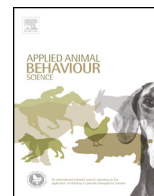




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Environmental enrichment for parrot species: Are we squawking up the wrong tree?

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ABSTRACT

Parrots are kept in zoos, homes and laboratories for conservation, companionship and research purposes. The intelligence, longevity and behaviour of parrots raise concerns for keeping them in these environments. Captive settings may limit the expression of normal behaviours and, as a consequence, abnormal behaviours may develop. Husbandry practices often provide animals with enrichment opportunities to prevent negative effects on their well-being. The purpose of this review is to examine the existing literature on parrot enrichment to identify which efforts are successful with these species and detect areas where more work is needed. A total of 23 articles were found to provide enrichment to parrots. Based on these, research has centred on options to diversify foraging strategies and determine object preferences. Studies analysing well-being focus on abnormal behaviour in the form of stereotypies and feather picking. Variables such as sample size and protocol duration present variable ranges across experiments. There is an under-representation of parrot enrichment studies in zoos. The most documented types of enrichment involve foraging and physical modifications while enrichment based on sensorial stimuli is non-existent. Other studies focusing on cognitive or technical capacities of parrots were not included as enrichment efforts. However, they have the potential to be considered as such if well-being is integrated into their analyses. Parrot enrichment does result in behavioural changes; exploration is already well documented. Further work should be directed towards exploring additional well-being indicators, especially in zoo environments. Environmental enrichment is not an easy concept to define since it is highly dependent on species-specific variables. Diet and sociality are varying factors across parrot species that require attention when deciding what enrichment they may benefit of. In addition to being biologically relevant, enrichment should include opportunities to solve challenges and exert control on the environment. Environmental enrichment may also be of benefit to wildlife conservation.

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1. Introduction

Psittaciformes, members of the aves class commonly known as parrots, are comprised by three groups: New Zealand parrots (Strigopoidea), cockatoos (Cacatuoidea) and all other parrots (Psittacoidea) (Joseph et al., 2012). They can be distinguished from other birds by morphological features such as beaks with curved mandibles, zygodactyly (two opposing pairs of toes) and a prehensile tongue (Forshaw, 2010). Plumage is green in many species. Many psittacines are known to live in flocks of numerous members, composed of breeding pairs and family groups (Evans, 2001), but there are exceptions such as the New Zealand kakapo (*Strigops habroptilus*) (Diamond et al., 2006). Play behaviour is also characteristic of psittacine species. Parrots exhibit all three forms of play: solitary, object and social. (Kaplan, 2015 page 79). Several avian orders have been reported to exhibit locomotive or object play (Diamond and Bond, 2003) but only Psittaciformes, Passeriformes (passerines) and Bucerotiformes (hornbills) express social play (Diamond and Bond, 2003; Diamond et al., 2006). Social play is more widespread in parrots, with evidence found in 13 species compared to 10 species of corvids and two species of hornbills (Kaplan, 2015 page 79).

Parrots have been kept in captivity for several purposes. van Hoek and ten Cate (1998) identify two captive scenarios: zoological collections and household pets. Each situation has different validating reasons for captivity: conservation and companionship. Psittaciformes are classified as one of the most threatened bird groups according to The World Conservation Union's 2000–2004 Status Survey and Conservation Action Plan (2000). Bennett and Owens (1997) describe them as one of eight bird families with significantly higher numbers of threatened species. The biggest threats to their survival are habitat destruction and direct exploitation (Beissinger and Bucher, 1992; Snyder et al., 2000). Spix's macaws (*Cyanopsitta Spixii*) are considered to be extinct in the wild, with the species only surviving thanks to *ex situ* captive breeding efforts (Reinschmidt et al., 2008; Tschudin et al., 2007; Hammer and Watson, 2012). In the United States, an estimated 10.1 million parrots were kept as companion animals in 2002, making them the third most popular pet (Kalmar et al., 2010). Existing data on other countries show that in the Netherlands there are approximately 5.35 million pet psittacines (Roe, 1991). Previous records for the United Kingdom indicate a population of 5 million budgerigars (*Melopsittacus undulatus*) in private homes (Roe, 1991).

