Potential for primary poisoning of a Critically Endangered endemic land bird during rodent eradication operations at Gough Island, Tristan da Cunha

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Abstract

Eradicating introduced rodents from islands restores these communities, but operations must mitigate bait uptake by non-target species to ensure adequate bait coverage, and minimize mortality of non-target species. Ingestion of toxic bait is a recognised risk for scavenging birds, but is also a concern for generalist feeders. Gough Island, Tristan da Cunha, in the South Atlantic Ocean, has introduced house mice (*Mus musculus*) that negatively affect the island ecosystem. It is also home to the endemic globally threatened Gough bunting (*Rowettia goughensis*), a generalist that may be affected by primary poisoning. We presented 26 wild individuals with non-toxic bait pellets and observed their reactions for up to 30 min, or until they flew away. While 23% of Gough buntings did not react to bait pellets, 77% showed some level of interest. Generalist feeders, such as Gough bunting, may also be at risk of primary poisoning during rodent eradication operations.

Introduction

Introduced rodents can cause significant damage to island ecosystems (Atkinson, 1985; Jones et al., 2008; Kurle et al., 2008; Angel et al., 2009), affecting the entire community, including plants, invertebrates, and vertebrates (Croll et al., 2005; Kurle et al., 2008; Mulder et al., 2009; Towns et al., 2011). Since the 1970s, hundreds of island ecosystems have been restored by eradicating introduced vertebrates (Towns & Broome, 2003; Howald et al., 2007; Russell & Holmes, 2015), to the benefit of island communities, especially their avifauna (Jones, 2010; Lavers et al., 2010). Operationally, this is often accomplished by helicopter-based delivery of rodenticide in cereal bait pellets (Towns & Broome, 2003; McClelland, 2011; Keitt et al., 2015).

Such rodent eradication operations are not without their challenges. Native species may compete for bait pellets, which reduces bait availability for target species (Cuthbert et al., 2012; Engeman et al., 2013), and has the potential to cause non-target mortality (Wanless & Wilson, 2007; Wanless et al., 2010; Parkes et al., 2011), although the exposure pathways of non-target species to rodent anticoagulant can be poorly known (Rattner et al., 2014). Risks of primary and secondary poisoning can be mitigated in part by bringing a population into captivity during the eradication operations (Wilkinson & Priddel, 2011).

Introduced house mice (*Mus musculus*) were introduced to Gough Island, Tristan da Cunha in the 19th century, and cause significant negative effects on the island's avifauna (Cuthbert & Hilton, 2004; Wanless et al., 2007; Davies et al., 2015; Dilley et al., 2015). The 6500 ha island presents several operational challenges owing to its remoteness, rugged terrain, and potential for non-target mortality among scavengers (e.g., Subantarctic Skuas, *Stercorarius antarcticus*) and land birds (Cuthbert et al., 2011a; Cuthbert et al., 2011b; Rexer-Huber & Parker, 2011; Cuthbert et al., 2014).

Gough buntings (*Rowettia goughensis*) are endemic to the island, and are classified as Critically Endangered by the IUCN, with a population of approximately 1000-1400 individuals,

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and are negatively affected by the mice (Cuthbert & Hilton, 2004; Ryan & Cuthbert, 2008; Birdlife International, 2015b). Preliminary work suggested that Gough buntings were unlikely to be susceptible to primary poisoning by ingesting cereal bait pellets, but was based on a relatively small sample size (Wanless et al., 2010). Here, we examined how wild Gough buntings reacted with non-toxic cereal pellets, particularly during the winter when other food sources are likely to be scarce, and the likely time of any mouse eradication attempt.

Materials and methods

From 4 April-19 July 2015, we encountered Gough buntings opportunistically in southeastern Gough Island (40° 21´ S, 9° 55´ W), and presented them with 2-11 non-toxic cereal bait pellets (Pestoff 20R; Cuthbert et al., 2011a) pale green in colour, and weighing approximately 1 g. These are identical (other than lacking the rodent anticoagulant) to the bait that will be used during the proposed mouse eradication. Any bunting that allowed close approach was tested; this created a bias towards juvenile birds, which tend to be more approachable. Pellets were tossed to within 1-2 m from birds, and birds were observed until they flew away from the vicinity. We scored the reactions of buntings to the bait on a scale of 0-3, where 0 represented no reaction, 1 a minimal reaction (pecking at, but not eating any of the pellet), 2 a moderate reaction (picking up the pellet, but apparently not eating any), and 3 a large reaction (ingesting a portion of a pellet). Most trials used dry pellets, but two trials were conducted with soft, moist pellets.

Results

We recorded the reactions of 26 Gough buntings to bait pellets: 22 juveniles and 4 adults (3 males and 1 female). Six (23%) ignored the bait pellets entirely, but 20 (77%) inspected the pellets, with 5 (19%) scored as minimal reaction, 13 (50%) as moderate reactions, and 2 (8%) as large reactions. Only juveniles were observed to eat pellets. Both trials with moist pellets were presented to juveniles; one showed no interest, while the other ingested part of a pellet, and carried another away.

Discussion

Wanless et al. (2010) suggested that Gough buntings would not be at risk of primary poisoning through cereal bait ingestion, but only tested the reactions of 6 wild and 4 captive individuals of unknown age. We found that while both adult and juvenile birds showed interest in bait pellets, only juveniles were seen to consume them. This could be because of the low number of adults encountered opportunistically during our trials, which were often in lowlands where the breeding population is lower (Ryan & Cuthbert, 2008).

Gough buntings have a mixed diet consisting of invertebrates, seeds, and berries, and are often seen digging and pulling up vegetation (Ryan & Cuthbert, 2008). Birds with such a general diet are probably more likely to ingest bait pellets than more specialised feeders. Brodifacoum in invertebrates can also cause secondary poisoning in land birds (Masuda et al., 2014). This

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demonstrates that during rodent eradication operations, generalist feeders, in addition to predatory or scavenging species, have the potential for both primary and secondary poisoning.

The eradication of mice from Gough Island will be a complex and highly challenging endeavour. The island is > 2800 km from land, is surrounded by high cliffs, deep valleys, and has complex cave areas (Cuthbert et al., 2011a; Cuthbert et al., 2011b; Cuthbert et al., 2014). Gough Moorhens (*Gallinula comeri*) are also endemic, are listed as Vulnerable by the IUCN (Birdlife International, 2015a), and their well-known scavenging behaviour and preliminary trials suggest they will ingest bait pellets (Wanless & Wilson, 2007; Wanless et al., 2010), necessitating a captive population while bait pellets remain available (Rexer-Huber & Parker, 2011). Our results show that a similar approach will be required for Gough bunting.

Planning for addressing non-target mortality prior to eradication operations is important, though often inadequate, as is monitoring mortality and tissue concentrations of rodenticides following eradication operations (Keitt et al., 2015; Pitt et al., 2015). Gough buntings are present on at least one mouse-free offshore islet, Penguin Island, which may act as a partial refugium (Ryan & Cuthbert, 2008; Wanless et al., 2010). Though the risk may be relatively low, as Wanless et al. (2010) suggested, as a precautionary measure, a population of Gough buntings will likely be kept captive during the eradication of house mice from Gough Island.

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