

Marked dietary differences between sympatric feral rock doves and rock pigeons

R.M. Little

FitzPatrick Institute, University of Cape Town, Rondebosch, 7700 Republic of South Africa

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Although feral rock doves *Columba livia* and rock pigeons *C. guinea* fly daily in mixed flocks between roosting and nesting sites in Cape Town, South Africa, they feed separately in farmlands north of the city during the austral summer. Examination of the crop contents of 32 feral rock doves and 48 rock pigeons revealed that 28 (88%) of the feral rock doves had fed on processed cereals, whereas all 48 (100%) of the rock pigeons had eaten whole wheat. The processed cereals were obtained from dairy cattle feedlots, whereas the whole wheat is waste, found within the stubble. There is equal nutritional advantage from feeding on both food types, and feral rock doves have no apparent preference for either food type. This differential feeding behaviour suggests resource partitioning, and that introduced feral rock doves do not displace indigenous rock pigeons from summer food sources in the south-western Cape Province.

Alhoewel tuinduiwe *Columba livia* en kransduiwe *C. guinea* daaglik in gemengde troppe vlieg tussen slaap- en broeiplekke in Kaapstad, Suid-Afrika, en plase noord van die stad gedurende die suidelike somer, vreet hulle in aparte lokaliteite op hierdie plase. 'n Ondersoek na die kropinhoud van 32 wilde tuinduiwe en 48 kransduiwe het aan die lig gebring dat 28 (88%) van die wilde tuinduiwe verwerkte graangewasse gevreet het teenoor die 48 (100%) kransduiwe wat heelkoring gevreet het. Die verwerkte graankosse word verkry vanaf melkbeeste se voerkrale, terwyl die heelkoring afval is wat in die stoppellande gevind word. Die voedingswaarde van die twee kostipes verskil nie, en die wilde tuinduiwe toon geen oënskynlike voorkeur vir enige van die kostipes nie. Hierdie eiesoortige vreetgedrag dui daarop dat hulpbronverdeling plaasvind, en dat die uitheemse tuinduiwe nie die inheemse kransduiwe verplaas van hulle somer voedselbronne in die suidwestelike Kaapprovinsie nie.

The Eurasian rock dove *Columba livia* was introduced to southern Africa as a free-flying domestic species as early as the mid-1700s, and has since successfully established feral populations in most of the major urban regions of the sub-continent (Brooke 1981). These feral populations potentially compete for food with other granivorous feeders, e.g. the Afrotropical rock pigeon *C. guinea*, other dove species, sparrows *Passer* spp. and starlings, *Sturnidae*.

In Africa, feral rock doves and rock pigeons feed on cereals in farmlands, and both are reported to travel from either urban or mountain roosts to these feeding grounds (Skead 1971; Rowan 1983; Morel, Morel & Fry 1986). In the south-western Cape Province, South Africa, large numbers of feral rock doves and rock pigeons fly daily between roosting and nesting sites in the greater Cape Town metropolitan area and feeding sites in the farmlands north of the city during the austral summer. The aims of this study were to investigate the feeding behaviour of mixed flocks of feral rock doves and rock pigeons, and to determine if any variation in the feeding behaviour of these two species might have helped the feral rock doves to survive.

Study area

Wheat farms north of Cape Town in the south-western Cape comprise extensive fields which are in a post-harvest stubble state during the mid-to-late austral summer (December–February). Some of these farms also have intensive feedlots in which dairy cattle are fed throughout the year on either commercial or self-milled (processed) mixed cereals. These feedlots are usually located adjacent to farm houses and farm service buildings where human activity is high, whereas the wheat fields are relatively free from human disturbance.

After feeding, feral rock doves and rock pigeons fly from these farms towards Cape Town and cross over a ridge (33°50'S/18°35'E) which extends from east to west across their flight path. Occasionally, when a south-east wind blows strongly (> 20 km/h), hunters take advantage of the effect of the wind, which forces the pigeons to fly low over this ridge.