Universities and laboratories also house certain parrot species for research purposes as they have been described as “cognitively superior to other birds and in many cases even apes” (Emery, 2006). The literature is well represented by experiments examining African grey parrot (*Psittacus erithacus*) cognition and communication (Pepperberg, 1983, 1990, 1993). A review of all psittacine studies published in 2009 found a total of 483 individuals in laboratory settings (Kalmar et al., 2010). The intelligence and longevity that characterise parrots raise concerns for keeping them in captivity (Kalmar et al., 2007).

2. Parrots in captivity: well-being as a problem and enrichment as a solution

2.1. Captivity-related problems

The “Five Freedoms” is a framework to assess well-being proposed by the UK's Farm Animal Welfare Council. It states that animals should be free (1) from thirst, hunger and malnutrition; (2) from discomfort; (3) from pain, injury and disease; (4) to express normal behaviours; and (5) from fear and distress. A welfare problem occurs when one or more of these principles are not satisfied.

In the setting of captive wildlife, the Five Freedoms may be accomplished by appropriate husbandry and veterinary practices (*i.e.* provision of food and water, an adequate physical living environment and medical care). However, the last two freedoms could appear more complicated to achieve.

Restrictions to the expression of normal behaviours are often imposed by captive living conditions. One of the most recognised avian behaviours is flight. A study on a non-psittacine bird (Peng et al., 2013) assessed well-being impacts of constrained flight in captivity due to cage size and anatomical manipulation (*i.e.* wing clipping). Results showed that captive subjects maintained a preference to fly, evidenced by higher mean times spent in larger spaces and a decrease in size of the pectoral muscle of one subject. This study involves a small sample size and lacks statistical analysis, so general conclusions based on this design should be drawn with care.

André (2007) provides a descriptive account of the behavioural repercussions commonly occurring in pet parrots. He outlines the most frequent problems as fear, aggression, excessive vocalisations, misdirected reproductive behaviour, stereotypical locomotion, feather-picking and over-preening. The author suggests that the animals' rearing environment (wild-caught, captive-born, parent or human-raised) has a strong impact on the development of such conditions. Quantitative research has been focused on analysing fear (Meehan and Mench, 2002; Fox and Millam, 2004), stereotypies (Meehan et al., 2004; Garner et al., 2006; de Andrade and de Azevedo, 2011; Polverino et al., 2015) and feather-picking (van Hoek and King, 1997; Meehan et al., 2003b). From a welfare perspective, it is clear that behaviours such as feather plucking and excessive self-preening are detrimental for the individual whereas fear, aggression and loud vocalisations tend to be considered negative because owners prefer calm and sociable pets.

Foraging behaviour is a concern as captivity can limit the availability, frequency or distribution of food resources and the behavioural repertoire linked to this activity. In the wild, animals develop different strategies to obtain their food resources. Parrots employ several body parts (*e.g.* feet, beak and tongue) while eating; manipulation methods vary according to food type (Zeigler, 1975). As reported by Rozek and Millam (2011), wild parrots spend around 40%–75% of their awake time searching for or accessing food, contrasting with 42 min out of a 12-h day in captive orange-winged amazons (*Amazona amazonica*). This discrepancy does not necessarily imply a negative effect on well-being. However, captive activity budgets may allow for abnormal behaviours to occupy the animals' “free” time.

The repercussions of captivity in psittacine play behaviour have not been extensively researched. However, social play in kea (*Nestor notabilis*), an inquisitive parrot, appears consistent between wild and captive specimens (Diamond et al., 2006). This may suggest that captivity does not hinder the expression of this behaviour but these results may be species-specific.

Brilot et al. (2009) analysed how abnormal behaviours (*e.g.* somersaulting and route tracing) developed after wild starlings (*Sturnus vulgaris*) were subjected to confinement, discussing how captivity promoted the development of stereotypical behaviour. Similar studies are still needed to determine the behavioural changes taking place in wild parrots following their confinement.

2.2. Past and present of parrot enrichment efforts

To subdue abnormal behaviours, discourage inactivity and increase behavioural diversity, husbandry practices for parrots often include the provision of environmental enrichment. For example, Edinburgh Zoo manages an avian enrichment program with the objective of promoting full behavioural repertoires and use of all senses (Field and Thomas, 2000).

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