STRIATED CARACARA (*PHALCOBOENUS AUSTRALIS*) RESPONSES TO MICE AND NOVEL OBJECTS ON AN UNINHABITED ISLAND IN THE FALKLAND ISLANDS IN WINTER

Reacciones de carancho negro (*Phalcoboenus australis*) a lauchas y objetos novedosos en una isla deshabitada de las Islas Malvinas en invierno

ROBIN WOODS[1], JONATHAN MEIBURG[2] & DAVID GALLOWAY[3]

[1]68 Aller Park Road, Newton Abbott. TQ12 4NQ, UK.
[2]27 Grace Court, Brooklyn, NY 11201, USA.
[3]School of Education, Durham University, DH1 1TA, UK.

Correspondencia: David Galloway, dmgalloway@phonecoop.coop

ABSTRACT.- Previous reports have suggested that mice are not a food source for Striated Caracaras. It is not known whether this remains the case in winter, at a time of food shortage. Nor is it known how they would respond to dead or dying mice during an attempt to eradicate mice. We made systematic observations of responses to recently dead mice (*Mus musculus*). In addition, nutritionally inert "pseudo–mice" were used to compare the birds' responses to mice and previously unfamiliar objects. Only one out of 25 dead mice was eaten. However, caching behaviour was observed in 11 birds presented with dead mice. Over 33% of the cached mice had been removed in the subsequent 2–11 days. No pseudo–mice were cached or eaten, but Striated Caracaras spent longer interacting with them than with dead mice. The risk of secondary poisoning following an attempt to eradicate mice may be low, but cannot be ruled out. Striated Caracaras' interest in novel objects was confirmed.
KEY WORDS.- Falkland Islands, food sources, mice, mouse eradication.

RESUMEN.- Investigaciones anteriores han sugerido que las lauchas no son una fuente de alimento para los caranchos negros. Sin embargo, no se tiene antecedentes si esto sigue ocurriendo en invierno, frente a la escasez de alimento. Tampoco se conoce cómo responderían las aves frente a lauchas muertas o moribundas durante acciones de erradicación. Se realizaron observaciones sistemáticas de las reacciones de caranchos negros frente a lauchas recién muertas. Además, se usaron "pseudo–lauchas" nutricionalmente inertes para comparar las reacciones de las aves a lauchas y objetos previamente desconocidos. Sólo uno de 25 lauchas (*Mus musculus*) muertas fue consumida. Sin embargo, se observó conducta de almacenamiento (caching) en 11 aves expuestas a lauchas muertas. Las aves eliminaron más del 33% de las lauchas almacenadas en los 2–11 días posteriores. Ningúna pseudo–laucha fue almacenada o comida, pero las aves pasaron más tiempo interactuando con ellas que con las lauchas muertas. El riesgo de envenenamiento secundario por caranchos negros durante acciones de erradicación de lauchas puede ser bajo pero no puede descartarse. Se confirma el interés de los caranchos negros por objetos novedosos.
PALABRAS CLAVE.- erradicación de lauchas, fuentes de alimento, Islas Malvinas, lauchas.

Manuscrito recibido el 22 de junio de 2017, aceptado el 02 de octubre de 2017.

IINTRODUCTION

Introduced house mice (*Mus musculus*) may cause ecological damage in the Falkland Islands through predation of eggs and nestlings (Hall *et al*. 2002, Bolton & Stanbury 2011, Woods 2017), particularly to threatened or vulnerable native songbirds and seabirds. Mice are therefore a target for eradication as an invasive species. Poisons used in eradication may be harmful to native

wildlife (Eason *et al*. 2002, Phillips 2010) via direct consumption of poison baits by non–target species, or secondary consumption of target species by non–target species. The potential effects of poison baits on Striated Caracaras (*Phalcoboenus australis*) are a particular concern. Striated Caracaras are opportunistic predators and scavengers whose range is restricted to the Falklands and exposed islands in Chilean and Argentine Fuego–Patagonia. With an estimated global population of 1,500– 4,000 individuals they are classified as Near–Threatened (Meiburg 2006, IUCN 2017). They are known for their attraction to novel objects and food sources (Barnard 1979, Darwin 2003, Strange 1996) and thus, could be especially vulnerable to secondary poisoning; but on New Island in the Falklands, where at least 85 breeding pairs of Striated Caracaras live alongside introduced mice and rats, researchers noted that Striated Caracaras appeared to avoid consuming freshly-killed rodents (Catry *et al*. 2008).

