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Biometrics of Red-breasted Geese *Branta ruficollis*

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Abstract

Biometrics were taken from 253 Red-breasted Geese *Branta ruficollis* caught during the annual wing moult in summer on the Taimyr Peninsula, arctic Russia in 1996 and between 2010 and 2014 and 94 birds from four catches on the wintering grounds in Bulgaria between 2011 and 2014. Summary data provided in this short note represent the first published data of body measurements, wing lengths and mass using sample sizes of greater than ten birds. Males were statistically larger in head and bill and tarsus measurements than females amongst adults and first winter birds, and adults in winter showed lower body mass than in moult. In common with other arctic moulting goose species, the mass of adult geese remained constant throughout the flightless moult period. An index of adult winter wing length x body mass was a 100% accurate predictor of sex determined by cloacal eversion (n = 22), but less successful for first winter birds (92-93%, n = 27). It is suggested that biometric data are pooled and that additional data could be gathered from shot birds.

Key words: Red-breasted Goose, *Branta ruficollis*, biometrics

There have been few published details of the biometrics of Red-breasted Geese *Branta ruficollis*. Mass and measurements from five wild birds were given in Witherby *et al.* (1939), and from nine skins in Bauer & Glutz (1968). But, as far as the authors could determine, no other published biometrics are available, at least in literature published in English. This is hardly surprising; there have been few Red-breasted Geese ringed. Red-breasted Geese are protected throughout their range and measurements of shot birds, killed accidentally or even deliberately, are currently not likely to be taken. Red-breasted Geese caught on the breeding grounds in Russia and as part of a recent LIFE project in Bulgaria gave an opportunity to record and report measurements.

Methods

Red-breasted Geese were caught during the annual wing moult in the Taimyr Peninsula, Russia (approx 72.34°N, 85.87°E) in 1996. Further samples were caught using cannon-nets in north east Bulgaria (approx 43.69°N, 28.55°E) between 2011 and 2014. The sex of the geese was determined by eversion of the cloaca and age (adult or first winter) on the winter quarters was determined through plumage characteristics (Cramp & Simmons 1977). Measurements followed Dzubin & Cooch (1992). Mass was determined using a spring balance accurate to ±10g, and total head and bill length and tarsus length were measured using callipers accurate to 0.1mm. The total length of the ninth primary (during the wing moult) and total wing length (during the winter) were measured using a plastic rule accurate to 1mm.

Results

In Russia, 199 Red-breasted Geese were caught in July and early August 1996 and, of these, biometrics were taken from 198 geese. Eleven goslings were not sexed and the biometrics from these birds were not used in this analysis. Measurements were also taken from 55 birds caught in 2010 to 2014. In Bulgaria, 158 Red-breasted Geese were caught and biometrics were taken from 94 birds (Table 1). In both catch areas, not all biometrics were taken from all birds (Table 1).

Table 1. The number of Red-breasted Geese caught during the annual wing moult in Russia (1996 and 2010-14) and in four cannon-net catches in Bulgaria (2011 to 2014) and the number of biometrics taken.

			No. of birds measured			
Catch	**Date**	**Total catch**	**Wing**	**Head & Bill**	**Tarsus**	**Mass**
Taimyr Peninsula, Russia (1)	6 July - 13 Aug 1996	199	191	147	192	198
Taimyr Peninsula, Russia (2)	16 June to 15 July 2007	13	0	0	0	13
Taimyr Peninsula, Russia (3)	June 2010	1	0	0	0	1
Taimyr Peninsula, Russia (4)	21 June to 1 July 2013	6	0	0	0	6
Gydan, Russia (5)	9 July to 21 July 2012	15	11	0	0	15
Taimyr Peninsula,	1 July to 17 July 2013	14	14	0	0	13

Russia (6)						
Yamal, Russia (7)	5 July to 17 July 2014	6	3	0	0	6
Bulgaria (1)	11 Jan 2011	6	6	6	6	6
Bulgaria (2)	8 Feb 2013	95	0	0	0	31
Bulgaria (3)	9 Jan 2014	12	0	0	0	12
Bulgaria (4)	12 Feb 2014	45	43	0	0	45
Total		**412**	**268**	**153**	**198**	**346**

Total wing length was only measured in Bulgaria. The mean wing length of adult males was significantly longer than that of adult females (F_{21}=34.62, P<0.001) and first winter males were significantly longer than those of first winter females (F_{26}=23.11, P<0.001; Table 2). The mean wing length of adult males was significantly longer than first winter males (F_{27}=15.50, P<0.001) but adult females were not significantly different to first winter females (F_{20}=1.85, P=0.19). Birds caught on the Taimyr Peninsula were regrowing remiges at the time of capture (see below).

