Ascension Island Biodiversity Action Plan

BLACK RAT (*Rattus rattus*)

Photo: M. Lambert

SUMMARY

Taxonomy: Kingdom: Animalia; Phylum: Chordata; Class: Mammalia; Order: Rodentia; Family: Muridae; Genus: Rattus; Species: *Rattus rattus*

Nativeness: Introduced, naturalised

Description: Widespread, omnivorous rodent commonly dispersed by people. Occurs in several colour morphs with fur ranging from black to tawny brown. Can be distinguished from the related brown rat (absent from Ascension Island) by its smaller ears, pointed face and a longer, hairless tail that is used for balance. Highly arboreal in wooded areas, preferring a diet of fruit and seeds where available, but will consume a wide range of food items, including predating small animals and eggs.

Local trend: Increasing

Impacts: Known predators of green turtle hatchlings and of seabird eggs and chicks, particularly those of sooty terns. May facilitate the spread of certain invasive weeds. Unknown impacts on terrestrial invertebrates but may predate larger species and compete with native land crabs in some habitats.

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2. Distribution

Global

Native to tropical Asia, but is one of the world's most widely introduced species, with a global distribution that includes all continents except Antarctica and numerous oceanic islands [1]. It is particularly common in coastal, tropical areas, having been displaced from many temperate regions by the Norway rat (*R. norvegicus*).

Local

Although their exact distribution has never been mapped, black rats are known to occur in all habitat types on the main island of Ascension, from the summit of Green Mountain to sea level [2]. According to trapping indices, densities are highest in sooty tern colonies, Mexican thorn scrub and around some turtle nesting beaches, moderate in montane habitats and guava scrub, and lowest in native, semi-desert grassland [2]. However, detection rates in trapping studies may be influenced by a range of factors, including habitat complexity and the availability of alternative food sources, so these results must be treated with caution. Rats have never been documented on the major seabird nesting islet of Boatswain Bird Island, or on any other offshore stacks, despite these being within the known swimming range of black rats (300–750 m; [3]). Steep cliffs, strong currents and wave action, and an abundance of predatory fish may act as an effective barrier, although periodic verification of their absence would be advisable.

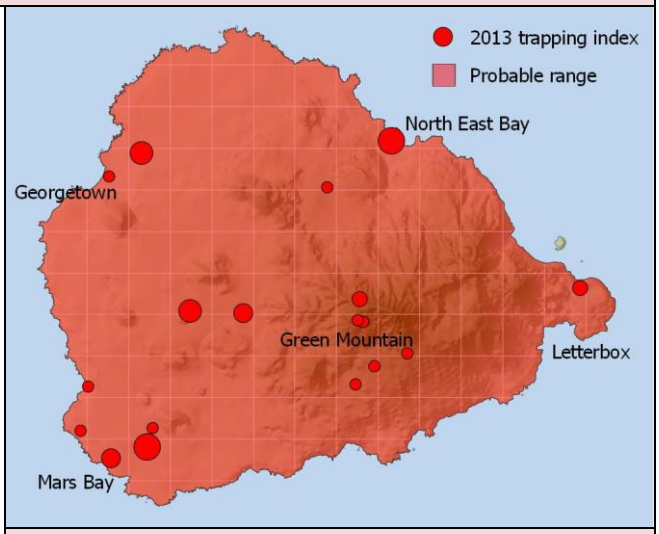

Figure 1. Approximate distribution of black rats on Ascension Island. Symbols show the location of habitat-stratified trapping grids used by Dawson [2] and are scaled according to trapping rates. Overall distribution is inferred from this study, other trapping work and casual observations.

3. Status

Population estimate:	Unknown	Trend:	Increasing

Black rats were introduced to Ascension Island from passing ships sometime before 1701 [4]. Both Dampier, shipwrecked on the island in 1701, and Hasenbosch, marooned in 1725, found them to be abundant [4,5]. In the 19th Century the British Admiralty introduced cats and barn owls (now extinct) in an effort to control the burgeoning rodent population [4], and paid a bounty for their capture [6]. Rats apparently remained abundant in montane areas throughout the 20th century, but were reported to be scarce in arid, low-lying areas [4,7]. Two factors have acted to change this situation in recent decades. The eradication of feral cats between 2001 and 2004 appears to have released rodents from predation, resulting in a significant increase in rat abundance and a substantial increase in body size (and presumably longevity) around coastal seabird nesting colonies, particularly those of the sooty tern [8]. In addition, the rapid spread of Mexican thorn (*Prosopis juliflora*) across much of the coastal lowlands since its introduction in the late 1960s has greatly expanded the area of suitable habitat. Indeed, in a 2013 study, rat abundance indices in thorn scrub were approximately 10 times higher than in the native grassland and semi-desert habitats it has replaced, with *Prosopis* bark and seeds featuring prominently in their diets [2]. Thus, while accurate abundance estimates are lacking, it is reasonable to assume that the black rat population has increased significantly in recent decades, particularly at lower elevations.

