

Prioritising pest eradications on Tasmanian Islands for biodiversity conservation

In brief

Invasive vertebrate species, such as cats and rodents, pose a serious threat to the biodiversity on Tasmanian offshore islands. Many of these islands support threatened species, species found nowhere else, and high concentrations of seabirds. A challenge for managers is determining which islands to focus invasive animal management for the purpose of conservation. To help address this, we identified priority islands for cat and rodent management, using a prioritisation model with set budgets under a range of scenarios.

Of the 590 islands we examined, 224 islands supported native species of significance. The islands supporting the greatest number of threatened species were larger islands such as Flinders, King and Bruny Islands. We determined that eradicating the numerous feral animals on these larger islands would be costly and complicated.

In a fixed budget prioritisation scenario focused on cat eradication and islands with threatened species, only one island was identified for pest management. When we included both threatened species and island dependent species in the prioritisation, 13 islands were identified. When both cats and rodents were to be eradicated in the prioritisation scenario, 25 islands were identified which contained several threatened species and 18 island significant species. These target islands were typically small in area and therefore a cheaper option for pest eradication.

We suggest that broadening the aims of conservation management to include threatened species and island significant species brings greater conservation gain. By including island significant species in our prioritisation process for invasive vertebrate eradication, we identified many more islands where eradication would benefit biodiversity for the same cost.

Background

Invasive species currently pose one of the greatest threats to island biodiversity. Invasive species eradications are becoming increasingly important as a conservation tool for islands, due to the positive benefits they have for biodiversity; and because islands often support species that are threatened and/or endemic (found nowhere else). We are now seeing larger islands being targeted, and multiple invasive species being tackled at the same time. Investing in pest eradication on islands has the potential to achieve greater conservation outcomes than on the mainland due to reduced risk of reinvasion and the ever-increasing threats to biodiversity on mainland Australia.

Tasmania has hundreds of offshore islands. Many of these islands support threatened species, endemic species and high concentrations of seabirds not found on mainland Tasmania or, indeed, anywhere else in the world. There are at least 70 threatened vertebrate and invertebrate species that occur on Tasmania's islands (listed as threatened either under Tasmanian (TSPA 1995) and/or Australian (EPBC 1999) legislation). Unfortunately, some of these islands also support invasive vertebrates,



Courts Island. Image: Justine Shaw



Background (continued)

including those introduced intentionally, such as cats (*Felis catus*), and pigs (*Sus scrofa*), and some unintentionally (e.g., rodent, *Rattus rattus*, *Mus musculus*). The challenge for managers is determining which islands to focus their efforts at feral animal management on, for the purpose of conservation, given that there are hundreds of islands to choose from, each with a variety of values.

Main aims of the research

We had four main aims:

1. To collate threatened species records and identify other biodiversity values across Tasmania's islands;
2. To identify key species in Tasmania that are significant to islands, or where islands are a key part of their distribution;
3. To collate information on invasive species on Tasmanian islands; and
4. To identify priority islands for invasive species management.



What we did

This work was a collaboration between The University of Queensland, Queensland University of Technology and Biosecurity Tasmania involving researchers and practitioners with expertise in island biodiversity, invasive species and pest eradication. We collated and examined information from 590 Tasmanian islands. We then focused on which of these islands support invasive vertebrate pests.

Species distributions

We collated contemporary data on all threatened species and a suite of species that we termed "island significant species" on Tasmanian islands. These are

species that are highly dependent upon islands for habitat, breeding and/or food. We determined the distribution of threatened species across the islands. Species data was collated from a range of published sources and databases. A primary source of species records was the Natural Values Atlas (Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE)). These records were validated by species experts.

Information about invasive species on Tasmania's islands was collated from published, historical records, grey literature and DPIPWE data sources, and updated with contemporary field observations. We included non-native game birds. We didn't include plants in our study, due to a lack of data.

Species interactions

For invasive species, there is rarely detailed population or distribution information describing their occurrence on an island, or detailed information about their diet and interactions. We reviewed literature on predator-prey dynamics of key invasive species. Our work was also informed by field observations from many of the islands.

Cats eats seabirds, and rodents eat bird and reptile eggs on many of the islands. We determined how native species might be impacted by cats and rodents based on field observations, existing peer-reviewed literature and reports. For the few native species for which there was no information on how they may be impacted by these invasive predators, we relied on prey species' body size to determine whether cats were likely to prey on them.

Eradications

The most suitable methods for pest eradication are island and species specific. Estimating costs for pest eradications for an island can be challenging, given nuanced logistics relevant to each island. In this study, we focused on eradicating cats and rodents, given their direct impacts on native species.

In our prioritisation exercise, we aimed to optimise the protection of threatened species and island significant species on Tasmanian islands. We used island size and standard published costings for cat and rodent eradications to inform our prioritisation.



White-faced storm-petrel.
Image: Ed Dunens, Flickr, CC BY 2.0



LEFT: Babel Island, Tasmania.
Image: Mary Gilham, Flickr, CC BY 2.0

Key findings

Of the 590 islands we examined, 224 supported native species of significance. We determined that there are 19 invasive vertebrate species across Tasmania's islands including: cat, rat, mouse, pig, hare, deer, pea fowl, chicken, turkey, pheasant, Californian quail, chukka partridge and guinea pig. Some were introduced intentionally, and subsequently escaped to become feral, while others self-introduced, likely in association with human activity. Rabbits, mice, cats and rats are the most common invasive vertebrates across Tasmanian islands.

