

The effect of the removal of buffalo *Syncerus caffer* (Sparman 1779) on the host selection of yellow-billed oxpeckers *Buphagus africanus* Linnaeus 1766 in Zimbabwe

JAMES DALE¹

P.O. Box FM 424, Famona, Bulawayo, Zimbabwe

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Past studies of yellow-billed oxpeckers *Buphagus africanus* Linnaeus 1766 have shown that buffaloes *Syncerus caffer* (Sparman 1779) are their preferred hosts. Yellow-billed oxpeckers were successfully introduced into the Matobo National Park, Zimbabwe, in 1975. In 1986, all the buffalo were removed from the park. The oxpecker population shifted their host selection onto other ungulates present in the park, and continued to breed successfully.

KEY WORDS: yellow-billed oxpeckers, buffalo, host selection, preference index, Zimbabwe.

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INTRODUCTION

The two species of oxpeckers, the red-billed oxpecker (*Buphagus erythrorhynchus* Stanley 1814) and the yellow-billed oxpecker (*B. africanus*), feed almost exclusively on ticks and other ectoparasites found on their herbivorous mammalian hosts (MOREAU 1933, VAN SOMEREN 1951). In all studies of yellow-billed oxpecker host selection, the

¹Present address: Biology Department, Queen's University, Kingston, Ontario K7L 3N6, Canada.

buffalo (*Syncerus caffer*) clearly stands out as the major host of this species (ATTWELL 1966, BUSKIRK 1975, GROBLER & CHARSLEY 1978, STUTTERHEIM & PANAGIS 1985, HALL-MARTIN 1987, HUSTLER 1987).

In 1975, a total of 47 yellow-billed oxpeckers and 12 red-billed oxpeckers were released in the Whovi Wilderness area of the Matobo National Park, Zimbabwe (GROBLER 1976). The red-billed oxpeckers did not survive, but the yellow-billed oxpeckers flourished. The successful introduction of yellow-billed oxpeckers was accredited to the abundant buffalo in the park, availability of suitable breeding sites, and to the presence of suitable country for the location of hosts (GROBLER 1979). In a follow up study, buffalo were identified as their main hosts (GROBLER & CHARSLEY 1978). In May 1986 all the buffalo (approximately 600) were removed from the Whovi area, due to an outbreak of foot-and-mouth disease nearby. Due to the importance of buffaloes in past studies of yellow-billed oxpeckers, it was expected that the removal of this oxpecker symbiont would result in a decline in the oxpecker population. During May 1990 I studied the oxpeckers at Matobo, in order to determine the effect of the removal of their main host on their numbers and host selection.

METHODS

Observations on yellow-billed oxpeckers and their hosts were made in the Whovi Wilderness Area (game park) of the Matobo National Park (20°30'S; 28°30'E) from 15 May to 29 May 1990. Ungulates were searched for by vehicle and on foot. When ungulates were found, the number and species, as well as the number and ages of any attendant oxpeckers was recorded. Oxpecker ages were determined by bill colour as described by STUTTERHEIM et al. (1976). Oxpeckers that arrived on a host after the initial sighting was made were ignored. Information from a repeat sighting of a host were recorded provided that at least 3 hr had elapsed since the last time the host was seen.

Host selection by oxpeckers was analyzed using the preference index (PI) described by GROBLER & CHARSLEY (1978). The index is calculated for each host species by dividing the number of individuals of each host species seen by the number of oxpeckers seen on them. The result represents the number of host individuals that support one oxpecker.

In order to compare my results with those obtained before the buffalo were removed (GROBLER & CHARSLEY 1978), I assumed that the PI would be the same with or without buffalo and that the removal of the buffalo would result in the elimination of those oxpeckers that were dependant on them. The expected values for this study were calculated for each host species as follows:

$$E = H/PI$$

where: E = expected number of oxpeckers on host species *a*,
 PI = Preference Index (from GROBLER & CHARSLEY 1978),
 H = number of host species *a* seen in this study.

A chi-square test was used to compare the host selection between the two studies.

The sizes of the oxpecker populations (P_o) with and without buffalo were estimated with the formula:

$$P_o = \sum_a^i (P_a/PI) \text{ for all host species } a \text{ to } i$$

where: PI = Preference Index (from Table 1),
 P_a = estimated size of host *a* population.

The estimates of the numbers of host animals were obtained from National Parks staff.

RESULTS

The selection of hosts by yellow-billed oxpeckers before and after the buffalo were removed is given in Table 1. There are significant increases in preference for rhino *Ceratotherium simum* (Burchell 1817) ($\chi^2 = 1349.5$, $P < 0.001$), zebra *Equus*

Table 1.

