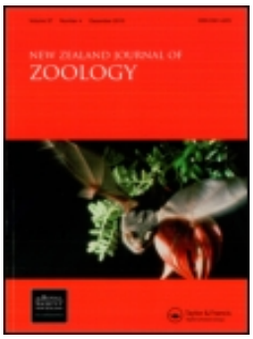

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SHORT COMMUNICATION

Cat predation of short-tailed bats (*Mystacina tuberculata rhyocobia*) in Rangataua Forest, Mount Ruapehu, Central North Island, New Zealand

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Cats (*Felis catus*) are known predators of New Zealand bats, although all records to date have been from domestic cats thought to have caught foraging bats. We outline the first evidence of predation of short-tailed bats (*Mystacina tuberculata rhyocobia*) at a roost tree. A total of 156 individual bat wings (78 pairs) and 22 intact bodies were found at the base of two colonial roost trees in Rangataua Forest on the southern slopes of Mount Ruapehu, Central North Island in New Zealand, over a period of 7 days. Assuming a pair of wings belonged to one individual, at least 102 bats were killed by a male cat caught in a live trap at the base of one roost tree. No more deaths were recorded after its capture.

Keywords: short-tailed bat; *Mystacina tuberculata*; cat; predation; roosts; New Zealand

Introduction

Cats (*Felis catus*) are recognised as predators of bats, with predations recorded in countries such as Britain (Woods et al. 2003), Australia (Barrat 1997), Mexico (Floyd et al. 2010) and Puerto Rico (Rodríguez-Durán et al. 2010). Concern about cats as a predator of New Zealand bats was raised in Daniel & Williams (1984), who found that the deaths of six of 23 greater and lesser short-tailed bats (*Mystacina robusta; M. tuberculata*) and 10 of 36 long-tailed bats (*Chalinolobus tuberculatus*) were attributed to domestic cats. This high percentage in comparison with other causes of deaths was most likely because domestic cats left the bodies in conspicuous places for owners to find and report; however, it did indicate that cats had the potential to be an important predator of bats.

Although the bats brought in by these cats were likely to be foraging around urban lights (Daniel & Williams 1984), the potential impact of a cat within a forested environment was of concern. The lesser short-tailed bat is the only extant *Mystacina* species and is thought to be particularly vulnerable, especially as they congregate in large colonial roosts, often with several thousand bats (Lloyd 2001; Scrimgeour et al. 2010), which would be conspicuous to mammalian predators. However, hundreds of hours of filming roost entrances to count bats as they emerge have recorded no actual predation event despite visitations from possums, rats and stoats (Lloyd 2001, 2005; Wallace 2006).

During a monitoring operation to investigate the population of short-tailed bats in Rangataua Forest on the slopes of Mount Ruapehu, Central North Island, evidence of bat predations by a feral cat at two colonial roost trees was found. This paper outlines the predation event.

Methods and results

Short-tailed bats were captured in March 2010 whilst undertaking a seasonal count of the bat

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population. Mistnets were hoisted into the canopy using a pulley system, resulting in the capture of 10 individuals. Transmitters (BD-2 model, Holohil Ltd, Canada) were glued to any bat weighing over 12 g to ensure the transmitter weighed less than 5% of the bat's body weight. Because of the limited range of handheld telemetry equipment, a fixed-wing aeroplane was used to track the bats within the 10,000-ha forest to an area where staff on the ground could obtain the signal. The specific roosts were located using a handheld TR4 receiver (Telonics Inc, United States of America) and yagi antenna (Sirtrack, New Zealand).

Two colonial roosts were found in red beech trees (*Nothofagus fusca*), approximately 15 m from each other. Roost 1 had a large south facing entrance, reaching from the ground to 5 m high and approximately 1 m wide at ground level, narrowing to 10 cm at its height. The entrance of Roost 2 was smaller, approximately 6 m high, and an estimated 30×15 cm in size.

