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Data on the effect of predation by an Eagle Owl (*Bubo bubo*) of captive origin on fauna of an island environment (Aves, Strigidae)

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Invasive species are today one of the main causes of decline in the biota of a region. This is particularly severe in island environments, where native biodiversity is much more vulnerable, above all due to the small size of their populations and unique evolutionary features brought about by isolation (see Russell *et al*., 2017 [*Environ. Conserv.* 44: 359-370] & refs. cited therein). Among exotic birds and specifically birds of prey, the escape of species held in captivity (e.g. for falconry or other recreational purposes) is seriously detrimental to their native relatives. Besides the risk of genetic introgression (see Rodríguez *et al*., 2019 [*J. Raptor Res.* 53: 189-197]), this is because they may compete for breeding sites and food, transmit diseases or prey on them directly (Krone *et al*., 2004 [*Vet. Rec.* 154: 110-113]; Naldo & Samour, 2004 [*J. Avian Med. Surg.* 18: 229-241]; Cugnasse *et al*., 2017 [*Ornithos* 11: 1-11]). Furthermore, their introduction for biological control purposes has had highly adverse consequences for local non-target taxa (Simberloff & Stiling, 1996 [*Biol. Conserv*. 78: 185-192]), such as seabirds in the Hawaiian archipelago following release of the American Barn Owl (*Tyto furcata*) for control of rats (*Rattus* spp.) in the 1950s (see Raine *et al*., 2019 [*Mar. Ornithol*. 47: 33-38]).

The consequences for native oceanic island fauna can be expected to be much more tragic when a top predator such as the Eagle Owl (*Bubo bubo*) is introduced, since it is even known to catch the largest numbers of other nocturnal raptors (Mikkola, 1983 [*Owls of Europe*]). The purpose of this note is therefore to provide data on the diet of an adult of this species, escaped from captivity on the island of Fuerteventura (eastern Canary Islands), and thereby contribute to evaluating its potential effect on the local fauna. The first record of its presence in the natural environment of the island dates back to November 2016 (L. M. Gutiérrez, pers.

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obs.). In January 2017, its calls were recorded (Pieterse [*Xeno-canto, XC356279*]) and in March 2019 it was finally captured and its origin elucidated (REDEXOS - Gobierno de Canarias).

The Eagle Owl was established during this period on Risco de Las Peñas (approx. 1 km^2), a rocky outcrop of plutonic origin which, as an interfluve, separates two ravines in the central-western part of the island (Betancuria Rural Park). It is a considerably steep place with little vegetation, dominated by scarps and gullies, as well as crevices, ledges and shallow caves of varying sizes. Together, these form a highly optimal environment for birds with a marked predilection for such rocky enclaves. Somewhat less rugged, the SE sector of the area is crossed by a road that includes a wide viewpoint, which is usually quite busy. In the surrounding areas there are more similar hills, a succession of small ravines where xeric-thermophile scrub predominates, a dam silted up with sediment covered with *Tamarix canariensis*, and some rural farmhouses with many cultivated plots.

Eagle Owl feeding data were obtained by analysing both complete and disaggregated (*c*. 82) pellets collected in 2017 (December) and 2019 (January, June, September and October) at the foot of several rock perches or plucking sites (e.g. Donázar & Ceballos, 1989 [*Ornis Scand.* 20: 117-122]) near its usual roosts. To determine the prey species, we took into account the high degree of bone fragmentation, selecting the most diagnostic parts and those belonging to mammals (e.g. dental and parietal remains, pelvis, proximal epiphyses of cubitus and femur) and birds (e.g. tarsus and sternum). Finally, in order to quantify the minimum number of individuals (MNI), as well as the trophic niche breadth, we proceeded to match these bony parts (see Laudet *et al.*, 2002 [*Acta Zool. Cracov*. 45: 341-355] & refs. cited therein) and applied Levin's index, $B = 1/\sum p_i^2$ (where p_i is the proportion each taxon; the values were standardised [*Bsta*] on the scale 0 [trophic specialisation] – 1 [wide range]: Krebs, 1998 [*Ecological methodology*]), respectively.

Eight taxa were identified from the 89 prey items counted, four introduced mammals and four birds (Table 1). The European Rabbit (*Oryctolagus cuniculus*), which made up about 88% of the total prey species, was by far the most depredated, especially individuals within the sub-adult age class. Together with the low diversity of prey species, this high rate of predation determined the level of dietary specialisation (B_{sta} = 0.04) (Table 1). Despite decreased abundance due to the arrival of variant 2 of viral haemorrhagic septicaemia (VHS), rabbits are a well distributed species on Fuerteventura (López-Darias & Lobo, 2009 [*Biodivers. Conserv*. 18: 3687-3704]) and still maintain acceptable densities in the game reserves. One of these areas corresponds to the that where the Eagle Owl became established (P. García, pers. comm.). In fact, the predominance of this introduced lagomorph as the main

Table 1.- Diet composition and niche breadth, based on a sample of *c*. 82 pellets, for an Eagle Owl (*Bubo bubo*) escaped from captivity on the island of Fuerteventura, Canary Islands. [a] Taxa grouped generically to calculate Levin's index. [b] Given its occurrence in the same pellet, this individual is likely associated with the capture of *Tyto alba*. Photo: owl at one of its roosting sites at Risco de Las Peñas on February 23, 2019 (© L. M. Gutiérrez).

