

# WHEN THE CAT'S AWAY, WILL THE RATS PLAY?

Informing decision making for integrated invasive species management on Christmas Island

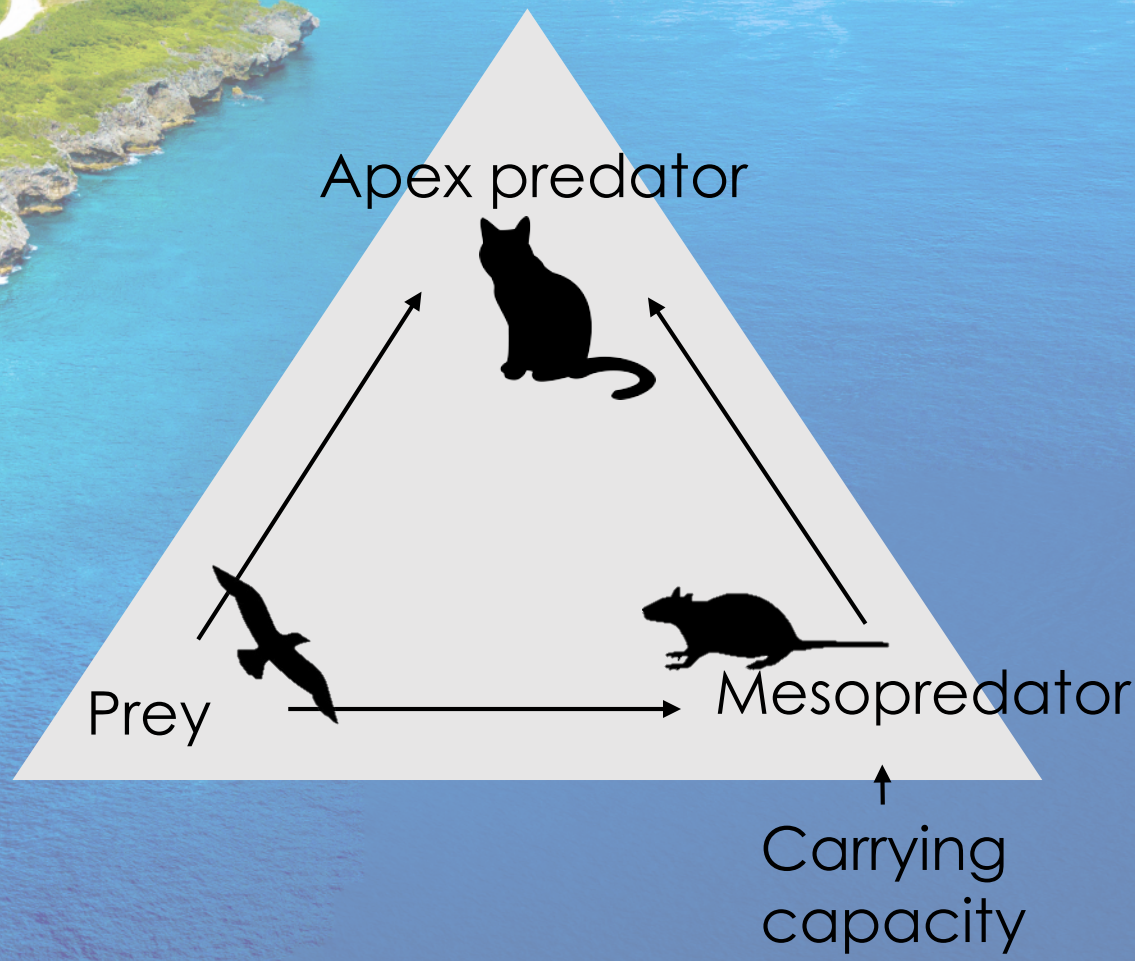


## The Challenge

Cats and rats are recognised as the most damaging invasive predators for island species, and mitigating their impact is a top priority. Invasive species control and eradication programs usually lead to immediate benefits for impacted native species. But on some islands, controlling the apex invasive predator has led to increased abundances of smaller invasive species (mesopredators). For example, numbers of rats increased in some parts of Little Barrier Island, New Zealand, after cat eradication, with reduced breeding success for native bird. While there is potential for negative effects from controlling invasive species in this way, outcomes are uncertain and vary between places, habitats and even over time, depending on factors including ecosystem carrying capacity.

## The Project

Christmas Island is home to a suite of native animals found nowhere else, but also to invasive species including Asian wolf snakes, giant centipedes, feral cats and black rats. These invasive animals have contributed to many extinctions and declines of Christmas Island's native species. The Australian Government is undertaking a range of conservation initiatives to safeguard the island's native wildlife, including an island-wide cat eradication program. This project, a Threatened Species Recovery Hub collaboration with Parks Australia, is investigating the potential outcomes of the cat control, including whether rats will need concurrent control.



