



## Original Research Article

# The influence of anti-predator training, personality and sex in the behavior, dispersion and survival rates of translocated captive-raised parrots



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## ABSTRACT

Predation is one of the main factors responsible for the failure of reintroduction/translocation programs. Animal's personality and sex can also influence key behaviors for survival and reproduction. This study aimed to evaluate the influence of anti-predator training, personality and sex on the survival and behaviors of translocated blue-fronted Amazon parrots. Thirty-one captive-raised parrots were translocated to a *Cerrado* area in Brazil. Parrots were separated into two groups: anti-predator trained group (ATG) and control group (CG). Personality tests were performed with individuals of the ATG group. Data were collected using focal sampling with instantaneous recording of behavior every minute. Anti-predator training, personality and sex did not influence parrots' survival after release. However, anti-predator training proved to be efficient in eliciting more natural behaviors in parrots after release. Shy individuals and males showed to be more sociable than bold individuals and females. Personality and sex did not influence behavior exhibition. Parrots interacted more, positively or negatively, with individuals of its own group. Training session closer to the release date should be tried. Behavioral data and not just survival rates should be used to evaluate the efficiency of the techniques, because behavior can give clues about the adaptation of the individuals to the new habitat, increasing the success of the conservation program.

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## 1. Introduction

Translocations and pan-situ conservation [the exchange of animals between in situ populations (in the wild) and ex situ populations (in human care); Keulartz, 2015] are important tools for the management of animal species facing the risk of

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extinction (Seddon et al., 2012). The mortality caused by predation is one of the main factors responsible for the failure of the conservation projects (Beck et al., 1991; Seddon et al., 2012; Cortez et al., 2015). Predation of the released animals is due mainly to the loss of skills in recognizing and responding to a predator, especially if the released animals are captive-bred (Griffin et al., 2000; Aaltonen et al., 2009). Anti-predator training techniques have been used to reduce this problem and increase appropriate behavioral responses to predators (Azevedo and Young, 2006a,b), however, studies that evaluated the effectiveness of anti-predator training after the release are rare (Gaudioso et al., 2011; Alonso et al., 2011; Cortez et al., 2015).

Individuals' personalities are normally not considered in conservation programs when selecting the animals for release (Teixeira et al., 2007), although some studies indicate that personality can influence key behaviors for survival and reproduction in nature (anti-predator, aggressiveness, sociability, exploration, feeding behaviors; Hollander et al., 2008; Aplin et al., 2013). Animal personality can be understood as differences in the behaviors exhibited by different individuals of the same species that is consistent across time and situations (Realé et al., 2007). Different dimensions of animal personalities can be evaluated: exploration, sociability, aggressiveness, risk-taking, etc (Gosling and John, 1999). In one of these contexts, personalities can be classified in a shy-bold continuum, based on the propensity to take risks of each individual: some individuals seem to thrive on risk and novelty (boldness) while others shrink from the same situations (shyness) (Wilson et al., 1994). Released individuals with inappropriate levels of boldness can theoretically survive less in nature (Azevedo and Young, 2006c; Oers and Naguib, 2013). Bolder animals probably have insufficient wariness of predators and this can be a non-adaptive response, but, in another context, they can be more willing to explore the environment and find food, which can be seen as an adaptive response (Coleman and Wilson, 1998; Watters and Meehan, 2007). Personality tests can be used as a method to better choose the animals in conservation programs, helping in the avoidance of choosing animals that scored higher on traits linked to risky behaviors (Bremner-Harrison et al., 2004).

The animals' sex is another important parameter that is not usually evaluated in conservation programs (Lambertucci et al., 2013), but sex can be linked to personality (Titulaer et al., 2012), stress (Keller et al., 2015), dispersion (Le Gouar et al., 2012), reproduction (Ball and Ketterson, 2007) and can influence the survival rate and in the behavior of the released individuals. In a translocation program of swift foxes in Canada, females presented lower survival rates than males, thus researchers suggested that it should be translocated a greater proportion of females in comparison to males, in order to establish balanced sex ratios in the released population (Moehrenschrager and Macdonald, 2003).

The blue-fronted Amazon parrot (*Amazona aestiva*) is found in eastern Bolivia, northern Argentina, southern Paraguay and central-southern Brazil (Sick, 2001), inhabiting the *Caatinga*, *Cerrado*, *Pantanal* and *Chaco* biomes (Schunck et al., 2011). It is one of the parrot species most removed from the wild in the world (Schunck et al., 2011). In Brazil, it is among the most received species in the Wild Animal Triage Centers (CETAS), governmental facilities destined to receive animals rescued from the illegal trade, and are normally released into nature without any systematic study or monitoring (Vilela, 2012). Although this species is considered of least concern by IUCN (2017), the species was included in the "National Action Plan for the Conservation of Threatened Parrots of the Atlantic Forest" in Brazil, due to the high pressure that this species suffers from the trafficking of wild animals (Schunck et al., 2011). Studies directed to this species can help in the development and improvement of techniques for release this parrots and endangered species, as the study of Rodrigues (2013), who evaluated if rescued blue-fronted Amazon parrots were able to learn anti-predator skills.

In this study, it was examined the influences of the anti-predator training, personality and sex of the captive-raised blue-fronted Amazon parrots on the survival, behavior and dispersal of the individuals after release. We hypothesized that these parameters would influence survival and dispersal of release parrots and expected that trained, female and shy parrots would survive more after release due to acquired anti-predator skills, and the tendency to take less risk than bold males.

## 2. Methods

### 2.1. Animals, housing and maintenance

Thirty-one reproductive adult blue-fronted Amazon parrots were selected from CETAS in Belo Horizonte City after general health exams. These parrots were illegally removed from the wild while chicks and were raised in captivity, being rescued from the owners. Thus, their ages and places of birth were unknown. All parrots lived for at least 5 years in captivity. They were randomly assigned into two groups: the anti-predator trained group (ATG), with 15 parrots (seven males and eight females); and the control group (CG), with 16 parrots (ten males and six females) (Table A.1).

Each parrot received a microchip and was marked on the chest with a non-toxic Expo® low odor dry-erase marker; the ink marks indicated the sex and the group of the individual (right side for females and left side for males; blue color for ATG and red color for CG). Parrots also received one colored leg ring and one stainless steel leg ring, with an identification number and a contact telephone number. Three individuals from each group also received a VHF radio collar; model TXE304CP, Telenax Company®.

Parrots were kept separated by group in two similar aviaries for at least ten months before the release. The aviaries were partially shaded and had 12 m length, 4 m width and 3.5 m height each, and were placed 2 m distant from each other in the release area, away from human interferences and surrounded by natural habitat. Aviaries were covered with a black plastic canvas to avoid individuals of the CG to see individuals of the ATG. Birds were daily fed at 8:30 AM with a mixture of industrialized parrot food (Megazoo®), sunflower seeds and seasonal fruits; fruits and seed of plants found in the release site

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