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Source: *Ardea*, 95(2) : 311-315

Published By: Netherlands Ornithologists' Union

URL: <https://doi.org/10.5253/078.095.0213>

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Predatory behaviour of the Gough Moorhen *Gallinula comeri*: conservation implications

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Wanless R.M. & Wilson J.W. 2007. Predatory behaviour of the Gough Moorhen *Gallinula comeri*: conservation implications. *Ardea* 95(2): 311–315.

The Gough Moorhen is endemic to Gough Island and is classified by the IUCN as Threatened. We present several observations of Gough Moorhens preying on introduced House Mice *Mus musculus* and on eggs and chicks of burrow-nesting procellariiform seabirds. The incidence of egg predation is almost certainly related to incubation breaks or abandonment. We estimate that Moorhens could access and depredate unattended eggs of at least five species but levels of predation appear to be low and are unlikely to affect population parameters of impacted species. Moorhens hunting live mice and scavenging carcasses presents a significant conservation concern. A possible eradication of mice from Gough Island is likely to employ poisons that are toxic to the Moorhens. Therefore secondary poisoning of Moorhens, by eating poisoned mice, is a threat to the Gough Moorhens. An eradication effort will be required to take appropriate mitigation measures. The introduced Gough Moorhen population on Tristan da Cunha serves as an ex situ population and could, if required, be used to re-stock Gough.

Key words: Gough Moorhen *Gallinula comeri*, conservation, predatory behaviour, Gough Island

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Introduction

The Gough Moorhen *Gallinula comeri* is endemic to the lowlands of Gough Island, South Atlantic Ocean (Fig. 1) (Watkins & Furness 1986). It was introduced to Tristan da Cunha, c. 400 km NNW of Gough Island, in 1956 (Angel & Cooper 2006), where it now thrives as an ecological replacement for the extinct Tristan Moorhen (A. Beintema,

pers. comm., RMW pers. obs.). Although the Gough Moorhen is categorised as Threatened (BirdLife International 2004), little is known about the species apart from a basic description of breeding biology and crude population estimates (Richardson 1984, Watkins & Furness 1986, Cuthbert & Sommer 2004). They are known to feed on invertebrates, plant matter and carrion.

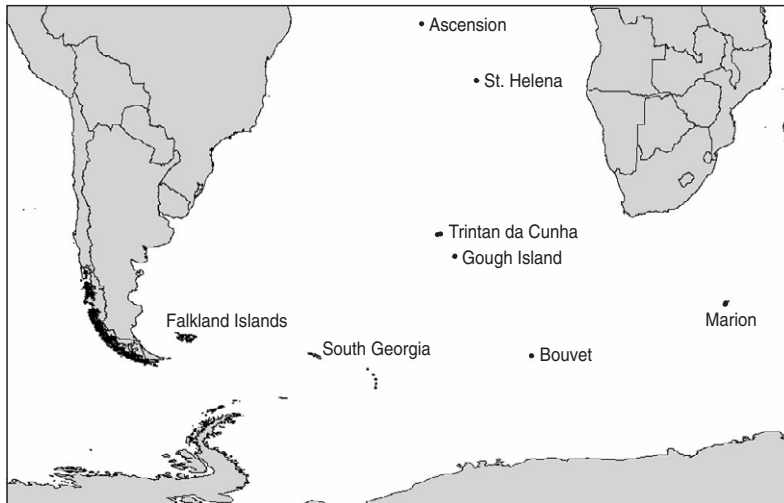


Figure 1. The southern Atlantic and Indian oceans, showing the position of Gough Island (40°19'S, 09°33'W) relative to other islands and continents.

The House Mouse *Mus musculus* is the only introduced mammal on Gough Island. It has recently been demonstrated that Gough mice are capable of depredate the chicks of burrow-nesting and surface-nesting procellariiform seabirds (Wanless *et al.* 2007). This is a major conservation concern for the seabirds of Gough, especially for the Tristan Albatross *Diomedea dabbenena* (Red-list status: Endangered) and Atlantic Petrel *Pterodroma incerta* (Red-list status: Vulnerable), both functionally endemic to Gough. As a consequence of this discovery, serious consideration is being given to the possibility of eradicating mice from Gough by means of aerial broadcast of toxic baits.

This paper reports new observations of predatory behaviour in Gough Moorhens. We also consider the conservation implications of these data for the Moorhen in the light of a possible toxic bait operation.

