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SEXING ADULT SILVER GULLS *Larus novaehollandiae* BY EXTERNAL MEASUREMENTS WITH CONFIRMATION BY DISSECTION

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Body measurements of 88 breeding adult Silver Gulls *Larus novaehollandiae* from north-west Tasmania enabled sexing of 95 percent of individuals based on Total Head Length and 93 percent of individuals on Bill Depth at Gonys measurements. Other body measurements exhibited higher degrees of overlap between males and females and were considered unsuitable for sexing purposes.

INTRODUCTION

Two subspecies of the Silver Gull *Larus novaehollandiae* were recognized in Australia by Condon (1975). One, *L. n. forsteri*, breeds in northern Australia, and the other, *L. n. novaehollandiae*, in all other regions of Australia (Blakers *et al.* 1984). However, in a recent review, Johnstone (1982) recognized only one subspecies, *L. n. novaehollandiae*, based on an examination of museum skins. The Silver Gull is widespread in Tasmania (Thomas 1979, Serventy *et al.* 1971), but there is no estimate of the size of the breeding population. A third subspecies, *L. n. scopulinus*, breeds in New Zealand (Mills 1971).

In September 1986 a culling programme was undertaken at Egg Island (41°09'S., 146°26'E.), one kilometre offshore from Devonport Airport in Bass Strait. Approximately 6 000 breeding adults were poisoned at the nest site using alpha-chloralose. Surprisingly few morphological data have been published on this widespread species, and the culling programme provided the opportunity to collect such data from a relatively large sample. The present paper reports on the data obtained, supplementing two previous studies (Mills 1971, Wooller and Dunlop 1981) on the species.

METHODS

Six standard measurements (total head length, exposed culmen, bill depth at gonys, tarsus, wing length and tail length — Baldwyn *et al.* 1931), and one non-standard measurement (gape, the straight line distance from bill tip to the posterior point of bare skin at the gape — Mills 1971), were obtained from 88 (51 male and 37 female) breeding adults. Individuals were measured and their sex then determined by dissection. Tail length and wing length data were not examined statistically as moult and abrasion introduce seasonal variation. An index of sexual dimorphism (mean of male data/mean of female data × 100) was calculated for each measurement.

RESULTS

Males were larger than females for each measurement examined, consistent with previous studies, with overlap present between sexes for each measurement. The means, standard deviations, ranges and medians of male and female data for five measurements are given in Table 1. The frequency distributions for these measurements are presented in Figure 1.

Total Head Length

The overlap between male and female data extended from 82.9–86.0 mm. If a division at 84.5 mm were made in the pooled data, and females were assumed to have Total Head Lengths below that value and males above it, then only four birds (two male and two female) or 4.5 per cent in this sample would be incorrectly sexed. The mean male Total Head Length was significantly different from the mean female ($t_{86}=14.76$, $p<0.001$), and the mean male length was 7.9 per cent larger than the mean female length.

Bill Depth at Gonys

The overlap between male and female data extended from 8.8–9.5 mm. If a division at 9.2 mm were made in the pooled data, and females were assumed to have bill depth measurement below that value and males above it, then only six birds (four male and two female) or 6.8 per cent in this sample would be incorrectly sexed. The mean male bill depth measurement was significantly different from the mean female measurement ($t_{86}=12.98$, $p<0.001$), and the mean male bill depth was 13.5 per cent larger than the mean female depth. This measurement exhibited the greatest sexual dimorphism in this sample, and was almost identical to the 13.6 per cent reported by Wooller and Dunlop (1981) who reported male and female means of 11.7 mm and 10.3 mm respectively. This measurement also exhibited the greatest degree of sexual dimorphism in birds from New Zealand (Mills 1971).

Tarsus, Exposed Culmen, Gape

All showed high degrees of overlap between male and female data (17, 17 and 12.5 per cent respectively), although the mean male measurements were all significantly different from the mean female measurements ($t_{85}=8.47$, $t_{86}=9.26$, $t_{86}=11.84$ respectively, all $p<0.001$). The sexual dimorphism indices for the measurements were 7.1, 9.4 and 8.4 per cent respectively.

