Weights and measurements of Bewick's Swans during winter

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Introduction

Weights of Bewick's Swans *Cygnus columbianus bewickii* and the conspecific Whistling Swan *Cygnus columbianus columbianus* have been examined previously as an index of condition. Evans *et al.* (1973) compared the weights of Bewick's Swans carrying lead pellets with those of pellet-free birds, while Seegar (1977) compared those of Whistling Swans parasitized by the heartworm *Sarconema eurycerca* with those of non-parasitized birds.

Scott *et al.* (1972) published average weights of male and female, first winter (cygnet) and adult Bewick's Swans, as well as linear measurements of bill, head, tarsus, and wing. This paper incorporates larger samples and broadens the study by considering second winter birds (yearlings), recognizable by vestiges of grey cygnet plumage on head and neck and, in the case of weights, seasonal and individual variations.

At Slimbridge, Gloucestershire, Bewick's Swans are the subject of a long-term intensive study of social behaviour, so catches were neither made frequently, nor immediately after, nor before, migration, in order to minimize possible disturbance. Thus some sample sizes are small. However, Slimbridge is the only place where Bewick's Swans are caught in any number, making it even more desirable to place on record the data available.

Methods

Since 1963–1964 increasing numbers of Bewick's Swans have wintered at the Wildfowl Trust, Slimbridge, Gloucestershire. They are attracted on to a lake in a large enclosure by a liberal food supplement of wheat or barley, which is distributed on average three times a day. The food is also taken by many hundreds of ducks, so no precise estimate of the quantity available to, and consumed by, the swans can be made.

At first the swans were caught when they accidentally landed in confined spaces. In 1969 a screened channel was constructed off the lake, in which feeding swans could be trapped (Evans 1970), and this became the main means of catching. The trap was later modified to improve its efficiency (Evans 1977; Evans & Rees 1978).

Each swan was weighed by being suspended from a spring balance in a specially designed plastic jacket (Evans & Kear 1975). Linear measurements were made of bill, head, and tarsus while the swan was still in the jacket, and of the wing (standard chord) when the jacket was removed prior to the bird's release.

Sex was determined by cloacal examination, and results agreed well with sexing by observation of behaviour. In male cygnets, however, the penis was not always well developed, and resexing in subsequent years revealed that some males had been sexed as females at the cygnet stage. This problem was largely overcome by practice.

Results

Mean weight

Mean weights and ranges, obtained from 1966 to 1978 for each age and sex class, are given in Table 1. Only weights taken in November, December and January, and only one weight per individual in each age class, were used in this table.

As the annual sample sizes were usually small, and any natural variation between years was likely to be eliminated by the freely available food supply, all the data were combined.

The weights of the age classes within each sex were significantly different, yearling males and females respectively being 8% and 9% heavier than cygnets, and 8% and 5% lighter than adults.

Males were heavier than females in each age class: 13% heavier in adults, 10–11% in yearlings and cygnets, the differences being significant.

Weight changes

Figure 1 shows the mean weight of each age and sex class in half-monthly intervals. Samples were not less than 10, except where indicated by brackets, where they were at least five. Repeat weights could be included here, since we were, in effect, taking a cross section of the population at different stages of the winter. A catch could include birds newly arrived at Slimbridge, and those which had spent some weeks there, taking advantage of the more concentrated diet.

Weights were lowest at the beginning of

the winter, rising to a maximum in the second half of December. However, a small sample of yearling females showed a continued increase in the first half of January. Adult weights were fairly well maintained, but the younger classes suffered a loss during January followed by something of a recovery.

The rate at which individuals put on (or in some cases lost) weight could also be examined, averages and ranges of *per diem* changes being determined for each age and sex class, and for the periods before 31st December and after 1st January (Table 2). Where capture was before 31st December and recapture was after that date, the rate of

Table 1. Mean weights (g) of Bewick's Swans in November, December and January, 1966–1967, to 1977–1978

	n	Mean	Range	SE	V*	p (t test)
A ♂	211	6,380	4,536–8,391	45·39	10·33	
						0·001
Y ♂	62	5,887	4,281–7,638	145·61	19·48	
						0·05
C ♂	101	5,462	3,856–7,200	140·01	25·76	
A ♀	189	5,642	4,300–7,825	45·37	11·06	
						0·01
Y ♀	46	5,365	4,167–6,583	82·33	10·41	
						0·001
C ♀	101	4,919	3,294–7,000	71·76	14·66	

