nutritional supplement via gavage tube. His weight continued to fluctuate but remained low for an average male SBS (note from long-term records of both birds of the 2019 cohort weight and appearance, it appears they were both smaller than the average male captive SBS). Mar Maintained consistent weight. Gradually weaned off nutritional supplement. **No other symptoms**	
Feb-Apr RL	Weight loss, tame, head and throat feathers damp/dirty (likely from scratching often), plumage lost water-proof quality (often seen completely saturated)	Likely *Candida* infection	Stressors, underlying health issues, possibly amyloidosis	Initially given a nutritional supplement administered remotely but failed to gain weight. Started a course of new anti-fungal treatment at precautionary dose given via gavage tube daily. Isolated two days after treatment start in Room #1 with PBlueR. Mar Gained weight steadily. Treatment dose increased from precautionary level. Joined by PRR in Room #1 when PBlueR was euthanised. Continued treatment and nutritional supplement for two weeks then moved to a BA with PRR for natural light and environmental conditions and moved back to Room #1 for the night. Germicidal barrier ointment applied to crack on feet periodically. Apr Continued to receive nutritional supplement administered remotely. **Symptoms subsided**	
Feb PWL	Damp feathers around eye, feathers obstructing eye	Feathers irritating eye	Feathers growing irregularly due to previous collision injury	Same issues seen in 2019. Caught for examination- feather trimmed around eye and antibiotic eye drop applied. **Symptoms subsided**	
Feb POL	Damp chest, generally greasy plumage, low weight, fluffed feathers, dropping wings, leg flicking, shivering, sneezing, falling over	Likely *Candida* infection	Stressors, underlying health issues, possibly amyloidosis		Intermittent symptoms since late Nov 2019. No treatment other than group treatments. **Found dead unexpectedly**
Mar PRR	Pacing, tame, low weight	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Mar Caught for examination and to move to Room #1 for isolation with RL. Keel prominent. Course of new antifungal given via gavage tube daily, oral pain relief periodically. Also given a nutritional supplement administered remotely periodically throughout the day. After two weeks she and RL moved to a BA	

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
				during the daytime for natural light and environmental conditions and moved back to Room #1 for the night. **Condition slowly deteriorating** Apr Continued to receive nutritional supplement administered remotely. **Found dead one morning**	
Mar PWL	Limping	Constriction of toes	Human hair		Caught to remove hair, some was deeply embedded. No further treatment given.
May PRL	Holding leg up, not weight bearing. Later, lethargy, would gorge on live food then appear very uncomfortable and inactive. Eventually disinterested in live food	Possibly trauma related, likely Candidiasis	Strong winds during flight, stressors	Given periodical doses of oral anti-inflammatory, plus nutritional supplement administered remotely. Caught to give treatment when he began refusing live food. **Found dead the morning after being caught**	
May-Jun PLGL	Lethargic, subdued, would gorge on live food then appear very uncomfortable and inactive Limping	Likely Candidiasis Cracked feet	Stressors, underlying health issues, possibly amyloidosis		May Given nutritional supplement administered remotely. **Deteriorated in hot weather** Jun Increased quantity of nutritional supplement, also given subcutaneous injections of vitamin and mineral solution. **Condition improved rapidly in cool weather** Given a course of oral anti-inflammatory administered remotely. **Limp continued intermittently**
May LBRL	Small pale lump on upper mandible	Unclear	Unclear, possibly trauma		May Lump did not appear to change or affect its behaviour. No treatment given, continued to monitor. Jun Lump increased in size slightly and became black as rest of bill, likely scaring. Didn't appear to affect behaviour. Continued to monitor.
Jun PWL	Limping, holding leg up (not tucked to body)	Unclear	Unclear	Given a course of oral anti-inflammatory treatment administered remotely. **Limp continued**	
	Feathers around eye and shoulder (from rubbing eye) damp	Feathers irritating eye	Feathers growing irregularly due to previous collision injury		Continued to monitor without treatment. New feathers growing. **Symptoms subsided**
Jul-Oct POR	Lethargic, limping, low weight Hunched, pacing, disinterested in usual live food -though did eat brown crickets that were acquired (usually fed black crickets)	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Jul Caught for treatment. Given oral antifungal, oral pain relief, and a nutritional supplement via gavage tube. Also given subcutaneous injections of vitamin and mineral solution. Germicidal barrier ointment was also applied to crack on the feet. Wing feathers were cut as it is likely to need further treatment. **Limp cleared the following day, appeared bright**	

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)	No treatment received
	Weight loss				
				Aug No additional treatment to the group, antifungal treatment and nutritional supplement already given. Continued to monitor. **Appear more comfortable after a few days eating brown crickets** Sep Began receiving extra nutritional supplement administered remotely in the afternoons due to his low weight. Oct Continued receiving extra nutritional supplement administered remotely in the afternoons due to his low weight.	
Jul LBDGL	Weight loss	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Jul Given a nutritional supplement administered remotely. Aug Continued nutritional supplement until feathers were no longer being dropped.	
Aug-Dec PLGL	Lethargic, subdued Severe limp	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Aug Began receiving addition nutritional supplement administered remotely periodically throughout the day. Continued to monitor. **Symptoms persisted**	
				Sep Continued to receive nutritional supplement administered remotely after antifungal treatment ceased. **Symptoms continued,** started another course of oral anti-inflammatory administered remotely **Appetite and activity increased with treatment.** Thereafter given short course of anti-inflammatory whenever she was looking lethargic. **Intermittent symptoms** Oct Started a routine of three days on/two days off anti-inflammatory treatment administered remotely. Also received nutritional supplement daily administered remotely. **Intermittent symptoms** Nov Continued treatment plan. Additionally given course of oral antibiotics administered remotely due to severe limp. **Intermittent symptoms** Dec Number of days between anti-inflammatory course increased. **Intermittent symptoms**	
Sep LBDGL	Limping, gasping, headshaking frequently particularly after eating,	Possibly Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Caught for examination- no obvious cause for gasping. Feet were in good condition. Given oral anti-inflammatory while in the hand, administered remotely thereafter. Wing feathers were also cut in anticipation of needing further treatment.	

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal) / No treatment received
				No further symptoms after treatment
Oct-Nov PWL	Severe limp, weeping eye	Feathers irritating eye	Feathers growing irregularly due to previous collision injury	Oct Given course of oral anti-inflammatory administered remotely. Later caught for examination- feathers trimmed around eye, antibiotic eye drops applied. Feet looked in okay condition through scaring was evident. **Eye continued to weep** Nov Examined remotely, no treatment given. Continued to monitor.
Nov-Dec LBRL	Severe limp	Cracked feet	Unclear, stressors	Dec Caught for examination- germicidal barrier ointment applied to cracks in feet. Given a course of oral anti-inflammatory administered remotely. A few days later also started a course of oral antibiotics administered remotely. **No improvement seen, started to lose weight** Also given a nutritional supplement administered remotely up to three times a day. **Limp persisted** Another course of oral anti-inflammatory and antibiotic administered remotely. Limp switched between legs. **Improvement by the end of the month** Dec One-off dose of anti-inflammatory administered remotely for limp. **Symptoms subsided**
Nov POR	Coughing, struggling to swallow and recoils backwards when doing so	Unclear	Unclear, stressors	Symptoms lasted one whole day and no more. Continued to monitor.
Dec LBDGL	Limping	Cracked feet	Unclear, stressors	One-off dose of anti-inflammatory administered remotely for limp. **Symptoms subsided**
Dec PWL	Tripping Leg flicking	Entanglement Unclear	Human hair Possibly stress	Caught to remove hair. Ring also cleaned as dirt build-up prevented them moving freely on leg. Limping following removal of hair. Continued to monitor.
Dec RL	Not weight bearing	Unclear, possibly amyloidosis	Unclear, stressors	Given a course of oral anti-inflammatory treatment administered remotely. Continued into Jan 2021.

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
'Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual
Details of death in Section 2.4.5.1

A10.2 Locality

A10.2.1 SBS facility configuration

See Figure A40. Further details in Section 2.1.2.