Too few head and bill and tarsus measurements were taken in Bulgaria to make any comparisons with those taken in the Taimyr Peninsula. However, from the measurements taken in Russia, both the head and bill and tarsus length were significantly longer in adult males than adult females (F_{150}=58.45, P<0.001 and F_{148}=74.07, P<0.001, respectively; Table 2).

The mass of adult male Red-breasted Geese was significantly lower in July/August in Russia than in January/February in Bulgaria (F_{114}=48.47, P<0.001, Table 2). Although the mass of adult female Red-breasted Geese was lighter in July/August than in January/February, the difference was not significant (F_{89}=0.60, P=0.44).

Table 2. Summary biometrics of Red-breasted Geese caught in the Taimyr Peninsula, Russia in 1996 and in four catches in Bulgaria (2011 to 2014).

Measurement	**Wing (mm) (a)**	**Head & Bill (mm)**	**Tarsus (mm)**	**Mass (g)**
Adult male				
Mean ± SE	367.9 ± 2.6	74.8 ± 0.4	61.1 ± 0.4	1352 ± 13 (b) 1464 ± 10 (c)
Range (Min – Max)	344 – 381	58.6 – 78.4	53.4 – 73.9	1200 – 1625 (b) 1290 – 1660 (c)
Sample size	14	70	70	48 (b) 67 (c)
Adult female				
Mean ± SE	345.8 ± 2.0	71.4 ± 0.2	57. 2 ± 0.2	1232 ± 22 (b) 1259 ± 12 (c)
Range (Min – Max)	340 - 356	66.8 – 75.5	52.2 – 61.6	1130 – 1320 (b) 955 – 1480 (c)
Sample size	8	81	79	9 (b) 81 (c)
First-winter male (d)				
Mean ± SE	355.0 ± 2.0	75.6	62.1	1323 ± 18
Range (Min – Max)	340 – 368	75.6	62.1	1150 - 1450

Sample size	14	1	1	19
First-winter female (d)				
Mean ± SE	342.0 ± 1.8	69.8	56.5	1193 ± 19
Range (Min – Max)	330 – 356	69.8	56.5	1005 - 1400
Sample size	13	1	1	18

Notes:
a) wing length only determined in Bulgaria in winter.
b) mass determined in Bulgaria in January and February.
c) mass determined in Russia in July and August.
d) measurements of first-winter birds only taken in Bulgaria in winter.

Change in mass during the annual wing moult
The mass of both male and female adult Red-breasted Geese did not change with stage of remige re-growth (Figure 1). In contrast, goslings showed a positive relationship between mass and the length of the remiges (Figure 2).

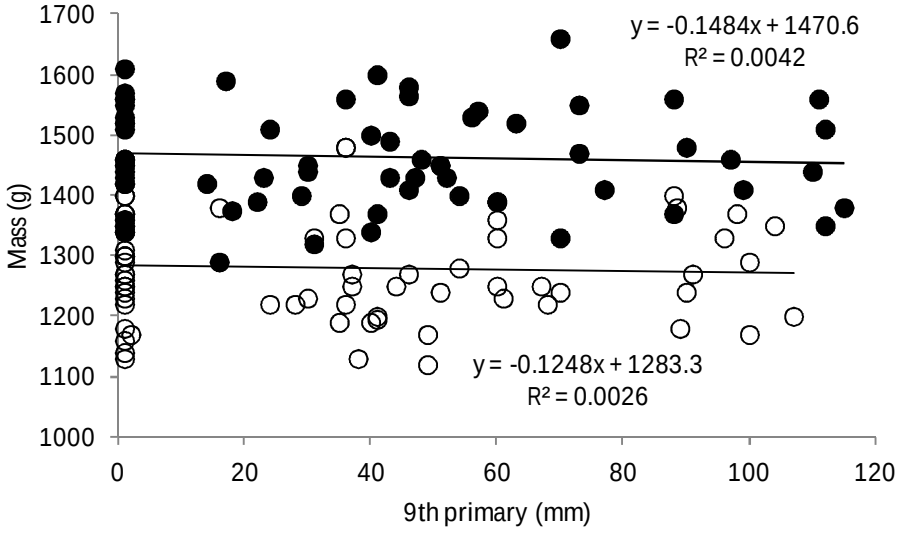

Figure 1. Relationship between 9th primary length (mm) and mass of adult male (●) and adult female (○) Red-breasted Geese caught in Russia in July and August. Linear regression lines fitted.

