Pre–release training of juvenile little owls *Athene noctua* to avoid predation

R. Alonso, P. Orejas, F. Lopes & C. Sanz

Alonso, R., Orejas, P., Lopes, F. & Sanz, C., 2011. Pre–release training of juvenile little owls *Athene noctua* to avoid predation. *Animal Biodiversity and Conservation*, 34.2: 389–393.

Abstract

Pre–release training of juvenile little owls Athene noctua *to avoid predation.*— Anti–predator training of juvenile little owls was tested in a sample of recovered owls raised in captivity in Brinzal Owl Rescue Center (Madrid, Spain). Mortality caused by predators has been described previously in released individuals. Nine little owls were conditioned during their development to a naturalized goshawk and a large live rat, whose presence was paired to the owl's alarm call. All nine owls and seven non–trained individuals were then released during the late summer and autumn and radio–tracked for six weeks to test their survival. In total 71.4% of the trained owls survived while only the 33.3% of the untrained group were alive at the end of week six. The only cause of death that was detected was predation. Antipredator training, therefore, seems to be beneficial in maximizing survival after the release of juvenile little owls.

Key words: Little owl, *Athene noctua,* Reintroduction, Release, Survival, Antipredator training.

Resumen

Entrenamiento antes de la liberación en mochuelos europeos Athene noctua *para evitar su depredación.*— Un entrenamiento sobre mochuelos juveniles para evitar la depredación, se ha testado en una muestra de ejemplares recuperados y criados en el Centro de Recuperación de Rapaces Nocturnas Brinzal (Madrid, España). Previamente se ha descrito una alta mortalidad en ejemplares liberados, causada por los depredadores. Se condicionaron nueve ejemplares durante su desarrollo, frente a un azor naturalizado y a una rata viva de gran tamaño, cuya presencia se había asociado a una llamada de alarma del mochuelo. Estos nueve ejemplares, junto a siete más no entrenados, se liberaron durante la última parte del verano y el otoño y fueron radiomonitorizados durante seis semanas con objeto de comprobar su supervivencia. En total sobrevivió el 71,4% de los mochuelos entrenados, mientras que sólo el 33,3% de los no entrenados sobrevivía a las seis semanas. No se registró ninguna otra causa de mortalidad que no fuera la depredación. El entrenamiento antidepredación parece ser beneficioso para la liberación de juveniles de mochuelo, de cara a maximizar su supervivencia.

Palabras clave: Mochuelo europeo, *Athene noctua*, Reintroducción, Liberación, Supervivencia, Entrenamiento antidepredación.

(Received: 10 VI 11; Conditional acceptance: 8 VII 11; Final acceptance: 10 X 11)

Raúl Alonso, Patricia Orejas, Francisca Lopes & Carmen Sanz, Centro de Recuperación de Rapaces Nocturnas Brinzal, Albergue Juvenil Richard Schirrmann, Casa de Campo s/n., Madrid, España (Spain).

Corresponding author: R. Alonso. E–mail: raulalonso@brinzal.org

ISSN: 1578–665X

Introduction

In recent decades, governments and private organizations have increasingly used captive bred animals in reintroduction attempts to reestablish or restock populations for conservation or hunting (Seddon et al., 2007). Post–release predation has been documented as one of the main cause of failure in release projects for mammals and birds (*e.g.* Kleiman, 1989; Beck el al., 1991; Short, 1992; Miller, 1994; Parish & Sotherton, 2007). As a result of captivity, animals can show variation in behavior, especially when the number of captive generations increases. This could result in decreased survival upon reintroduction to the wild (McPhee, 2003). Artificial rearing of birds tends to disrupt the normal development in recognizing innate predators (Curio, 1998) and may decrease opportunities for animals to acquire essential learned behaviors, such as predator recognition (Kleiman, 1989; Griffin et al., 2000). As adequate responses imply the presence of recognition processes (Curio, 1993), it has been proposed that animals that have been isolated from predators may loose antipredator behavior (Berguer, 1998; Lima & Dill, 1990). Understanding and mitigating these factors is essential for ethical reasons and to ensure successful reintroduction (Seddon et al., 2007). Animals should therefore be given the opportunity to acquire the necessary information to enable survival in the wild through training in their captive environment (IUCN/SSC).

