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Prepared for: Canterbury Conservancy, Department of Conservation
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**THE POTENTIAL FOR ERADICATION OF
HEDGEHOGS (*ERINACEUS EUROPAEUS*) FROM
QUAIL ISLAND, BANKS PENINSULA**

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Summary

European hedgehogs (*Erinaceus europaeus*) are the most abundant mammal species remaining on Quail Island in Lyttelton Harbour. They are likely to be impacting on the existing native fauna of the island and will impede any future efforts to reintroduce native invertebrates, lizards and ground-nesting birds.

During the summer of 1999/2000, Lincoln University researchers assessed the potential for eradication of hedgehogs from the island. Bait trials suggested that hedgehogs were readily live-trapped, that meat baits were more effective than eggs or cereal baits as lures, and that hedgehogs are present in all major habitat types on the island. A review of past studies suggested that a trap spacing of 150m should be suitable for hedgehog trapping. This spacing can be achieved on the 86 ha island by means of a grid of c.60 traps, which can be checked by one person in a day.

Preliminary trapping with a grid of 53 live-traps over 11 nights resulted in the capture of 24 hedgehogs and 2 rats, with a time investment of 3.1 person hours per hedgehog captured. Catch rates did not decline significantly during the trial, which implies that a substantial population of hedgehogs remains on the island. It will take considerable additional effort to ensure that the last of these are captured.

Introduction

Unlike the other carnivorous mammals introduced to New Zealand, the European hedgehog (*Erinaceus europaeus*) is viewed with positive sentiment by many New Zealanders. They are viewed as beneficial in gardens, where they consume pests such as slugs and snails, and so many people encourage their presence. Nevertheless, although the impact of hedgehogs upon New Zealand's native fauna has yet to be properly quantified, it is becoming clear that these ecological impacts have been underestimated.

Hedgehogs are generalist predators, with the bulk of their diet consisting of invertebrates such as beetles (adults and larvae), millipedes, slugs and snails, moth larvae and earthworms (Brockie, 1959; Campbell, 1973), and, in certain habitats Orthoptera (including weta) and Hymenoptera (Moss, 1999). Estimates of consumption exceed 150 g/day per individual (equivalent to that of ten ship rats; Berry, 1999, citing Wroot, 1985). East (1972) calculated a potential daily consumption of 850 adult grass grubs (*Costelytra zealandica*) per hedgehog.

Eggs and chicks of ground-nesting birds are a secondary dietary source for hedgehogs, and such predation may represent a significant pressure upon vulnerable bird populations (Sanders, 1997). Lizards are also preyed upon (Moss, 1999).

Quail Island is an 86 ha island in Lyttelton Harbour, and is a recreation reserve under the administration of the Department of Conservation. It is significantly modified, having served a number of uses, including pastoral farming, since human occupation. Ecological restoration of the island is currently in progress. Part of the

restoration programme has involved the eradication of exotic mammalian pests, and it is currently thought that all mammals with the exception of hedgehogs and a few surviving rats (*Rattus* spp.), have been eradicated.

The island's hedgehog population is relatively low at present (pers. obs.), perhaps because of past rabbit baiting and a shortage of fresh water in summer. Nevertheless, since invertebrate reintroductions may be an early step in the restoration programme the eradication of hedgehogs from the island is under consideration. Consequently, during the summer of 1999/2000, Lincoln University researchers assessed the potential for eradication of hedgehogs from the island.

Quail Island is a recreational reserve, and receives a high number of visitors during daylight hours. Eradication of hedgehogs by live-trapping and translocation was therefore considered the technique most likely to be acceptable to the general public, and of lowest risk to visitors and non-target wildlife.

Methods

Preliminary bait trial

Two initial hedgehog baiting trials were carried out at the Lincoln University horticultural research area. Pairs of wire cage traps (N=10-12) with each of two bait types were placed at >50m intervals adjacent to vehicle tracks and shelter belts. The first trial compared fresh rabbit meat with non-toxic 'RS5' cereal pellets. The second trial compared 'Kitekat chunky fish' catfood with cracked quail eggs. The relative catch rates of the four baits were compared over 12 nights during November and December 1999, with the rate corrected for catches of non-target species and sprung traps by treating such traps as having been available for half a night.

