

## MALE SIZE AND MATE SELECTION IN LESSER SNOW GEESE

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**ABSTRACT:** Mating in Lesser Snow Geese apparently is not random with respect to size. In mated pairs the male is larger than the female more often than should occur by chance. Interpreting these data is difficult as pair formation in Lesser Snow Geese has not been studied. Nevertheless, it is argued that females select males larger than themselves because this improves their chances of reproducing successfully.

\* \* \*

## Introduction

The quality of the male must be an important consideration of the female in her choice of a mate. Orians (1969) proposed that a female chooses the genetically fittest male, on the basis of his phenotype, to optimize the genotypes of her offspring. Williams (1975:130) argued that this would require an unrealistically high heritability of fitness and suggested that 'the important female adaptation in relation to courtship is an ability to predict future resources for her offspring from the appearance and circumstances of a courting male'. In some bird species the female's choice of a mate should also consider his ability to defend her and the nest, e.g., in densely nesting Canada Geese (*Branta canadensis*) the presence of the gander on the territory is important in preventing attacks on the incubating goose by neighboring, territorial ganders (Ewaschuck and Boag 1972). In the Lesser Snow Goose (*Chen c. caerulescens*) the gander defends the nest against avian predators (Cooch 1958, Harvey 1971). Ryder (1975) hypothesized that in colonial nesting geese a gander's ability to perform these functions (defence of female and nest) depends on his acquiring a territory of suitable size, and that the size of the territory defended by a gander has evolved in relation to the food reserves accumulated by him before arrival on the breeding grounds. Ryder (ibid.) suggested that the amount of a gander's reserves is limited by his structural size. I have presented evidence (1974, 1977) which supports part of Ryder's hypothesis, i.e. male Lesser Snow Geese feed very little after their arrival on the breeding grounds until the end of incubation and they utilize large amounts of fat and protein reserves during that period. If Ryder's hypothesis about territory size and food reserves is also true then a female goose should attempt to mate with a large gander. Here I show that in pairs of Lesser Snow Geese the male is larger than the female more often than would happen if mating were random with respect to size.

## Methods

I collected breeding Lesser Snow Geese, in 1971 and 1972, at a large colony near the mouth of the McConnell River (60°50'N, 94°25'W),

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Northwest Territories, Canada (Ankney 1974). Both members of a pair were taken when feasible but usually only one member was obtained. I used culmen length, measured to 0.1 mm (after Godfrey 1966), as an index of structural size. There were highly significant correlations between culmen length and body weight in geese arriving on the breeding grounds (males:  $r = + 0.495$ ,  $df = 43$ ,  $p < 0.01$ ; females:  $r = + 0.553$ ,  $df = 76$ ,  $p < 0.001$ ). A similar relationship has been found in other goose species (e.g. Pink-footed Goose (*Anser brachyrynchus*, Beer and Boyd 1962), Canada Goose (*B. c. hutchinsi*, MacInnes 1966)). My assumptions here are that: 1) geese with longer culmens are structurally larger than geese with shorter culmens, and 2) that these differences in structural size are detectable by the geese. Thus I do not assume that culmen length is the criterion by which Lesser Snow Geese choose their mates but rather that they do so on the basis of overall size.

I used a computer simulation program to determine the expected proportion of pairs in which the male was larger than the female if mating were random with respect to size. The program uses the means and standard deviations of two normally distributed statistical populations to calculate pseudorandom normal variates (after Naylor *et al.* 1966:95). The program uses these normal variates to calculate the expected proportion of  $N$  randomly drawn pairs in which the individual from the population with the greater mean will be larger than the other individual. I used  $N = 10,000$  to calculate this proportion in Lesser Snow Goose pairs.

### Results and Discussion

Culmen lengths were determined for 48 mated pairs and for another 296 females and 117 males whose mates were not collected. The mean culmen lengths (and their standard deviations) of breeding male and female Lesser Snow Geese were calculated from the latter birds (Table 1).

Table 1. Culmen lengths of breeding Lesser Snow Geese collected at the McConnell River, N.W.T., in 1971 and 1972.