Prey taxa	MNI (%)
Mammalia	
Rattus rattus[a]	1 (1.1)
Rattus sp.[a]	2 (2.2)
Mus musculus[b]	1 (1.1)
Atlantoxerus getulus	1 (1.1)
Oryctolagus cuniculus	78 (87.6)
Aves	
Alectoris barbara	2 (2.2)
Columba livia	2 (2.2)
Tyto alba	1 (1.1)
Aves indet.	1 (1.1)
B_{sta}	0.04

prey species on the island was to be expected, owing especially to its great importance in the owl's trophic spectrum in other latitudes (e.g. Pérez Mellado, 1980 [*Ardeola* 25: 83-112]; Donázar *et al*., 1989 [*Ornis Scand*. 20: 298-306]).

Among the remaining mammals captured, all with a minimal contribution to the diet, the Barbary Ground Squirrel (*Atlantoxerus getulus*) (Table 1) stands out because of its exclusively diurnal habits (van der Marel *et al*., 2019 [*Anim. Behav.* 151: 43-52] & refs. cited therein). Among the few options, we cannot rule out that this occurred due to alteration of the individual's activity pattern attributable to anthropic impact (M. López-Darias, pers. comm.) in the vicinity of the owl roost. In fact, there is a lookout point at which visitors habitually feed squirrels where they often remain until dusk (L. M. Gutiérrez, pers. obs.).

Within the small group of birds of prey, also with a low quantitative contribution to the diet (Table 1), the Barn Owl individual (*T. alba*) stands out starkly. Its attribution to the endemic subspecies of the eastern islands and islets, the Eastern Canary Islands Barn Owl (*T. a. gracilirostris*), makes this predation a worrying loss to the native island biota. This exclusive taxon appears as "Vulnerable" in the regional and national catalogues of threatened species. It currently has a very small popu-

Table 2.- Individuals of different species of the genus *Bubo* escaped from captivity in the Canary Islands (L = Lanzarote; F = Fuerteventura; T = Tenerife) that have been detected during recent decades. [a]Although unconfirmed, very likely an escaped bird; [b]almost certainly again the individual dealt with in this note. Sources: 2) Martín & Lorenzo, 2001 (*Aves del archipiélago canario*); 3) La Tahonilla Wildlife Rehabilitation Centre, Cabildo de Tenerife (*in litt*.); 4) rangers of the Fuerteventura Natural Protected Areas, Cabildo de Fuerteventura (pers. comm.); 5) rangers of the Tenerife Natural Protected Areas, Cabildo de Tenerife (pers. comm.); 6) this study.

Bubo species	*N*	Island	Date	Remarks	Source
B. bubo[a]	1	L	1980s	Electrocuted	2
B. bubo[a]	1	F	Dec 1993	Seen at Barranco de Río Cabras	2
B. bubo	1	T	Jun 2007	Recovered	3
B. bubo	1	T	Feb 2009	Recovered with band and injury	3
B. bubo	1	T	Feb 2009	Only wearing anklets	3
B. virginianus	1	F	Jan 2013	Recovered wearing anklets and bands	4
B. virginianus	1	T	Jul 2013	Not recovered	3
B. bubo	1	T	Dec 2013	Recovered	3
B. bubo	1	T	May 2014	Falconry	3
B. bubo	1	T	Mar 2015	Falconry	3
B. ascalaphus	1	T	Dec 2019	Electrocuted wearing anklets and bands	5
B. bubo[b]	1	F	Dec 2019	Settled at Risco de Las Peñas	6

lation on Fuerteventura (F. Siverio, pers. obs.), which is not exempt from other serious conservation problems (Siverio & Palacios, 2004 [in Madroño *et al.* (eds.), *Libro rojo de las aves de España*]). If we consider that the foraging radius of the Eagle Owl may even exceed 5 km (Mikkola, 1983; van Nieuland *et al*., 2018 [*Ardea* 106: 147-162]), it may have preyed on Eastern Canary Islands Barn Owls from at least two of their breeding territories. One of these latter coincides precisely with the enclave where it was settled (F. Siverio, pers. obs.). Moreover, considering the size of our sample of pellets, their rate of formation in *Bubo* (approx. 1 per day; Marti, 1973 [*Wilson Bull*. 85: 178-181]) and the time the individual remained at liberty (min. 850 days), we have only analysed about 10% of its total predatory activity in this study. This suggests that, apart from more owls, other birds with which it shares habitat could also have been its prey, including the Egyptian Vulture (*Neophron percnopterus*). This species, which is preyed upon by the Eagle Owl in other regions (Tella & Mañosa, 1993 [*J. Raptor Res*. 27: 111-112]), is in danger of extinction and constitutes a subspecies (*N. p. majorensis*) in the Canary Islands (Donázar *et al*., 2002 [*J. Raptor Res*. 36: 27-33]).

There is clearly a need to modify the current law on falconry in the Canary Islands, firstly in order to avoid genetic mixing between exotic and native birds of prey (Rodríguez *et al*., 2019). More generally, it is now urgent to draw up and approve regulations that prohibit the entry and/or possession on the islands –in both private and zoological centres– of species considered to be major predators, such as the genus *Bubo*. Its apparently strong ability to escape from captivity is proven by several known examples in the archipelago, among them the apparent recidivism of the individual described here (Table 2). Apart from damage to the local fauna (this study), recapture of these birds of prey escaped from zoos and private individuals –who use them for profit and/or recreation– involves considerable costs to public funds.

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