Fearless animals can be trained to respond to predators (*e.g.* Ellis et al., 1977; Curio, 1988; Maloney & McLean, 1995), and in recent decades interest has grown in training animals to avoid post–release predation (*e.g.* Curio, 1998; Griffin et al., 2000). Antipredator training is usually done through the use of Pavlovian or classical conditioning. In this process, trials of conditioned stimulus (the predator figure) are paired to an unconditioned stimulus (a frightening, alarming or pain–inducing stimulus). Such training can be used not only to illicit a fear response but also to improve the efficiency of responses (Griffin et al., 2000) and to enhance initially low–level antipredator responses (Miller et al., 1990; McLean et al., 1996). Moreover, this type of training increases vigilance behaviour (McLean et al., 1996). The feasibility of antipredator training depends on the type of isolation (evolutionary –over generations– or ontogenetic –during an animal´s life) and on the specific components of antipredator behavior (avoidance, recognition, and response) that have been lost (Griffin et al., 2000). Animals that have been isolated only ontogenetically (*e.g.* bred in captivity) may have the capacity to express appropriate antipredator behaviour, but this might not occur without specific experience (Griffin et al., 2000).

In the case of little owl *Athene noctua*, several release projects have been attempted in Europe with little or no success (Stahl, 1982; Mohr, 1989; Leicht, 1992; Möller, 1993; Génot & Sturm, 2003) primarily due to predation (Van Nieuwenhuyse et al., 2008).

Implementation of animal behaviour experiments has been proposed to determine why reintroductions fail, to shed light on what can be done to improve the chances of success, and to evaluate the impact of interventions such as environmental enrichment (Mathews et al., 2005). Although the evidence suggests that a large percentage of released juvenile little owls do not survive in the wild, nothing has been done to decrease the main cause of death, predation. Here, our main aim was to determine whether antipredator training is effective in improving survival of released juvenile little owls.

Material and methods

Little owls entered the Brinzal Owl Rescue Center (Madrid, Spain) as eggs, chicks, fledglings or fully fledged individuals. Eggs were artificially incubated and owl chicks were hand–fed only during their first week of life. Chicks and fledglings received medical treatment when necessary. After the first week of life, special care was taken to keep the owls isolated from humans and to assure establishment of species imprinting, which promotes adequate reproductive behavior. A relation between misimprinting and predator avoidance has been described (Curio, 1998). As imprinting occurs not only in parents but also in siblings (Fox, 1995), chicks were exposed 24 h/day to a square angle mirror placed inside their intensive care cages. When medical treatment was given(fractures, large wounds, etc.), a non–releasable adult accompanied them. Chicks were transferred to adult foster parents in outdoor cages as soon as possible after the first week of life.

Antipredator training was performed when the owls were in outdoor cages (foster parent cages and aviaries). Classical or Pavlovian conditioning trials were conducted using conditioned stimuli as follows: a stuffed goshawk in flight position was moved along an iron cable above the cages and a live rat was trained to cross a mesh corridor connecting two boxes with one–way doors. Since alarm calls are closely associated with predatory events and can potentially favour species–specific learning mechanisms (Griffin et al., 2000), we used a digital recorded alarm call of the little owl as unconditioned stimulus. The call was manually activated by remote control during the goshawk 'flight', and automatically activated by the rat when it triggered a switch while running through the mesh corridor.

Goshawk trials occurred at any time during the day, while rat trials were performed at night. Although learning about predators occurs after just one or two trials in controlled conditions (Maloney & McLean, 1995; McLean et al., 1999), we conducted two to four trials per week from fledgling until the bird was released.