TABLE 1

Range, mean, standard deviation and median of body measurements from male (n=51) and female (n=37 except tarsus where n=36) Silver Gulls *Larus n. novaehollandiae* from north-west Tasmania. All measurements in mm.

	Min.	Max.	Mean	S.D.	Med.
Male					
Total Head Length	82.9	93.0	88.2	2.2	88.4
Bill Depth at Gonys	8.8	10.8	9.8	0.4	9.8
Tarsus	47.9	56.3	51.5	2.1	51.4
Exposed Culmen	33.0	40.6	36.8	1.9	36.9
Gape	52.3	59.6	55.7	1.8	55.7
Female					
Total Head Length	78.4	86.0	81.7	1.9	81.8
Bill Depth at Gonys	7.8	9.5	8.7	0.4	8.7
Tarsus	43.5	51.9	48.1	1.7	48.5
Exposed Culmen	31.0	36.3	33.6	1.3	33.9
Gape	47.2	54.3	51.4	1.7	51.2

DISCUSSION

The value of any measurement as a sexing guide relies on the degree of the sexual dimorphism of that measurement, and the extent of any overlap between male and female data.

In this study, two measurements (Total Head Length and Bill Depth at Gonys; were shown to have minimal overlap and a relatively high degree of sexual dimorphism, indicating that for this breeding population these would be useful sexing criteria. Wooller and Dunlop (1981) have also reported Bill Depth at Gonys was a useful sexing guide for birds from a breeding population in Western Australia.

The relatively high degree of overlap in the other measurements in this study reduces their usefulness for sexing individuals, except at the extremes of the ranges of data reported. Gape has the additional disadvantage in that it is a relatively difficult measurement to reproduce, even on dead birds. Its usefulness on live birds is difficult to predict, but would be expected to be low.