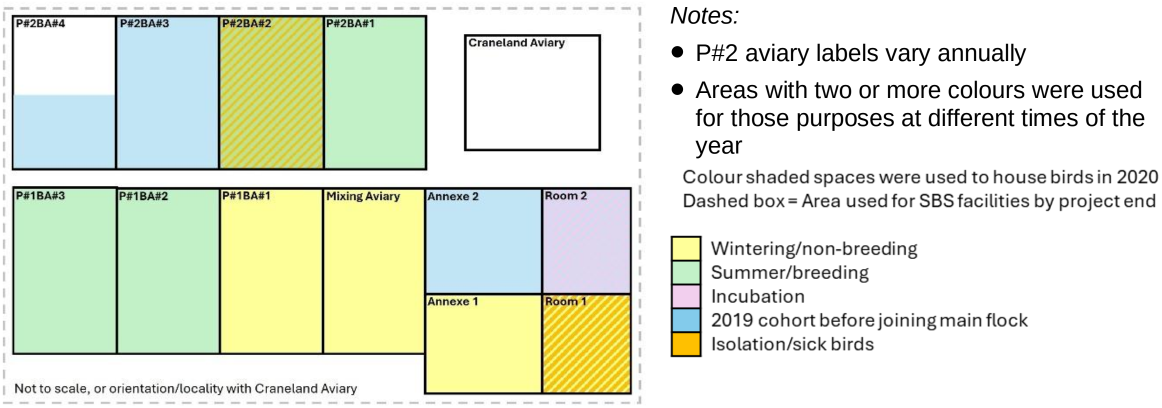


Figure A40 – SBS facility configuration: 2020

A10.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A125.

January

- The main adult flock had access to Room #1 and An#1, MA. Denied access to the MA from 20-31 whilst polytunnel roof was replaced. The 2019 cohort had access to Room #2 and An#2.

February

- Adults shut out of Room #1 from 2 February. Room #1 prepared and used as isolation for two sick birds (PBlueR and RR) on new antifungal treatment trial. The birds were confined to An#1 in periods of strong winds after recent storms ripped some of the inner netting elsewhere in P#1. The 2019 cohort had access to Room #2 and An#2.

March

- The 2019 cohort moved from Room #2 and An#2 to P#2BA#3 on 25 March.
- Main adult flock shut in An#1 in periods of strong winds, otherwise had access to the MA too. After PBlueR was euthanised, PRR joined RL in Room #1. They remained here until 25 March when they were put in P#2BA#2 during the daytime and put back in Room #1 for the nights.
- 25: Pairs were moved into BAs:
    - P#1BA#2 PDGR and PLGL.
    - P#1BA#3 POR, PRL, PWL.
    - P#2BA#1 BlueR and PWR.

April

- 2: RL was moved to P#1BA#3 after companion PRR died.
  27: PRL was moved to P#2BA#1 to join PWR after her partner BlueR died.

28: PRL and PWR were moved to P#2BA#2 after heavy rain which appeared to saturate PWR (P#2BA#2 less exposed to weather than P#2BA#1).

May

- 17: PWR was moved to P#1BA#3 after her partner PRL died.

June

- 26: The pop-holes were opened between P#1BA#2 and BA#3 marking the end of the breeding season. The 2019 cohort remained in P#2BA#3.

July

- 24: The adults in P#1BA#2 and BA#3 were walked through pop-holes to occupy the MA and P#1BA#1. On 30 July they were also given access to An#1. The 2019 cohort remained in P#2BA#3.

August-September

- The adults continued to occupy An#1, MA and P#1BA#1. The 2019 cohort remained in P#2BA#3.

October

- The adults continued to occupy An#1, MA and P#1BA#1. Given access to Room #1 from 13 October. The 2019 cohort remained in P#2BA#3.

November

- 4: P#2BA#2 and BA#3 was divided into two with a short barrier creating two 5m x 5m aviaries with the 2019 cohort occupying the side under the polythene roof to keep the worst of the winter weather off them. The chicks occupied the sides underneath the polythene roof to keep the worst of the winter weather off them.
- 6: The adults were shut out of P#1BA#1, occupying only Room #1, An#1 and the MA.

December

- 28: The 2019 cohort were moved from P#2BA#2/3 to join the adult flock, comprising of Room #1, An#1, and the MA. This was because these aviaries are more suitable for winter conditions, and they had already previously tested positive for *Candida*.

Table A125 – Space occupancy: 2020

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1		2	2							13		
Room #2			25									
An#1			25				20					
An#2			25									
MA			25				24					
P#1BA#1							24				6	
P#1BA#2			25			24						
P#1BA#3			25			24						
P#2BA#1			25	28								
P#2BA#2			25	28	17						4	28
P#2BA#3			25									28
P#2BA#4												
Craneland Aviary												

Notes:

- Wintering/non-breeding
- Summer/breeding
- Incubation
- 2019 cohort before joining main flock
- Isolation/sick birds

A10.3 Social network

A10.3.1 Sexing

Repeated DNA sexing from feathers of LBDGL showed him to be male. Feathers collected from both birds again were checked at another lab, however, results could not be obtained due to resources pulled during the Covid-19 pandemic.

A10.3.2 Introductions/departures/interactions

On 28 December the two birds of the 2019 cohort hatched in the facility were introduced to the main adult flock. There did not appear to be any notable encounters and integrated without issue.

It is unclear whether the deaths within the flock affected the social dynamics when they occurred. BlueR died in a BA with PWR mid-morning. She did not appear distressed after BlueR died or being on her own in the aviary while it was decided which other bird to put in the aviary with her.

A10.4 Breeding

Breeding activity began in March with singing and heightened aggression between birds.

Breeding behaviours began to subside in the first week of May, ceasing almost completely (barring a few sporadic songs) by June.

The Black-tailed godwits housed adjacent to the SBS facility started hatching on 24 May, the parent birds were very vocal for the next few days. This seemed to have no obvious effect on the SBS.

Activity was considerably lower on days of high temperatures.

A10.4.1 Pairs

From 28 April, pairs had to be rearranged (Table A126) due to two deaths which occurred. Prior to bird moves one possible copulation was witnessed between PRL and PWL, though this was later deemed an aggressive encounter.

Prior to death, BlueR showed some breeding activity (singing) but less so than others.

Table A126 – Pairs: 2020

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Notes
P#1BA#2	PDGR		PLGL	Most activity seen was from this pair, both singing and chasing each other in Apr. Male frog-calling frequently early May, following female around aviary.
P#1BA#3	POR RL		PWL	Both males singing semi-regularly in April, little interest from female. POR frog-calling frequently early May, and performing ground displays.
P#2BA#2	PRL		PWR	Some singing from male but little interest from female.
P#2BA#3	LBDGL LBRL		-	One male seen singing once in Apr.

Note:

Highest				Lowest	None	:Observed breeding activity overall

A10.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximate temperatures required by the birds depending on time of year and health status; Table A127. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary).

Table A127 – Temperature data summary: 2020

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan	1.5	6.3	7.8	9.7	12.0	-1.5 (An#1)	18.0 (R1, R2)
Feb	2.5	6.3	8.3	11.5	14.0	-1.0 (MA)	17.5 (R2)
Mar	2.5	6.0	8.9	13.5	19.0	-1.0 (P#2BA#1, P#2BA#3)	31.5 (P#1BA#3)
Apr	4.0	9.3	14.1	21.7	28.0	1.5 (P#1BA#3, P#2BA#3)	38.0 (P#1BA#3)
May	6.5	11.9	17.6	26.9	34.5	5 (P#1BA#2 and BA#3, P#2BA#3)	38.5 (P#1BA#3)
Jun	11.0	15.0	19.9	28.9	40.5	7.5 (P#1BA#3)	43.5 (P#2BA#3)
Jul	9.5	15.0	19.8	29.0	42.0	8.5 (MA)	42.0 (MA)
Aug	11.5	16.3	19.5	25.0	36.5	7.5 (MA)	39.5 (P#1BA#1)
Sep	6.5	12.6	15.9	21.3	28.0	2.5 (An#1)	31.5 (MA)
Oct	8.0	10.0	12.0	14.9	19.5	6.0 (P#1BA#1)	25.0 (P#1BA#1)
Nov	3.0	7.8	9.9	12.4	16.0	1.5 (P#1BA#1, An#1)	20.0 (P#1BA#1)
Dec*	-	-	-	-	-	-0.5 (An#1)	12.5 (An#1)