The trials were randomly spaced and we made sure that no noises or activity occurred before these trials to avoid establishing clues regarding their onset. To avoid habituation, the appearance of the predator was very short in time (a few seconds only) and it was always associated with the alarm call. To allow appropriate responses (*e.g.,* hiding, freezing, flying or staying high enough to escape) to the predators,

Table 1. Results of the radio–monitoring of little owls.

Tabla 1. Resultados del seguimiento por radio de mochuelos.

Group	Nº	Release date	Predation	Signal lost	Alive at week 6
Control	7	2007	4	1	2
Experimental	9	2010	2	2	5

cages and aviaries were equipped with natural vegetation, nest–boxes and high perches. The experimental group consisted of nine individuals that were trained to avoid predation while the control group was made up of seven individuals that had no antipredator training. For logistical reasons, the control group of owls was reared and released in 2007, while the trained experimental group was reared and released in 2010.

Before their release into the wild, all the individuals had at least 15 days of hunting training. Finally, they were ringed and radio–tagged with backpack tags (TW–4 from Biotrack Ltd.) attached with Teflon ribbon (Bally Ribbon, Bally, PA) harness (Kenward, 1987). These were switched on, on the day before release to check function and attachment system. Because the typical maximum allowable tag to body weight ratio is 3%, the total weight of each tag was 3.8 g. (2.5% of the average little owl weight). The receivers were a TRX–1000 (Wildlife Materials, Inc.) and a VR–500 (Vertex Standard Co., Ltd.) connected to a three–element Yagi antenna (Biotrack Ltd.). Birds were released during the late summer or autumn (August to October) in an appropriate habitat (olive orchards, open holm oak forests, or ash trees in meadows) in the province of Madrid where we knew little owls occurred. After release, owls were monitored a minimum of four times per week during the day or at night. Since most predation events in artificially reared birds occur in the first weeks after release (*e.g.* Sokos et al., 2008), little owls were monitored for six weeks, the minimum time considered necessary to evaluate the success or failure of released rehabilitated raptors (Duke et al., 1981).

Results

Table 1 shows the results of the monitoring. Signals from three individuals were lost in the first five days after release due to unknown reasons. Two of these were from birds in the trained group. Four of six controls (66.6%) were preyed upon in the first twenty–five days (mean 14.25) after release (survival rate = 33.3%). In the experimental group, two of the seven individuals (28.5%) were depredated on the third and eighth day (mean 5.5) after release (survival rate = 71.4%). Predators were a variety of raptors and mammals. Probable predators (judged on the condition of the carcasses) included two tawny owls (*Strix aluco*), a sparrowhawk (*Accipiter nisus*), a goshawk (*Accipiter gentilis*), a least weasel (*Mustela nivalis*) and a genet (*Genetta genetta*). No other causes of death cause were found.

Discussion

Although our sample was relatively small, predation was two–fold higher in the control group than in the experimental group, suggesting that pre–release training of juvenile little owls could improve the efficacy of release projects.

Nevertheless, further testing is needed to determine whether these results are sustained over time, as has been shown in other species (*e.g.* Azevedo & Young, 2006). A release program carried out in Toledo, Spain in 2001 and 2009 showed that 15 out of 23 (65%) radio–monitored little owls were depredated during the first four weeks after release (P. Cervera, pers. comm.).

We should emphasize that the predation rates could have been be affected by the fact that the control and experimental releases occurred in different years. It should also be kept in mind that our sample sizes were small. Nevertheless, our results suggest the benefits of training and the technique merits further testing and adoption when birds raised in captivity are released into the wild.

As knowledge acquired via training is supposedly transmitted culturally (Curio, 1998), in a similar way to conditioning, antipredator training in captive–bred birds should not be overlooked. When trained animals are reintroduced into the wild, they could potentially serve as models for predator–naive individuals, including their offspring and other adults (Griffin et al., 2000).