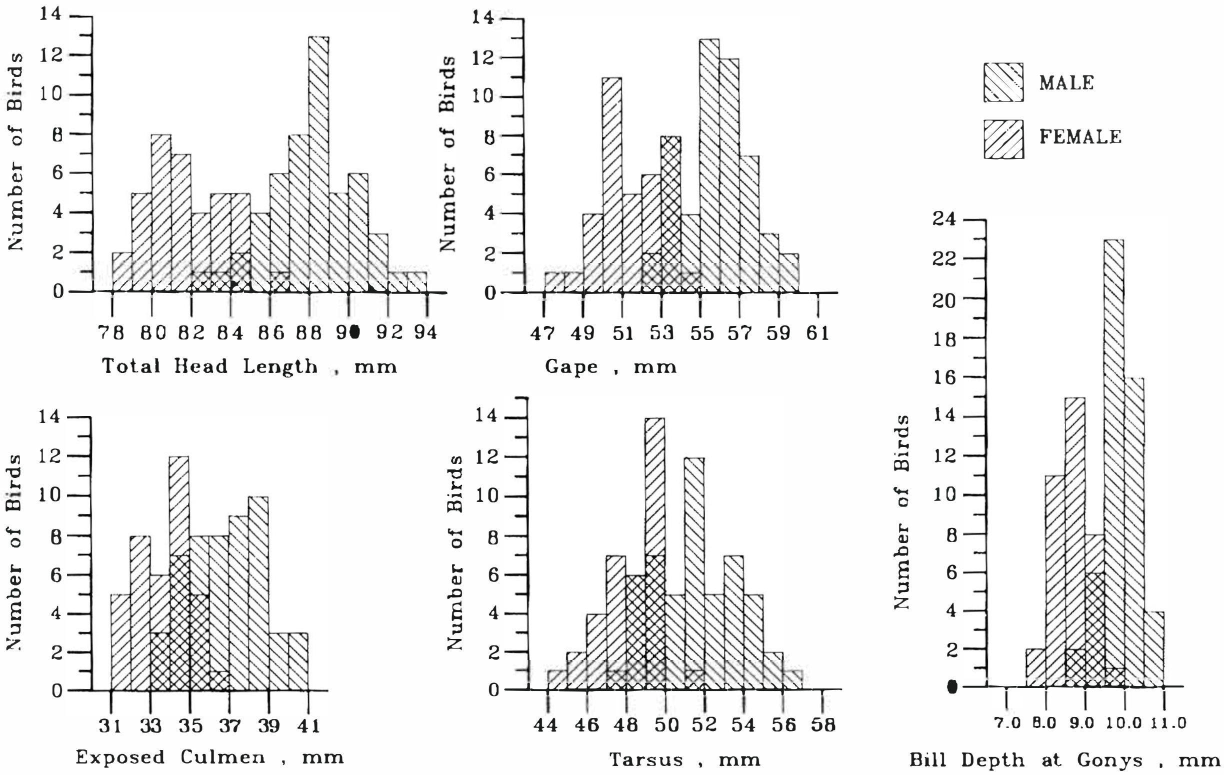

Figure 1. *Frequency distributions of morphological data from Silver Gulls from north-west Tasmania.*

More complex methods of determining the sex of individuals have been reported, utilizing Discriminant Function Analysis, using three or more measurements (Mills 1971, Coulson *et al.* 1983, Shugart 1977), but the results obtained in this study have shown that it is possible to determine correctly the sex of an individual with over 95 per cent accuracy based on one measurement only.

The results obtained in this study are strictly applicable only to the breeding population in north-west Tasmania. However, the recovery of six birds originally banded in south-east Tasmania during the culling operation, and movements of Silver Gulls between Tasmania and south-east Australia reported by Murray and Carrick (1964), Thomas (1967) and Johnstone (1982), suggest it is likely that the results obtained in this study may be applicable to Silver Gulls in south-east Australia, since the dispersal between breeding colonies results in gene flow between colonies and a decrease in the heterogeneity between colonies.

The measurements reported in this paper are clearly different from those presented by Wooller and Dunlop (1981), and demonstrate a morphological difference exists between breeding populations of Silver Gulls in Australia. Murray and Carrick (1964) showed there were also behavioural differences in dispersion patterns between populations in south-eastern Australia. Clearly comparable morphological data need to be collected from the other breeding populations to determine the extent of this variation.

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SHORT CONTRIBUTION

A RECORD OF FIRST-YEAR DISPERSAL FOR A BLACK NODDY *Anous minutus*

The Black Noddy *Anous minutus* is widely distributed throughout the tropics of the Pacific and Atlantic Oceans (Harrison 1983). Australian breeding colonies occur off the Queensland coast between Torres Strait and the Capricorn-Bunker Group at the southern extremity of the Great Barrier Reef, and in the Coral Sea (Serventy *et al.* 1971, Blakers *et al.* 1984).

On the Capricorn-Bunker islands, breeding takes place between October and early March. Ashmole (1962) and Cullen and Ashmole (1963) have described in detail the reproductive biology for Ascension Island noddies but no equivalent breeding data are available for any Pacific Ocean location.

The Black Noddy has been considered to be a predominantly sedentary species feeding within a 30 km radius of island roosts (Serventy *et al.* 1971, Hulsman 1977). However, McClure (1974) has recorded the migration of a bird 640 km to the west of where it was banded in the Hawaiian Islands.

Heron Island (23°26′S., 151°55′E.) is situated in the Capricorn-Bunker Group of islands and was inhabited by an estimated 87 000 adult Black Noddies during the 1983–84 summer breeding season (Hulsman, pers. comm.). In February 1985, 133 adults and 75 juveniles were banded at three study sites (comprising 11 trees). Nests of banded birds were marked to determine site attachment in subsequent nesting seasons.

On 19 May 1985, one of these banded juveniles was sighted on Michaelmas Cay (16°35′S., 146°02′E.), 976 km from the breeding site, 320 degrees to the north (advice from the Australian Bird and Bat Banding Schemes). This bird was banded as a pullus between 6 and 9 February 1985, with a red darvic band on its left leg and a metal band on its right leg. It could not have been older than 21 weeks at the time it was sighted. The bird was not captured, consequently precise details relating to that bird cannot be provided. Four or five other juvenile Black Noddies were present at the time of sighting (J. McKean, pers. comm.).