Note: * No data due to faulty data logger

A10.6 Lighting and photoperiod

Figure A41 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

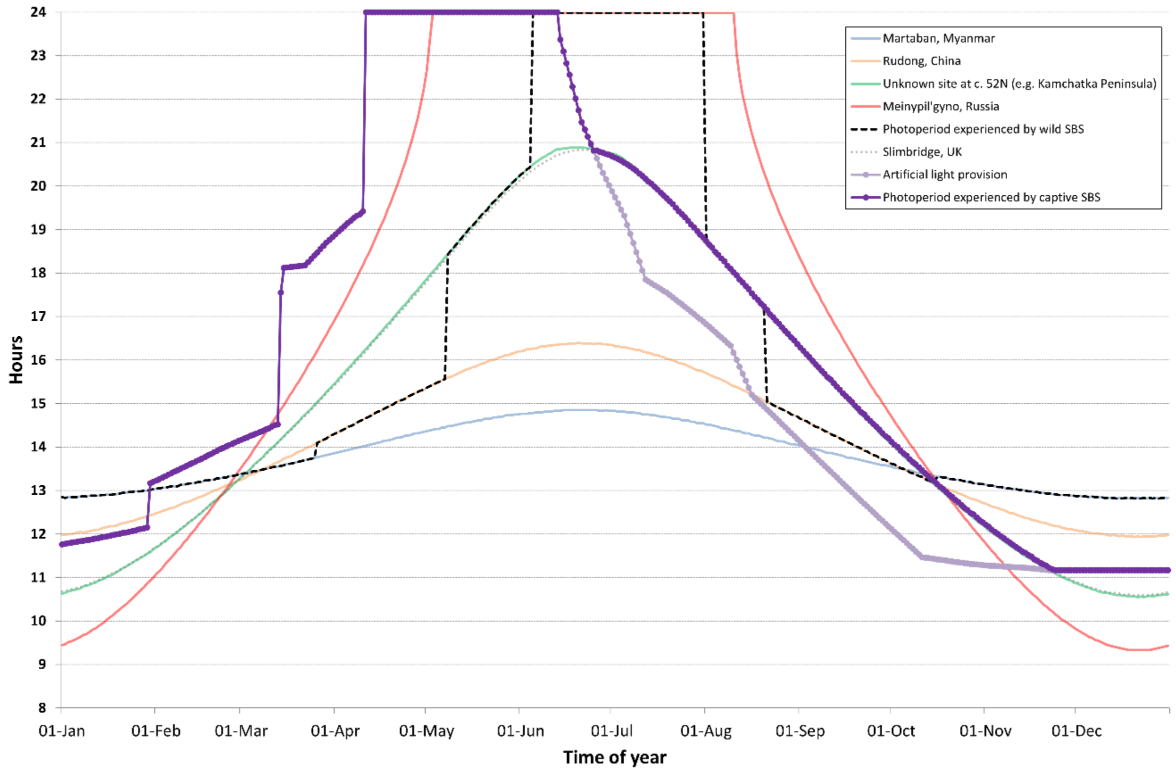


Figure A41 – Photoperiod wild SBS experience during the year based on location: 2020

A10.6.1 Photoperiod experienced by the captive SBS

For the first half of the year the captive SBS experienced a photoperiod roughly similar to that of wild SBS. They had three migratory jumps in location/photoperiod before reaching 24 hours of light during the breeding season on 10 April. The time shift continued with the breeding season being brought forward eight weeks earlier than what wild SBS experience. The breeding season was also extended from eight weeks to nine weeks and one day. From 13 June, the number of light hours rapidly decreased until it reached the Slimbridge (UK) photoperiod which took over until the beginning of December where they were held at approximately 11 hours of light for winter 2020/21.

A10.6.2 Notes

To avoid the birds being plunged into sudden darkness, the on/off times for the various lights in use were staggered with about one minute between each.

UVI readings were taken approximately once a week outside of the breeding season; Table A128. Bulbs were replaced as and when needed.

Table A128 – Mean monthly UVI readings from accessible light units: 2020

UV Unit* ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MA	4.4	3.5						5.3	5.4	5.5	5.1	4.3
An#1 large	4.6	3.0						3.2	2.9	3.0	1.8	2.6
An#1 small	4.2	4.6										
Room #1	4.7	5.2								4.0	5.5	5.4
Room #2	4.1	4.6										
An#2	4.0	4.7										
P#1BA#1								3.7	3.6	3.5	3.2	
P#1BA#2			5.4	5.6	5.8	5.3	5.4					
P#1BA#3			4.9	5.7	6.0	5.7	5.4					
P#2BA#1			3.0	6.2	5.8							
P#2BA#2			4.9								4.9	3.5
P#2BA#3			5.9	5.9	5.6	5.5	5.4	4.6	4.6	4.0	4.3	3.6

Note:
* Not all UV units were accessible at any one time i.e. one unit in each breeding aviary during the breeding season

A10.7 Diet and nutrition

The 2019 cohort diet (while separate from the main flock) was the same as the adults in content though they received Avipro throughout the year. They did not eat the plankton or Brine shrimp offered and these were eventually removed from the diet in March.

From October all birds were offered a portion of their Lundi pellet in dishes of tap water.

In November LBRL refused to walk on the towels the food dishes were placed on regardless of type of food. Dishes were placed at the edge of the towels until confident he was walking on the towels again.

Grit, including oyster shell grit, was present year-round; Table A129.

Table A129 – Food present/absent in diet: 2020

Food item/supplement***	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio Lundi micro **35**	0	12.5	37.5	50	50	50	33.3	33.3	0	0	0	0
Lundi micro **20**	100	87.5	62.5	50	50	50	66.6	66.6	100	100	100	100
Insectivorous Feast	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Frozen bloodworms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live crickets (brown/black)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avripro (on dry food)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oyster shell grit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Salt water*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live fruit flies	X	X	X	✓	✓	✓	↓	↓	↓	X	X	X
Zolcal-D supplement**	X	✓	✓	✓	✓	X	X	X	X	X	X	X
Frozen Brine shrimp+ omega3	X	✓	✓	✓	✓	X	X	X	X	X	X	X
Frozen red plankton	X	✓	✓	✓	✓	X	X	X	X	X	X	X
Rat tail bones (autoclaved)	X	X	X	✓	✓	✓	X	X	X	X	X	X
Live mealworms	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp	✓ for meds /supp

Notes:
* Salt water only provided in BAs if foot condition is poor
** Females daily, males every other day
*** Most frequently provided items to least

✓	Present in diet
↓	Decreasing that month
	Present for certain birds
X	Absent from diet

A10.8 Sanitation

A10.8.1 Water systems

- The annexe and polytunnel ponds, sumps and filters were cleaned thoroughly approximately once a fortnight when in use. The annexe pond water was refreshed every few days. The MA pond water was refreshed daily with salt added. It was scrubbed of algae as needed.

A10.8.2 Substrates

- Following environmental sampling in February showing An#1 had the highest *Candida* burden in the facility, all sand was replaced, including the pond, in hopes of reducing the *Candida* load in these areas. Sand in the An#1 pond was replaced again in April and December.
- Sand in the MA pond was replaced in January, and in April.
- Sand was removed from An#2 pond in April.
- All towels began being dipped in antiseptic solution before being used in aviaries from August.

A10.8.3 Biosecurity

- Additional foot dips and changes of footwear were instated at the entrances to the 2019 cohort areas following positive faecal tests for Candida (January).

- Room #1 was converted into an isolation area with near-quarantine conditions with its own equipment and washing facilities. It was thoroughly cleaned and disinfected with new sand added. The tent was not used as the birds placed here were feather cut to inhibit flight (February).

A10.9 Environment provisions, modifications, and events with consequences

A10.9.1 Climate

- Ice and fresh water regularly added to the sump in the polytunnel corridor in an attempt to cool water in BA ponds during hot weather (April onwards).
- The misting system was used during the hottest parts of the day in an attempt to cool the air and surface temperatures in the BAs (April-September).
- A large water chiller was installed to chill water in the polytunnel pond systems sump. This water feeds directly into the aviary the birds have access to. This was an emergency measure during periods of extremely hot weather (June).
- Ice packs were placed under sand/towels and replaced regularly as an emergency measure in the extremely hot weather (June).
- Ice blocks were added to occupied BA ponds as an emergency measure in the extremely hot weather (June).
- 2019 cohorts occupied aviary was given an ark shelter over the pop-hole between P#2BA#2 and BA#3 with heat lamp and soil cable inside. Plus infrared heaters outside ready for winter conditions (November).

A10.9.2 Light

- UV unit in An#1 replaced due to some bulbs not working (December).
- A scaffolding tower fitted with luminaires was put in between P#2BA#2 and BA#3 to provide those aviaries with additional lighting (April).