Methods and Results

MOORHENS EATING HOUSE MICE

During research on the introduced House Mouse on Gough Island (2003–2006), we regularly observed Moorhens at mouse trapping sites. At

live-trapping sessions Moorhens sometimes actively pursued and preyed on the mice being released. During snap-trapping sessions, Moorhens went to considerable lengths to scavenge trapped mice and accounted for significant trap failure and loss of trapped mice (RMW unpublished data). In addition to these observations, JWW witnessed active mouse predation by Gough Moorhens away from mouse trapping sites. In this instance, a mouse was heard squealing, close to a path in an area where no mouse trapping had been conducted. On closer investigation, two Gough Moorhens were found eating a very fresh mouse carcass. From the mouse squeals heard and the fresh state of the mouse carcass, we assume that the Moorhens had preyed on the mouse.

MOORHENS DEPREDATING SEABIRD NESTS

Gough Moorhens regularly enter the burrows of larger seabirds, apparently in search of food (Watkins & Furness 1986, this study). We have three records of Gough Moorhens depredate burrowing seabird nests. The first record was of a Moorhen that had brought an unguarded Great Shearwater *Puffinus gravis* egg from the nest

chamber to the burrow entrance. It was eating the egg when discovered, but was disturbed by the observer and left. Approximately seven minutes later the egg had disappeared.

RMW studied the breeding success of Atlantic Petrels on Gough Island from March to September 2004 (to be reported elsewhere). Small cameras and infrared LEDs were placed inside burrows, and activities were filmed on VHS cassettes using time-lapse video recorders, filming continuously at 1 frame per second. Video and nest checks show that Atlantic Petrels will occasionally break incubation for short periods, leaving the egg unguarded. On one occasion an adult was filmed abandoning an egg. The following day, a Gough Moorhen was captured on film entering the burrow and eating the contents of the egg (Fig. 2). Prior to this, the video also showed at least two House Mice repeatedly attempting to eat the egg, but failing each time.

For the third observation, RMW heard the distress calls of an Atlantic Petrel chick. Upon investigating, an adult Moorhen was seen on the surface attacking a wounded chick. The Moorhen reluctantly moved away from the chick at the approach of the observer and continued to show strong interest until the chick was removed. The chick had recent, but dry wounds on its back and rump, one of which was bleeding afresh. It died half an hour later. The wounds were consistent with those caused by mouse attacks (Wanless *et al.* 2007). We assume that the Moorhen entered the burrow containing the chick that had already been weakened by mouse attacks. Mice (being largely nocturnal) occasionally desist attacks at dawn (RMW unpubl. data), which would explain the recent, but dry wounds. The Moorhen then presumably carried the chick to the surface and began to attack, causing the fresh bleeding to an existing wound.

Discussion

Mice pose a significant threat to Gough Island's biodiversity (Jones *et al.* 2003, Wanless *et al.* 2007). Plans to eradicate the mice, using poisons proven to be effective against mice but which are also toxic to birds, are well advanced (Brown



Figure 2. Still images captured from video showing (A) a House Mouse attempting to eat an unattended Atlantic Petrel egg, and (B) a Gough Moorhen inside the same burrow, a few hours later (note date and time data on top left hand corner of images) eating the egg.

2005, Angel & Cooper 2006). Gough Moorhens both prey on House Mice and scavenge their carcasses, placing them at significant risk of secondary poisoning (from eating poisoned mice) in the event of a toxic bait operation. Therefore any eradication operation on Gough Island that broadcasts rodenticide should include a plan to mitigate the effects or safeguard the Gough Moorhen population from secondary poisoning, e.g. taking a captive population. Fortunately for Gough Moorhen conservation, their introduction on Tristan da Cunha established another population. In the (unlikely) event of incidental elimination of the

entire Gough Moorhen population during a toxic bait operation, birds from Tristan could be used to reintroduce the species to Gough.

Gough Island is the breeding site for 12 burrowing seabird species (Swales 1965). Three of these (Great Shearwater, Grey Petrel *Procellaria cinerea* and Great-winged Petrel *Pterodroma macroptera*) excavate burrows that are similar in size to or larger than those of Atlantic Petrels. The Great Shearwater's breeding habitat overlaps completely with the habitat range of the Moorhen and that of the Grey and Great-winged petrels does so partially. Thus, if these seabirds exhibit temporary egg abandonment, Moorhens will probably depredate their eggs too; this study shows that Great Shearwater eggs are indeed abandoned and are depredated by Moorhens. The Broad-billed Prion *Pachyptilia vittata* breeds both in burrows and in caves, mostly within the habitat range of the Moorhen. Prion burrow nests would not be vulnerable to predation by Moorhens as the entrances are too small. However, unattended eggs in caves could also be subject to opportunistic predation by Moorhens. We speculate that the Moorhen can depredate the nests of as many as five native seabird species.

