

## Variation in cohesion of a brood of Mute Swans

R. P. de JONG and P. J. BACON

Casual observations by one of us on developing broods of Mute Swans *Cygnus olor*, suggested that early in development the parents, particularly the female, initiate activities such as feeding and movements between feeding areas and that very young cygnets invariably follow them. Later in development the process may reverse; cygnets will set off to feed of their own accord and their parents usually accompany them. Thus during the brood's development there may be a change as to who determines the group's movements, resulting in a change in the average distance between them. This paper reports a preliminary study on a brood of Mute Swan cygnets which was designed to test if there were significant behavioural changes during development and if individual cygnets behaved consistently differently from their siblings.

### Methods

As part of a study of Mute Swan breeding biology in the Oxford area, cygnets within a brood were individually marked with patches of a yellow dye and named accordingly, e.g. Crown, Nape, Left Cheek, Right Cheek and Throat. A convenient family of five cygnets near the city was tame enough to be approached closely without disturbing their normal behaviour.

The distance of each cygnet from the female, in terms of the number of female waterline lengths was recorded when *Feeding* and when *Resting* and engaged in other activities. *Swimming order* was recorded when the family moved actively from one area to another; the position of each cygnet behind its parent being noted as a rank (1, 2, ... 5).

Cygnets move around actively when feeding, and can also change position in the swimming order very rapidly. Thus, for a particular cygnet, distances from the female were recorded on to a dictaphone at ten second intervals. Each series of observations lasted for several minutes. A new individual would then be selected and the process repeated. Swimming order was similarly recorded on to tape every ten seconds, starting with the cygnet closest to the female. Although such data are not strictly

independent, sufficient series were recorded for each cygnet to preclude serious bias.

It should be pointed out that a more rigorous treatment would ideally record for feeding the total distance each cygnet was from *both* parents and for swimming order distinguish between the usual sequence of male, female, cygnets and the occasional one of female, cygnets, male, since in all cases it is possible for a cygnet to be far from the female but close to the male. The male acts relatively independently from the rest of the family and there appeared no tendency for particular cygnets to feed consistently close to him. However we assume that large samples adequately reflect the general picture.

The observations were made in two separate periods, the first when the cygnets were between 25 and 30 days from hatching and the second when they were 55 to 60 days old.

### Results

Figure 1 shows the frequency distribution of distances from the female, for each cygnet in each period (with the exception of Crown who died in the interval). The differences between these distributions within each period are highly significant, showing that individuals of the same age behave differently (first period, including Crown,  $\chi^2_{24} = 101.9$ ;  $p < 0.001$ ; second period  $\chi^2_{33} = 123.3$ ;  $p < 0.001$ ). The difference between the totalled distributions for the two periods is also highly significant ( $\chi^2_{11} = 101.9$ ;  $p < 0.001$ , data for Crown omitted from first period total).

Examination of the modal class and median values for individual cygnets reveals a consistent tendency to feed further from the female at the later age.

Figure 2 contrasts the behaviour while feeding with that while not feeding. The distributions are significantly dissimilar ( $p < 0.001$ ) and show that the cygnets stay closer to the female when they are not feeding.

Figure 3 shows the distribution of rank swimming positions for each individual during the first period. A Friedman test shows their average ranks to be different (Q

= 38.3;  $p < 0.001$ ). Similar results for the second period also showed differences (at the  $p = 0.05$  level, based on a smaller sample).

Table 1 gives the average feeding distances from the female and the preferred swimming orders for each cygnet in both periods; winter weights and sexes are given when known.

**Discussion**

Our results show that it is possible to measure 'cohesion' for a family of swans and document changes in cohesion. Individual

cygnets behave differently, and the family forms a less closely knit group when feeding than when not, and also when the cygnets are older. Our observations were made outside those periods when cygnets are assisted in feeding by their parents and when the female broods resting cygnets between bouts of feeding (Kear 1970).

We had the strong impression that individuals showed consistent behaviour between days within the period, in contrast to the differences observed between periods, but our data were insufficient to test this rigorously.