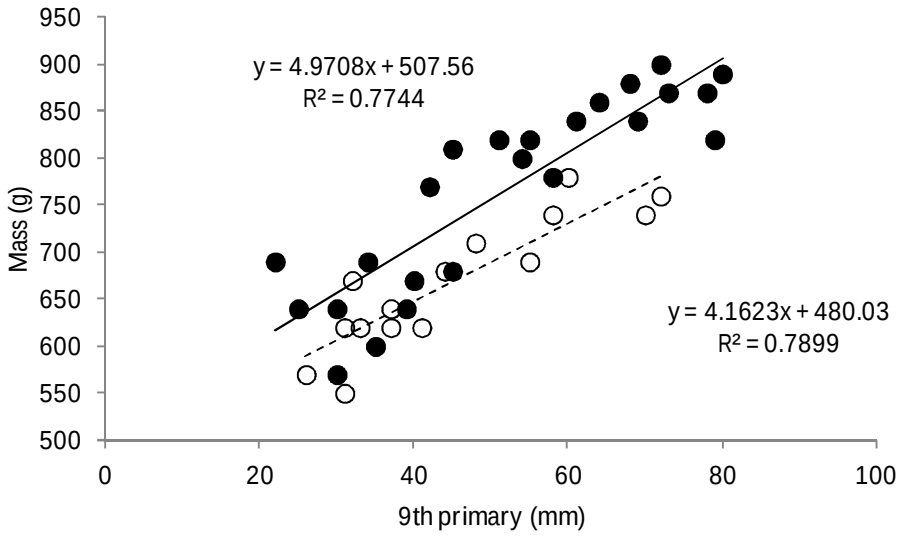

Figure 2. Relationship between 9th primary length (mm) and mass of male (●) and female (○) Red-breasted Geese goslings caught in Russia in July and August. Linear regression lines fitted.

Comparison of sex determination by eversion of the cloaca and by using measurements obtained during the winter.

We used values from multiplying wing length and mass (and divided each value by 1000) and compared these results with the sex of geese determined from eversion of the cloaca. For adults, there was complete separation, with females having values of less than 470 (Figure 3). For first-winter birds, 12 out of 13 females (92%) had values of less than 440 and 13 out of 14 males (93%) had values greater than 440 (Figure 4).

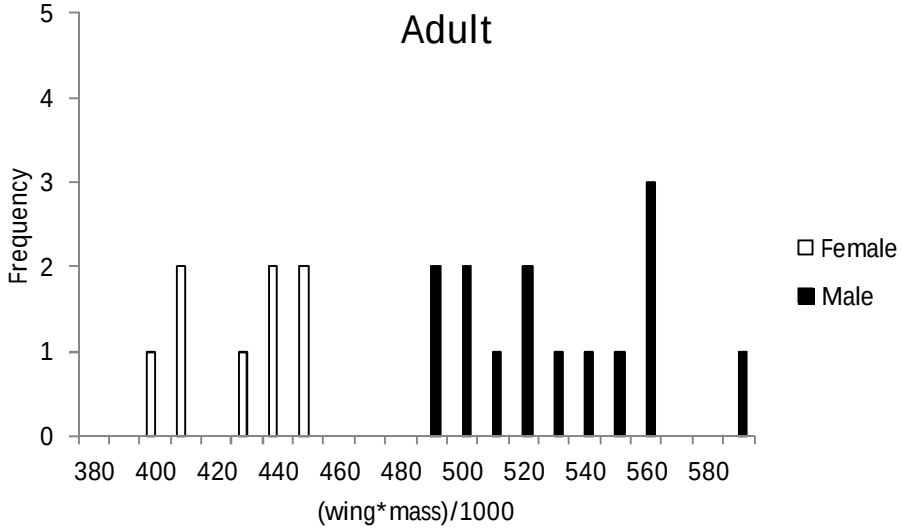

Figure 3. Frequency distribution of measurements of (wing x mass)/1000 amongst adult Red-breasted Geese caught in Bulgaria in 2011-2014.