A10.9.3 Enclosure

- Both the polytunnel rooves and the corridor between, were replaced between 20-24 January (Figure A42). The outer halves of the BAs were covered in 18mm knitted nylon net whilst the inner halves, the MA and the corridor were covered in UV transmissible semi-opaque polythene. The fans in the BAs were also removed. Inner netting was re-stitched, and aviaries thoroughly searched/cleared of any debris from the process.
- Pipe lagging was replaced in places it was disintegrating (March).
- Ceiling netting in BAs of P#1 replaced (March).
- Ceiling netting of MA replaced (July).
- Room #1 prepped for use in winter. Cleaned and disinfected, tent erected, new sand added and disinfected, UV unit bulbs replaced, radiator added, soil cables added, pipe lagging added to exposed pop-holes edges (August).

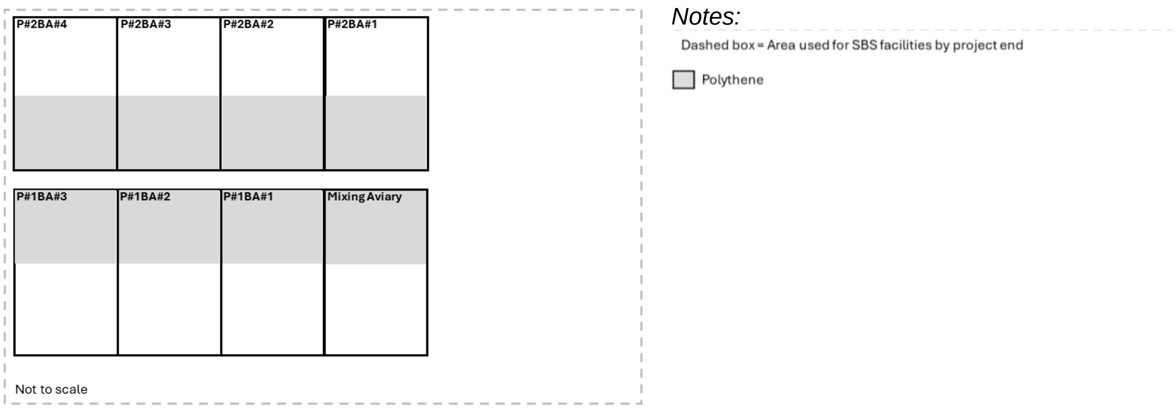


Figure A42 – Changes to the enclosure roof: 2020

A10.9.4 Substrate/habitat

- Dried Dwarf willow leaves added to BAs as nesting material (March-May).
- Saltwater trays added to BAs to help with birds' cracked feet during the breeding season (April-August).
- Grass was cut where necessary in the occupied BAs where it was getting long and unmanageable for the birds, growing rapidly due to increase in water and sunlight this year (April).
- Areas of P#2BA#2 watered with disinfectant solution over concern it was too dry for the feet of the 2019 cohort, who were limping at the time (November).

A10.9.5 Other

- An experiment was conducted to determine whether sand burdened with *Candida* could be effectively treated with two different disinfectants, however it showed application of either disinfect did not reduce the *Candida* load. Untreated sand from the aviaries was used as a control. Sand prior to entry into the SBS facility was also tested and showed no yeasts to be present (February).
- Fewer staff present on site after furloughing due to the Covid-19 pandemic (March).
- Pigeon spikes replaced external to the MA (March and November).
- Water pump for An#1 switched off during times of high ground water due to back flow into sump from drains (October).
- Two Wren *Troglodytes troglodytes* inside facility periodically (November).

A10.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A130.

Table A130 – Number and type of visitor to the breeding facility: 2020

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan	3 (vet interviews)	1 (VIP/externals)		4 (replacing rooves)
Feb	1 (VIP/externals)	1 (VIP/externals)		1 (fixing extractor fans)
Mar				
Apr				1 (to use CCTV network for live stream for Black-tailed godwit nest)
May				
Jun				1 (to check fire alarms)
Jul				1 (PAT testing all electrical equipment)
Aug				
Sep				
Oct				
Nov				1 (electrician to look at faulty timers and sockets)
Dec	1 (inspection from Animal and Plant Health Agency due to avian influenza presence on site)			

A11. 2021 Summary

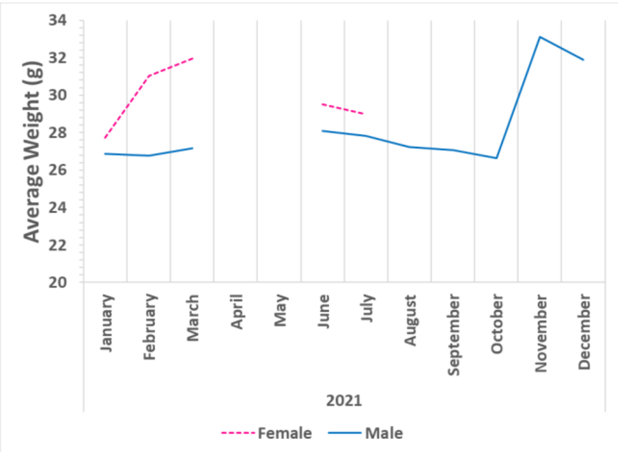
Table A131 – Individual records/deaths: 2021

SBS ID	Cohort	Sex	Deaths	Cause
RL	**2011**	M		
POR	2012	M	02 Oct	Amyloidosis, Candidiasis, kidney disease and articular gout
PWL	2012	F	26 Jan	Candidiasis and septicaemia
PWR	2012	F	04 Jul	Amyloidosis, Candidiasis, pneumonia, and severe left hock joint infection
PLGL	2012	F	23 Jul	Euthanised. Amyloidosis and osteomyelitis
PDGR	2012	M		
LBDGL	2019	M		
LBRL	2019	M		

A11.1 Health

A11.1.1 Body weights: all birds

Not all birds were weighed at each weighing session. No weights were taken in April and May, and very few in June to minimise disturbance during the breeding season; Figure A43 and Table A132.



Note: Includes remote weights and in-hand, and 2019 cohort weights. Excludes death weights

Figure A43 – Mean body weights of all birds: 2021

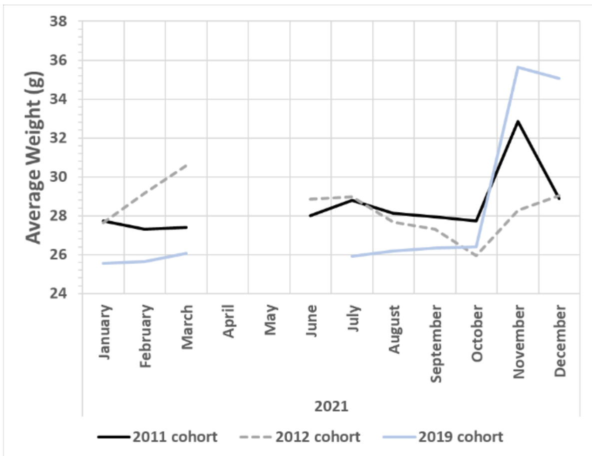
Table A132 – Number of individuals by sex (end of each month): 2021

Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Males	5	5	5	5	5	5	5	5	5	4	4	4
Females	2	2	2	2	2	2	0	0	0	0	0	0

Note: includes two males from 2019 cohort

A11.1.2 Body weights: 2011 and 2012 cohorts

Not all birds were weighed at each weighing session. No weights were taken in April and May, and very few in June to minimise disturbance during the breeding season; Figure A44 and Table A133.



Note: Includes remote weights and in-hand, excludes death weights

Figure A44 – Mean body weights of all birds: 2019

Table A133 – Number of individuals by cohort (end of each month): 2021

Cohort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	4	4	4	4	4	4	2	2	2	1	1	1
2019	2	2	2	2	2	2	2	2	2	2	2	2

A11.1.3 Moult scoring

Assessment of moult scores; Table A134. From October there was only one male from each of the 2011 and 2012 cohorts. No sex comparison for the 2012 cohort from October, and no cohort comparison for sex, or sex comparison for 2011 cohort was possible.