Procellariiform seabirds lack appropriate behaviours to avoid terrestrial predators (Moors & Atkinson 1984). Those procellariiforms breeding on islands in the high southern latitudes have had to evolve strategies to cope only with predatory Skuas (*Catharacta* spp.) and Giant-Petrels (*Macronectes* spp.). For the smaller species, the main strategy for avoiding predation is to nest in burrows underground. An advantage of burrows that are secure from nest predators is that adults are able to break incubation and leave their eggs temporarily unattended (Moors & Atkinson 1984, Roby & Ricklefs 1984, Warham 1990). Furthermore, the constraints of provisioning a chick are such that adults stop brooding as soon as chicks can thermoregulate independently. On Gough Island, burrow-nesting Atlantic Petrels and Great Shearwaters stopped brooding after 2–3 days (RMW unpubl. data). Very young chicks are expected to have a constrained capacity to defend

themselves. This makes them more vulnerable to attack by both mice and Moorhens.

Many rallids, especially insular species, are generalist and opportunistic foragers that readily take eggs (Taylor & van Perlo 1998), including burrowing seabird eggs (e.g. Bester *et al.* in press). These are the first records of active predation of seabird eggs and chicks by Gough Moorhens. Procellariiform seabirds are unable to lay more than a single egg per breeding attempt and are unable to lay a replacement egg (Warham 1990). Therefore the loss of an egg automatically translates into zero breeding success for that year. For now it appears that predation levels are low and probably limited to abandoned eggs and moribund chicks, in which case the population-level impacts for the affected seabird species are probably negligible. Of greater concern, the difference between preying on weakened versus healthy chicks may not be great, and this behaviour may not have reached its evolutionary endpoint. Such effects are especially concerning when considered in concert with the effects of predatory mice on Gough's burrowing petrels (Wanless *et al.* 2007). Last, it is worth considering how nest predation affects the incidence and nature of incubation breaks in those procellariiforms whose breeding range overlaps with rallids.

Logistical support at Gough Island was provided by the South African Department of Environmental Affairs and Tourism through the South African National Antarctic Programme, and research conducted with the permission of the Administrator and Island Council of Tristan da Cunha. RMW is supported by an NRF Prestigious Scholarship. Andrea Angel, Albert Beintema and Craig Symes provided useful comments to earlier versions of this manuscript.

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SAMENVATTING

Op het in de zuidelijke Atlantische Oceaan gelegen eilandje Gough komt het endemische Goughwaterhoen *Gallinula comeri* voor, dat wordt aangemerkt als een bedreigde vogelsoort. Uit waarnemingen van de auteurs blijkt dat het Goughwaterhoen Huismuisen *Mus musculus* eet, een zoogdier dat door toedoen van de mens het eiland heeft bereikt. Ook eieren en jongen van stormvogelachtigen staan op het menu van de waterhoentjes. De predatie van eieren vindt waarschijnlijk vooral plaats als de broedende zeevogels het nest hebben verlaten om voedsel te zoeken of nadat ze het nest in de steek hebben gelaten. Naar schatting kunnen de waterhoentjes nesten van vijf verschillende zeevogelsoorten prederen, waaronder die van de Grote Pijlstormvogel *Puffinus gravis* en Schlegels Stormvogel *Pterodroma incerta*. Maar de predatiedruk wordt laag geacht en het is onwaarschijnlijk dat de waterhoentjes enig effect op de zeevogelpopulaties hebben. De vaststelling dat de waterhoentjes muizen eten noopt tot grote voorzichtigheid bij het beheer van het eiland. Er bestaan namelijk plannen om de geïntroduceerde muizen te verdelgen, waarbij mogelijk stoffen worden gebruikt die ook voor de waterhoentjes giftig zijn. Mocht er voor het Goughwaterhoen iets misgaan bij deze operatie, dan zou als uiterste maatregel kunnen worden overwogen om het eiland te rekoloniseren vanuit het naburige Tristan da Cunha. (JP)

Corresponding editor: Jouke Prop

Received 23 November 2006; accepted 17 August 2007