Methods

During the austral summers of 1991/92 and 1992/93, crop contents were collected from 32 feral rock doves and 48 rock pigeons which were shot while returning from the farmlands and flying low over the ridge. The sex and body mass of each bird was recorded. Crop contents were removed and stored in plastic bags which were labelled individually to species, sex and date, and stored at -20°C. Thawed crop contents were identified as either whole wheat or processed cereals, weighed and measured volumetrically by the displacement of water. Although the processed cereals contained wheat, amongst other grains, these grains were crushed, and therefore readily distinguishable from the whole wheat seeds found in the fields. Samples were then refrozen for later nutritional analysis. Protein and gross energy content of the diet were measured for each bird, whereas neutral detergent fibre was measured for each sample (hunt) (AOAC, 1980). The proportions of eight minerals (Ca, P, Mg, K, Na, Cu, Zn and Mn) were measured by atomic absorption spectroscopy for each species per sample.

Three farms frequented by feeding pigeons were visited during January 1993, and the feeding behaviour of both feral rock doves and rock pigeons was observed. Farmers were also interviewed, and asked where they had seen rock doves

and pigeons feeding. A feral rock dove feeding-preference experiment was conducted at one of these farms during February 1993. For this trial, six 50-g piles each of a specific food type (three whole wheat piles, three processed cereals piles) were presented, alternating along a linear arrangement, with a distance of 1,5 m between each pile (after Lefebvre 1983). These food sources were placed in the feedlot at 10h00, and the number of feral rock doves landing near to a particular food type and feeding from it was recorded.

Results

Crop contents

All 80 crops examined contained either whole wheat or processed cereals, exclusively (Table 1). Only four (12%) of the 32 feral rock dove crops contained whole wheat, whereas all 48 (100%) of the rock pigeon crops contained whole wheat ($p < 0,001$; Fisher's exact test). There were no significant differences in mean crop volume or food type in the crops, between sexes, or between years ($p > 0,05$; t test), within the same species (Table 1). Although the mean volume of feral rock dove crop contents ($\bar{x} = 26,2$; $SD = 9,1$) was not significantly greater than that for rock pigeons ($\bar{x} = 22,5$; $SD = 8,9$; $p > 0,05$; t test), the mean body mass of the feral rock doves ($\bar{x} = 407,3$; $SD = 64,9$) was significantly greater than that of the rock pigeons ($\bar{x} = 352,9$; $SD = 23,1$; $p < 0,001$; t test). Therefore, the ratio of crop volume to body mass (mean of individual crop volume divided by individual body mass) was not significantly different

between species ($C. livia$ $\bar{x} = 6,5\%$; $SD 2,2$; $C. guinea$ $\bar{x} = 6,3\%$; $SD = 2,4$; $p > 0,05$; t test). The nutritional content of the diet was also similar for both species (Table 2).

Feeding behaviour

During all observations, feral rock doves fed in feedlots, whereas rock pigeons fed only in wheat fields. Interviews with farmers confirmed that feral rock doves feed daily on the food in cattle feedlots, whereas rock pigeons feed on waste wheat in the lands and did not visit the feedlots.

Feeding preference experiment

Of 75 feral rock doves which approached the piles of food, 72 fed from the pile nearest to their point of landing. Of these 72 birds, 38 fed on wheat and 34 fed on processed cereals. Therefore, there was no significant difference between the proportion of birds which landed nearest to, and fed from a pile of processed cereals, and the proportion that landed next to, and fed from a pile of wheat ($p > 0,05$; Fisher's exact test). The three birds that fed from a pile of food other than the one which was closest to where they landed are not considered, because the reason why they did not feed from the closest pile is not known.