To conclude, we suggest that the extent of natural predation in recovered juvenile raptors should be studied in greater depth. Results to date seem to indicate that predation on birds reared in captivity could explain reintroduction/restocking failures more than any other factor.

Acknowledgements

We would like to thank Fundación Biodiversidad (Ministerio de Medio Ambiente y Medio Rural y Marino), Comunidad de Madrid (Consejería de Medio Ambiente y

Dirección General de Juventud), Ayuntamiento de Madrid, VOLCAM–Caja Mediterráneo, MANIMALS, S.L. and IMAGINARTE, S.L., for their economic support and for their encouragement with this project. This work was possible thanks to the generous collaboration of Antonio Agudo, Sara Agudo, Carolina Battistoni, José Mª Blázquez, Mª José Caballero, Marta Conejo, Manuel Galán, Emilio Escudero, Iván García, Marta García, Lucas González, José Manuel Hebrero, Abel Herrero, Fernando Jiménez, Alfonso Mamán, Rebeca Urquía y Cristina Ruiz. We would specially like to thank Rocío Blanco, Lidia Lopez and Verena Valenzuela for their dedication and tenacity spending countless hours radiotracking. Thanks too to Pilar Cervera (CERI) for sharing with us the results of little owl radiotracking in Toledo, Cristina González–Onandía and Victoria Pérez for helping us beyond their own professional responsibilities sharing with us the enthusiasm for these exciting big–eyed animals. This article benefited from comments on an earlier draft by I. Zuberogoitia, G. L. Holroyd and V. Penteriani.

References

Azevedo, C. S. & Young, R. J., 2006. Do captive–born greater rheas *Rhea Americana* remember antipredator training? *Revista brasileira de zoologia*, 23(1): 194–201.

Beck, B. B., Kleiman, D. G., Dietz, J. M., Castro, I., Carvalho, C., Martins, A. & Rettberg–Beck, B., 1991. Losses and reproduction in reintroduced golden lion tamarins *Leontopithecus rosalia*. *Dodo: Journal of the Jersey Wildlife Preservation Trust*, 27: 50–61.

Berguer, J., 1998. Future prey: some consequences of the loss and restoration of large carnivores. In: *Behavioral ecology and conservation biology*: 80–100 (T. M. Caro, Ed.). Oxford University Press, New York.

Curio, E., 1988. Cultural transmission of enemy recognition by birds. In: *Social learning: psychological and biological perspectives:* 75–97 (T. R. Zentall & B. G. Galef Jr., Eds.). Lawrence Eribaum Associates, Hillsdale, New Jersey.

– 1993. Proximate and developmental aspects of antipredator behaviour. *Advances in the study of behaviour*, 22: 135–238.

– 1998. Behavior as a tool for management: intervention for birds. In: *Behavioral ecology and conservation biology*: 80–100 (T. M. Caro, Ed.). Oxford University Press, New York.

Duke, G. E., Redig, P. T. & Jones, W., 1981. Recoveries and Resightings of Released Rehabilitated Raptors. Journal of *Raptor Research*, 15(4): 97–107.

Ellis, D. H., Dobrott, S. J. & Goodwin, J. G., 1977. Reintroduction techniques for Masked Bobwhites. In: *Endangered birds: management techniques for preserving threatened species:* 345–354 (S. A. Temple, Ed.). University of Wisconsin Press, Madison.

Fox, N., 1995. *Understanding the bird of prey*. Hancock House, Surrey

Génot, J. C. & Sturm, F., 2003. Bilan de l´expérience de reinforcement des populations de Cheveche d´Athena *Athene noctua* dans le Parc naturel regional des Vosges du Nord. *Alauda*, 71: 175–178.

Griffin, A. S., Blumstein, D. T. & Evans, C. S., 2000. Training captive–bred or traslocated animals to avoid predators. *Conservation biology*, 14(5): 1317–1326.