	Culmen length (mm)	
	Males	Females
Range	49.5 - 64.7	48.7 - 62.2
Mean $\pm$ S.D.	58.04 $\pm$ 2.93	55.34 $\pm$ 2.54
Sample size	117	296

A Kolmogorov-Smirnov test (Sokal and Rohlf 1969:571-575) showed that the distributions of male and female culmen lengths did not differ significantly from normal distributions ( $P > 0.9$  in both cases). As indexed by culmen length the average male was larger than the average female.

The expected proportion of pairs in which the male was larger than the female was 0.753. The male was larger than the female in 44 of the 48 mated pairs I collected (Appendix I). This proportion (0.917) was significantly higher than the expected ( $P < 0.004$ ; Binomial Test, Siegel 1956:36-42). Therefore, in Lesser Snow Geese mating is

not random with respect to size; females tend to be mated with males larger than themselves. However, there is little tendency for mates to be of similar size, i.e. there was no significant positive correlation between the culmen lengths of mated pairs ( $r = + 0.21$ ;  $p > 0.05$  with  $df = 46$ ).

There are several possible explanations of why females are mated to males larger than themselves more frequently than expected: case 1) males tend to court females smaller than themselves; case 2) when a female is courted by more than one male the largest male drives the smaller males away; case 3) females prefer to mate with males larger than themselves. The first case may be true but I cannot think of a reason why this trait would become established (but H. Boyd (in litt) suggests that there is a possible advantage to the pair in having a clear, size-related, dominance relationship between themselves). Concerning the other two cases, I have no data to suggest which is more likely to be operating; possibly both are. A case 2 situation would provide information to the female that a particular male would be successful in defending her and the nest. In either case, if Ryder's (1975) hypothesis is correct, the female's chances of reproducing successfully should be enhanced.

The question remains whether in Lesser Snow Geese the male or female makes the final choice in pair formation. Cooke and Cooch (1968) attempted to explain anomalies in 'observed versus expected' Blue X Snow pairs by hypothesizing that males took the active role in mate selection. However, Cooke *et al.* (1975) showed that these anomalies can be explained by the differential emigration patterns of males and females from their natal colony. Cooke (pers. comm.) has no evidence concerning which sex makes the final choice in the pairing of Lesser Snow Geese. Prevett (1973:105-106) suggested that the male takes the active role in courtship but continues displaying only if the female permits him to approach. Fischer (1965:275) made similar observations on Greylag Geese (*A. anser*). Williams (1975:Chapter II) argued that in most species the female's energetic commitment in reproduction is much higher than the male's, and that she should be more selective than the male in choosing a mate. This argument should apply to Lesser Snow Geese as females occasionally starve to death during incubation but this has not been observed in males (Harvey 1971, Ankney 1975). Thus, it is likely that a female Lesser Snow Goose does not mate with the first male which approaches her. I suggest that when possible female Lesser Snow Geese select males larger than themselves. However, a study of the process of pair formation in Lesser Snow Geese is needed before the results presented here can be adequately interpreted.

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## Appendix I

Culmen lengths (mm) of Lesser Snow Geese from mated pairs collected at the McConnell River, N.W.T., in 1971 and 1972.

Male	Female	Male	Female
59.6	56.2	59.9	57.4
53.6	51.1	60.0	55.7
60.2	55.5	57.0	51.3
58.4	56.5	55.7	49.9
61.9	53.1	59.6	54.1
60.1	54.0	58.1	57.5
62.1	54.0	60.1	57.1
57.4	55.6	60.6	55.2
56.8	50.2	58.6	57.2
56.7	56.3	61.9	54.2
59.5	58.7	58.7	56.6
59.0	58.0	58.0	57.1
59.6	55.1	60.4	56.5
61.9	53.0	57.0	51.7
60.7	60.0	60.0	55.9
*58.3	59.9	57.3	55.0
57.3	56.5	60.5	56.5
58.0	57.7	55.3	52.9
61.4	52.0	59.3	54.5
60.0	59.0	*52.5	57.3
57.7	52.7	58.7	56.6
57.0	56.5	58.0	55.6
*58.3	58.3	56.4	53.7
59.6	57.8	*56.4	60.1

\*Denotes pair in which male's culmen was not larger than female's.