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Research paper

The effect providing space in excess of standards on the behaviour of budgerigars in aviaries

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ABSTRACT

Budgerigars housed in conventional cages have no opportunity for some normal behaviours, in particular flight, and develop stereotyped behaviours. Increasingly aviaries are used for groups of budgerigars but the minimum space requirement to support normal behaviour is not known. We compared the behaviour of budgerigars in three aviaries, with 0, 28 and 56% increases in space above the minimum size required by Queensland Government, 0.65 m^3/bird. Groups of four birds were accommodated in each aviary and behaviour was video-recorded over three 21 day periods in a changeover design. Flight distance increased with space allowance ($P = 0.001$), and more flights were initiated at the start of each period in the largest aviaries ($P = 0.03$), which is evidence of thwarted motivation for flying in the smaller aviaries. After budgerigars had spent a period in the small aviaries, they had increased flight times if they were in the larger aviary in the subsequent period ($P = 0.003$). Budgerigars with low space allowance flapped their wings ($P = 0.05$) and tail wagged ($P = 0.004$) more and scratched ($P = 0.05$) less at the start of each period. It is concluded that there are benefits to the behaviour and welfare of budgerigars by providing increased space in aviaries above that specified in standards.

1. Introduction

The budgerigar (*Melopsittacus undulatus*) was the first domesticated member of the Psittaculidae family in Western culture, and it has been commonly kept as a companion animal since the 1850's (Polverino et al., 2012). The birds are also kept as experimental animals for research purposes. In the wild, these birds exist in flocks and are native to Australia. As companion animals, they are housed in a variety of enclosures, such as aviaries, cages and boxes, all available in a variety of sizes. Key requirements for space include an opportunity to exercise, to engage in social interactions, and to utilise environmental enrichment (Hawkins, 2010). When kept in a restricted space, budgerigars demonstrate stereotypic behaviours involving repeated locomotion, especially pacing, object-directed behaviours, such as screaming and pecking, and abnormal oral behaviours, in particular sham chewing (Polverino et al., 2015).

In a domestic and experimental environment, the importance of space for these birds is not well understood. Birds that are housed in small cages are prone to obesity, stereotypies and altered mentation (Gebhardt-Henrich and Steiger, 2006; van Hoek and Ten Cate, 1998). Obesity is common in captive budgerigars because they are fed an energy dense diet and they lack the ability to fly long distances, compared to their wild counterparts who do this when foraging for food (van Hoek and Ten Cate, 1998). Obese birds are prone to many diseases, such as degenerative joint disease, pododermatitis, cardiac and reproductive diseases, and hepatic lipidosis (Sakas, 2002). In caged birds, stereotypic weaving has been demonstrated in parrots, especially cockatoos and maccaws, and route tracing demonstrated in canaries (van Hoek and Ten Cate, 1998). These behaviours closely resemble the pacing behaviour that is seen in caged mammals, and are more prominent in animals that are wild caught compared to ones that are bred for laboratory purposes (van Hoek and Ten Cate, 1998). The prevalence of route tracing and weaving behaviour is a welfare concern as it is correlated with spacial restriction by improper housing conditions (van Hoek and Ten Cate, 1998). In budgerigars, stereotypies are mainly associated with housing in small cages (Polverino et al., 2012).

Previous studies that have detailed the effects of different cage sizes compared to each other and to aviaries suggest that as well as a decrease in stereotypies in birds housed in larger enclosures, flying speeds of birds housed in large cages are faster than those in small cages (Gebhardt-Henrich and Steiger, 2006). In an aviary setting budgerigars that are housed in groups fly more than those housed alone, leading to

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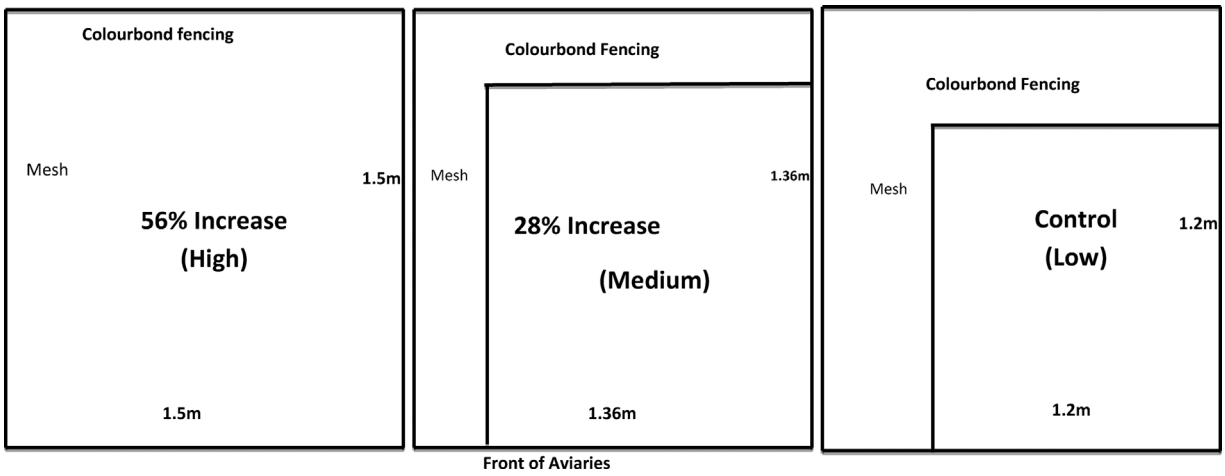