4. Ecology

Habitat & diet

Black rats are generalist omnivores, although apparently favour a diet of fruit and seeds where available [3,9]. They are agile climbers and are highly arboreal in wooded areas [3]. Home ranges are typically between 0.2 and 1 hectare, depending on environment [10,11]. Black rats occur in all habitat types on Ascension Island, and occupy a broad

niche, ranging from a predominantly herbivorous diet in inland, montane areas to a predominantly carnivorous diet in more sparsely-vegetated coastal areas [2]. Carrion (fish and seabirds), sooty tern chicks, seabird eggs and green turtle hatchlings all feature prominently in the diets of coastal populations [2,8,12,13]. Black rats are generally nocturnal but are often active during the day on Ascension Island, presumably due to limited disturbance and predation risk.

Reproduction & life history

Black rat life history is characterised by high fecundity and short generation times, allowing populations to grow rapidly and rebound quickly following control. Females are able to breed year round when conditions are favourable and can produce 3-6 litters of 3-7 young annually [3]. Gestation time is 20-22 days [3]. Pups wean at 3-4 weeks old and reach sexual maturity at 2-4 months [3]. The average lifespan of wild rats is generally less than 1 year, although they may live for up to 4 years under ideal conditions [3].

Taxonomy & population structure

The *R. rattus* complex consists of numerous subspecies (and potentially species), many of which are hard to distinguish visually [3]. In addition, three interbreeding colour morphs have been described [3,14] – *R. r. rattus* (uniformly dark grey/black), *R. r. alexandrinus* (agouti back, grey belly) and *R. r. frugivorous* (agouti back, creamy-white belly) – all of which occur on Ascension Island. Reports of the larger and more aggressive Norway rat (*R. norvegicus*) on Ascension Island [4] probably arise from confusion with the brown morphs of *R. rattus* [15], although this requires verification.

5. Impacts*

2. Predation on native species **Magnitude:** DATA DEFICIENT

Birds: Rats are notorious predators of birds and their eggs, and have been implicated in the decline and extinction of more island bird species than any other taxa [16,17]. On Ascension Island, the only well-documented impacts of rats on seabirds relate to sooty terns (*Onychoprion fuscatus*), of which they appear to be a serious predator of both eggs and chicks [2,8,12,18]. However, it is unclear whether this predation is having a population level impact or is 'merely' reducing individual fitness. Larger seabird species such as frigate birds and boobies are generally not susceptible to nest predation by rodents [17], and the presence of rats has certainly not prevented re-colonisation of the main island of Ascension by these species following the eradication of feral cats. However, it is possible that rat predation is limiting or preventing re-colonisation by smaller species such as brown noddies, white terns, storm petrels and white-tailed tropic birds, most of which currently nest on inaccessible cliffs or offshore stacks.

Turtles: Black rats have been observed directly predating green turtle hatchlings on Ascension Island and may constitute a significant source of mortality on some nesting beaches [2]. Rat abundance at North East Bay was amongst the highest recorded in a 2013 trapping survey and there was evidence of considerable predation on hatchlings [2]. As with sooty terns, it is unclear whether this predation is currently influencing, or has the potential to influence, overall population trends.

Invertebrates: The detrimental impacts of rats on native island invertebrates are becoming increasingly apparent, with large-bodied species being particularly at risk [19]. According to a 2013 study, invertebrates were relatively uncommon in the diets of black rats on Ascension Island [2], although an earlier report found substantial quantities of insect cuticle in the stomach of a single individual on Letterbox [13]. Most endemic, terrestrial invertebrates are small, cave-dwelling species that are unlikely to be targeted by rats. However, the Island's largest native terrestrial invertebrate, the land crab *Johngarthia lagostoma* is potentially vulnerable (see [20]). Little is known about interactions between the two species, but it appears that some predation occurs in both directions [2,15].