A = Adult, Y = Yearling (second winter), C = Cygnet (first winter)

$$* \text{ V} = \text{coefficient of variation} = \frac{\text{standard deviation} \times 100}{\text{Mean}}$$

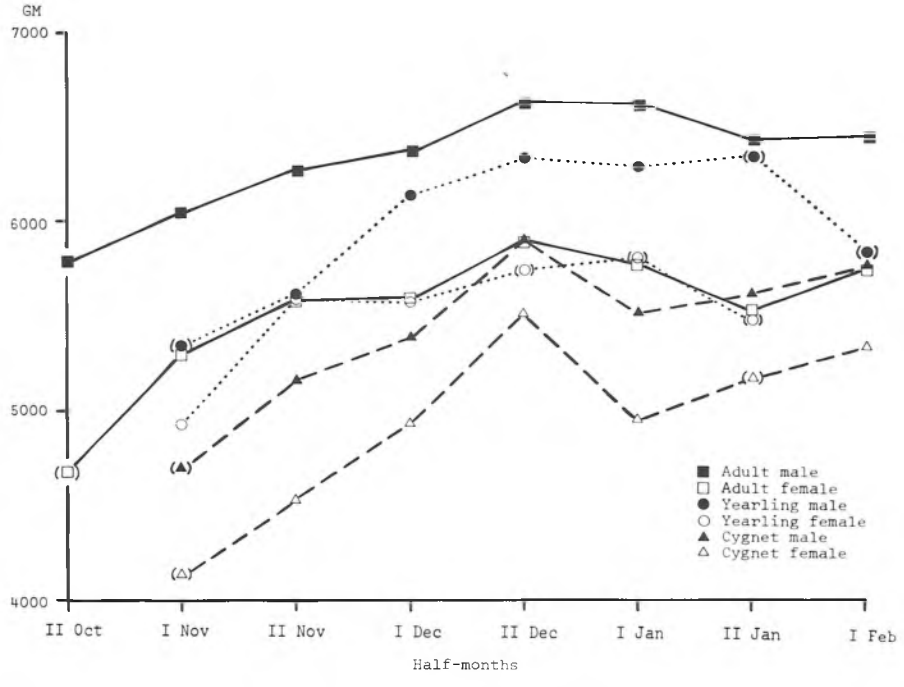

Figure 1. Mean weights of age and sex classes at half-monthly intervals.

Table 2. Mean weight changes per day in individual Bewick's Swans, in g, and as a percentage of body weight.

	n	Change (g)	Change (%)	Range (g)	p(t test)
Before 31st December					
A ♂	96	+20·0	+0·34	−47·3−+107·6	
Y ♂	23	+32·7	+0·60	−21·2−+ 86·3	
C ♂	32	+19·3	+0·39	−14·1−+ 90·0	
A ♀	72	+17·0	+0·33	−23·7−+107·1	
Y ♀	18	+24·7	+0·50	−0·4−+ 85·0	
C ♀	20	+25·8	+0·59	−27·5−+ 80·0	
After 1st January					
A ♂	30	−0·2	—	−36·4−+ 40·2	0·001
Y ♂	6	+1·1	+0·03	−81·8−+ 23·8	0·05
C ♂	16	+7·0	+0·15	−50·0−+ 39·5	0·05
A ♀	16	+6·8	+0·14	−11·4−+ 40·0	NS*
Y ♀	4	−18·6	−0·30	−83.3−+ 7·4	0·05
C ♀	16	+7·3	+0·18	−20·8−+ 35·0	0·1

* NS = Not significant.

change figure was allocated to the period in which the majority of the intervening days was passed. It is unlikely that any loss of weight from the stress of capture markedly affected the average rate of change. The minimum interval between capture and recapture was eight days.

Up to 31st December the smallest average daily gain was 17 g, but all classes were able to put on up to 80 g a day. After 1st January the average daily gains were significantly less, none more than 7 g with a maximum of 40 g for adults. In two classes average losses rather than gains were recorded and individual losses reached over 80 g among yearlings, compared with a maximum loss of 47 g before 31st December, recorded by an adult male. Differences between weight changes in the two periods were significant in all classes but adult females.

The average daily weight changes are also shown as a percentage of the swan's first weight (Table 2). Before 31st December both sexes of cygnets and yearlings gained proportionately more weight than adults, and the cygnets continued to do so after that date. Although adult female weight gains had been proportionately very similar to that of adult males before 31st December, they then continued to increase at almost the same rate as cygnets. This is probably due to the necessity of putting on reserves for egg laying, as well as for migration.