IUCN/SSC. Guidelines for Re–Introductions. http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Policy_statements/Reintroduction_guidelines.pdf (consulted on May 10th of 2011).

Kenward, R., 1987. *Wildlife radio tagging: Equipment, field techniques, and data analysis*. Academic Press, London.

Kleiman, D. G., 1989. Reintroduction of captive mammals for conservation: guidelines for reintroducing endangered species into the wild. *BioScience*, 39: 152–161.

Leicht, U., 1992. Erfahrungen mit der steinkauzzucht und der Auswilderung. *Naturschutzzentrum Wasserschloss Midwitz*, 2: 35.

Lima, S. L. & Dill, L. M., 1990. Behavioral decisions made under the risk of predation: a review and prospectus. *Canadian Journal of Zoology*, 68: 619–640.

Maloney, R. F. & McLean, I. G., 1995. Historical and experimental learned predator recognition in free living New Zealand robins. *Animal Behaviour*, 50: 1193–1201.

Mathews, F., Orros, M., McLaren, G. Gelling, M. & Foster, R., 2005. Keeping fit on the ark: assessing the suitability of captive–bred animals for release. *Biological Conservation*, 121: 569–577.

McLean, I. G., Hölzer, C. & Strudholme, B. J. S., 1999. Teaching predator–recognition to a naive bird: implications for management. Biological Conservation, 87: 123–130.

McLean, I. G., Lundie–Jenkisns, G. & Jarman, P. J., 1996. Teaching an endangered mammal to recognise predators. *Biological Conservation*, 75: 51–62.

McPhee, M. E., 2003. Generations in captivity increases behavioral variance: considerations for captive breeding and reintroduction programmes. *Biological Conservation*, 115**:** 71–77.

Miller, B., Biggins, D., Hanebury, L. & Vargas, A., 1994. Reintroduction of the black–footed ferret (*Mustela nigripes*). In: *Creative Conservation: interactive management of wild and captive animals:* 455–464 (P. J. S. Olney, G. M. Mace & A. T. C. Feistner, Eds.). Chapman and Hall, London.

Miller, B., Biggins, D., Wemmer, C., Powell, L., Hanebury, L. & Wharton, T., 1990. Development of survival skills in captive raised Siberian polecats (*Mustela eversmanni*) II. Predator avoidance. *Journal of Ethology*, 8: 95–104.

Mohr, H., 1989. Steinkäuze brüten wieder in Schwaben. *Gefierdete Welt*, 113: 308–309.

Möller, B., 1993. Erste Ergebnisse zur Wiedereinbürgerung des Steinkauzes (*Athene noctua*) in den Landkreisen Hildesheim und Peine. *Beiträge zur Naturkunde Niedersachsens*, 46: 72–81.

Parish, D. M. B. & Sotherton, N. W., 2007. The fate of released captive–reared grey partridges *Perdix*

perdix: implications for reintroduction programmes. *Wildlife Biology*, 13(2): 140–149.
Seddon, P. J., Armstrong, D. P. & Maloney, R. F., 2007. Developing the science of reintroduction biology. *Conservation Biology*, 21(2): 303–312.
Short, J., Bradshaw, S. D., Giles, J., Prince, R. I. T. & Wilson, G. R., 1992. Reintroduction of macropods (*Marsupialia*: *Macropoidea*) in Australia: a review. *Biological Conservation*, 62: 189–204.
Sokos, C. K., Birtsas, P. K. & Tsachalidis, E. P., 2008. The aims of galliforms release and choice of techniques. *Wildlife Biology*, 14(4): 412–422.
Stahl, D., 1982. Zucht und Auswilderung des Steinkauzes (*Athene noctua*). *Voliere*, 5: 178–180.
Van Nieuwenhuyse, D., Génot, J. C. & Johnson, D. H., 2008. *The Little Owl. Conservation, Ecology and Behavior of Athene noctua*. Cambridge University Press, Cambridge.