

The size of Little Penguins *Eudyptula minor*, on Penguin Island, Western Australia

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Abstract

Little Penguins *Eudyptula minor* on Penguin Island, Western Australia are consistently heavier and have larger bills than conspecifics elsewhere in Australia or New Zealand. No latitudinal or other geographical trend in size is apparent.

Introduction

The Little Penguin *Eudyptula minor*, the smallest of the 16 penguin species, is confined to Australia and New Zealand. Kinsky and Falla (1976) have divided it into six subspecies, only one occurring in Australia. Little Penguins reach the northernmost limit of their breeding range in Western Australia, on Penguin and Carnac Islands (Serventy *et al.* 1971), although occasional birds have been recorded as far north as the Abrolhos Islands (Storr *et al.* 1986).

During studies of Little Penguins on Penguin Island (Klomp 1987), it became clear that the weights of birds there were substantially greater than those recorded in the literature for this species elsewhere. This paper documents these differences and suggests some possible explanations.

Methods and Results

Breeding Little Penguins, caught for banding or dietary studies between March 1986 and March 1987, were weighed to ± 25 g in bags, using a 2.5 kg spring balance. Vernier calipers were used to measure the length of the bill from its tip to its junction with the skull, ignoring curvature, as well as the depth of the bill along a vertical line through the centre of the nostrils.

The weights of penguins may vary with the age or sex of an individual, and seasonally. All individuals considered in this paper were breeding adults. Since all birds handled were marked uniquely, it was possible to avoid using repeated measurements from the same individuals; the last set of measurements obtained from an individual were used.

In Little Penguins, males are slightly larger than females, but there is considerable overlap between the sexes in size (Kinsky and Falla 1976). In general, the bill of a male is stouter and has a more pronounced hook at its tip. However, there was no clear bimodality, indicative of sexual dimorphism, in the samples of

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measurements taken. The measurements of six birds, found dead during the study and sexed by dissection, also showed extensive overlap. Following Gales (1987), the mean values presented are therefore calculated as mid-sex values to reduce any variation introduced by sexual dimorphism in size.

The weight of penguins also varies seasonally, particularly at the time of moult. Little Penguins may reach up to twice their normal weight in an intensive foraging bout, as they store subcutaneous fat in preparation for moult. Since they cannot go to sea during moult they may lose weight at this time, regaining lost weight again after the moult. Birds weighed at this time may therefore give an erroneous impression of size. Data from the moulting period on Penguin Island (December to February) were therefore discarded and means calculated using only values from the breeding season (March to November). Similarly, means for the non-moulting period were used for comparison with other studies where these were available.

Figure 1 shows the frequency distributions of body mass and bill length from Penguin Island. These are essentially normal distributions with no real evidence of sexual dimorphism. Table 1 gives the mean body mass and bill length of the six subspecies recognised by Kinsky and Falla (1976), as well as from other studies of *E. minor*. It is clear that birds on Penguin Island are much heavier than conspecifics elsewhere, except perhaps the White-flipped Penguin *E. m. albosignata*, sometimes separated as a full species.

Table 1 Mean body mass and bill length of Little Penguins *Eudyptula minor* from different colonies. Sample sizes in parentheses. Values marked * calculated for non-moulting season only; that marked ** for moulting season only.

Locality	Subspecies	Latitude	Mean (\pm S.D.) body mass (g)	Mean (\pm S.D.) bill length (mm)	Reference
NEW ZEALAND:					
Southland Westland	<i>E. m. minor</i>	47°S	1004 \pm 150 (10)	35.2 \pm 1.9 (27)	Kinsky and Falla 1976
Otago coast	<i>E. m. minor</i>	46°S	1169 \pm 138 (19)	35.9 \pm 1.9 (20)	Kinsky and Falla 1976
Otago		46°S	1144 \pm 86 (39)**	36.2 \pm 2.0 (39)	Richdale 1940
Otago		46°S	1282 \pm 171 (36)	37.9 \pm 1.9 (37)	Gales 1987
Chatham Is	<i>E. m. chathamensis</i>	44°S	1135 \pm 130 (19)	36.8 \pm 1.9 (33)	Kinsky and Falla 1976
Banks Peninsula	<i>E. m. albosignata</i>	44°S	1327 \pm 176 (18)	37.8 \pm 2.0 (47)	Kinsky and Falla 1976
Cook Strait	<i>E. m. variabilis</i>	41°S	1117 \pm 114 (48)	36.7 \pm 1.4 (145)	Kinsky and Falla 1976
Wellington		41°S	1174 \pm 113 (993)*	-	Kinsky 1960
Northland	<i>E. m. iredalei</i>	36°S	902 \pm 101 (17)	36.2 \pm 1.7 (72)	Kinsky and Falla 1976
Auckland		37°S	910 \pm 150 (272)*	35.3 \pm 2.2 (272)	Jones 1978
AUSTRALIA:					
	<i>E. m. novaehollandiae</i>		-	37.2 \pm 2.4 (46)	Kinsky and Falla 1976
Tasmania		43°S	1105 \pm 110 (3195)*	38.0 \pm 1.2 (82)	Hodgson 1975
Victoria		38°S	1207 (564)*	-	Montague, T. 1982
South Australia		36°S	1106 \pm 148 (8)*	-	Baudinette <i>et al.</i> (1986)
Western Australia		32°S	1390 \pm 193 (51)*	-	Montague, D. 1982
Western Australia		32°S	1403 \pm 207 (366)*	39.6 \pm 2.1 (384)	Klomp 1987