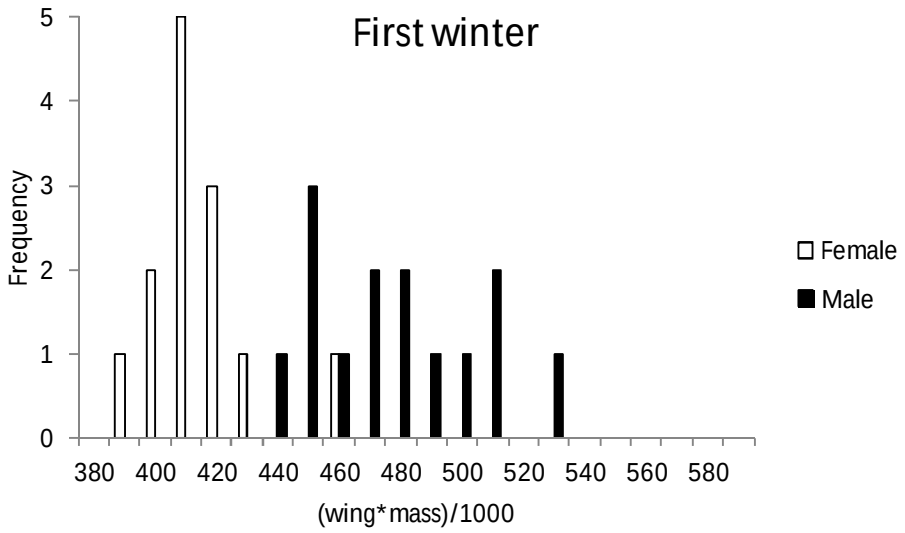

Figure 4. Frequency distribution of measurements of (wing x mass)/1000 amongst first-winter Red-breasted Geese caught in Bulgaria in 2011-2014.

Discussion

The marking of Red-breasted Geese in the Taimyr Peninsula in 1996 and the recent catches of geese in Bulgaria have provided an opportunity to document their measurements. These cannot be easily compared to those in the existing published literature since the measurements in Witherby *et al.* (1952) and Bauer & Glutz (1968) do not differentiate between adults and first-winter birds. However, the mass of five wild Red-breasted Geese given in Bauer & Glutz (1968) ranged from 1200-1625g, identical to the mass obtained for adult males in Bulgaria.

Documenting data on mean mass is important when considering deploying telemetry devices. Current best practice suggests that telemetry devices should be no greater than 3-5% of body mass (Murray & Fuller 2000, Barron *et al.* 2010). This would therefore suggest that devices (including any associated attachments, straps etc.) should weigh no more than 40g if fitted to adult male Red-breasted Geese and even then, only the largest (heaviest) individuals should be fitted with devices. However body mass is known to vary in free-living wild geese during the year (Owen 1980) and, although the mass of adult males was significantly higher in July/August (by a mean of 112g), caution is recommended and we suggest that the total mass of telemetry devices used should be no more than 40g.

In Red-breasted Geese, body mass appears to remain constant during the wing moult suggesting that they do not suffer nutritional stress nor do they deplete energy stores (in the sense that they burn stored fat to meet the needs of feather replacement) during the re-growth of remiges. That is to say, the nutritional and energetic needs of the geese during moult can be met from exogenous sources. This is similar to the pattern observed in adult Greenland White-fronted Geese *Anser albifrons flavirostris* and Canada Geese *Branta canadensis* captured in west Greenland (Fox *et al.* 1998). However, Greylag Geese *A. anser* lost up to 22% of overall body mass (mean 760g) during the flightless period (Fox & Kahlert 2005). This involved fat utilisation, apparently consumed to meet shortfalls between daily energetic needs and observed rates of exogenous intake.

Our study suggests that a simple metric (multiplying wing length and mass) could be used for sex determination in adult Red-breasted Geese with up to 100% accuracy and amongst first-years with approximately 90% accuracy compared to cloacal eversion. This might be

considered if fieldworkers without training in vent sexing were to undertake catches of Red-breasted Geese. However, if this metric is used to assign a sex, this method should be recorded in any publications. Certainly a far greater number of measurements (matched with results from eversion of the cloaca) need to be gathered to see if the pattern of segregation persists.

The current conservation status of Red-breasted Geese (globally Endangered on the IUCN Red List) means that more attention is being paid to this species by researchers. Through catching wild birds, this should increase the number of measurements obtained for this species. It is recommended that the biometric data collected follow those suggested by Dzubin & Cooch (1992). Through contacts within the Wetlands International Goose Specialist Group, biometric data from any birds caught for ringing and any geese illegally shot could be pooled to increase the knowledge base for this species. Anyone with knowledge of published biometric data for Red-breasted Geese, or anyone who holds data from caught live birds and wishes to share those data, are encouraged to contact the correspondence author.

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