Quail Island bait trial

A subsequent bait trial was undertaken on Quail Island. Five baits were tested: (i) 'Kitekat chunky fish' catfood; (ii) 'Tasti Dinner' dog roll; (iii) Sanitarium smooth peanut butter; (iv) non-toxic RS5 cereal pellets; and (v) quail eggs. Forty-five 6g samples of each of the five bait types (i.e., 225 samples in all) were laid out at 25m intervals on the island's tracks overnight. The samples were ordered in blocks of five, with each bait type represented in each block. Bait types were randomly distributed within each block to avoid any position bias. On 10-11 January 2000, the number of baits of each type that were consumed overnight was recorded. Given the very low number of rats on the island (see Results) it was assumed that hedgehogs were the only species interfering with the baits.

Quail Island cage trapping trial

A grid of 53 cage traps was established on the island. Trap spacing averaged 150m, although this was adjusted in places to permit ease of access to, and relocation of, the traps in relation to the island's walking tracks and fencelines. Overall trap density was around one per 1.6 ha.

Three different trap types were used, all of which were known to have caught hedgehogs as bycatch in programmes targeting other pest species. Two were wire cage traps (600x300x250mm) with bait placed in a gauze pouch hung from a triggering hook. The third was a wooden treadle trap design (600x180x100) with baits placed at the rear of the trap. Chunks (c.10g) of 'Tasti Dinner' dog roll were used as bait; these were replaced every 2-4 days to reduce desiccation.

The cage trapping trial began on 18 January 2000, with traps checked daily during the week and closed for the weekends. Captured hedgehogs were placed in small cartons or bags and translocated back to the mainland where they were released.

Results

Preliminary bait trial

The wire cage traps had a tendency to jam open, but nevertheless were effective in catching hedgehogs. All the bait types attracted at least some hedgehogs, but quail eggs appeared to be the least effective of the four types tested (Table 1).

Table 1: *Relative catch success of four potential hedgehog baits at Lincoln in November 1999.*

	Bait	Trap nights	No. of hogs trapped	Catch rate (%)
Trial One	Cereal pellets	64.5	5	7.6
	Rabbit meat	65.5	3	4.7
Trial Two	Catfood	78	9	11.5
	Quail eggs	80	1	1.2

Quail Island bait trial

The second bait trial, on Quail Island, demonstrated that three of the bait types (catfood, dog roll and peanut butter) were attractive to hedgehogs (Table 2), whereas cereal pellets and eggs were relatively unattractive. As there was no significant difference in preference among the top three baits, we chose dog roll for the subsequent trapping because it was the most convenient to handle.

Table 2: *Relative consumption of potential baits (N=45 for each type) by hedgehogs on Quail Island in January 2000.*

	Cereal pellets	Catfood	Dog roll	Peanut Butter	Quail eggs
% consumed	7	64	71	78	2

Baits were taken in all the main habitat types on the island, with the take of the three most favoured baits (catfood, dog roll and peanut butter) being highest in areas of grass, with or without a mixture of scrub or bracken (*Pteridium esculentum*). Takes

were lowest around the stands of pine (*Pinus* spp.) and macrocarpa (*Cupressus macrocarpa*) (Table 3).

Table 3: *Influence of habitat type on hedgehog bait consumption rates on Quail Island*

	Grass	Mixed grass, scrub, bracken	Mixed grass, scrub, pine, macrocarpa	Pine, macrocarpa	Sycamore, eucalypt
No. of baits	50	27	35	20	4
% consumed	90	93	54	20	75

Quail Island cage trapping trial

After 11 nights of trapping 24 hedgehogs had been captured and removed from the island, which represented an average of 2.2 captures per night (a 4% success rate per trap per night). These catches were widespread across the island, and came from the full range of habitat types (Fig. 1).