Measurements

Lengths of wing, skull, bill and tarsus, and tarsus thickness were examined (Table 3). There were significant differences between the age classes in wing length and bill length. Tarsus thicknesses also were significantly different, except between female yearlings and cygnets. Skull length and tarsus length showed no significant differences between age classes.

Males were larger than females at every age, the differences being significant in all but cygnet bill length. This is an unreliable measurement in their case, because the juvenile down on the culmen recedes at variable rates until a final sharp line between feathering and bill is established.

Discussion

While the weights of all the classes of Bewick's Swans clearly overlap, it is of interest that the average weights of yearlings are significantly different from those of adults, as well as of cygnets. This has not hitherto been demonstrated for any swan species, yearlings usually being lumped with adults.

The mid-winter weight maximum of the population is not unexpected. Having reached peaks in December, Greylag Geese *Anser a. anser* lost weight in January (Matthews & Campbell 1969), as did

Table 3. Linear measurements (mm) of wing, skull, bill and tarsus length, and tarsus thickness of Bewick's Swans in winter.

		n	Mean	Range	SE	V	p (t test)
Wing	A ♂	152	529·0	480–570	1·25	2·92	0·001
	Y ♂	62	518·0	489–570	2·18	3·32	0·001
	C ♂	69	500·0	468–538	2·03	2·81	
	A ♀	133	509·0	474–542	1·21	2·75	0·001
	Y ♀	48	500·0	468–538	2·03	2·81	0·001
	C ♀	65	482·0	445–525	1·95	3·27	
Skull	A ♂	109	163·2	148–187	0·60	3·83	NS
	Y ♂	63	161·4	146–177	0·69	3·37	NS
	C ♂	69	159·9	135–171	0·80	4·15	
	A ♀	106	156·7	144–167	0·44	2·90	NS
	Y ♀	46	156·3	148–168	0·63	2·74	NS
	C ♀	65	155·6	141–167	0·74	3·81	
Bill	A ♂	112	94·5	81–110	0·52	5·87	0·001
	Y ♂	63	91·4	80–100	0·52	4·48	0·001
	C ♂	69	75·9	65–93	0·65	7·15	
	A ♀	112	91·2	79–102	0·43	4·94	0·05
	Y ♀	46	89·4	76–99	0·73	5·53	0·001
	C ♀	65	75·6	64–82	0·63	6·70	
Tarsus length	A ♂	111	106·6	93–119	0·49	4·87	NS
	Y ♂	62	106·2	87–115	0·69	5·11	NS
	C ♂	69	106·1	94–115	0·56	4·39	
	A ♀	110	102·4	87–113	0·41	4·23	NS
	Y ♀	46	101·4	89–113	0·72	4·83	NS
	C ♀	64	102·9	93–111	0·49	3·81	
Tarsus thickness	A ♂	110	10·22	9·2–11·2	0·04	4·28	0·05
	Y ♂	63	10·03	9·0–11·0	0·07	5·14	0·01
	C ♂	68	9·78	8·9–11·0	0·06	4·65	
	A ♀	110	9·87	8·8–11·1	0·05	4·89	0·05
	Y ♀	46	9·66	9·0–11·0	0·07	5·00	NS
	C ♀	65	9·57	8·5–10·9	0·06	5·41	

Canada Geese *Branta c. canadensis* (Elder 1946), with subsequent increases for most classes in both species.

This rapid increase in weight after the stresses of migration is confirmed by individual weight changes, with those birds still growing, cygnets and yearlings, gaining relatively more.

Wing length has the lowest coefficient of variation and is thus probably the most reliable measurement, as has been indicated in many other species. Again, yearlings are quite distinct from adults, as well as from cygnets, and this is probably a more useful measurement than bill length, discussed earlier, and tarsus thickness. Although this last measurement shows mostly quite distinct differences between the age classes, in absolute terms these are very small indeed and thus highly vulnerable to any variability in different operators. In this study over 90% of the measurements were made by one person (M.E.E.).

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Summary

Weights and measurements of Bewick's Swans *Cygnus columbianus bewickii* in winter are given for different age classes and periods. Males are heavier than females, and adult birds heavier than

yearlings which, in turn, are heavier than cygnets. Weights rise during the early winter to a late December peak. After 1st January some losses are recorded but adult females and cygnets continue to increase.

Wing and bill length show significant differences between age classes, as do tarsus thicknesses in some cases, but skull length and tarsus length showed no significant differences. Males were larger than females at every stage.

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Wrapped in a special jacket, a wild Bewick's Swan *Cygnus columbianus bewickii* waits quietly to be weighed and measured. (*Maurice Tibbles*)