Selection of ungulates by the yellow-billed oxpecker in the Matobo National Park, Zimbabwe, with buffalo (data from GROBLER & CHARSLEY 1978) and without buffalo present.

| Host species | Buffalo present | | | | Buffalo absent | | | |
|--|-----------------------|-----------------|-------------------|-------------------------------|-----------------------|-----------------|-------------------|-------------------------------|
| | Host individuals seen | Ox-peckers seen | Pref-erence index | Estimated hosts in population | Host individuals seen | Ox-peckers seen | Pref-erence index | Estimated hosts in population |
| Buffalo <i>Syncerus caffer</i> | 2601 | 556 | 4.67 | 150 | — | — | — | 0 |
| White rhino <i>Ceratotherium simum</i> | 1399 | 186 | 7.52 | 26 | 142 | 179 | 0.79 | 33 |
| Zebra <i>Equus burchelli</i> | 1303 | 87 | 14.98 | 26 | 305 | 125 | 2.44 | 120 |
| Giraffe <i>Giraffa camelopardalis</i> | 588 | 31 | 18.97 | 9 | 105 | 66 | 1.59 | 40 |
| Wildebeest <i>Connochaetes taurinus</i> | 5778 | 63 | 91.71 | 140 | 468 | 85 | 5.51 | 170 |
| Impala <i>Aepyceros melampus</i> | 9104 | 29 | 313.93 | 250 | 1089 | 5 | 217.80 | 800 |
| Warthog <i>Phacochoerus aethiopicus</i> | 948 | 2 | 474.00 | 150 | 156 | 7 | 22.29 | 250 |
| Eland <i>Taurotragus oryx</i> | 857 | 58 | 14.78 | 90 | 8 | 7 | 1.14 | 26 |
| Kudu <i>Tragelaphus strepsiceros</i> | 41 | 0 | — | 15 | 10 | 2 | 5.00 | 60 |
| Sable <i>Hippotragus niger</i> | 2160 | 57 | 37.89 | 150 | 8 | 0 | — | 60 |

burchelli (Gray 1824) ($\chi^2_1 = 532.7, P < 0.001$), giraffe *Giraffa camelopardalis* (Linnaeus 1758) ($\chi^2_1 = 649.0, P < 0.001$), and wildebeest *Connochaetes taurinus* (Burchell 1824) ($\chi^2_1 = 1236.2, P < 0.001$) after the buffalo were removed. Due to low expected values calculated ($E < 5$) for impala *Aepyceros melampus* (Lichenstein 1812), warthog *Phacochoerus aethiopicus* (Pallas 1767), eland *Taurotragus oryx* (Pallas 1766), kudu *Tragelaphus strepsiceros* (Pallas 1766), and sable *Hippotragus niger* (Harris 1838) these ungulates were treated as a group and a significant increase in preference for this group was observed ($\chi^2_1 = 55.9, P < 0.001$). Yellow-billed oxpeckers were seen on kudu, which represent a new host species for these birds in the game park (Table 1). Thus, contrary to the assumption, the yellow-billed oxpeckers have changed host preference.

Out of 308 yellow-billed oxpeckers that I was able to age, 70 were juveniles (22.7%). GROBLER (1979) counted 32 juveniles out of 182 oxpeckers sightings (20.9%) before the buffalo removal. The percentage of juveniles from the two studies are similar ($\chi^2_1 = 1.538, P > 0.05$).

Using the formula to estimate the population size of the oxpeckers when the buffalo were present (GROBLER & CHARLESLEY 1978; two years after 47 oxpeckers were released) I estimate that there were 50 oxpeckers. Four years after the buffalo were removed I estimate a population of 196 individuals.

DISCUSSION

Buffalo are the main host of the yellow-billed oxpecker. MUNDY (1983) suggested that the buffalo was essential for the survival of the yellow-billed oxpecker in an area, and HUSTLER (1987) provided data from Hwange National Park, Zimbabwe, as support for this idea. The yellow-billed oxpecker population in the Matobo National Park did not decline after the buffalo were removed because they used other hosts (Table 1). Rhino, giraffe, zebra and wildebeest comprise the key hosts of the oxpeckers when buffalo are absent (Table 1), and this study marks the first time that wildebeest have been shown to be a significant host of yellow-billed oxpeckers. HUSTLER (1987) recorded a significant increase in the selection of giraffe as hosts by yellow-billed oxpeckers in a part of his study site where buffalo were reduced. This result coupled with the findings of my study indicate that the relative densities of different hosts in an area are a major factor motivating specific host choice in these birds.

The percentage of juvenile oxpeckers observed in this study indicates that the birds can maintain themselves without buffalo. GROBLER (1979) recorded 20.9% juveniles 2 years after the release, and showed that the population of yellow-billed oxpeckers was growing. If the oxpecker population were dependant on buffalo one would expect a significant decrease in the percentage of juveniles observed after the buffalo were removed. This is not the case as the juvenile to adult ratios are similar before and after the removal.

It is difficult to estimate the size of the oxpecker population, especially as the numbers of ungulates are also estimates. Even so, there has been a substantial growth in the population: in 1977 there were an estimated 50 birds, while in 1990 there were 196, a four fold increase. The buffalo were removed in 1986, and the oxpecker population could have been larger than 196 at that time. However, the percentage of

juveniles observed in the population 4 years later suggests that they are reproducing at the same rate as before. It is therefore likely that there are more yellow-billed oxpeckers in the Matobo now than when the buffalo were removed, and that the shift on to other hosts has not affected their survival or breeding success.

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