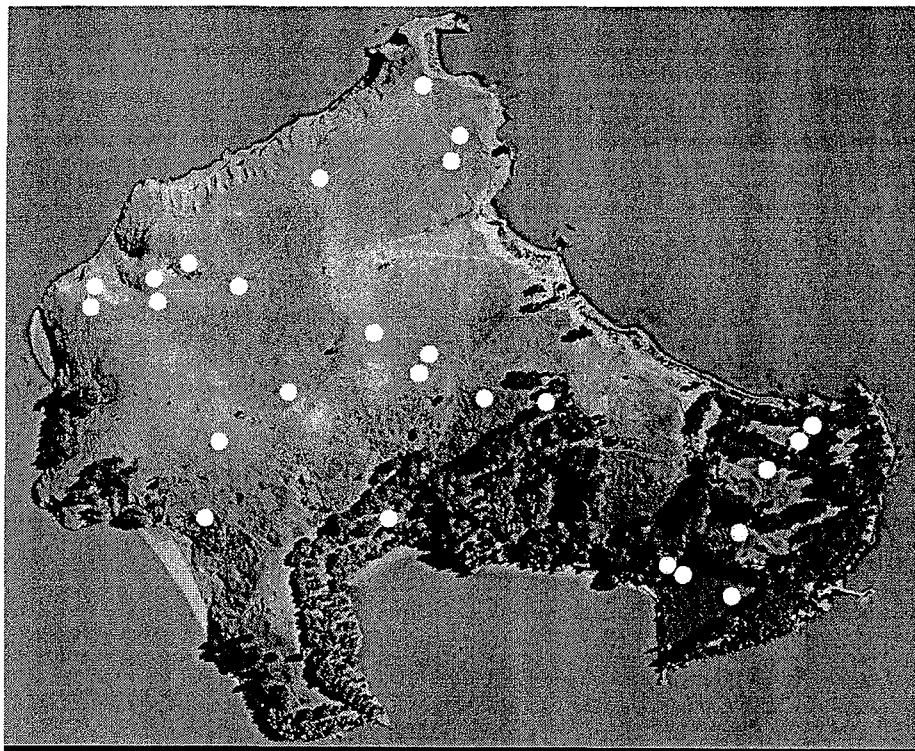


Figure 1. *Hedgehog live-capture locations on Quail Island in January 2000.*

The number of hedgehogs livetrapped varied markedly from night to night (range 0 – 6). When nightly catch was plotted against cumulative catch (as shown in Fig. 1), the resulting trend line can in theory be extrapolated through the horizontal axis of the graph to provide an estimate of the total population in the trapping area (Seber, 1981). However, our data were so variable that no downwards trend was evident. This implies *i*) that only a small proportion of the population was being caught each night, and *ii*) that a substantial number of hedgehogs remain on the island.

Over the trapping period there were also 2 captures of rats, 7 of magpies, and 6 traps were sprung without capture. No native species were trapped.

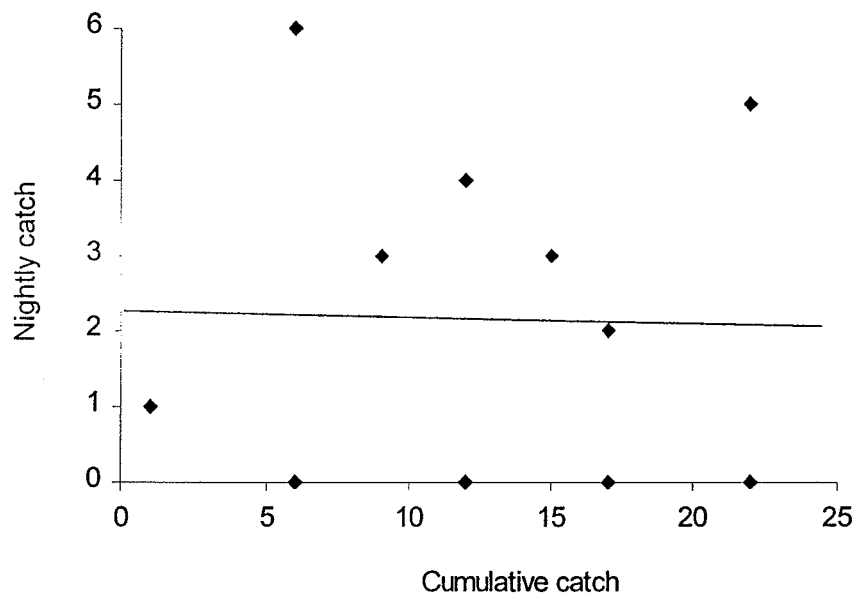


Figure 1: *The relationship between nightly catch and cumulative catch of hedgehogs for 11 nights of trapping on Quail Island. The (non-significant) trend line was fitted by linear regression ($R^2 = 0.0$, $P = 0.92$).*