Discussion and conclusions

The significant differences in diet of the feral rock doves and rock pigeons do not suggest either selection of, or preference for, the particular food types. Considering the question of choice, flocks of feral rock doves and rock

Table 1 Mean body mass and crop volume (± 1 standard deviation), and the number of feral rock doves and rock pigeons that contained either whole wheat or processed cereals in their crops

| Summer | Sex | n | Rock doves | | | | Rock pigeons | | | | |
|---------|-----|----|-------------------------|----------------------------|-------------|-------------------|-------------------------|----------------------------|-----------------|-------------------|---|
| | | | \bar{x} Body mass (g) | \bar{x} Crop volume (ml) | Diet | | \bar{x} Body mass (g) | \bar{x} Crop volume (ml) | Diet | | |
| | | | | | Whole wheat | Processed cereals | | | Whole wheat | Processed cereals | |
| 1991/92 | ♂ | 10 | 417,5 \pm 73,5 | 25,0 \pm 9,4 | 1 | 10 | 10 | 354,0 \pm 25,1 | 25,5 \pm 11,3 | 10 | 0 |
| | ♀ | 12 | 380,0 \pm 61,8 | 26,8 \pm 11,0 | 1 | 11 | 13 | 352,7 \pm 22,4 | 18,9 \pm 8,9 | 13 | 0 |
| 1992/93 | ♂ | 6 | 442,0 \pm 56,0 | 25,8 \pm 5,6 | 2 | 4 | 12 | 361,7 \pm 20,7 | 24,3 \pm 8,0 | 12 | 0 |
| | ♀ | 4 | 427,5 \pm 46,0 | 29,5 \pm 5,0 | 0 | 4 | 13 | 344,2 \pm 23,6 | 22,3 \pm 6,9 | 13 | 0 |
| Overall | | 32 | 407,3 \pm 64,9* | 26,2 \pm 9,1 | 4 | 28 | 48 | 352,9 \pm 23,1* | 22,5 \pm 8,9 | 48 | 0 |

* significantly different means ($p < 0,001$; t test)

Table 2 Mean protein (P*, %), neutral detergent fibre (NDF, %), gross energy (GE, Mj/kg), digestibility (D, Mj/kg) and mineral composition of the diet of feral rock doves ($n = 22$) and rock pigeons ($n = 23$) collected during the austral summer of 1991/1992 in the south-western Cape Province, South Africa

| Species | P* | NDF | GE | D ¹ | Minerals (%) | | | | | | | |
|-------------|------|------|------|----------------|--------------|------|------|------|------|--------|--------|--------|
| | | | | | Ca | P | Mg | Na | K | Cu | Zn | Mn |
| Rock doves | 11,9 | 13,0 | 18,0 | 14,9 | 0,19 | 0,30 | 0,17 | 0,13 | 0,42 | 0,0009 | 0,0042 | 0,0053 |
| Rock pigeon | 11,8 | 9,3 | 16,5 | 14,5 | 0,10 | 0,28 | 0,13 | 0,06 | 0,28 | 0,0005 | 0,0027 | 0,0029 |

¹ digestibility (Mj/kg) = $3,77 - (0,019 \times \text{NDF}) + (0,758 \times \text{GE})$

pigeons fly 15–20 km from the greater Cape Town area to the farmlands, but the rock doves separate to feed within the feedlots on processed cereals while rock pigeons feed in the fields on waste wheat. However, neither the quantity nor the quality of these foods within the crops appear to be significantly different, and both species appear to be obtaining sufficient food, at least in comparison with that necessary to maintain normal body mass in homing pigeons *C. livia* (Baum 1974).

Although the feral rock doves fed only in the feedlots, they showed no preference for either of the food types, when offered at similar levels of availability within the feedlots. Unfortunately, similar preference experiments could not be done for the rock pigeons, because this species was not seen feeding in one particular area of the wheat fields on the different occasions. Furthermore, although there is evidence that food resources studied appeared to be equally available in both areas, processed cereals are consistently available, but might be less available to a shy species because of relatively high human disturbance. Moreover, feral rock doves elect to feed within the feedlots but have no apparent preference for food type. Therefore, feral rock doves might be more tolerant of human presence than rock pigeons which apparently select to feed in the fields. Therefore, the feral rock doves are able to exploit the more continuously available processed cereals. This differential feeding behaviour suggests resource partitioning, and that introduced feral rock doves do not displace indigenous rock

pigeons from summer food sources in the south-western Cape Province.

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