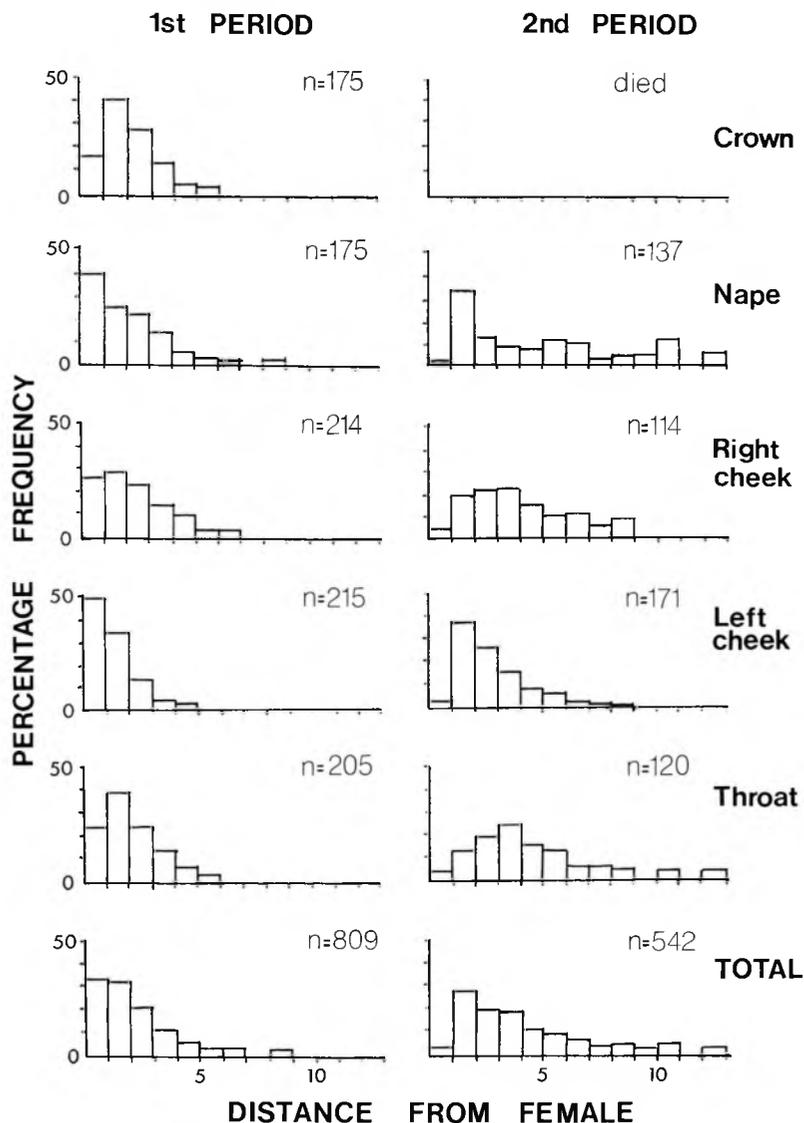


Figure 1. Cygnet feeding distances from female.

When cygnets first hatch they are led to feeding sites by their parents who frequently pull water weed to the surface for them. As they become older their parents assist them less often in feeding and cygnets a week or so old may even dive for weed when feeding in deep water (pers. obs.). It seems that very young cygnets derive an advantage from feeding near their parents, both by learning to identify food and by being provisioned

with it, whereas older birds do not. Davies (1976) discusses the development of independence of passerine birds and shows

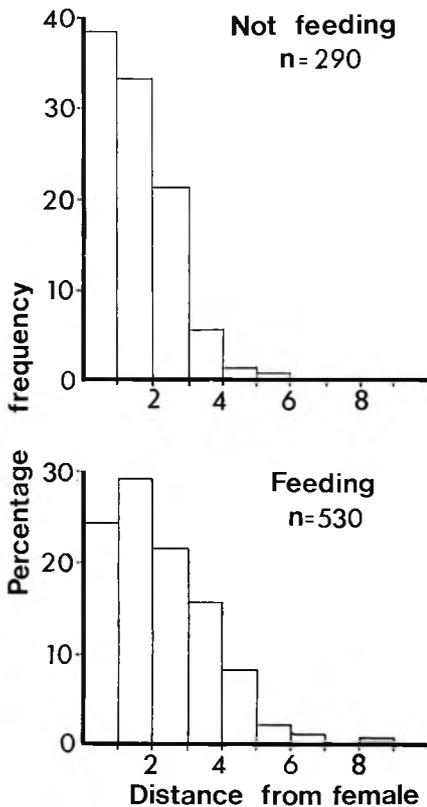


Figure 2. Distances from female when not feeding and when feeding; combined data.

