

# SEXING BLACK-BACKED GULLS FROM EXTERNAL MEASUREMENTS

By G. NUGENT

## ABSTRACT

Six body measurements were taken from 283 adult and subadult Black-backed Gulls (*Larus dominicanus*) in Auckland, New Zealand. Sex was determined in 158 of these by dissection or chromosomal methods. Using measurements from these 158 birds a classification function was derived and used to assign sexes to the remaining 125 gulls. Discriminant analyses were then made on the measurements from all 283 birds to describe the sexual size dimorphism accurately and to derive a simple classification function for the routine sexing of birds in the field.

## INTRODUCTION

Gulls are typically monomorphic in plumage patterns and external genitalia, but are sexually dimorphic in body size (e.g. *L. argentatus*, *L. fuscus*, Harris & Hope-Jones 1969; *L. glaucescens*, *L. hyperboreus*, Ingolfsson 1969; *L. dominicanus*, Kinsky 1963). A number of workers (Mills 1971 for *L. novaehollandiae*; Shugart 1977 for *L. delawarensis*; Ryder 1978 for *L. argentatus*; Threlfall & Jewer 1978 for *L. argentatus*) have been able to predict sex correctly in a high percentage (i.e. >95%) of cases by using two or more measurements in a classification function. Such a function is derived from a discriminant analysis of measurement data, the analytical theory and tests for statistical significance being described by Nie *et al.* 1975.

In this study, discriminant analyses were used to describe the sexual size dimorphism of the Southern Black-backed Gull (*L. dominicanus*) and give a classification function for routine sexing of this species using two external measurements.

## METHODS

A sample of 283 Black-backed Gulls over 1 year of age was obtained between 15 February and 24 June 1980 from three sites in the Auckland metropolitan area. Potential sampling biases in the sex and size of the birds were minimised by using an unbaited cannon-net on flocks of resting gulls at or near high tide and after 11.00 a.m., when feeding activity was generally low.

Six body measurements were taken from each bird: head length, gape, and bill depth (as in Fig. 1) measured to the nearest 0.1 mm; wing chord to the nearest 0.5 cm; tarsus length to the nearest 0.1 mm; and body weight to the nearest 10 g as in Baldwin *et al.* (1931).

Thirty-one birds killed for gut analysis were sexed by dissection. A further 127 birds were sexed by chromosomal analysis of growing feather tissue (see Nugent 1981). Preliminary data confirmed that male and female size distributions did not overlap at the extremes of the size range. Very large and very small birds could therefore be assumed to be male and female respectively. The time-consuming and expensive chromosomal sexing was therefore carried out on all birds within the overlap region of male and female size distributions, but only on one-third of those at the extremes. All these latter birds were proven to be of the assumed sex.

A classification function derived from the measurements of the "known sex" birds correctly predicted sex for 98.7% of the 158 such birds. The so-far unsexed birds were then assigned a sex using this preliminary function. As these "assigned sex" birds were in the main those at the extremes of the size range, no more than 1% of them are likely to have been incorrectly sexed. To describe the sexual dimorphism of this species accurately required that the data from "known" and "assigned-sex" birds be pooled. This data was subjected to discriminant analysis to distinguish the most dimorphic measurements. A classification function using two measurements was then derived for routine field use. All analyses were carried out using the sub-program "Discriminant" in SPSS (Nie *et al.* 1975).

## RESULTS

The overall difference in body size between male and female Black-backed Gulls is highly significant (6-measurement discriminant analysis, Wilks lambda = 0.1568, Chi square = 537, df = 6, <0.001). The mean for each sex, the standardised discriminant function coefficient, and a univariate F ratio (one-way analysis of variance) are