Table A134 – Moult scoring: all birds (last score of month): 2021

Month (no. of times scored that month)	Min score	Average overall	Max score	Average male	Average female	Average 2011 cohort	Average 2012 cohort (+ av. scores of sexes)	Average 2019 cohort
Jan (5)	1.0	1.5	4.0	1.5	1.5	1.0	1.0 (1.0:1.5)	2.5
Feb (4)	1.0	2.5	4.0	2.5	2.0	2.0	2.5 (3.0:2.0)	2.5
Mar (4)	1.5	3.0	5.0	3.0	3.0	2.5	3.0 (3.5:3.0)	3.5
Apr (2)	2.0	4.5	6.5	5.0	3.0	6.5	3.5 (4.5:3.0)	5.0
May (5)	2.0	4.5	7.0	5.0	4.0	6.5	4.0 (4.5:4.0)	4.5
Jun (4)	2.0	4.0	7.0	4.0	3.5	5.0	4.0 (4.5:3.5)	3.5
Jul (4)	2.0	3.0	5.0	3.0	-*	4.0	3.5 *	2.5
Aug (4)	1.0	1.5	2.5	1.5	-	2.5	2.0	1.0
Sep (6)	1.0	1.5	2.0	1.5	-	1.5	1.5	1.5
Oct (5)	1.0	1.0	1.0	1.0	-	1.0	1.0	1.0
Nov (4)	1.0	1.0	1.0	1.0	-	1.0	1.0	1.0
Dec (4)	1.0	1.0	1.5	1.0	-	1.5	1.0	1.0

Notes:
* No longer any females
Some variation between score takers
Rounded to the nearest 0.5

A11.1.4 Lameness data

A summary of lameness for each month and whether treated or not, is included as Table A135. Of approximately 45 cases of lameness this year 47% were treated. Those which needed additional care or had other symptoms are included in more detail in Section A11.1.5 & Tables A136 and A137.

Table A135 – Summary of lameness for each month: 2021

Month	No. of birds Present	Lame	Treated for lameness	Occurrence*
Jan	8-7	7	5	58
Feb	7	4	1	37
Mar	7	2	1	17
Apr	7	5	0	8
May	7	3	1	4
Jun	7	7	4	71
Jul	7-5	3	3	25
Aug	5	2	1	19
Sep	5	2	1	18
Oct	5-4	2	2	4
Nov	4	4	1	13
Dec	4	4	1	18
				Total: 292

Note: * 1 = One day of one lame bird

A11.1.5 Afflictions/treatments

- All birds appear lean end of May.
- PWR freed from seeding grass wrapped around rings, couldn't have freed itself (June).
- Green faeces found in July, August, September, October and November.
- Red/bloody faeces found in August.
- Faeces with undigested naturally occurring Daphnia from the BA ponds found in September.
- All birds went through a period of headshaking in November.

Table A136 – Group health checks/treatments: 2021

Month	Treatment received
Jan-Dec	All receiving nutritional supplement since end of group anti-fungal treatment in Sep 2020. Given remotely during morning routines. If given medication extra nutritional supplements were given simultaneously.

Table A137 – Individual afflictions/treatments: 2021

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
Jan PWL	Weeping eye during moult, limping	Feathers irritating eye, possibly Candidiasis	Feathers growing irregularly due to previous collision injury	Caught for treatment, feathers around eye trimmed and antibiotic eye drops administered. Given course of anti-inflammatory administered remotely. **Condition deteriorated, losing weight** Given course of antibiotics and anti-inflammatory remotely, plus extra nutritional supplement. Much of this was refused. Caught for treatment. Eye flushed and antibiotic eye drops applied. **Continued to deteriorate** Caught a few days later for vitamin and mineral solution subcutaneous injection. Also given a nutritional supplement via gavage tube. **Found dead the next morning**
Jan LBRL	Severe limp	Possibly amyloidosis	Moult, other stressors	Given course of anti-inflammatory administered remotely. **Symptoms subsided**
Jan-Mar POR	Not weight bearing Gasping, head shaking, neck stretching, all after eating. Struggling to poo. Excessively drinking, tipping head back when drinking, hunched	Possibly amyloidosis, cracked feet Likely Candidiasis	Moult, other stressors Stressors, underlying health issues, possibly amyloidosis	Jan Given course of anti-inflammatory administered remotely. **No improvement** Given another course of anti-inflammatory administered remotely. **No improvement** Caught for examination – feet were cracked, dry, with flaking skin. Germicidal barrier ointment applied, and given another course of anti-inflammatory administered remotely. **Intermittent symptoms** Feb Another course of anti-inflammatory administered remotely. Caught for treatment. Given a vitamin and mineral subcutaneous injection. Also started a course of antifungal administered remotely. **Intermittent symptoms** Mar Continued antifungal treatment administered remotely. **Additional symptoms** Given another course of antifungal treatment administered remotely plus one-off dose of anti-inflammatory. **Intermittent symptoms**
Jan RL	Tender on feet	Possibly amyloidosis	Moult, other stressors	Given a course of anti-inflammatory administered remotely. **Symptoms subsided**
Jan-Mar PLGL	Ongoing lethargy Limping	Likely Candidiasis Entanglement/constriction (repeated entanglement possibly due to weakness leaving	Stressors, underlying health issues, possibly amyloidosis Human hair	Jan • Continued on/off treatment of anti-inflammatory administered remotely which started in Sep 2020 through to Dec approx. (five days off, three days on). • Also caught to remove human hair from foot, constriction was substantial appearing to have lost blood flow. Caught again two weeks later to remove another hair. **Lethargy continued periodically** Feb Continued on/off treatment increasing the number of days between courses.

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
		her unable to free herself as other birds sometimes can)		Caught to remove another human hair from her feet. One nail looked yellow, possibly infected. All nails trimmed and germicidal barrier ointment applied. Mar • Continued on/off treatment increasing the number of days between courses. One-off doses of anti-inflammatory received on two days in Mar. • Caught on two more occasions with two more human hairs entangled/constricting feet. Appeared infected from entanglement in Feb so given course of antibiotic administered remotely. Two toes appeared dead although present. **Generally improved greatly, no treatment given in Apr**
May-Jul PWR	Decreased appetite, struggling to swallow, lethargic, sneezing, dehydrated/ leathery bill	Unclear. Likely Candidiasis Bumble foot	Reproduction stress, other stressors, possibly amyloidosis	May Given a one-off dose of anti-inflammatory followed by a course, administered remotely. **Symptoms continued** Jun • Started course of anti-inflammatory, course of antifungal, and course of antibiotic administered remotely. • A couple of days later caught for examination. Given subcutaneous injection of vitamin and mineral solution. Nutritional supplement also increased, administered remotely. **Intermittent symptoms** Started course of anti-inflammatory administered remotely. **Symptoms continued, condition deteriorated** Jul Started a course of anti-inflammatory administered remotely. **Died two days later**
May-Jul PLGL	Hunched, lethargic decreased appetite Limping	Likely Candidiasis Bumble foot	Stressors, underlying health issues, possibly amyloidosis	May Given two separate courses of anti-inflammatory administered remotely. Also started course of antifungal administered remotely. **Intermittent symptoms** Jun Back to on/off treatment plan of anti-inflammatory, three-on and three-off, administered remotely. Caught for examination, toes appear swollen, skin dry and flaking. Also now missing end of a toe. Nails trimmed, feet washed with antimicrobial skin wash and germicidal barrier ointment applied. Started course of antibiotic and course of antifungal administered remotely. **Symptoms worsened** Jul Caught for treatment, given subcutaneous injection of vitamin and mineral solution. Foot swollen, feet cleaned and germicidal barrier ointment applied. Started a course of antibiotic and given hydrating supplement alongside, administered remotely. **Condition deteriorated** Started a course of antifungal and moved (due to heat and bullying from other SBS) to Room #1 with air-conditioning. Given subcutaneous injection of vitamin and mineral solution, and injection of anti-inflammatory.