An earlier study on Penguin Island (Montague 1982) revealed that this was not a new or transitory situation, and incidental measurements on penguins from Carnac Island indicated that they were similar in size to those on Penguin Island. Other colonies also showed a relative consistency in the size of their penguins (Table 1). There was also a significant correlation ($r_s = +0.81$; $p < 0.01$) between the mean mass of penguins in the populations studied and their bill length. It is therefore probable that both measurements are good indicators of overall size, although there is no clear trend for them to vary with latitude or geographically in any other simple pattern.

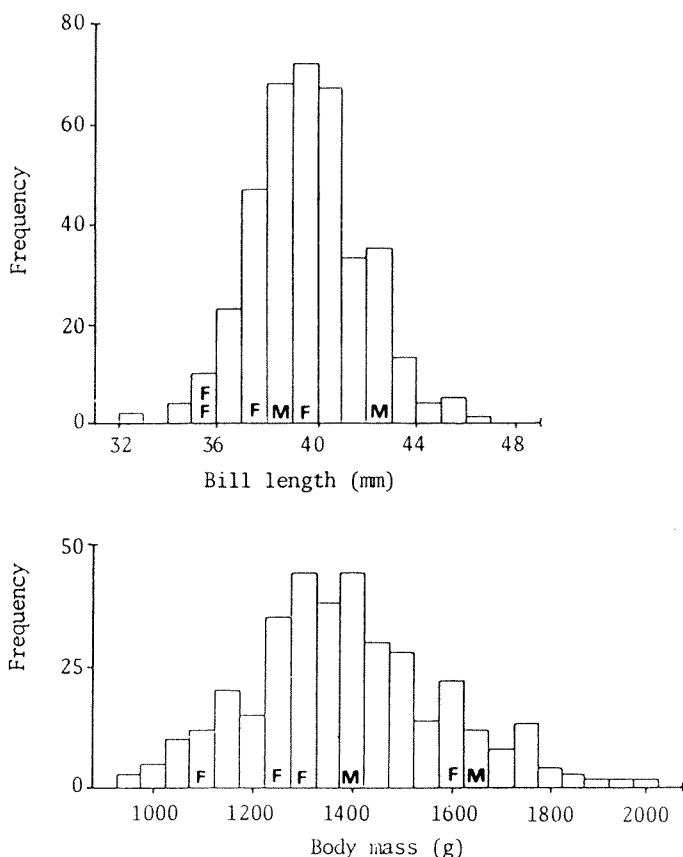


Figure 1 The frequency distributions of 366 measurements of body mass (lower) and 384 bill lengths (upper) from Little Penguins *Eudyptula minor* on Penguin Island, Western Australia. Values for males (M) and females (F) sexed by dissection are indicated.

Discussion

The large size of Little Penguins at their northern limit is puzzling. The larger species of penguins tend to inhabit the higher latitudes and smaller penguins lower latitudes. Bergmann's rule would also predict that populations of a species would be smaller in a warmer climate, such as that near Perth, particularly in a surface-nesting population such as that on Penguin Island. However, the thermo-regulatory problems of life at sea may result in opposing selective pressures for larger size. The penguins from Penguin Island appear to feed mainly in shallow, inshore, relatively warm waters. Their bigger size may therefore be related to a more favourable climate and food supply linked to the Leeuwin Current, warm tropical water which flows south down the Western Australian coast each winter and leads to unusually protracted breeding in the area (Dunlop and Wooller 1986). It would be interesting to examine the size of Little Penguins from the south coast of Western Australia under a much cooler climatic regime.

Penguin colonies are often essentially isolated from one another, and a different suite of selective pressures presumably occurs at each. This may result in complex patterns of geographical variation in size, such as that seen in Gentoo Penguins *Pygoscelis papua* (Stonehouse 1970). The relative isolation of Little Penguins on the west coast of Australia may have enhanced the development of a population of very large birds. Indeed, they are much more distinct in size from other conspecifics than several of the subspecies recognised by Kinsky and Falla (1976).

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