On the day of discovering the two roosts, 86 individual bat wings and one intact body (unknown sex) were found at the base of the two trees. The following day, six bat wings and 19 bodies (12 female, six male and one unknown) were found scattered around the base of Roost 1. Seven of the bodies collected were sent to Massey University in Palmerston North for post-mortem analysis. A waterproof IR camera (SN-W5331VO model, Viewtech Limited, New Zealand) and spotlight (SAL-30, Viewtech Limited, New Zealand) was established at each tree to film the first 2 h of emergence (taken from the first bat leaving).

A DOC200 trap designed to target rats, stoats and weasels was set at the base of Roost 1 baited with an egg and a dead bat for three nights. A large female stoat was caught with an inter-canine distance of 8 mm. Its stomach was empty despite finding another 26 wings and an intact body in a small pile at the base of Roost 2. The post-mortem report subsequently implicated a predator with an inter-canine distance of 16–17 mm—either a cat or a large ferret. Two of the seven bodies had clear puncture wounds, and the other five died of tearing, bruising and internal bleeding associated with a predation event.

A further 32 wings were found in a pile at the base of Roost 2, and another three intact bodies (two males, one female) with two separate wings about 5 m from the roost in a hollow under a tree. Visual inspection of hair strands found in the hollow indicated a tabby cat might be responsible. The hair samples were sent to Ecogene (Auckland) for DNA analysis.

A live capture cat trap baited with rabbit meat was set at the base of the tree. Four more wings were found (two at the base of each roost) before a cat was caught less than 24 h after the trap had been set—a small male tabby. Its stomach contained only rabbit meat (the bait) and its inter-canine distance was 16 mm, matching the inter-canine distance of the post-mortem report. A hair sample of the cat was sent to Ecogene (Auckland) and was found to match the hair collected next to the dead bats in the hollow.

Monitoring continued for a further 10 days, with no more dead bats found.

Discussion

At least 102 individuals (assuming all wings pair up) were found over a period of 7 days. Based on the matching DNA samples from the captured cat and the hair found in the hollow, in association with the inter-canine distance of the cat matching the post-mortem results and cessation of deaths after the cat was caught, we suspect that the cat was responsible for the deaths (Fig. 1). An unknown number of bats may have been removed from the area to be consumed.

All bodies and wings found were at the base of the two trees, scattered around Roost 1 and usually in a small pile at the base of Roost 2. The cat may have entered the roost during the day and pulled the bats out, which would have been feasible for Roost 1, but unlikely for Roost 2 considering the small entrance. Cats are known to hook bats from the air as they

Figure 1 The feral cat thought to be responsible for the deaths of at least 102 short-tailed bats in Rangataua Forest, Mt Ruapehu, Central North Island, next to some bodies and wings collected at the base of two roost trees.

emerge from caves (Racey & Entwistle 2003; Rodríguez-Durán et al. 2010), which, although at a tree, would correspond with the re-occurring pile of dead bats and wings found in the same place at the base of Roost 2, directly below the small entrance. However, as no predation events were recorded during the filming of emergence at these roosts, and no cat visits have been noted during hundreds of hours of recordings at roosts within the same forest (B. Lloyd, independent ecological contractor, pers. comm. 2010), the method of bat capture is unknown.

Although this type of event is likely to be relatively rare (as it had not been recorded before), it could be potentially devastating. Thousands of short-tailed bats can congregate in one roost at a time (Lloyd 2001, 2005; Scrimgeour et al. 2010), which increases the potential impact a predator could have on a population. In this event, despite an almost daily predation event, the bats did not desert the roost until after the cat had been caught. If the cat had not been caught, the number of bats killed could have been significantly higher.

We suspect that roost trees within a cat's home range would be easy to locate because of the strong smell and noise from thousands of individuals, and that with a density of anywhere between 20 and 100 cats in the 10,000-ha area (estimates from Fitzgerald & Karl 1979; Dowding 1997; Gillies & Fitzgerald 2005), roosts could be targeted more often than previously thought and cumulatively have a significant impact. In addition, a large stoat was caught within 24 h of a trap being set, confirming the presence of another potential predator at the base of the roost. Further monitoring will confirm whether a noticeable decline in the bat population has occurred since the late 1990s.

This is the first confirmed evidence of cat predation at a roost within Rangataua Forest, and to our knowledge (based on a literature survey), within New Zealand.

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