Fig. 1. Diagram of aviary dimensions (height for all aviaries 1.8 m). Cameras were located in front of, and at 45° angles to the sides of the cage.

the hypothesis that either the increased space or the disturbance by other birds may have stimulated this increase in activity (Nicol and Pope, 1993). Flight is most common during courtship and can be encouraged in aviaries by placing food low down (Nicol and Pope, 1993). It has a high energy cost but little is known about the needs for budgerigars to fly and what space allowance will satiate this need.

Space allowances are often based on that required for basic comfort movements, but this is not sufficient for normal social interaction, e.g. 0.25 m^2 in the case of a chicken, whereas in the wild, feral chickens maintain a distance of 2 m or more (Hawkins, 2010). Currently, the general guidelines for space allowance for budgerigars as pets rarely specify exact cage sizes, most requiring a size related to the wingspan and height of the bird. In intensive breeding facilities the standard cages are 28 × 28 × 34 cm high per pair of budgerigars (Polverino et al., 2012), allowing 0.013 m^3/bird. Standards that do specify minimum size for budgerigars as pets include The Victorian Code of Practice, which requires at least 0.05 m^3/budgerigar (Victorian State Government, 2017), and the Queensland Government Code of Practice, which for a pair (the minimum number allowed) of 20 cm budgerigars requires 0.65 m^3/bird, with a minimum height of 1.8 m (Department of Environment and Heritage Protection, 2010). The shape of the floor is also specified, with the shortest side required to be at least 40 cm long and the ratio of length to side no more than 4:1, unless the shortest side is at least 90 cm.

The solution to the behaviour problems caused by housing budgerigars in small cages may be to accommodate them in aviaries, which is increasingly common. Little is known about the minimum space requirements for aviaries, but it was hypothesised that an increase in aviary size would increase flying distance, flight times, reduce stereotypies, and overall, provide for a better welfare environment. We tested this hypothesis by investigating the behaviour of budgerigars in a standard sized aviary and two larger aviaries providing 28% and 56% more space.

2. Materials and methods

Procedures were approved by The University of Queensland's Animal Ethics Committee (UQAEC Approval Number 198/15).

2.1. Animals

Twelve adult male budgerigars (*Melopsittacus undulatus*) (three blues, three greys, three greens, two yellows and one white) held in captivity at the University of Queensland's Small Animal Hospital were utilized for the study. Animals were sourced from a local breeder (Brookfield Produce & Pet Pavilion, Brookfield, Queensland, Australia). An initial health assessment was performed and, as a preventive measure against *Chlamydia*, the antibiotic doxycycline was administered over a 45 day period at a concentration of 3 g/2L of water.

2.2. Diet

The budgerigars were fed a proprietary millet grain feed (Peckish Budgie Feed, Vetafarm, Sydney, Australia) ad libitum in hanging food bowls, with feed offered at 1600 h, and a branch of callistemon of the Myrtaceae family was added daily in the morning. Water was provided ad libitum, with the addition of doxycycline HCL, at a concentration of 1.5 g/l of water (Psittavet, Vetafarm, Sydney, Australia).

2.3. Test enclosure design, habituation and treatments

Immediately after arrival, animals were housed in three groups of four by randomly selecting one bird of each colour to facilitate animal identification. The initial housing enclosures were 150 cm wide, 150 cm long and 180 cm high (Absco Flat Roof Aviaries, Zincalume with wide mesh; Cheap Sheds Pty Ltd; Brisbane, Australia). After a week of habituation, two of the aviaries were reduced in size using colorbond fence panels (Neetascreen Colorbond Fencing, Lysaght, Rocklea, Australia) and mesh (White Wires Mouse and Snake Mesh, Whites Group, Richlands, Australia) to create false walls identical to the colourbond wall and mesh wall on the back and side, respectively, of the original cage (Fig. 1). Thus, three space allowances were generated: a low space allowance treatment (L; 120 cm wide, 120 cm long and 180 cm high, equivalent to the Queensland Government standard, DEHP, 2010), a medium space allowance treatment (M; 136 cm wide, 136 cm long and 180 cm high) and a high space allowance treatment (H; 150 cm wide, 150 cm long and 180 cm high; unmodified cage), providing 0.65, 0.83 and 1.01 m^3/bird, respectively. Treatments M and H represented increases of 28 and 56% in available space, respectively.

The three bird groups experienced all three treatments in three 21 day experimental periods in a balanced changeover design. In the first period, treatment M was allocated to bird group 1, treatment L to group 2 and treatment H to group 3 (Table 1). After periods one and two, one day was taken to rearrange the aviaries, with each bird group being held in a small cage on this day. Cages were portable and were rotated anticlockwise between three positions while bird groups remained in the same location (to eliminate any confounding of treatment differences those in the environment at the three cage locations).

2.4. Behaviour recording and analysis

Birds' activities were recorded continuously throughout the