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
				Caught a few days later to treat feet again, still appear swollen. Repeated two days later, nares, face, and chest also cleaned. **Euthanised one day later**
Jun LBRL	Holding leg up (not tucked to body), limping	Possibly Amyloidosis	Moult, other stressors	Given one-off dose of anti-inflammatory administered remotely. **Symptoms continued** Given course of antifungal administered remotely. **Symptoms subsided**
Jun-Oct POR	Not weight bearing, swollen hock Decreased appetite, decreased activity Headshaking, damp feathers around eye, limping, matted feathers on back, general discomfort Above symptoms, plus gasping	Possibly Amyloidosis Likely Candidiasis	Moult, other stressors Stressors, underlying health issues, possibly amyloidosis	Jun Started course of anti-inflammatory administered remotely. **Symptoms continued** Started course of antifungal and one-off dose of anti-inflammatory administered remotely. **Symptoms continued** Caught for examination, feet cleaned with antimicrobial skin wash, started course of anti-inflammatory administered remotely. **New symptoms arose** Jul One-off dose of anti-inflammatory, and course of antifungal administered remotely. Another dose of anti-inflammatory due to persisting limp. **Symptoms continued** Aug • 2x one-off doses of anti-inflammatory. • Started course of anti-inflammatory. During course caught for examination and given subcutaneous injection of vitamin and mineral solution. • Started course of antifungal and one-off dose of anti-inflammatory. • Caught for treatment, given subcutaneous injection of vitamin and mineral solution. **Plumage appeared in better condition but other symptoms remained** Sep Started course of anti-inflammatory. **No improvement** Started course of antifungal. Also started course of anti-inflammatory and on-off dose of anti-inflammatory. **Condition deteriorated** Oct **Found dead**
Oct PDGR	Headshaking, hunched, low weight	Likely Candidiasis, open cracks on feet	Stressors, underlying health issues, possibly amyloidosis	• Given a one-off dose of anti-inflammatory, shortly followed by a course of antifungal. • Caught for examination, feet cleaned with antiseptic solution. • Given 2x additional one-off doses. **Symptoms subsided**
Oct LBDGL	Headshaking	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Started course of anti-inflammatory administered remotely. **Symptoms continued** Started course of antifungal, administered remotely. **Symptoms subsided**

Month/ ID	Symptoms	Affliction	Possible contributing factors	Treatment received (medicinal)
Nov-Dec RL	Preening between legs and cloaca often, wet nares, poor condition in general	Likely Candidiasis	Stressors, underlying health issues, possibly amyloidosis	Nov Given a one-off dose of anti-inflammatory administered remotely. **Symptoms continued** Started course of antibiotic and extra nutritional supplement administered remotely. **Symptoms continued** Dec Started course of anti-inflammatory and extra nutritional supplement administered remotely. **Symptoms continued** Started another course of anti-inflammatory and course of antifungal administered remotely. **Symptoms continued** Started another course of anti-inflammatory and course of antifungal administered remotely. **Symptoms continued into Jan**
Nov-Dec PDGR	Limping	Possibly amyloidosis	Stressors underlying health issues	Given one-off dose of anti-inflammatory administered remotely. **Limp worsened** Started course of anti-inflammatory and extra nutritional supplement. **Intermittent symptoms**

Notes:
Highlighted green indicates recovery, **highlighted orange** indicates ongoing issues and **highlighted red** indicates death
Remote' treatment indicates medication or supplement was injected into live food and target fed to an individual
Details of death in Section 2.4.5.1.

A11.2 Locality

A11.2.1 SBS facility configuration

See Figure A45. Further details in Section 2.1.2.

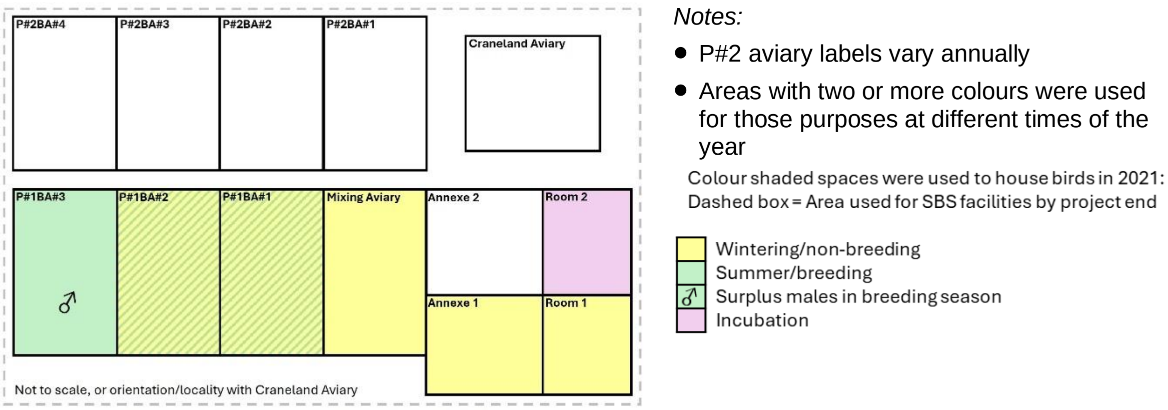


Figure A45 – SBS facility configuration: 2021

A11.2.2 Bird moves

Males and females are colour coded accordingly for ease of reading. Occupancy shown in Table A138.

January

- All birds occupied Room #1, An#1 and the MA.

February

- The birds were shut out of the MA between 11-12 February due to hard frost freezing the pond and sand. Otherwise continued to have access to Room #1, An#1 and the MA.

March

- The birds were shut out of Room #1 on 30 March, continued to have access to An#1 and the MA.

April

- 3: The birds were moved into the BAs:
  - P#1BA#1 LBDGL and PWR.
  - P#1BA#2 PDGR and PLGL.
  - P#1BA#3 POR, RL, and LBRL.
- 29: PWR and PLGL were swapped over.

May

- The birds continued to occupy the following aviaries:
  - P#1BA#1 LBDGL and PLGL.
  - P#1BA#2 PDGR and PWR.
  - P#1BA#3 POR, RL, and LBRL.

June

- 26: All birds moved out of BAs, occupying the MA and P#1BA#1.

July

- Given access to An#1 in addition to the MA and P#1BA#1 from 7 July. All birds shut out of the MA during extremely hot weather.

August

- The birds had access to An#1, MA and P#1BA#1. Given access to P#1BA#2 from 12 August.

September

- The birds had access to An#1, MA and P#1BA#1.

October

- Shut out of P#1BA#2 from 3 October. The birds were given access to Room #1 from 18 October and shut out of P#1BA#1 on 27 October. They continued to have access to An#1 and the MA.

November

- Continued to occupy Room #1, An#1, and the MA. Temporarily shut out of the MA overnight at the end of November. Became extremely nervous in this area so shut out overnight to reduce risk of flight collisions.

December

- Continued to occupy Room #1, An#1 and the MA. Shut out of the MA during periods of strong winds.

Table A138 – Space occupancy: 2021

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Room #1			30							18		
Room #2												
An#1				3			7					
An#2												
MA				3		26						
P#1BA#1				3		26				27		
P#1BA#2				3		26		12		3		
P#1BA#3				3		26						
P#2BA#1												
P#2BA#2												
P#2BA#3												
P#2BA#4												
Craneland Aviary												

Note:

Wintering/non-breeding
Summer/breeding
♂ Surplus males in breeding season
Incubation

A11.3 Social network

A11.3.1 Departures

It is unclear whether the deaths within the flock affected the social dynamics when they occurred. One case of aggression observed in LBRL the day after the death of PWR, a very dominant female.

A11.4 Breeding

- Breeding activity began in early April with singing and some aggression between birds. This continued to increase reaching peak season around the second week in May.
- Breeding behaviours subsided rapidly ceasing almost completely by June.
- The Black-tailed godwits previously housed adjacent to the SBS facility were moved away from CBU in late summer/autumn.
- Activity was considerably lower on days of high temperatures.

A11.4.1 Pairs

From 29 April the two females were swapped as the pairing showed little or no compatibility.

Refer to Section 2.5 for egg collection, storage, incubation/hatching and rearing protocols.

Table A139 – Pairs: 2021

Aviary	Male(s)	Confirmed nest scrapes	Female(s)	Notes
P#1BA#1	LBDGL	0	PLGL	• PLGL was not in good health and showed little to no signs of breeding when initially housed with PDGR. She had little interest in breeding though LBDGL showed some signs.
P#1BA#2	PDGR	8	PWR	• Once swapped on 29 Apr PWR initially chasing PDGD. Quickly developed into vigorous displaying by both birds. PDGR also nest scraping with PWR observing/inspecting. PWR appeared to present for copulation but opportunity missed by PDRR. • By 2 May there were two active nest scrapes, copulation at one nest observed on 7 May. Both very attentive to nest, not leaving general area on 8 May. Copulation observed again. • First egg was laid on 14 May. Appeared elongated, thin shelled, and had a substantial dent on side. • By 15 May (approx. 36 hours after first egg) no second egg was laid. • PWR looking hunched, generally uncomfortable, with wings dropped on 17 May. She was resting often and breathing heavily.
P#1BA#3	RL POR LBRL	2 1 (using RL's)	-	• RL most dominant and active in terms of breeding behaviours. Triggered by other birds, including the other males in the aviary when they came close, though not in an aggressive manor. LBRL appeared interested in RLs scrapes visiting when invited, even tending the nest and adding pieces to it. POR seen to investigate scrapes as well.

Note:

Highest				Lowest	None	: Observed breeding activity overall

A11.4.2 Eggs

Details of eggs laid in 2011 in Figures A46 and A47 & Table A140.