Chris Bray Photography

## Filling in knowledge gaps - how to monitor rats?



Our work depends on gathering data on rat abundance. To achieve this, we needed to outwit the superabundant, curious and hungry land crabs. During the wet season (and especially during crab migration season), red crabs and robber crabs frequently interfered with traps, making rat detection extremely challenging. For this reason, we first evaluated which method (ink-card tracking, cage trapping or DNA hair traps) was the most cost effective for monitoring rat abundance in this unique ecosystem.



## What drives rat populations?



We also measured several other ecological factors (like crab density, crazy ant presence, habitat type) that might explain variations in rat density, and help us understand the relationships between cats, rats, and other species on the island, and whether cat removal is likely to lead to more rats. If rats are limited by cat predation, cat control will be risky, but if rats are bottom up limited, rat population release is unlikely.

## Assessing current impacts



Red-tailed tropicbird chicks have previously experienced mortality rates of up to 95% mostly due to cat predation. While cats have been controlled near one of the colonies and breeding success seems to have improved, there has been little monitoring to see if rat activity around nests has increased. To assess the effects of both cat and rat predation on this and other threatened Christmas Island species, we relate patterns of rat abundance and activity across the island to forest bird abundance and nesting success using the Christmas Island thrush as an exemplar species, and to seabird nesting success (using the red-tailed tropicbird as the seabird "exemplar").

## Do more rats matter?

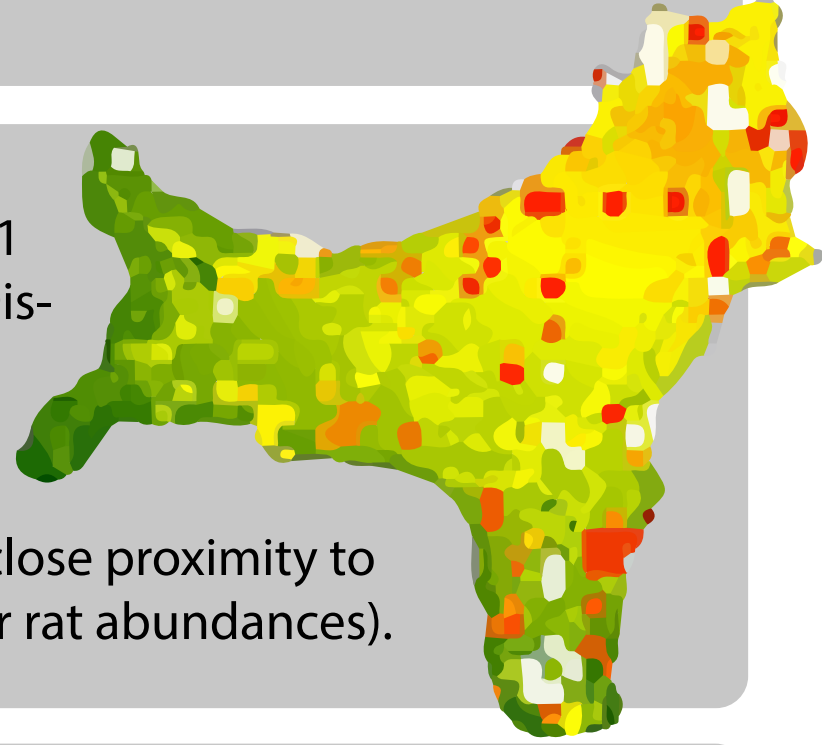


Using modelling and decision science tools, we will combine the empirical data collected through field work studies to investigate 1) the likelihood for rat release to occur 2) what rat densities pose a concern for the species we care about and 3) what and how monitoring approaches could be implemented, and when to act to safeguard against potential emerging problems.