Discussion

These preliminary trials suggest that several bait types (catfood, dog roll and peanut butter) are suitable for luring hedgehogs, and that both the wire-cage and treadle trap designs are suitable for hedgehog capture (although the former are prone to jamming unless carefully set).

Hedgehogs are present across the whole island, although they are somewhat less common in the pine and macrocarpa areas, perhaps because there is little food for them there (the catch of invertebrates in pitfall traps tends to be low in these habitats; M. Bowie, pers. comm.).

Our nightly catch rate of hedgehogs was low and highly variable. At present it is unclear why this is so, but it may be that weather, night temperature or bait age affect the catch – these potential effects are still to be analysed. Radio telemetry studies elsewhere in New Zealand suggest that hedgehogs have summer home ranges in the order of 30 - 90 ha, with core ranges (where the animal spends over 50% of its time) in the order of 6 - 8 ha (Berry, 1999; Moss, 1999). If hedgehogs on Quail Island have similar ranges then each individual would have been at risk of capture from at least three traps within its core range, and 15-20 within its home range.

The lack of any clear decline in trap catch over successive nights suggests that only a small proportion of the total population was being caught on any given night, and that a substantial number remain on the island. It may be that these hedgehogs have small home ranges (in which case additional locations will need to be trapped) or that they are only covering a small part of their range each night (in which case the trapping period needs to be extended).

The removal of hedgehogs reported here involved a considerable investment in labour. Given the constraints imposed by the ferry timetable to the island, checking and clearing the traps took two people 2½ hours each morning, or a single person 3½ hours each afternoon. Ten person hours were needed to initially distribute the traps around the island and set them up, and 5 person hours were needed to collect the traps at the end of the trial. Additional time was required on days when traps were rebaited (15 minutes per person per day) or if hedgehogs needed to be extracted from traps and transported from the island (15 min per hedgehog). Ferry transport between the Lyttelton dock and Quail Island required 30 minutes per person per day. Overall, c.75 person hours were required to remove the first 24 hedgehogs (i.e., 3.1 hours per individual).

It is inevitable that the effort required to trap further hedgehogs will increase progressively as the residual population declines. If the livetrapping effort becomes prohibitive then a switch to lethal traps - checked and rebaited, say, once every three days – would be one option that could be considered for reducing the time invested per hedgehog caught. Lethal trapping would also reduce the risk of escapes (hedgehogs are passive when handled by humans but proved to be surprisingly adept at escaping from containers when left undisturbed). Nevertheless, lethal trapping does represent a (small) risk to the public and to non-target species, and has welfare implications for the hedgehogs. On several occasions during our trial, visitors to the island commented favourably on the fact that the hedgehogs were not being killed.

The use of dogs to detect and recover hedgehogs may also be worth considering. Dogs played a key role in the detection and eradication of the last possums on Kapiti Island (Cowan, 1991). Hedgehogs give off a strong scent and hunting dogs have a natural instinct for hunting hedgehogs; thus dogs need little specific preparation (J. Wise, pers. comm.). Critically, however, dogs would need to be trained to ignore

non-target species, in particular the white-flipped penguins (*Eudyptula albosignata*) known to be present on Quail Island.

In mainland habitats, hedgehogs can reach population densities in excess of 5 per ha (Campbell, 1973; Berry, 1999). It is unlikely that those densities are approached on Quail Island, where much of the habitat is dry and relatively unfavourable. Nevertheless, we have to date removed only 0.28 hedgehogs per ha, and it is likely that a substantial population remains on the island. It will take considerable effort to ensure that the last of these are captured.

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