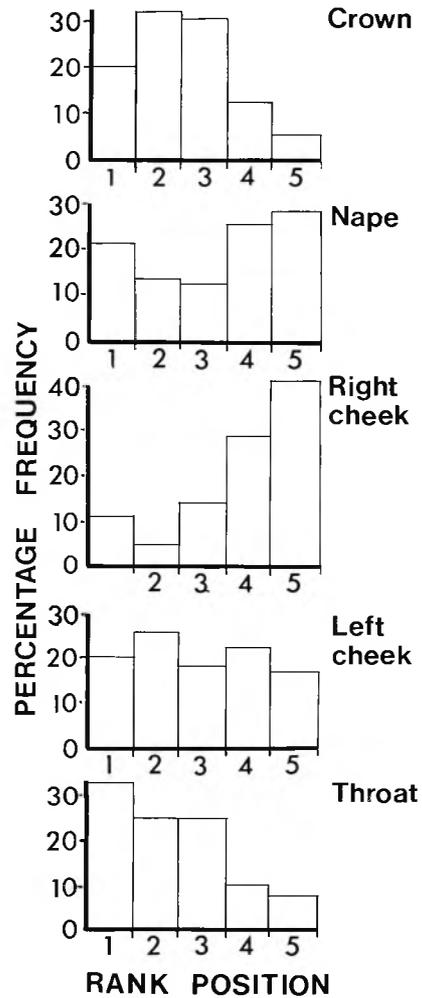


Figure 3. Preferred swimming positions in first period.

Table 1. Average feeding distance from female, preferred swimming order and weights of cygnets.

Identity	Average feeding distance from female		Preferred swimming order		Cygnet's 'conditions'	
	First period Av. $\pm$ S.E.	Second period Av. $\pm$ S.E.	1st	2nd	Winter Weights	Sex
Crown	1.76 0.08	— —	2	—	<i>Died</i>	—
Nape	1.78 0.10	4.38 0.29	4	1	Heaviest	Male
Right Cheek	1.87 0.09	3.49 0.20	5	2	Heavy	Female
Left Cheek	1.06 0.05	2.46 0.12	3	4	Light	Female
Throat	1.72 0.08	3.83 0.24	1	3	Lightest	<i>Died</i>

that this coincides with the period when they become proficient at feeding themselves. Cygnets can feed themselves when only a few weeks old, and the family presumably stays together firstly to provide protection from predators and secondly to help the cygnets find suitable wintering sites (Kear 1970); there is circumstantial evidence that this latter aspect may be important for the non-migratory Mute Swan as well as other *Cygnus* species. Our data show that the cygnets stay closer to the parents when not feeding, as would be expected if they derive benefit from parental protection, and suggest that they may sacrifice some protection when feeding, presumably to increase their efficiency.

By the time cygnets are several weeks old a 'peck-order' develops between them, and this seems to affect their positions in our swimming order data. Cygnets are similar in weight soon after hatching but sexual dimorphism becomes apparent around three or four weeks. Table 1 shows that the cygnets who moved closer to the female between our observations became the heavier birds, while the one who lost position ap-

preciably was in relatively poor condition a few weeks later (when caught for ringing), and died in early winter. We believe that relative changes in the cygnets' 'dominance' and condition account for the different preferred swimming orders between the periods and may similarly affect the relative distances cygnets feed from their parents.

#### Acknowledgements

We would like to thank Dr N. B. Davies, Mr P. G. H. Evans and Mr P. J. Hudson for their constructive comments on an earlier draft, and Maggie Norris for typing the paper.

#### Summary

Individual cygnets within a brood of Mute Swans *Cygnus olor* keep varying distances from their parents depending on their age and what they, and their parents, are doing. Simple quantitative measures of these distances are used to show (1) significant differences between individuals within a brood (2) significant differences depending on cygnet behaviour and (3) significant differences at different ages for individual cygnets.

#### References

- Davies, N. B. 1976. Parental care and the transition to independent feeding in the young Spotted Flycatcher (*Muscicapa striata*). *Behaviour* 59: 280-95.
- Kear, J. 1970. The adaptive radiation of parental care in Waterfowl. pp. 357-92 in Crook, J. H. (Ed.) *Social Behaviour in Birds and Mammals*. London: Academic Press.
- R. P. de Jong, Vakgroep Dierkunde, Agricultural University, Ritzema Bosweg 32A, Wageningen, Holland.
- P. J. Bacon, Edward Grey Institute of Field Ornithology, Zoology Department, South Parks Road, Oxford OX1 3PS.