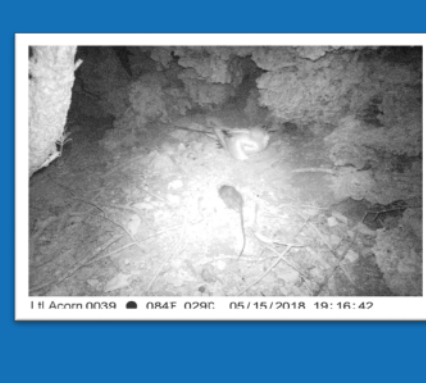
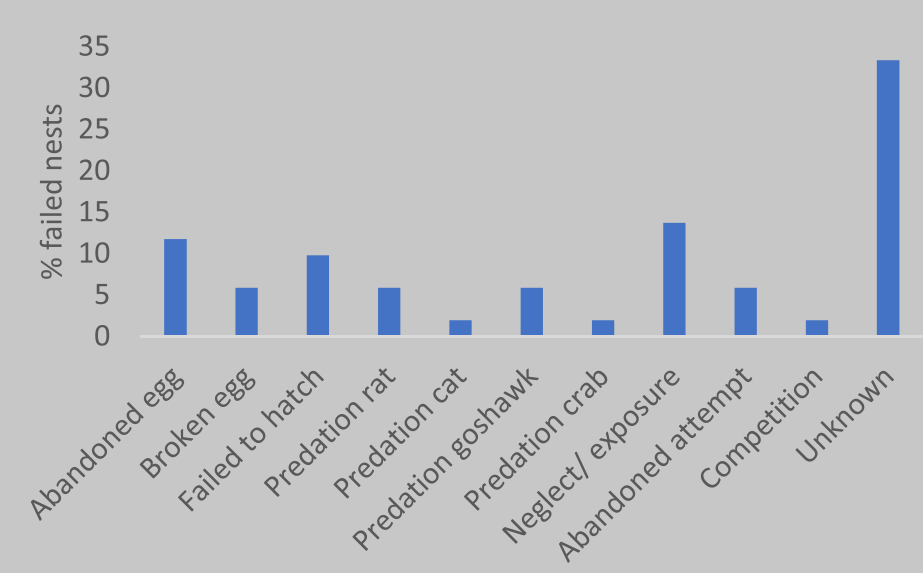
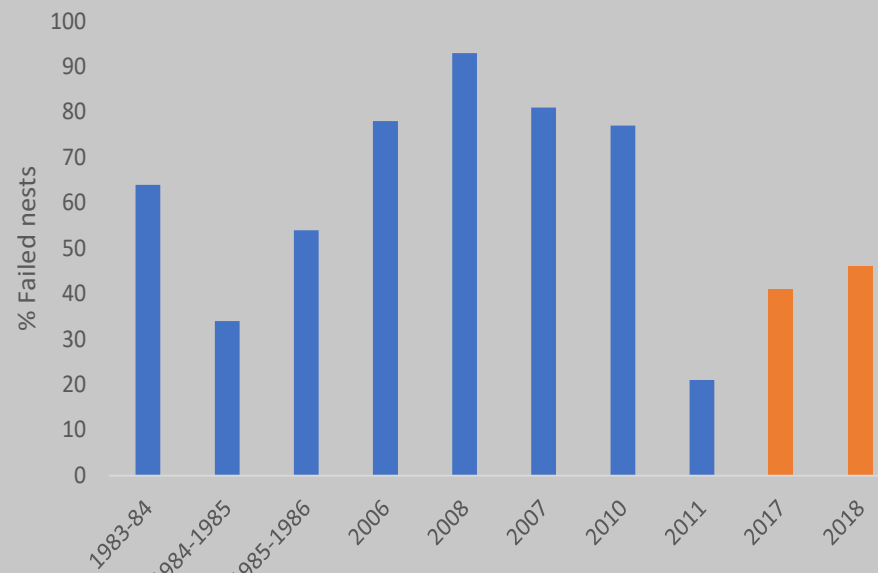
## Findings

Ink-card monitoring slightly outperformed other rat monitoring methods, detecting ~25% more rats per trap night after adjusting for crab interference. Overall, the patterns of rat abundance measured by each method in each habitat type was similar, so either method could be used to monitor rats on Christmas Island. Both methods also had similar statistical power to detect simulated increases in rat populations over time. However, due to already high rat activity in disturbed habitat, inkcards will not detect population changes there. Despite this limitation, ink-cards are considered the most cost effective approach for monitoring potential changes to rat population on Christmas Island over time as cat populations are reduced.

Rats are widespread across Christmas Island. Their average estimated density is 21.38 ha<sup>-1</sup> which is low - moderate compared to other tropical islands. Disturbed and dry habitats (i.e. mostly associated with mining) have higher levels of rat activity while wet areas or areas of high crazy ant abundance have lowest activity. High rat density associated with disturbed vegetation types including in close proximity to the settlement area (see figure, where **hotter** colours = higher rat abundances).



68% of thrush nests have been analysed so far. At those nests, there were 21 individuals that failed at the egg stage and 23 individuals that failed at the chick stage. Failures were due to nest abandonment and goshawk, rat, giant centipede and crab depredation. 40 and 48% of tropicbird nests failed, less than has been previously recorded for the island (see figure). Failures were due to nest abandonment, neglect and exposure, broken eggs (by adults), failure to hatch, competition with other birds, as well as depredation by cats, rats, goshawks and crabs (see figure). Overall, the observed rat predation rate was less than expected. Rats are omnivorous and may be meeting their energetic requirements on Christmas Island by consuming invertebrates, fruit and seeds. It has also been suggested that bird species that have evolved in the presence of land crabs may have behaviour that reduces their vulnerability to rat impacts.



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