A46a. Egg 1:1 needed repair on collection on 14 May. It was thin shelled and dented substantially, though membrane was not punctured

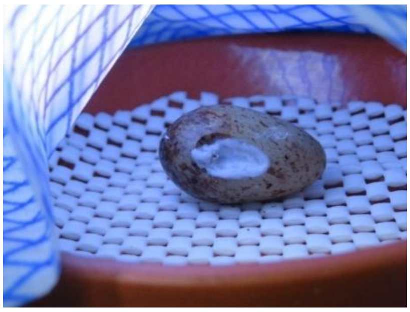
A46b. Egg 1:2 appeared normal on collection on 17 May

(Both photographs credit: WWT)

Figure A46 – Photographs of Egg 1:1 and Egg 1:2 for comparison

A47a. 14 May: Glue was applied to cracks of 1:1 in three stages, allowing to dry between each in the chiller

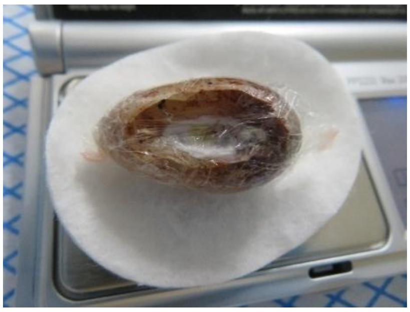
A47b. 15 May: it was placed in the chiller, with the dent to one side, with a high humidity to stop rapid weight loss considering the cracks and thin shell



A47c. 16 May: the dent had progressed deeper. The glue appeared to absorb the moisture in the air making this already weak area heavier and so collapsed further

A47d. 16 May: Nail varnish was applied to new cracks to seal these without risk of further moisture absorption and then wrapped in clingfilm to slow weight loss before being set in the incubator

A47e. 19-20 May: dent collapsed further
22 May: dent collapsed further
28 May: dent collapsing further



A47f. 28 May: Cracking now substantial, losing weight more rapidly

(All photographs credit: WWT)

Figure A47 – Photographs showing thin shelled egg repair and dent development (2021)

Table A140 – Egg status summary: 2021

Pair/ Location	Egg ID	Appearance	Date laid/ Date set	Incubation	Fertility	Outcome
PDGR PWR P#1BA#2	1:1	Large, elongated, thin shelled, already dented/damage on collection	14 May 2021 Put in cold storage (approx. 15^{o}C) 16 May 2021	Days 0-18 70+% RH	Candled at Day 3, 5, 6, 7, 9, 12. No signs of development throughout.	Day 18 removed from incubator. (18.2% average weight loss)
	1:2	Appeared normal	17 May 2021 Put in cold storage (approx. 15^{o}C) 21 May 2018	Days 0 45% RH Days 1-11 70% RH Day 12 60% RH Day 13 57% RH Day 16 54% RH Day 17 51% RH Day 19 48% RH	Candled at 11 days. couldn't see any veins but had pink hue. No movement seen, darker/foggy at yolk. No definitive structures visible. No change in appearance thereafter .	Day 24 removed from incubator. (17.7% average weight loss)

A11.5 Temperature

Temperature recording devices were not always present in occupied areas. Occupied areas also had various heat sources which were regularly altered to provide approximate temperatures required by the birds depending on time of year and health status; Table A141. Data was collected using temperature logger buttons from the MA (most frequently occupied aviary).

Table A141 – Temperature data summary: 2021

Month	Absolute Min °C	Mean Min °C	Overall Mean (daytime temp °C)	Mean Max °C	Absolute Max °C	Min recorded in all occupied areas for that month (+location)	Max recorded in all occupied areas for that month (+location)
Jan*	0.0	3.6	5.2	7.3	14..0	-1.0 (An#1)	19.9 (Room #1)
Feb	-0.5	4.1	6.2	9.3	15.5	-1.5 (An#1, MA)	18.5 (MA)
Mar	0.0	5.7	8.3	12.6	21.5	-2.0 (An#1)	22.5 (An#1)
Apr	2.5	4.9	9.3	16.6	23.5	0.5 (An#1)	35.5 (P#1BA#3)
May	4.5	9.1	12.3	18.4	25.0	0.0 (P#1BA#1)	34.5 (P#1BA#2)
Jun	9.5	14.3	18.2	25.0	32.0	8.0 (An#1)	38.5 (P#1BA#1, P#1BA#2)
Jul	14.0	15.8	19.9	27.1	36.0	12.5 (MA)	41.5 (P#1BA#1)
Aug	11.0	14.5	17.7	23.5	30.0	9.5 (MA)	35.0 (P#1BA#1)
Sep	9.0	13.6	17.2	23.4	31.0	8.5 (MA)	39.0 (P#1BA#1)
Oct	7.5	11.0	13.5	17.1	22.5	7.5 (MA)	22.5 (MA/P#1BA#1)
Nov	0.5	6.4	8.8	12.1	16.5	0.5 (MA)	17.5 (Room #1)
Dec**	2.0	6.3	7.8	9.6	13.5	0.5 (MA)	17.5 (Room #1)

Notes:
* Some data missing between 1-3 Jan
** Some data missing between 3-4 Dec
Snowfall was recorded in January with some entering the SBS occupied areas

A11.6 Lighting and Photoperiod

Figure A48 demonstrates the photoperiod (number of light hours including twilight) wild SBS experience during the year based on their location, shown as a dashed black line. The dark purple line is an approximate representation of what the captive SBS experienced this year, and the pale purple line showing the artificial lighting they were provided with.

The Slimbridge (UK) photoperiod is in conflict with what should be provided to the captive SBS. In the wild, SBS experience a shorter spring and autumn photoperiod compared that in the UK, so artificial lighting on timers was provided, but ultimately, it's the UK photoperiod the birds experienced. Unfortunately, this could not be remedied in this facility without detrimental changes in husbandry.

The graph also includes annual photoperiods for known breeding grounds (Meinypil'gyno, Russia), known wintering grounds (Martaban, Myanmar) and two key staging sites during migration (Rudong, China and Kamchatka Peninsula). Photoperiod for Slimbridge (UK) is also included here. All location photoperiods include twilight.

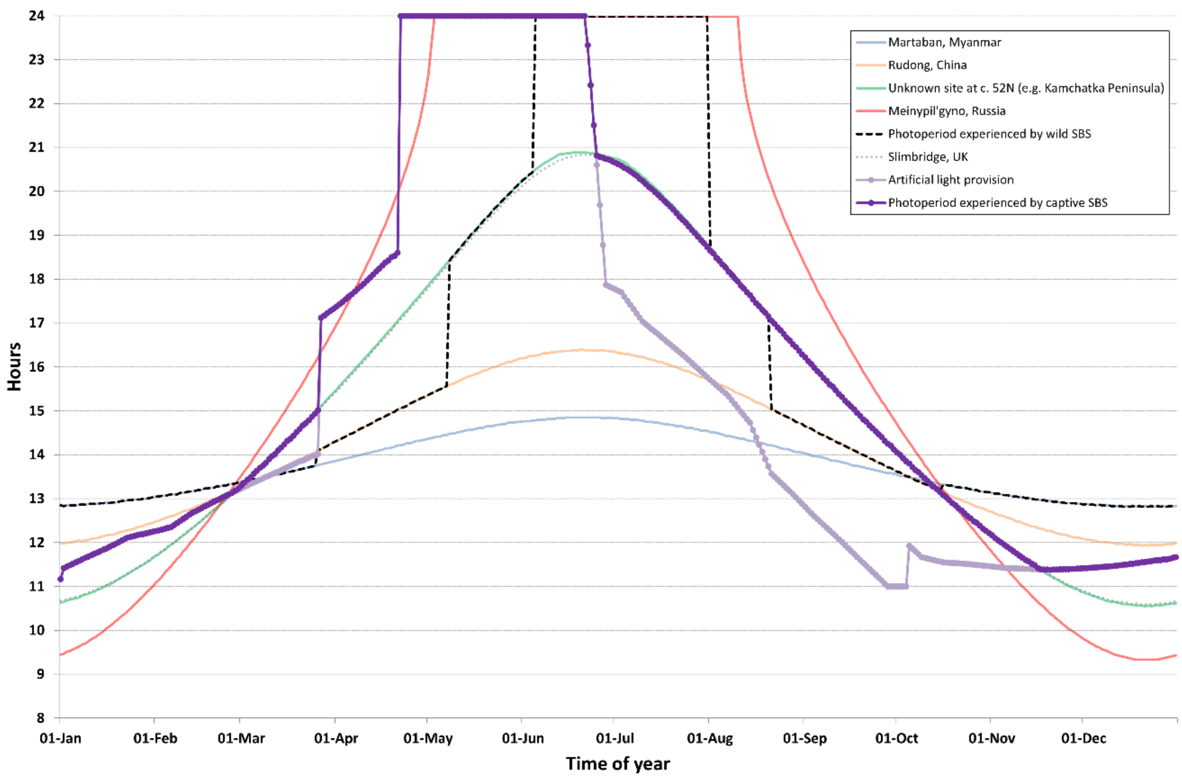


Figure A48 – Photoperiod wild SBS experience during the year based on location: 2021