8. Grazing & herbivory **Magnitude:** MINIMAL

Black rats are often highly herbivorous and can have a range of detrimental effects on native and endemic flora including seed predation, bark stripping and twig cutting [9]. Five of Ascension's seven endemic species are ferns which are seldom consumed by rats. The remaining two species (a grass and a spurge) have very small seeds which are unlikely to be appealing to rats. The only species potentially at risk is the spurge which grows in sparsely vegetated areas where few other sources of food and water are available. Rat densities in the semi-desert habitats favoured by spurge are generally very low [2], however cutting of shoots has been reported in some populations and

is often attributed to rodents .

1. Competition with native species	**Magnitude:**	DATA DEFICIENT

As mid-sized generalist omnivores, black rats potentially occupy a similar niche to Ascension Island's native land crabs and co-occur with them in many habitats. In more wooded areas the highly arboreal habits of black rats may create some niche separation, but in less complex habitats competition for resources such as food and burrows is possible. More detailed studies of the diets, distributions and behaviour of these species are needed to properly assess competitive impacts.

10. Interaction with other invasive species	**Magnitude:**	DATA DEFICIENT

Black rats are known to disperse plant seeds through their faeces and caching behaviour and may therefore facilitate the spread of invasive weeds [21]. Mexican thorn (*Prosopis juliflora*) seeds are common in the diet of rats living in thorn scrub but are predated rather than consumed whole [2]. Caching of *Prosopis* seeds has been documented and may aid in dispersal. However, rats also cause considerable damage to the vegetative parts of mature thorn trees, stripping bark and cutting shoots, so their net impact may be either positive or negative. A range of small, intact seeds were found in the stomachs of rats trapped in montane habitats, although they could not be identified to species level [2]. It is known that seeds of several highly invasive species found on Ascension Island, including *Clidemia hirta*, *Buddleja* sp. And *Rubus* sp., are consumed by rats and excreted intact [21], potentially facilitating their dispersal.

*Impacts are classified and scored according to the IUCN Global Invasive Species Database scheme [22]

6. Management notes

Tackling resurgent rodent populations in the wake of the feral cat eradication is emerging as one of the most pressing management issues on Ascension Island. An extensive programme of chemical control is already underway in the Territory, with more than 1700 fixed bait stations deployed Island-wide. These are primarily used to dispense whole grain baits and wax block formulations containing the anticoagulant rodenticides bromadiolone, brodifacoum (US Base only) and defethialone (US Base only). More than 3,000 kg of rodenticide are used annually at a total cost of over £10,000 (AIG Environmental Health & US Air Force, unpublished data). However, despite this investment, rat densities have continued to increase rapidly in seabird colonies [8] and some other habitats. A significant and sustained escalation in control efforts will clearly be needed to tackle this threat, and can only be justified if measurable conservation gains can be demonstrated. Further research into the impacts of rats on native species and the feasibility and benefits of control is therefore urgently needed to guide future rodent management policy. Research should initially focus on the sooty tern colonies where evidence of impacts is most severe, but should ultimately be extended to other small, mainland nesting seabirds, green turtles and land crabs. Assuming that significant benefits can be demonstrated, a revised strategy for rat control around key conservation sites will need to be adopted, drawing on the considerable international best practice in this field. Chemical control will inevitably continue to form part of any approach, but may be best combined with alternative control methods, such as trapping, to reduce the risk of selecting for rodenticide resistance. Habitat management to limit access to food and water may also be effective in some situations, such as the removal of invasive thorn scrub around seabird colonies and turtle nesting beaches.

A complete eradication of rats from Ascension Island must be regarded as the ultimate management objective for this species, but is unlikely to be financially or logistically achievable in the short to medium. Lambert estimated the cost of eradication at £4.4 million based on experiences in the Scottish Highlands [13], although this figure should be regarded as very approximate as numerous factors can influence the overall costs of such programmes. Despite efforts to eradicate rats from increasingly large islands, black rats have seldom been successfully removed from islands larger than 10 km2 (Ascension is ca. 100 km2) [23], particularly when these have a resident human population. Ascension Island's tropical climate, rugged terrain and the presence of land crabs that compete for bait all further increase the risk of failure [24]. There are also numerous higher priority targets for rodent eradications within the UK Overseas Territories reducing the probability of securing the significant funding needed for such a campaign [25]. Thus, while eradication may become feasible in the longer term, targeted management around sensitive sites will be necessary for the foreseeable future. Further research into impacts of rats on native biodiversity will also be vital to justify the costs of any future eradication attempt.

7. References

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