The Tasmanian islands that support the most threatened species, and many native species, are the larger islands such as Flinders, King and Bruny Islands. Unfortunately eradicating the numerous feral animals or, indeed, just one feral species on these islands would be costly and complicated. These large islands have multiple land tenure types, including large tracts of private, agricultural and forestry land. Human settlements are common, and considerable human and cargo traffic passes to, from and within these large islands. The more complex the island situation

the less feasible invasive vertebrate eradication becomes. Additionally, the co-occurrence of certain native species can complicate the pest eradication. For example, eradicating cats in the presence of quolls adds complexity to the eradication method, which equates to increased cost.

Our first prioritisation scenario had a fixed budget, and focused only on cat eradication and only on islands with threatened species present. In this case, only one island was identified as a priority by the model. We then chose to prioritise cat eradication on islands with both threatened species and island significant species, but weighting threatened species more heavily. In this scenario, 13 islands were identified by the prioritisation model.

Second, we ran a scenario where both cats and rodents were eradicated. The prioritisation model identified 25 islands where, if cats and/or rats and/or mice were eradicated, it would greatly benefit the future conservation of several threatened species, and at least 18 island significant species, predominantly seabirds,

land birds, shorebirds and a lizard. Many of the islands identified support numerous native species and are small in area, and therefore a cheaper option for eradication.

In our modelling approach, large islands with no threatened vertebrates species present are never selected. When giving priority to threatened species, islands like truwana (Cape Barren) and lungtalanana (Clarke) will never be selected. Yet both have many island significant species, and many other natural and cultural values impacted by multiple invasives. They simply do not support any threatened animal populations.

In a prioritisation such as ours, involving many species and many islands, it is challenging to incorporate the indirect effects of species on each other, as in most cases there is no data on the magnitude of any species interaction. For example, we know that rabbits and weeds greatly modify habitat, but in a multi-criteria decision approach it is difficult to weight the impact of this against direct predation.



Bruny Island. Image: Justine Shaw

Cited material

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Further Information

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Implications and recommendations

We found that focusing solely on threatened species greatly limits conservation opportunity, and that island biodiversity needs to be viewed under a broader lens. Most threatened species are on larger islands, and pest eradication on these islands may be complex and very costly. If the focus is to be only on threatened species which is often resultant of funding limitations or availability, then decision-making is quite straightforward: spend very large amounts of money over many years on invasive species eradication on Bruny, King and Flinders Islands, as they support many threatened species.

However, if we expand our species targets, more islands can be considered for an eradication program for the same cost. The island significant species that would benefit are short-tailed shearwater (*Ardenna tenuirostris*), little penguin (*Eudyptula minor*), white-faced storm petrel (*Pelagodroma marina*), sooty oystercatcher (*Haematopus fuliginosus*), pied oystercatcher (*Haematopus longirostris*), Caspian tern (*Hydroprogne caspia*), crested tern (*Sterna bergii*), silver gull (*Chroicocephalus novaehollandiae*), white fronted tern (*Sterna striata*), fairy tern (*Sternula nereis*), Pacific gull (*Larus pacificus*), kelp gull (*Larus dominicanus*), black-faced cormorant (*Phalacrocorax fuscescens*), Cape Barren goose (*Cereopsis novaehollandiae*) and the Bougainvillea skink (*Lerista bougainvillii*). In addition, many other lizards, marsupials, invertebrates and land bird species with no

conservation status (e.g., the swamp antechinus, *Antechinus minimus*) could also benefit.

Our work highlights that focusing only on threatened species in decision making reduces overall conservation benefits to other species. Our modelling showed how we could get greater value for money when we widened our targets for conservation. By identifying and including island-dependent species that contribute to island biodiversity there can be a greater return on investment.

Island significant species are subject to many threats, including pressure from invasive vertebrates. While we can't immediately manage many of the threats that occur at sea or, for example, climatic change, we can act now to remove threatening process on islands to improve species' resilience.

Many conservation opportunities are present on small islands in Tasmania for many species to be secured and protected. For example, invasive cats and rodents impact migratory short-tailed shearwaters. Most short-tailed shearwaters that travel to Australia breed on small Tasmanian islands. Eradication of cats and invasive rodents on these islands would be of substantial benefit to these and other burrowing and surface-nesting seabirds.

We recommend the eradication of cats, rats and mice from 20 small Tasmanian islands as a cost-effective means to ensure conservation benefits to several threatened species and many

seabirds, shorebirds, reptiles, land birds and some marsupials. For example, eradicating cats and mice from one of these islands would immediately benefit storm petrels, short-tailed shearwaters, little penguins, Cape Barren geese, Lewin's rails (*Rallus pectoralis clelandi*), pied oystercatchers and metallic skinks (*Niveoscincus metallicus*).

Acquiring accurate information on threatened, native and invasive species on the islands was challenging, and more effort is needed to undertake contemporary biodiversity surveys on Tasmania's islands. This should also include assessment of threatened plants, culturally significant species and weed coverage on islands. We also need to know the current distribution and abundance of invasive vertebrates on Tasmania's islands. If we rely on existing databases, we must acknowledge that some islands have never been comprehensively surveyed for native or invasive species, and other islands have not been surveyed for over 30 years.

While our study did not examine rabbit or weed eradication, both have been shown to impact threatened species and island significant species, and their eradication should also be considered on Tasmania's islands. For example, rabbit eradication on Breaksea Island in the Tasmanian Wilderness World Heritage Area could benefit short-tailed shearwaters, little penguins, silver gulls and fairy prions (*Pachyptila turtur subantarctica*), as rabbit grazing negatively impacts their nesting habitat.