House mice are present on Steeple Jason, an uninhabited, 8.75–ha island in the northwest of the Falklands archipelago which has been suggested by the Royal Society for the Protection of Birds as a candidate for an eradication attempt using brodifacoum–laced cereal baits (Bolton & Stanbury 2011, Rexer–Huber *et al*. 2013). From September through May, Steeple Jason supports globally significant populations of colonial seabirds including Black-browed Albatrosses (*Thalassarche melanophrys*), Southern Giant Petrels (*Macronectes giganteus*), Southern Rockhopper Penguins (*Eudyptes chrysoscome*)–and Thin–Billed Prions (*Pachyptila belcheri*) whose chicks, eggs, and adults are important food sources for Striated Caracaras. Steeple Jason held 63 breeding pairs in a 2006 survey, making it one of the most populous breeding islands for Striated Caracaras in the Falklands (Woods 2007, 2017).

Winter months from June to August when seabird colonies are largely absent would seem to be a time of food shortage. Groups of first–winter and sub-adult Striated Caracaras often appear around human settlements in winter. On Saunders Island Rexer–Huber and Bildstein (2012) found that they had lost 14% of their summer weight; they scavenged for carrion and invertebrates and supplemented their diets with offal and refuse from farms. On Steeple Jason, however, an adult population equal in number to the summer breeding population appeared to overwinter and relied on different food resources than in the summer (Woods 2017).

We aimed to conduct systematic observations of Striated Caracaras' responses to dead mice. As a result of observations while investigating this we added two further aims: (a) to investigate caching behaviour following presentation of recently dead mice; (b) to compare responses to recently dead mice with responses to previously unfamiliar objects.

MATERIALS AND METHODS

Systematic observations of responses to dead mice

We conducted 25 trials, all but one with Striated Caracaras fitted with alphanumeric ID bands: 16 adults, 8 first winter birds and 1 sub–adult (aged 2 to 4). In each trial we presented a freshly–killed mouse to a target bird that was actively foraging for invertebrates in a large area of disturbed degraded peat by hand–tossing it to within 1 m of the bird. We then recorded the bird's reaction and the time between presentation of the mouse and the end of visible interest in it.

Caching behaviour

We observed Striated Caracaras caching 11 mice. In a banding program we conducted five trials in which we hand–tossed a dead mouse towards a group of birds interested in the mutton bait laid down for trapping. Four of the mice were cached, three by the same individual. These caches were checked twice daily over the next 18 days or until each mouse had been removed. In addition six mice were cached in the study of responses to dead mice described above and one mouse was cached in a different part of the island. Because of the timing of this part of the research these caches could not be checked as frequently.

Responses to previously unfamiliar objects

We investigated Striated Caracaras' attraction to novel objects and food sources in two ways. First we presented a piece of cooked beef to five separate caracaras to examine whether they would consume a presumably unfamiliar edible object. Second, we created 20 "pseudo–mice" from pieces of rolled, corrugated cardboard with no food value, approximately 5x3 cm, tied with a piece of cotton string, to test their reaction to novel objects. We conducted 20 trials with different individuals, (12 adults, 1 sub–adult, and 7 first winter) and recorded the time between presenting the "pseudo–mouse" and the end of the target bird's visible interest in it. We then used the Mann–Whitney U test to compare these figures with the time spent on the dead mice.

