

taken over by penguins and shearwaters with many new burrows evident in the area. During the November 1982 visit, no sign of *E. minor* was seen in this location, and it appears that the shearwaters may now be the sole occupants of the colony.

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## SELECTION OF MATES AND SEXUAL DIMORPHISM BY SIZE IN THE BROWN FALCON *Falco berigora*

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Reversed sexual dimorphism (RSD), where the female is heavier than the male, is the rule among Falconiformes (Newton 1979); however, researchers have rarely agreed on why this occurs (Mueller and Meyer 1985). The general trend is for species like the Peregrine Falcon *F. peregrinus* which hunt very mobile, hard-to-catch prey, such as flying birds, to have a high degree of RSD (Cade 1982).

Each falconiform species has an average RSD. However, within a population, variation in body size within a sex is usual, and if birds select mates at random, occasions could occur where males

have a body size the same as or greater than their mates. Overlap in sizes between sexes should be more common in species with small RSD, such as the Brown Falcon *F. berigora* (for indices of RSD, see Baker-Gabb 1982). Using this species, this paper examines data on RSD by body size to see if this presents evidence that mates are chosen at random.

#### METHODS

Seventeen breeding pairs of Brown Falcons were trapped in south-eastern Tasmania and their wing chords taken from the front of the carpels

to the tip of the longest primary with the primaries flattened, a measurement commonly used in describing RSD (Lane 1974, Baker-Gabb 1982). Birds with any of the outer primaries missing or not fully grown were not considered in the study.

Sexing was carried out by comparing the relative separation of the pubis by palpation. Females that have laid eggs recently should have a relatively wide pubis. Estimates of pubis width were made by comparing the separation, using a vernier caliper. Repeated transfer of finger from pubis to caliper allowed a sufficiently consistent measurement. To verify the reliability of this method, I examined 50 dead (e.g., road killed) Brown Falcons first by palpation, later verifying their sex by direct observation of gonads after dissection.

Pairs of birds were trapped near or at active nests and their residential status at that nest verified by banding and retrapping, or by observation of colour bands.

Age of Brown Falcons was judged from plumage (see Weatherly *et al.* 1985).

## RESULTS

### Sexing

Eighty-seven per cent of dead adult Brown Falcons were sexed correctly, significantly more than would be expected by chance (Table 1,  $X^2=17$ ,  $df=1$ ,  $P<.01$ ). However, only 53 per cent of immatures could be correctly sexed by palpal estimates of relative pubis separation.

TABLE 1

Accuracy of sexing Brown Falcons by palpation of pubis compared to direct dissection. Percentage (N).

	Adults	Immature
Correctly Sexed by Palpation	87 (27)	53 (10)
Incorrectly Sexed by Palpation	13 (4)	47 (9)
Total	100 (31)	100 (19)

TABLE 2

Relative size of members of 17 pairs of Brown Falcons.

Male	Female	Brown Falcon
Smaller than average	Smaller than average	6
Smaller than average	Larger than average	3
Larger than average	Smaller than average	2
Larger than average	Larger than average	6
		17
Sexes same side of average		12
Sexes different side of average		5
		17

### Size within pairs

In all cases, the member of a pair with the larger wing chord had a larger pubis width. Even in pairs of Brown Falcons in which mates had similar wing chord sizes, this width was considerably different. In all pairs, females were larger than males, though within the sample of Brown Falcons, overlap in length of wing chord between the sexes occurred (males range 30-34 cm, females 33-36.5 cm). There was a trend for mates to each be on the same side of the average measurement for their sex (Table 2,  $X^2=7.1$ ,  $df=1$ ,  $P<.01$ ).

## DISCUSSION

Further studies would be advantaged by employing modern sexing techniques, such as laproscopy or estimations of steroid levels (Cooper 1978); however, I believe the accuracy of sexing in this study was adequate. Probably it was higher than the 87 per cent achieved in the study of dead Brown Falcons because any live females examined had almost certainly laid eggs.

There are many plausible theories why male raptors are smaller than females. The reason(s) this occurs in a population appears to be closely linked with the male's efficiency in providing food to the female (Mueller and Meyer 1985, Safina 1984, Olsen 1987). However, why should a particular size difference be demonstrated consistently in different pairs of the one species.

I believe the reason could be primarily behavioural, that is, a pair requires a certain difference in size to ensure compatibility and therefore breeding. If this was so, it would certainly be selected for. Each species of raptor would have a certain difference in size within pairs, its definition governed by the species' feeding ecology.

To further speculate is not useful. Size differences within pairs of other species will need to be studied to be sure the observed trend is not a peculiarity of the Brown Falcon. Perhaps researchers with captive raptors and appropriate facilities could compare actual pair compatibility of like-sized mates in a species with normally high RSD. This could be extended to behavioural studies of captive pairs matched so that their sexual dimorphism was the reverse of the norm. The use of the owl genus *Ninox*, in which males are normally larger than females, could further extend this research.

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