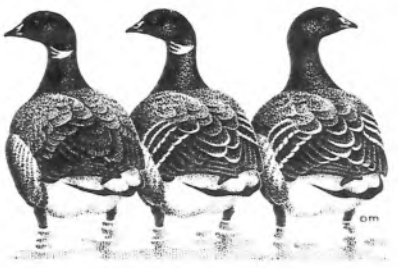
An age-related difference in the size of the nasal glands of Brent Geese *Branta bernicla*



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We tested the hypothesis that the reason for early inland movement of Brent Geese during years in which the percentage of first-year birds was high, was that the nasal or 'salt' glands of the first-year birds were under-developed and thus less able to excrete the high salt levels ingested while grazing on intertidal vegetation. The data showed that the glands of first-year geese were heavier than those of the adults during November to February. Therefore, the hypothesis was not supported but, because of the timing of sampling, we do not discount the possibility that first-year geese have smaller glands when they arrive on wintering areas.

The traditional winter food of the Dark-bellied Brent Goose *Branta b. bernicla* is *Zostera* sp., *Enteromorpha* sp. and a variety of saltmarsh plants (Burton 1961, Charman & Macey 1978) resulting in a large intake of salt. Salt concentrations in the blood are lowered by drinking fresh water and by the nasal glands. The nasal glands lie on top of the skull above the orbits (Fig. 1), remove salt from the blood and secrete it through the nares (Holmes & Phillips 1985).

Figure 1. The nasal glands on the skull of a Brent Goose. Photo: M. Smith.

Flocks of Brent Geese often fly inland to drink fresh water and the percentage of first-year birds in these flocks tends to be higher than in the population as a whole, suggesting that first-year geese do not have fully developed glands (Ebbinge *et al.* 1981). Since the winter of 1973-74, Brent Geese have included arable and grass fields as grazing habitats (St Joseph 1979) and usually switch from intertidal to inland habitats in early winter. However, in years when there is a high percentage of first-year geese in the population, the move to inland feeding occurs earlier (Tubbs & Tubbs 1982). These observations also suggest that first-year geese are less able than older birds to deal with a diet high in salt.

We tested the hypothesis that first-year Brent Geese have under-developed nasal glands by comparing the size of glands from adult and first-year geese, since function is related to size (Douglas 1964).

Methods

The study was carried out around Scolt Head Island, north Norfolk during the winter 1988-89. The area contains inter-tidal flats, saltmarsh, grassland and arable fields. Weekly surveys were conducted throughout the winter in order to count the population and describe habitat use (Summers & Critchley 1990).

Nasal glands were obtained from geese shot under a licence issued by the Ministry of Agriculture, Fisheries and Food on fields of wheat and oil seed rape. The body mass and age (first-year or adult) were recorded. Prior to removal of the paired nasal glands their relative positions were noted; i.e. whether the left gland overlapped the right or *vice-versa*. The fresh mass of each gland was recorded and dry mass recorded after drying at 80°C for seven days in a convection oven.

Results

Field observations

During the winter of 1988-89, the Brent Geese started feeding on fields of arable crops on 30

October, earlier in the season than the two previous winters (18 November in both 1986 and 1987). This is correlated with the high percentage of first-year geese within the population in 1988-89 (34.4%), compared with 0.5% in 1986-87 and 0.1% in 1987-88.

Table 1. Dry and fresh masses (g) ± S.D. of nasal glands of Brent Geese. Mass is shown as unadjusted means and when adjusted to take account of the variation due to differences in body mass and other factors (month and age).

			Mean Mass (g)			
					Adjusted for body mass and variation in other factors	
			Unadjusted			
Factor	Cat.	*n*	Dry	Fresh	Dry	Fresh
Month	Nov	24	0.67±0.18	2.52±0.72	0.64	2.41
	Dec	7	0.62±0.18	2.62±0.61	0.67	2.64
	Jan	14	0.56±0.13	2.13±0.48	0.58	2.23
	Feb	2	0.42±0.19	1.64±0.74	0.53	2.03
Age	Adult	30	0.60±0.18	2.34±0.67	0.59	2.28
	1st year	17	0.65±0.16	2.46±0.65	0.68	2.57

Analysis of covariance

Source of variation		Dry		Fresh	
	df	F	*P*	F	*P*
Body Mass$^{0.74}$	1	31.2	<0.001	40.4	<0.001
Month	3	1.3	n.s.	2.0	n.s.
Age	1	4.4	0.04	4.3	0.04
Interaction	2	0.03	n.s.	0.7	n.s.

Nasal glands

The mean dry mass of the left nasal glands (0.313 g ± 0.092 S.D.) was not significantly different from the mass of the right nasal glands (0.305 g ± 0.087) (t = 1.24, n.s.). However, the right gland overlapped the left gland more frequently (44 times out of 58) than the left gland overlapped the right gland (14 times) ($X^2 = 14.5$, $P<0.001$).

The fresh and dry masses of the nasal glands were analysed for seasonal and age-related differences. The metabolic body mass (body mass $^{0.74}$, King & Farner 1961) was used as a co-variate to account for any gland differences that may be related to differences in body mass. There was no seasonal effect but there was an age-related effect, with the nasal glands of the first-year geese being heavier than those of the adults. This applied to both unadjusted and adjusted masses for dry and fresh masses (Table 1).

Discussion

The field observations of the Brent Geese moving inland to feed earlier in the year when the percentage of first-year birds was high supports the observations of Tubbs & Tubbs (1982). However, the greater mass of the nasal glands of first-year birds does not support the hypothesis that first-years have to feed on a less salty diet because their glands are less developed than those of adults. The results do not disprove this hypothesis either, since the samples were collected after the transition to inland feeding. Ideally, samples should have been collected as soon as the geese arrived in the study area in October. The wet mass of the nasal gland of the Mallard *Anas platyrhynchos* can reach its maximum size two weeks after being exposed to saline drinking water (Holmes & Stewart 1968), growth being due largely to protein synthesis whilst the percentage of water remains constant (Stewart *et al.* 1979). Thus, it is possible that by November the first-year Brent Geese had fully developed nasal glands but under-developed glands on arrival in October.

The fact that first-year geese have larger nasal glands than adult geese is difficult to explain, although perhaps by mid-winter the first-year geese have a saltier diet than the adults. First-year geese may not be so selective as adults and feed on leaves with a higher salt content. At this time of the year geese still feed on saltmarshes, mainly in the morning, although the bulk of feeding is inland (Summers & Critchley 1990).

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