RESULTS

Systematic observations of responses to dead mice

In 24 of the 25 trials (96%) the target bird and/or another caracara feeding nearby picked up the mouse or pecked at it. In one trial the caracara merely stopped feeding, looked at the mouse and preened before flying 10 m

and continuing to rake the soil for invertebrates. In six trials (24%) the mouse was cached (see below). In one trial a first winter bird with no crop visible ate the mouse, picking it up within three seconds of presentation and swallowing it whole within 1 minute. We presented another dead mouse to this bird 17 minutes later. It immediately began eating the mouse, holding it down with its talons and tearing off pieces. The mouse was entirely consumed within three minutes. In all other trials the target birds' interest appeared inquisitive or exploratory, but did consume the mice. There were no attempts to remove fur, let alone eat the mouse. There were few signs of aggressive behaviour, and no evidence that they regarded mice as food.

Caching behaviour

Six of the 11 mice remained in the cache, apparently untouched, until we left the island between 6 and 18 days later. One had been moved, but remained within the cache site. Four had been removed. Of these 2 were removed between day 2 and day 3 after caching, one between days 6 and 9 and the other between day 10 and day 11.

Responses to previously unfamiliar objects

Each of the five target birds appeared to identify the cooked beef as food almost immediately. In all five trials it was consumed within 30 seconds.

No Striated Caracaras attempted to eat a "pseudo–mouse", nor were they seen to cache one. On the other hand, in most of the 20 trials the target caracara showed more interest in the inedible "pseudo–mouse" and spent significantly longer manipulating it than birds presented with actual mice ($U = 237.5$, $z = 5.0$, $p < 0.001$). In seven trials (35%), the "pseudo–mouse" was pulled to pieces; in nine trials (45%), the caracara lost interest in the "pseudo–mouse" and/or resumed foraging for invertebrates, and in four trials (20%), the target bird flew out of sight with or without the "pseudo–mouse."

DISCUSSION

The observation that in all but one of our trials Striated Caracaras did not immediately eat dead mice appears broadly consistent with other evidence that mice are not a typical or preferred food source (Catry *et al*. 2008). Striated Caracaras are mostly diurnal, and the nocturnal behaviour and tall grass habitats preferred by mice may protect them from predation by Striated Caracaras. However, as or given that one of our target birds consumed two dead mice, and 24% of birds presented with a dead mouse cached it, we cannot rule out the possibility that the birds regarded, or could come to regard, mice as food or potential food. Striated Caracaras are known for being opportunistic, flexible, and for feeding on carrion; if dead mice were conspicuously available following an eradication attempt, the risk of secondary poisoning could not be discounted. Direct consumption of cereal baits by Striated Caracaras is also a concern, as shown by Rexer–Huber *et al*. (2013).

Striated Caracaras frequently cache food items, including seabird and penguin chicks (Strange 1996). Although caching is not in itself evidence that the birds regarded mice as food items, the absence of caching behaviour with "pseudo–mice" suggests the possibility of a continuing interest when potential prey objects are cached. Striated Caracaras may follow the lead of conspecifics in identifying new sources of food, as Biondi *et al*. (2010) showed in Chimango Caracaras (*Milvago chimango*).

The fact that Striated Caracaras spent significantly more time investigating "pseudo–mice" than recently dead mice is in keeping with their history of interest in novel objects, a behaviour also observed in Chimango Caracaras (Biondi *et al*. 2015). This behaviour is reminiscent of Heinrich's (1995) observation that although the initial attraction of an item to young Common Ravens (*Corvus corax*) depended on its novelty rather than its palatability, inedible items were soon discarded. It is also consistent with the interest of young Keas (*Nestor notabilis*) New Zealand in inedible objects including windshield wipers and boot laces in southern (Diamond & Bond 1999). Like Keas, Striated Caracaras are non–migratory, have a limited range, and face periods of the year when food resources are unpredictable and unevenly distributed; their attraction to novel objects may be an adaptive response to similar environmental pressures, leading to early discovery of new food resources.

ACKNOWLEDGEMENTS.- This work was partly–funded by a Darwin Initiative Grant: Falkland Raptors – Reducing Conflict with Rural Livelihoods. Graham Harris and the Wildlife Conservation Society granted permission to stay in the Steinhardt Field Station on Steeple Jason. Rob McGill and Michael Clarke provided essential logistical support. Hawk Mountain Sanctuary's Director of Conservation Science, Keith Bildstein, directed the banding program and permitted use of relevant data. We received extensive support and advice from the RSPB team investigating aspects of mouse winter biology and assessing the effectiveness of aerial baiting and risk to non–target species, led by Kalinka Rexer–Huber with support from Graham Parker, Micky Reeves, and Andy Stanworth. We are extremely grateful to two anonymous referees for their critical, but constructive and helpful comments on the first draft of this paper.