A11.6.1 Photoperiod experienced by the captive SBS

For the first half of the year the captive SBS experienced a photoperiod roughly similar to wild SBS, though the captive birds had only to migratory jumps in location/photoperiod. In 2021 the birds were only time shifted by approximately six weeks, starting 24 hours of light hours on 22 April. This was due to the major health issues and numerous deaths seen in 2019, it was decided to give the birds a longer winter to recover/rest but still enabling the birds to breed in the cooler spring months. The breeding season lasted the usual eight weeks before a rapid decline in light hours. The birds then experienced the Slimbridge (UK) photoperiod from end of June to mid-November. At this point artificial lighting took over and very gradually began increasing over the 2021/2022 winter period.

A11.6.2 Notes

To avoid the birds being plunged into sudden darkness the on/off times for the various lights in use were staggered with about one minute between each.

A jump in artificial lighting occurred in winter to make up some time taken away the previous year. This was thought not to affect the birds as the Slimbridge (UK) photoperiod was longer and therefore the photoperiod they experienced.

UVI readings were taken approximately once a week outside of the breeding season in areas used by the birds; Table A142. Bulbs were replaced as and when needed.

Table A142 – Mean monthly UVI readings from accessible light units: 2021

UV Unit* ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MA	5.0	4.0	4.6				2.6	2.6	2.2	1.7	0.8	2.3
An#1	4.4	4.5	4.5				4.9	4.9	4.8	4.5	4.6	4.4
Room #1	5.4	5.4	5.0				5.2			5.1	5.1	5.0
P#1BA#1			5.5	5.5		5.5	5.0	4.9	5.1	4.0		
P#1BA#2			5.7	6.1		5.2		5.4	5.8			
P#1BA#3			6.2	6.2		6.0						

Note: * Not all UV units were accessible at any one time i.e. one unit in each BA during the breeding season

A11.7 Diet and nutrition

From February a portion of the Lundi pellet offered was crushed, to provide different sizes for those struggling with *Candida* symptoms.

A portion of the Lundi pellet was offered in dishes of fresh water through the year.

Grit, including oyster shell grit, was present year-round; Table A143.

Table A143 – Food present/absent in diet: 2011

Food item/supplement***		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%ratio	Lundi micro **35**	0	30	50	50	50	50	40	40	5	0	0	0
	Lundi micro **20**	100	70	50	50	50	50	60	60	95	100	100	100
Insectivorous Feast		√	√	√	√	√	√	√	√	√	√	√	√
Frozen bloodworms		√	√	√	√	√	√	√	√	√	√	√	√
Live crickets (brown/black)		√	√	√	√	√	√	√	√	√	√	√	√
Avripro (on dry food)		√	√	√	√	√	√	√	√	√	√	√	√
Oyster shell grit		√	√	√	√	√	√	√	√	√	√	√	√
Salt water*		√	√	√	√	√	√	√	√	√	√	√	√
Live fruit flies		X	X	√	√	√	√	√	√	√	√	√	√
Frozen Brine shrimp+ omega3		X	√	√	√	√	√	√	X	X	X	X	X
Zolcal-D supplement**		X	√	√	√	√	√	X	X	X	X	X	X
Frozen red plankton		X	X	X	√	√	√	√	X	X	X	X	X
Feather-up supplement		X	√	√	√	X	X	X	X	X	X	X	X
Rat tail bones (autoclaved)		X	X	X	√	√	√	X	X	X	X	X	X
Live mealworms		√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp	√ for meds /supp

Notes:
* Salt water only provided in BAs if foot condition was poor
** Females daily, males every other day
*** Most frequently provided items to least

√	Present in diet
	Present for certain birds
X	Absent from diet

A11.8 Sanitation

A11.8.1 Water systems

- The annexe and polytunnel ponds, sumps and filters were cleaned thoroughly approximately once a week when in use. The annexe pond water was refreshed every few days. The MA pond water was refreshed daily with salt added. It was scrubbed of algae as needed.
- Any saltwater trays present were refreshed at least once a day.

A11.8.2 Substrates

- Occupied areas were serviced twice a day to sweep up any faeces and rake/aerate the sand.
- Towels were used under food dishes and in roosting spots to catch the majority of faeces and any spilt food. These were washed at least once a day and soaked in antiseptic solution before being used in the aviaries.
- Room #1 sand used in winter 2020/2021 was disinfected for re-use in winter 2021/2022.
- Sand in the MA had the top scrapped off and the remainder disinfected before being topped up with fresh sand (June).
- Sand in An#1 was replaced in June, and the pond sand replaced in July.

A11.8.3 Biosecurity

- Remained the same.

A11.9 Environment provisions, modifications, and events with consequences

A11.9.1 Climate

- Snow showers in January.
- Ice and fresh water regularly added to sump in polytunnel corridor in an attempt to cool water in BA ponds during hot weather (April onwards).
- The misting system was used during the hottest parts of the day in an attempt to cool the air and surface temperatures in the BAs (April-October).
- All birds shut out of the MA during extremely hot weather (June-August).
- A large water chiller was used to cool the water stored for the misting system (June onwards).
- Ice packs were placed under sand/towels and replaced regularly as an emergency measure in the extremely hot weather (June).
- Ice blocks were added to occupied aviary ponds as an emergency measure in the extremely hot weather (June onwards).
- Small air-conditioning unit setup in An#2 but turned off the same day as ineffective (July).

A11.9.2 Light

- Overhead lights replaced in some BAs (March).
- Flickering bulbs changed in An#1 luminaire units (August and October).

A11.9.3 Enclosure

- Replaced pipe lagging and netting around UV units as they started to disintegrate (March).
- Tray of turf added to edge of aviary to create interest and reduce pacing (July).

A11.9.4 Substrate/habitat

- Tray of sand soaked in disinfectant placed in Room #1 to aid foot issues (January).
- Tray of fine gravel added to Room #1 with warm water with heat mat underneath in an attempt to alleviate foot issues (January).
- New linen towels were made to replace microfiber towels, which were continuously shedding fibre affecting at least the staff in the facility (November).
- Dried Dwarf willow leaves added to BAs as nesting material (March-May).
- Saltwater trays added to BAs to help with birds cracked feet during the breeding season (April-June).
- Grass cut where necessary in the occupied BAs where it was getting long and unmanageable for the birds, except those showing strong signs of breeding (April-June).

A11.9.5 Other

- Wren *Troglodytes troglodytes* seen in SBS facility and aviaries (January and December). Sparrow *Passer sp*., seen in polytunnel corridor (May).
- Pigeon spikes replaced external to MA (January).
- A Vole seen in SBS facility. Traps set but none seen since (June).
- Water pump for An#1 pond and BA ponds switched off during times of high ground water due to back flow into sump from drains.

A11.10 Visitors

Visitor is defined as anyone not usually in contact with the captive flock e.g. maintenance teams. Vets not included here. See Table A144.

Table A144 – Number and type of visitor to the breeding facility: 2021

Month	Occurrences (minimum)			
	Viewed from fence	Viewed from corridor	Went inside SBS aviaries	Contractors/maintenance inside the facility
Jan				1 (fix leaking tap)
Feb				1 (fixing heat detector in building)
Mar				2 (ladder checks, fixing water heater)
Apr	1 (VIP/visitors)			1 (replacing batteries in fire alarm)
May			1 (WWT media filming male breeding behaviour)	
Jun				1 (contractors checking fire alarms)
Jul				1 (fixing washing machine)
Aug				1 (installing water heater)
Sep	1 (management visiting)			2 (maintenance inspections, leaking water heater)
Oct			1 (trial tour of SBS facility with internal staff)	1 (replacing water heater)
Nov	1 (internal photographer)	1 (film crew to film SBS staff)		
Dec	1 (VIP/visitor)			

List of figures and tables in Annex 5