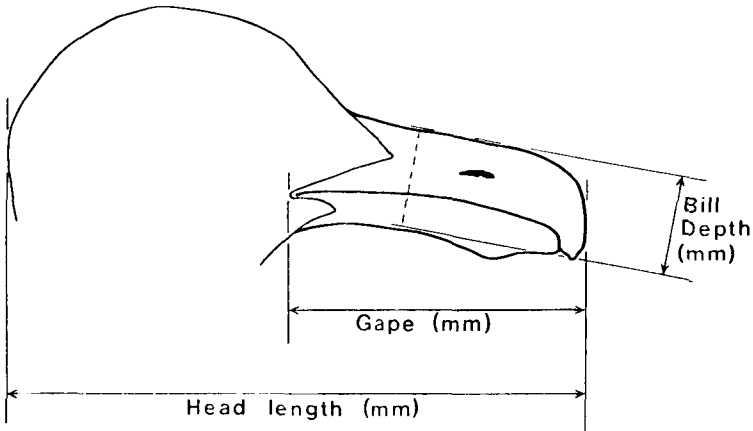


FIGURE 1 — The three head measurements taken from Black-backed Gulls

TABLE 1 — The relative sexual dimorphism in body measurements of Black-backed Gulls

	Measurement mean $\pm$ one standard error		SDFC <sup>1</sup>	F ratio df=16281
	MALE	FEMALE		
Head length (mm)	120.91 $\pm$ 0.20	110.79 $\pm$ 0.19	-0.461	1164***
Bill depth (mm)	18.93 $\pm$ 0.05	17.03 $\pm$ 0.05	-0.261	600***
Body wt. (gm)	988.0 $\pm$ 4.5	792.0 $\pm$ 4.5	-0.248	833***
Gape (mm)	76.36 $\pm$ 0.18	69.61 $\pm$ 0.20	-0.057	586***
Wing (cm)	41.87 $\pm$ 0.08	39.64 $\pm$ 0.08	-0.027	303***
Tarsus (mm)	67.22 $\pm$ 0.16	62.56 $\pm$ 0.16	-0.021	373***
N	137	146		

\*\*\*  $P < 0.001$

<sup>1</sup> SDFC = Standardised discriminant function coefficient.  
The measurements with the SDFC and F ratio of the greatest magnitude are the most sexually dimorphic.

given for each measurement in Table 1. Head length is the most dimorphic variable, followed by bill depth, body weight, gape, wing length and tarsus in order of decreasing dimorphism.

A 2-group 2-variable discriminant analysis using head length and bill depth also showed a highly significant difference between the sexes, (Wilks lambda = 0.1584, Chi square = 501.2, df = 2,  $< 0.001$ ) and the following classification function was derived.

$$\text{Classification score} = (0.126 \times \text{head length}) + (0.289 \times \text{bill depth}) - 19.707$$

A positive score indicates that the bird has a high probability of being male, and a negative score indicates a female. The function was able to predict sex correctly in 156 of the 158 "known-sex" birds (98.7%), and in 94.2% of cases sex was assigned with a 0.99 probability of correct group membership.

Some validation of the accuracy of this function was obtained from an independent sample of 28 dead birds in which sex was determined by dissection. The function correctly classified 27 (96.4%) of these birds. The single error was a juvenile male, which was classified as a female but may not have completed growth.

## DISCUSSION

The sexual size dimorphism of Black-backed Gulls is greatest in the head and bill measurements. These can be easily and accurately

measured with vernier calipers, and the function above can then be used to assign sex with nearly 99% accuracy. The function can be easily used in the field with the aid of a pocket calculator, enabling a captured bird to be sexed before being banded and released.

As growth in most body parts is largely completed by 4-6 months of age (Nugent 1981), the function can be used to sex all birds older than 6 months of age.

There may be regional differences in mean size of gull populations in New Zealand (Kinsky 1963). Therefore, the accuracy of the classification function may differ between populations and would have to be tested in each population with a small sample of known-sex birds.

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### SHORT NOTE

#### FAR-INLAND SIGHTING OF WELCOME SWALLOW

On 15 November 1981, while conducting a survey of the Kyeburn Riverbed, east of Ranfurly, Central Otago, my wife and I saw three Welcome Swallows (*Hirundo tahitica neoxena*) flying over the river, occasionally soaring to great heights (out of sight to the naked eye) and then descending close to the water again; they were not seen to land. There were no structures suitable for nesting in the immediate vicinity. (Grid Ref: 393367, NZMS 18, Sheet 23.)

This is the first sighting for Central Otago, and also the furthest distance from both east and west coasts that this species has been reported.

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