LITERATURE CITED

Barnard, C.H. 1979. *Marooned: being a narrative of the sufferings and adventures of Captain Chalrles H. Barnard. Embracing an account of the seizure of his vessel at the Falkland Islands & c., 18–12–1816*. Wesleyan, Middletown, USA. 276 pp.

Biondi, L.M., G.O. Garcia, M.S. Bo & A.I. Vasallo. 2010. Social learning in the Caracara Chimango *Milvago Chimango* (Aves: Falconiformes): An age comparison. *Ethology* 116: 722–735.

Biondi, L.M., J.M. Guido, M.S. Bo, R.N. Muzio & A.I. Vasallo. 2015. The role of stimulus complexity, age and experience in the expression of exploratory behaviour in the Chimango Caracara *Milvago chimango*. *Animal Cognition* 18: 139–150.

Bolton, M. & A. Stanbury. 2011. *Assessing the impact of house mice* Mus musculus *on the native flora of Steeple Jason, Falkland islands.* Report to Falklands Conservation and Royal Society for the Protection of Birds. RSPB, Sandy, Beds., UK. 11 pp.

Catry, P., M. Lecoq & I.J. Strange. 2008. Population growth and density, diet and breeding success of Striated Caracaras *Phalcoboenus australis* on New Island, Falkland Islands. *Polar Biology* 31: 1167–1174.

Darwin, C. 2003. *The voyage of HMS Beagle*. Folio Society edition, London, UK. 518 pp.

Diamond, J. & A.B. Bond. 1999. *Kea; Bird of paradox. The evolution and behaviour of a New Zealand parrot*. University of California Press, Los Angeles, USA. 244 pp.

Eason, C.T., E.C. Murphy, G.R.G. Wright & E.B. Spurr. 2002. Assessment of risks of brodifacoum to non–target birds and mammals in New Zealand. *Entoxicology* 11:35–48.

Hall, J.R., R.W. Woods, M.deL. Brooke & G.M. Hilton. 2002. Factors affecting the distribution of landbirds on the Falkland Islands. *Bird Conservation International* 12:151–167.

Heinrich, B. 1995 Neophilia and exploration in juvenile common ravens *Corvus corax*. *Animal Behaviour* 53: 695–704.

IUCN. 2017. The IUCN Red List of Threatened Species. Version 17–2. www.iucnredlist.org. Downloaded 25th September 2017.

Meiburg, J.A. 2006. *The biography of Striated Caracaras* Phalcoboenus australis. MA thesis, University of Texas at Austin, Austin, USA.

Phillips, R.A. 2010 Eradication of invasive mammals from islands: why, where, how and what next? *Emu* 110: i–vii.

Rexer–Huber, K. & K.L. Bildstein. 2012. Winter diet of Striated Caracara *Phalcoboenus australis* (Aves, Polyborinae) at a farm settlement on the Falkland Islands. *Polar Biology* 36: 437–443.

Rexer–Huber, K., G.C. Parker, M. Reeves, A. Stanworth & R.J. Cuthbert. 2013. Winter ecology of house mice and the prospect of their eradication from Steeple Jason (Falkland Islands). *Polar Biology* 36: 1791–1797.

Strange, I.J. 1996. *The Striated Caracara* Phalcoboenus australis *in the Falkland Islands*. Privately published, Stanley, Falkland Islands. 56 pp.

Woods, R.W. 2007. *The distribution and abundance of Striated Caracaras* Phalcoboenus australis *in the Falkland Islands, 2006*. Falklands Conservation, Stanley, Falkland Islands. 45 pp.

Woods, R.W. 2017. *The birds of the Falkland Islands: An Annotated Checklist*. British Ornithologists' Club, Tring, UK. 256 pp.